



Richard Watson, 16 February 2022
QUEEN'S UNIVERSITY
AI & RADIOLOGY LECTURE SERIES



HOW TO BE A FUTURIST...

- Call yourself one
- Sound really certain about everything
- Avoid any detail - especially timing
- Focus purely on technology
- Be highly provocative (“the end of...”)
- Use words like “will” and “won’t” a lot

TABLE OF DISRUPTIVE TECHNOLOGIES

A dashboard of 100 wonderful, weird (and possibly worrying) ways the world might change in the foreseeable future

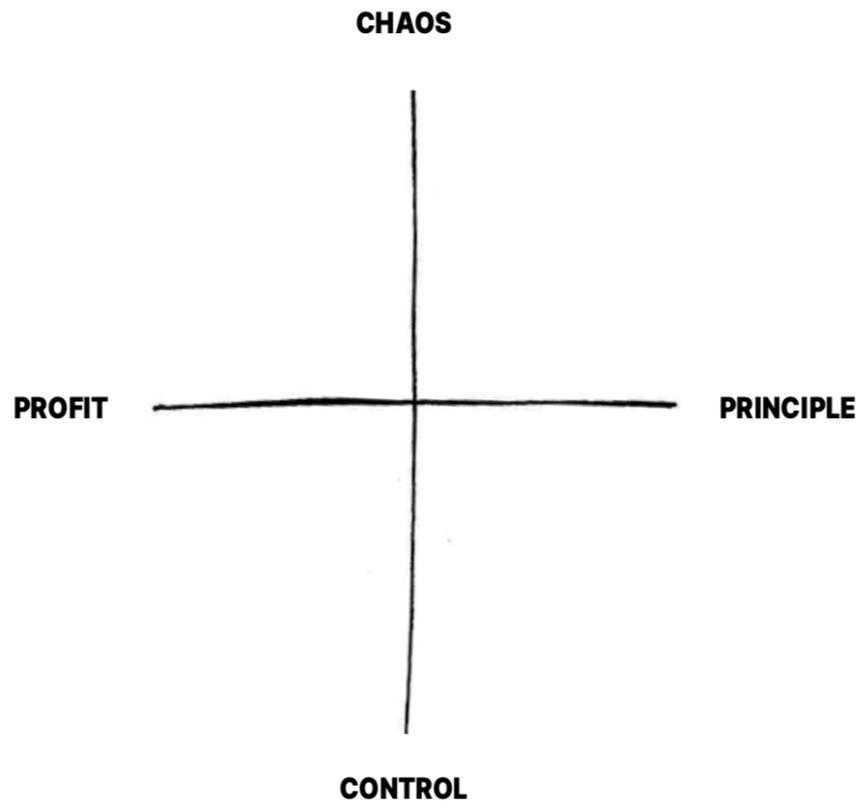
De Digital footprint eraser 91 DE	Ps Personal digital shields 92 DE	Ht Human head transplants 93 HA	Hc Human cloning & de-extinction 94 HA	Da Distributed autonomous corporations 95 DE	Sp Space solar power 96 SP	El Space elevators 97 SP	Vr Fully immersive virtual reality (VR) 98 DE	Co Artificial consciousness 99 EA	Qt We can't talk about this one 100
Ci Conversational machine interfaces 81 MI	Le Life-expectancy algorithms 82 DE	Sa Stratospheric aerosols 83 SP	Br Battlefield robots 84 EA	Ad AI advisors & decision-making machines 85 DE	Ab AI board members & politicians 86 EA	Is Invisibility shields 87 SP	Ph Factory photosynthesis 88 SP	Th Transhuman technologies 89 HA	Te Telepathy 90 HA
Ss Planetary-scale spectroscopy 71 SP	Ip Implantable phones 72 MI	He e-Tagging of humans 73 DE	Mp Male pregnancy & artificial wombs 74 HA	Dn DNA data storage 75 DE	Gv Genomic vaccines 76 SP	Qs Quantum safe cryptography 77 DE	Cp Cognitive prosthetics 78 HA	Ud Data uploading to the brain 79 HA	Rd Reactionless drive 80 SP
Gh Predictive gene-based healthcare 61 DE	Ak Automated knowledge discovery 62 EA	Rs Autonomous robotic surgery 63 EA	Em Emotionally aware machines 64 MI	Xx Humanoid sex robots 65 MI	Bh Human bio-hacking 66 HA	Me Internet of DNA 67 DE	Tc Thought control - machine interfaces 68 MI	Dr Dream reading & recording 69 HA	Wh Whole Earth virtualisation 70 DE
Md Meta-scale destination 51 SP	Sw Self-writing software 52 EA	Mm Public mood monitoring 53 DE	Pb Programmable bacteria 54 SP	Et Peer-to-peer energy trading & transmission 55 DE	La Lifelong personal avatar assistants 56 MI	Sd Smart dust 57 DE	Lc Low-cost space travel 58 HA	Pc Planet colonization 59 HA	Sh Shape-shifting matter 60 SP
Mc Medical tricorders 41 DE	Sf Smart flooring & carpets 42 DE	Dt Diagnostic toilets 43 DE	Se Smart energy grids 44 SP	Bf Algal bio-fuels 45 SP	Op Human-organ printing 46 SP	Bs Artificial human blood substitute 47 SP	Nm New materials 48 SP	Fu Fusion power 49 SP	Mr Self-reconfiguring modular robots 50 SP
Dl Distributed ledgers 31 DE	Pa Precision agriculture 32 SP	Av Autonomous vehicles 33 EA	Id Intention decoding algorithms 34 MI	Df Drone freight delivery 35 EA	Ap Autonomous passenger aircraft 36 EA	Fp 3D-printing of food & pharmaceuticals 37 SP	Sr Swarm robotics 38 EA	Fd 4-dimensional materials 39 SP	Ze Zero-point energy 40 SP
Rc Robotic care companions 21 MI	Sc Smart controls and appliances 22 DE	Cm Cultured meat 23 SP	Ro Delivery robots & passenger drones 24 EA	As Autonomous ships & submarines 25 EA	Rg Resource gamification 26 SP	Wa Water harvesting from air 27 SP	Eb Broadcasting of electricity 28 SP	Bp Bio-plastics 29 SP	Be Beam-powered propulsion 30 SP
Cr Cryptocurrencies 11 DE	So Concentrated solar power 12 SP	Pp Predictive policing 13 DE	Eh Micro-scale ambient energy harvesting 14 SP	Wt Airborne wind turbines 15 SP	Ac Avatar companions 16 MI	Mh Metallic hydrogen energy storage 17 SP	Sg Smart glasses & contact lenses 18 HA	Pe Pollution eating buildings 19 SP	Ff Force fields 20 SP
Sn Smart nappies 1 DE	Dw Deep ocean wind farms 2 SP	Va Vertical agriculture 3 SP	We Wireless energy transfer 4 SP	Bi Balloon-powered internet 5 SP	Px Powered exoskeletons 6 HA	Cc Computerized shoes & clothing 7 DE	Vt Vacuum-tube transport 8 SP	Sj Scram jets 9 SP	Am Asteroid mining 10 SP

Example of organizations active in each area

- 1 Monit (South Korea), Abena Nova (Denmark), Siempre Secor (Spain)
- 2 Statoil (Norway), Siemens (Germany), Voltum (US), UMaine (US)
- 3 Green Skies Vertical Farms (US), Aero Farms (US), Neo Farms (Germany), Urban Crop Solutions (Belgium)
- 4 WitTricity (US), Powermat (Israel), Apple/Power By Proxi (US), Qualcomm (US), Mojo Mobility (US), Mopar (US), Futon Innovation (US)
- 5 Google/Alphabet (US)
- 6 reWalk (US), Rex Bionics (US), SuitX/US Bionics (US), Ekso Bionics (US), Lockheed Martin (US)
- 7 Google/Alphabet (US), Samsung (Korea), Heroskin (Canada), Owllet (US), KomuTech (Canada), Shiftwear (US), Lechal (India), DM Signal (Canada)
- 8 The Boring Company/Elon Musk (US), China Aerospace Science and Industry Corporation (China)
- 9 Reaction Engines (UK), NASA (US), Boeing (US), Lockheed Martin (US), Airbus (France)
- 10 Deep Space Industries (US), Planetary Resources (US), Made In Space (US)
- 11 Bitcoin (Japan), Ripple (US), Litecoin (US)
- 12 Solarreserve (US), Abengoa (Spain), North China Power Engineering (China), Shanghai Electric (China), Zhejiang Supcon Solar (China), NWEFDI (China)
- 13 FredPol (US), ECM Universe (US)
- 14 Pavegen (UK), ECEEN (China)
- 15 Google/Alphabet (US), Joby Energy (US), Altaeros (US), Kitegen (Italy), Enerkite (Germany)
- 16 Pullstring (US), Amazon (US), Alphabet/Google (US), Nintendo (Japan), Invisible Girlfriend/Boyfriend (US)
- 17 NASA (US)
- 18 Alphabet/Verily (US), Amazon (US), Vuzix (US), Eversight (Israel)
- 19 Elegant Embellishments (Germany), iNova (Spain), Studio Roosegaarde (Netherlands), Prosvolve 370e (Germany)
- 20 Datt (UK), Boeing (US)
- 21 Softbank (Japan), AIST (Japan), Blue Frog Robotics (France), Care-o-bot (Germany), Riken/Sumitomo Riko (Japan), Mayfield Robotics (US)
- 22 Amazon (US), Google/Alphabet (US), Philips (Netherlands), Samsung (South Korea), Dyson (UK), Miele (Germany), iRobot (US)
- 23 Impossible Foods (US), Memphis Meats (US), Super Meat (Israel), Finless Foods (US), New Harvest (US)
- 24 Wing/Alphabet (US), Starship Technologies (UK), Volcopter (Germany), ehang (China), Piaggio (Italy)
- 25 Leidos (US), Boeing (US), Rolls Royce (UK)
- 26 Joulebug (US), Waterpebble (UK)
- 27 Permalution (US), Sun to Water (US)
- 28 Powercast (US)
- 29 NatureWorks (US), Gruppo MAIP (Italy), Genomatica (US), Green Dot Bioplastics (US)
- 30 NASA (US)
- 31 Everledger (UK), Stampery (Spain), Brickblock (Germany), Slack.it (Germany)
- 32 Blue River Technology (US), Hortau (Canada)
- 33 Google/Waymo (US), Voyage (US), Nvidia Automotive (US), most major auto-makers
- 34 Amazon (US), Google/Alphabet (US), Philips (Netherlands), Samsung (South Korea), Dyson (UK), Miele (Germany), iRobot (US)
- 35 Google/Alphabet (US), Amazon (US), Flirtey (US)
- 36 Airbus (France), Boeing (US)
- 37 FabCafe (Japan), NASA (US)
- 38 SRI International (US)
- 39 Stratasys (US), Autodesk (US)
- 40 NASA (US)
- 41 Basil Leaf Technologies (US), Dynamical Biomarkers Group (US/Taiwan), Scanadu (US)
- 42 Stanwood Hotels (US), ManiCare (Finland), Scanalytics (US), Futureshape (Germany)
- 43 Flowstyle (Japan), Scanadu (US)
- 44 Tesla (US), ABB (Switzerland), Siemens (Germany), IBM (US), Itron (US)
- 45 Synthetic Genomics/ExxonMobil (US), Global Algae Innovations (US), Algenol (US)
- 46 Organovo (US), Evison TEC (Germany), RegenHU (Switzerland), Cellink (Sweden), Seraph Robotics (US)
- 47 Hb2D Therapeutics (South Africa), Biospace (US)
- 48 For example Vantablack by Surrey NanoSystems (UK)
- 49 ITER (EU/France), Tokamak Energy (UK), Alphabet/Google/TriAlpha Energy (US), General Fusion (Canada), Helion Energy (US), Lockheed Martin (US)
- 50 Festo (Germany)
- 51 Israel Desalination Enterprises Technologies (Israel), Acciona (Spain), Fluence Corporation (US)
- 52 Microsoft (US), Google/Alphabet (US), Open AI (US)
- 53 Open Utility/Esent (UK/Netherlands), Knowleaps (China)
- 54 Gingko Bioworks (US), US Naval Research Laboratory (US), US Army Research Lab (US), Darpa (US)
- 55 Open Utility (UK/Netherlands), Power Ledger (Australia), LO3 energy (US), Energy Web Foundation (Switzerland)
- 56 Konami Corp (Japan), Mitsuoku (UK)
- 57 MOOG (US), Darpa (US)
- 58 Space X/Elon Musk (US), Blue Origin (US), Virgin Galactic (UK), Rocket Lab (US), Axiom Space (US), Spacell (Israel), Firefly Aerospace (US)
- 59 Space X (US), UAE Mars Mission (UAE), NASA (US)
- 60 Intel (US)
- 61 Kite Pharma/Gilead Sciences (US), 23andMe (US), Phenogen Sciences (US), Regeneron (US), Veritas Genetics (US)
- 62 IBM (US)
- 63 Intuitive Surgical (US), Verb Surgical/Alphabet/Johnson & Johnson (US), Da Vinci Surgery (US)
- 64 IBM (US), Toyota (Japan), Mimosys (Japan), Persado (US), Joy AI (US)
- 65 Realbotix (US), True Companion (US)
- 66 BioTeq (UK), Grindhouse Wetwear (US), Dangerous Things (US), see also The Eyeborg Project and the Eyborg Foundation
- 67 Alphabet/Google Genomics (US), Amazon (US), Illumina (US), Oxford Nanopore Technologies/Metricor (UK)
- 68 CTRL-Labs (US), Emotiv (US), Neuralink (US), maybe Facebook (US)
- 69 No example found
- 70 Improbable (UK)
- 71 European Organization for Astronomical Research in the Southern Hemisphere (European consortium of 16 countries)
- 72 No example found
- 73 Epicenter (Sweden) and Three Square Market 32M (US) are close
- 74 No example found
- 75 Twist Bioscience (US)
- 76 Vaccinogen (US), EpiVax (US), IBM (US), Juno Therapeutics (US)
- 77 Alphabet/Google (US), KETS (UK), IDQ (Switzerland), Isara (Canada)
- 78 Darpa (US)
- 79 Kernel (US), Neuralink/Elon Musk (US), 2045 Initiative (Russia), Darpa (US), General Electric/BrainGate (US), possibly Facebook (US)
- 80 NASA (US), Cannae (US)
- 81 Apple (US), Amazon (US), Alphabet/Google (US), Microsoft (US)
- 82 No example found
- 83 CIA (US)
- 84 Lockheed Martin (US), QinetiQ (UK), Boston Dynamics/Softbank (US/Japan)
- 85 Waeobot (US), Pelin (US), LV (UK)
- 86 Deep Knowledge Ventures (Hong Kong), Tieto (Finland)
- 87 BAE Systems (UK), Toyota (Japan), NB. Big difference between optical camouflage and bending light to make things disappear
- 88 Breakthrough Energy (US), RIPE (US), Joint Centre for Artificial Photosynthesis (US)
- 89 SENS Research Foundation (US), Methuselah Foundation/Peter Thiel (US)
- 90 Facebook (US), Neuralink/Elon Musk (US)
- 91 Suicide Machine (Netherlands), Just Delete Me (US)
- 92 No example found
- 93 Turin Advanced Neuromodulation Group (Italy)
- 94 Soomaa (South Korea), Revive and Restore (US)
- 95 No example found
- 96 Rebeam (US), Solaren Corp (US)
- 97 Thoth Technology (Canada)
- 98 Improbable (UK), HelloVR (US), Magic Leap (US), Microsoft (US), See also Mind Maze (US), Facebook (US) and possibly Apple (US)
- 99 Possibly Alphabet/Google (US)
- 100 As it says, we can't say

Management of Natural Systems

Economic priorities



Hype Cycle for Emerging Technologies, 2021

