Institutt for energiteknikk

27 Mar 2019

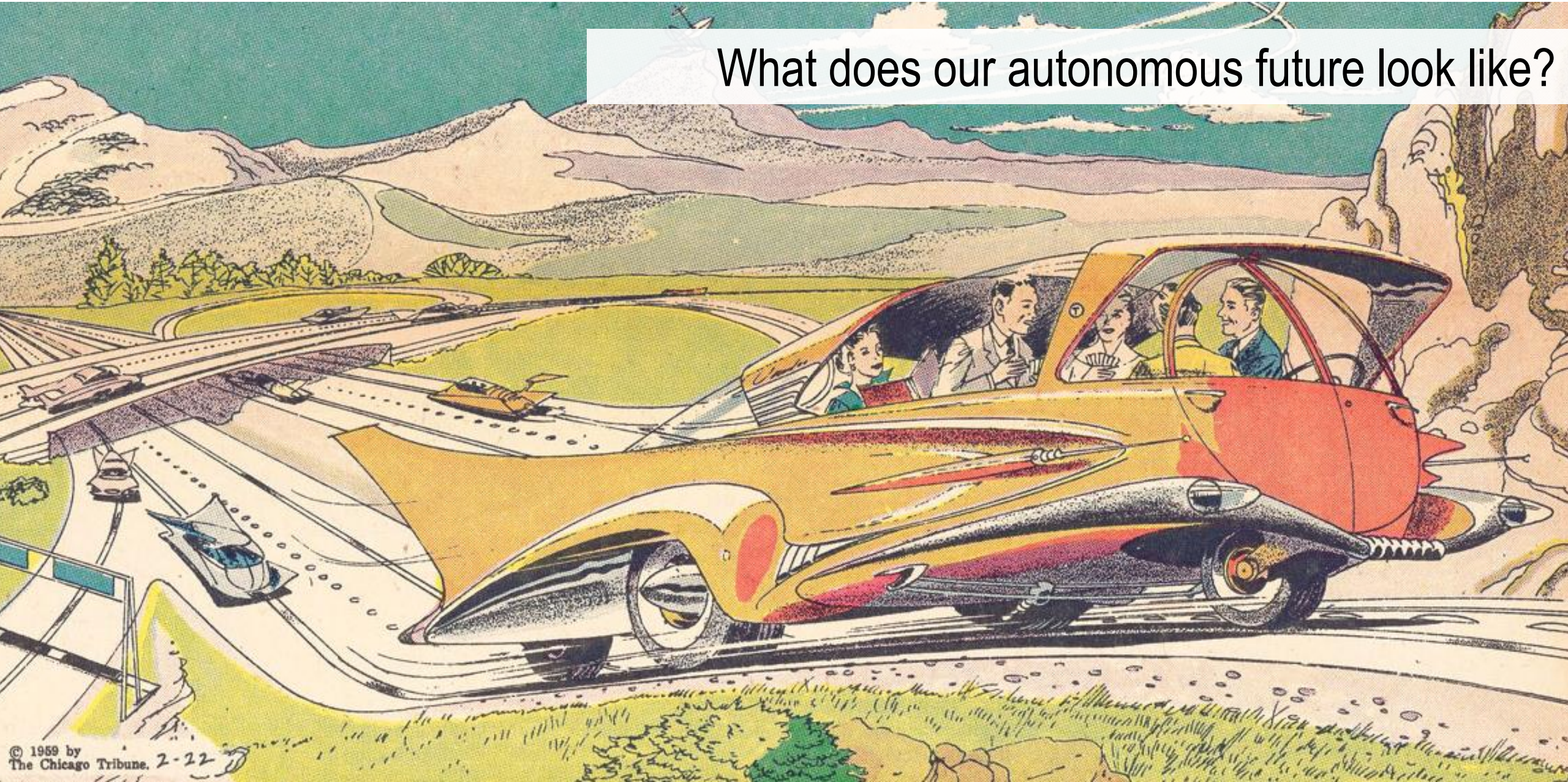
ESRA

Are we ready for our autonomous future?

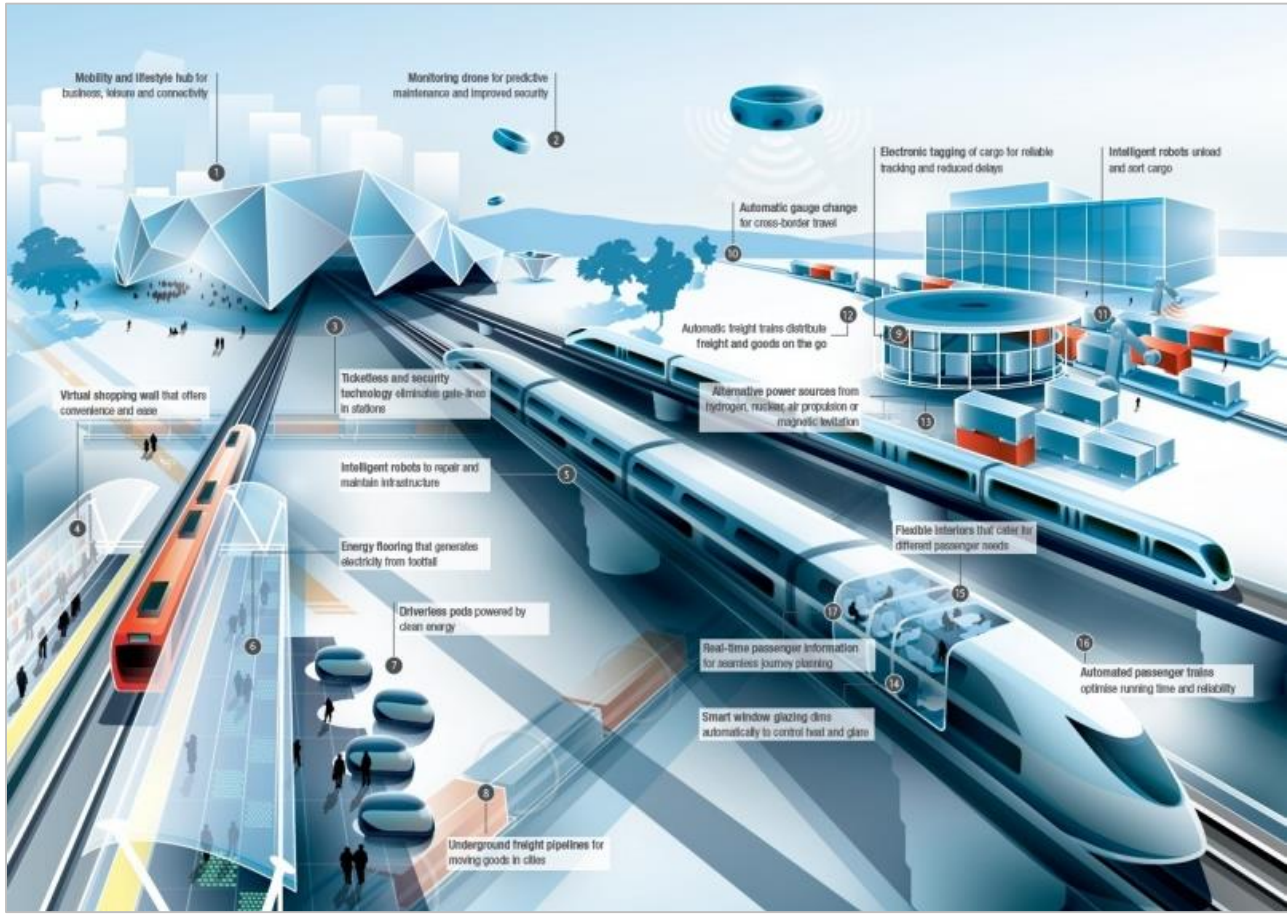
Dr. Claire Blackett Ph.D.

Manager, Dept. Automation & User Monitoring

What does our autonomous future look like?



Autonomous transport systems feature predominantly in predictions for future city development



Images by ARUP

THE FUTURE OF TRANSPORTATION STACK

COMET LABS

SERVICES

ROUTE PLANNING
SPATIAL, CITIViZ, waze, CommuteMaster, X, moovit, Citymapper

PARKING
Waypals, Cloud Parc, Aware, SpotHero, PEARL, seevider, Parko, FenSens, LUXE

CAR HAILING + POOLING
TESLOOP, lyft, RideCell, 滴滴

OTHER: AFTERMARKET, REPAIR, RENTAL
CARVUE, upshift, WRENCH PATROL, zipcar, Getaround, URGENTLY, Tantalum, bitkar

SAFETY & SECURITY

PHYSICAL CAR & DRIVER SAFETY +ACCIDENT DETECTION
drivebetter, splitsecnd, nexar, GUARDIAN Optical Technologies, phrame, SMART AUTOLABS, tourmalinelabs, iproc, eLSys, FORESIGHT

EMOTION, FATIGUE & ALCOHOL DETECTION + DISTRACTION AVOIDANCE
CORTEXLABS, eyeris, ALMAcare, CARMA, saverone, SMART wheel, Radiomize, EASYC, carvi

CYBERSECURITY
CYMOTIVE, cognomotiv, VisualThreat, ARGUS, Olympus Sky, Karamba Security, TrIAlum, Arilou

INTRUSION, TRACKING & RECOVERY
trackrstop, nonda, gmt Connect, ROADEYE, caruma

IN-CAR INTELLIGENCE + ASSISTANCE

VEHICLE DIAGNOSTICS & PREDICTIVE MAINTENANCE + SENSOR-BASED VEHICLE SAFETY
TrueMotion, BRAIQ, IQ, metromile, LIGHT

PASSENGER-FOCUSED SENSORS (INCLUDING USAGE-BASED INSURANCE)
Cartics, Zubie, nauto, SONICLUE, PREDICTSYSTEMS, NEBULA, engie

INFOTAINMENT + DISPLAY
link motion, HUDIFY, CARROBOT, swedspot, OverDrive, ROAV, ICONIC SOLUTIONS, RIGHTWARE, PELAGICORE, CLOUDCAR

PERSONAL / VOICE ASSISTANCE
navideck, AUTOMATIC, dash, GRIN, cariq

NAVIGATION ASSISTANCE + PEDESTRIAN ANALYSIS & COMMUNICATIONS
PERCEPTIVE AUTOMATA, navdy, hudly

AUTONOMY

AUTOMATION SYSTEM
AutoX, drive.ai, POLYSYNC, OXBOTICA, oryx, ARGO AI, AIMOTIVE, PILOT, cruise, nuTonomy, vector.ai, BWV, MOMENTA, cognivue, AIDRIVING

MAPPING, SIMULATION, & IMAGE RECOGNITION / ANNOTATION
ivi, minds.ai, NOMOKO, Mapper.ai, CARMERA, TOMTOM, IMPROBABLE, UDACITY, DEEPMAP, understand.ai, Civil Maps

AUTONOMOUS VEHICLE MAKER + TOOLS
nuro, WAYMO, ZOOX, FARADAY FUTURE

INFRASTRUCTURE + CONNECTED CAR

SENSOR NETWORKING INFRASTRUCTURE (V2V, V2X) - LPWA, CELLULAR, WIFI
DIGIMONDO, SAVARI, ZiFiSense, EVVOS, Actility

CONNECTED CAR - DATA, PLATFORM, SOFTWARE
ACTIVESCALER, INRIX, SPARC, mobiliuz, carvoyant, vinli, otonomo, bright box, VEHICLE DATA SCIENCE, mojio

FLEET + TRAFFIC MANAGEMENT
BESTMILE, synovia, Fleetmatics, Motionlogic, Travel.ai, Automile, Zendrive, GLYDEL, locoNav, Immense Simulations, MOTORWAY BUDDY, mentis, FR, Brisk Synergies

OTA CAR SOFTWARE UPDATION + SMART PHONE ENABLEDTELEMATICS
FIXD, DRIVEBOT, VOYOMOTIVE, ZENE, anyqa

INTELLIGENT MANUFACTURING

NEW/ADVANCED MATERIALS
AQUARIUS, NAWA TECHNOLOGIES, SIRRUS, NANOSTEEL

RAPID PROTOTYPING - 3D PRINTING, MODULARIZATION, OPEN SOURCE
Carbon, nanocore, DIVERGENT, OSVehicle, stratasys, VADER

ADVANCED / AUTOMATED ASSEMBLY LINE
Grabit, SYMBIO, CLEARPATH, ROBOMOTIVE, rethink robotics.

MATERIAL CHARACTERIZATION & TESTING
SynTouch, SASTRA, VIDI, OPTOFIDELITY

ONBOARD SENSORS

LOCATION - GIS, PRECISION POSITIONING, PATH PLANNING
swift NAVIGATION, radiosense, EXO TECHNOLOGIES

VISION / CAMERA
DEEP VISION, Carnegie Robotics, machines with vision, ROADSENSE, DEEPSCALE, Chronocam, VAYAVISION

LIDAR
faceI, INNOVIZ, PHANTOM INTELLIGENCE, VOYAGE, QUANERGY, AEYE, TRILUMINA, LeddarTech, Velodyne LiDAR, STROBE

RADAR
OCULii, TOPOSENS, RFISEE, 6TH SENSE, SDS

SPECIALTY VEHICLES

2-WHEELERS
MOOVIKE, smarthalo, superpedestrian, Zagster

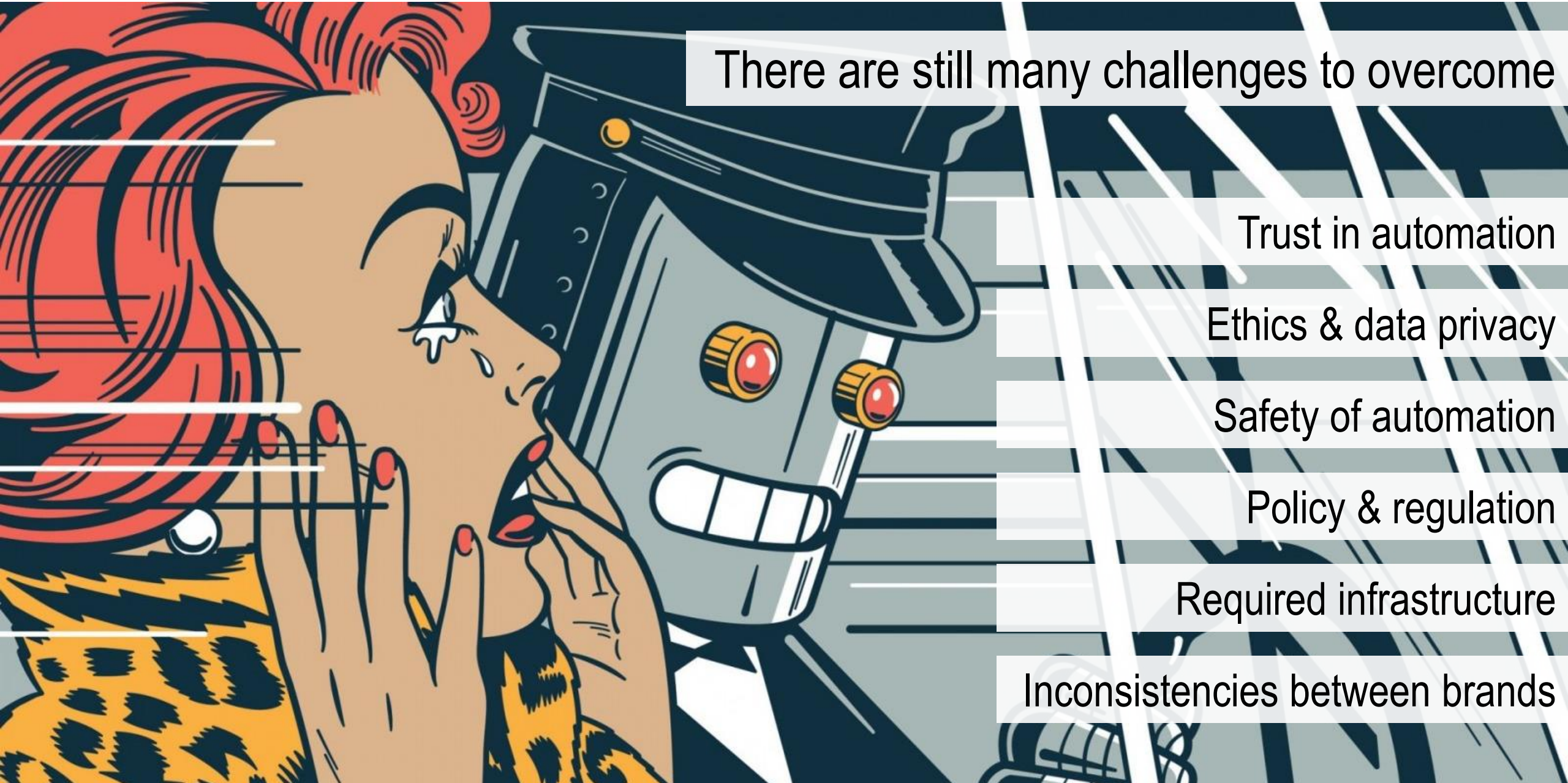
PUBLIC TRANSPORT
navya, Varden Labs, AURO, EASY MILE

TRUCKS / FREIGHT
JAYBRIDGE ROBOTICS, OTTO MOTORS, PELOTON, TESLA, FLEXPORT, TRUELITE TRACE, STARSKY ROBOTICS

FLIGHT
WRIGHT ELECTRIC, ZUNUM Aero, ZEE, JOBY, Kitty Hawk, LILIUM AVIATION, AEROMOBIL

OTHER: HYPERLOOP, PERSONAL MOBILITY
hyperloop one, ninebot, WHILL

https://www.wired.com/2017/05/mapped-top-263-companies-racing-toward-autonomous-cars/



There are still many challenges to overcome

- Trust in automation
- Ethics & data privacy
- Safety of automation
- Policy & regulation
- Required infrastructure
- Inconsistencies between brands

Experts predict another 30-40 years before autonomous cars are commonly seen on our roads

Self-Driving Cars Will Be Ready Before Our Laws Are

Putting autonomous vehicles on the road isn't just a matter of fine-tuning the technology

By Nathan A. Greenblatt

Intelligent Machines

Driverless Cars Are Further Away Than You Think

Don't expect self-driving cars to take over the roads anytime soon. Here's what carmakers are really working on.

by Will Knight October 22, 2013

Self driving cars will NEVER be able to drive in all conditions, the head of Google's Waymo autonomous vehicle unit admits

- **Phoenix-area residents have attacked Waymo's self-driving vans with knives, rocks, PVC pipes and guns, while others have attempted to run them off the road**
- **Nearly two dozen such incidents have been recorded since testing began in 2017**
- **Waymo hasn't gone after the assailants and drivers often don't call the police**

By MARK PRIGG FOR DAILYMAIL.COM
PUBLISHED: 17:37 GMT, 8 January 2019 | **UPDATED:** 20:15 GMT, 8 January 2019

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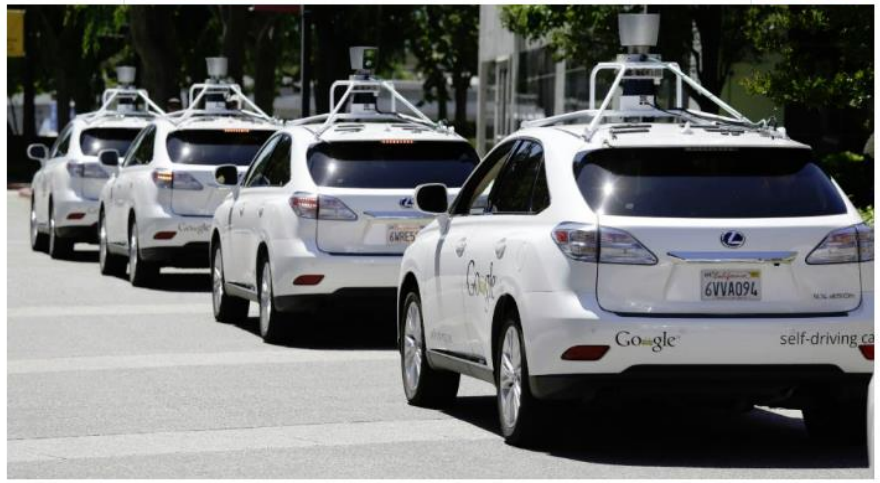
Self driving cars will never be able to drive in the very worst conditions, the head of Waymo has claimed.

He also says that while driverless cars are 'truly here', it will be decades before they are widespread.

https://spectrum.ieee.org/transportation/advanced-cars/selfdriving-cars-will-be-ready-before-our-laws-are
https://www.technologyreview.com/s/520431/driverless-cars-are-further-away-than-you-think/
https://www.dailymail.co.uk/sciencetech/article-6569967/Self-driving-cars-NEVER-able-drive-conditions-Google-self-driving-car-boss-admits.html

Consumers Don't Really Want Self-Driving Cars, MIT Study Finds

May 25, 2017 By Zeninjor Enwemeka



An MIT study finds that consumers are increasingly growing uncomfortable with the idea of fully autonomous cars. Pictured: A row of Google self-driving Lexus cars at the Computer History Museum in Mountain View, California. (Eric Risberg/ AP)

Tech companies and car manufacturers are spending billions to get self-driving cars out on the roads. But it turns out, people don't really want them, according to a new study from MIT.

The study asked nearly 3,000 people about their interest in self-driving cars. Nearly half — 48 percent — said they would never purchase a car that completely drives itself. Respondents said they're uncomfortable with the loss of control and don't trust the technology. They also don't feel self-driving cars are safe.

J.D. POWER Research Car Ratings Ratings by Industry Client Login Global

Hands Off? Not Quite. Consumers Fear Technology Failures with Autonomous Vehicles

< Back

But Drivers of All Ages Embrace Driving Assistance Features, J.D. Power Finds

COSTA MESA, Calif.: 18 April 2017 — With the exception of Gen Y[1], all other generational groups are becoming more skeptical of self-driving technology, which poses a new challenge to car manufacturers and technology developers, according to the J.D. Power 2017 U.S. Tech Choice Study,[SM] released today.

"In most cases, as technology concepts get closer to becoming reality, consumer curiosity and acceptance increase," said **Kristin Kolodge, executive director of driver interaction and HMI research at J.D. Power**. "With autonomous vehicles, we see a pattern where trust drives interest in the technology and right now, the level of trust is declining."

Trust

Safety

Acceptance

https://www.wbur.org/bostonomix/2017/05/25/mit-study-self-driving-cars
https://www.jdpower.com/business/press-releases/jd-power-2017-us-tech-choice-study

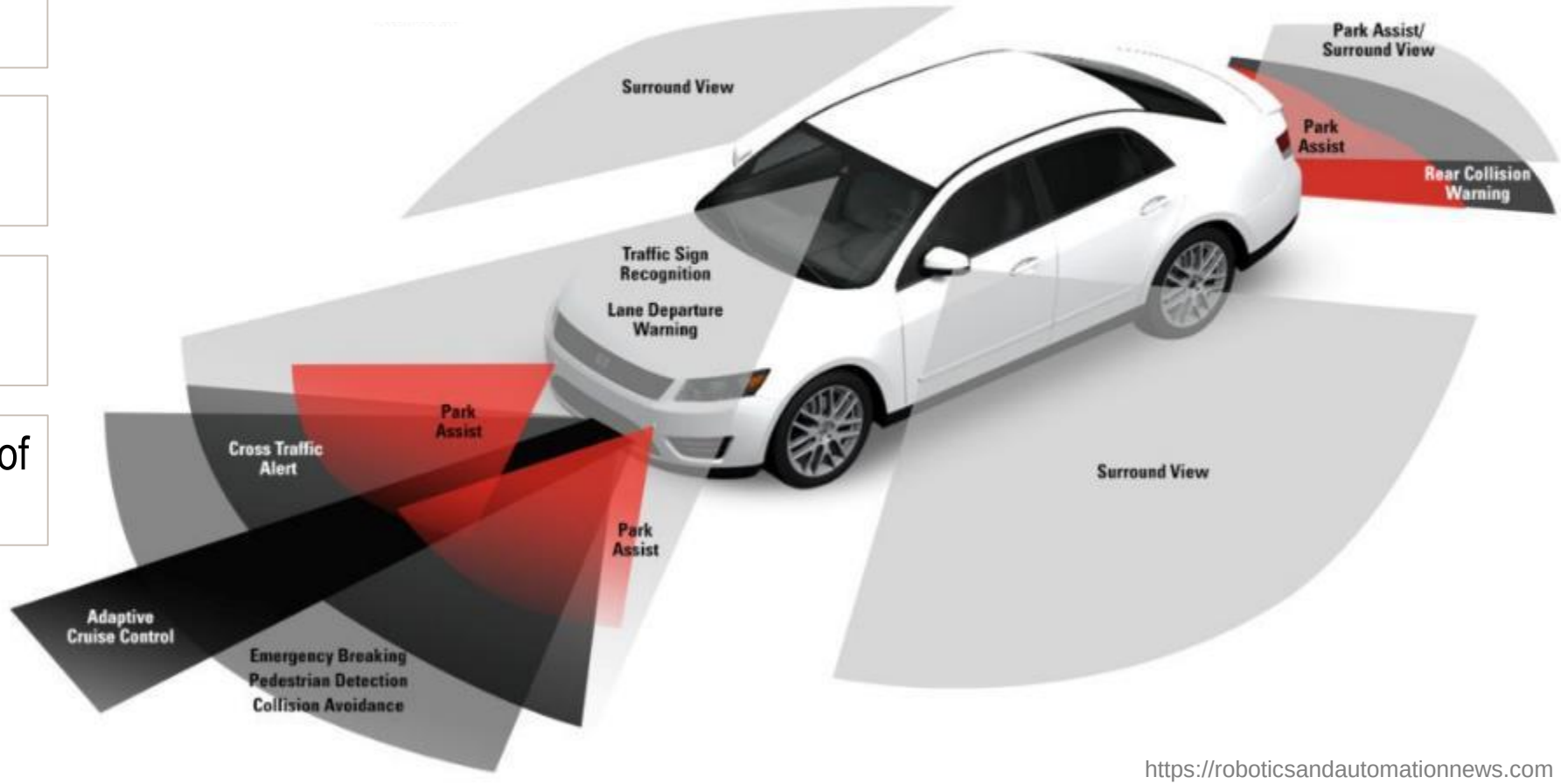
Today's vehicles are increasingly sophisticated and complex

How well do drivers understand the technology in their own cars?

How intuitive are these technologies, especially in extreme circumstances?

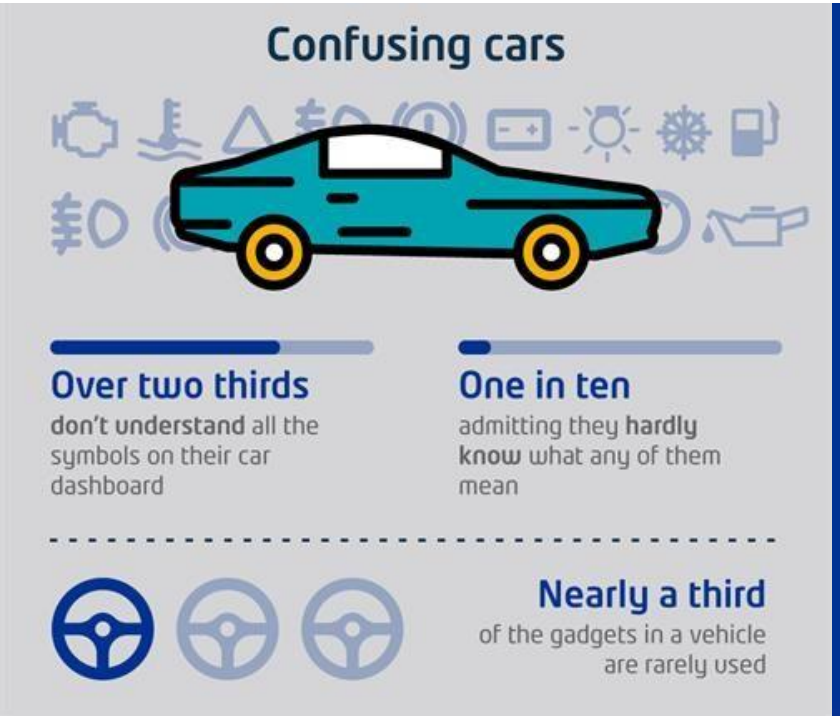
Could new technologies create new, unforseen problems and risks?

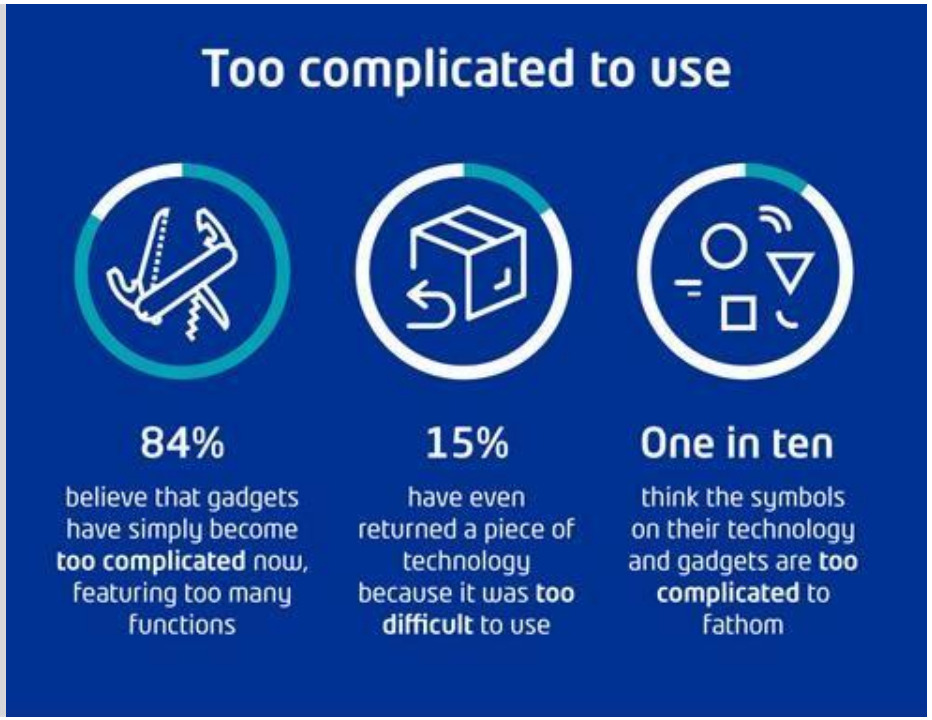
Could this affect people's perceptions of the safety of autonomous transport?



https://roboticsandautomationnews.com

Many people don’t use the technology already available





- Survey by Dacia on 2,000 British adults
- Conclusion that 84% of the population sees technology as «too complicated»

https://drivemag.com/news/car-tech-is-so-advanced-that-people-don-t-use-it-dacia-study-shows

Design intention ≠ human expectation

Case Study 1: The runaway Toyota

- Problems with unintended acceleration of the Toyota Prius as a result of issues with gas pedals, floor mats and brakes.
- One «fix» is to turn off the engine to stop the car.
- Engine power button was designed to operate similar to a computer power button – not intuitive to the average (panicking) driver!

https://www.youtube.com/watch?v=3N22LLJsChA

Design intention ≠ human expectation

Case Study 2: The misunderstood Volvo

- Demonstration of the new pedestrian detection system at a car dealership.
- Driver was not aware that the system was an optional extra, and not installed in this particular car.
- Driver was not aware that the system is not designed to function in this way & his actions overrode the safety feature.

https://www.youtube.com/watch?v=_47utWAoupo

The future may not be completely autonomous after all

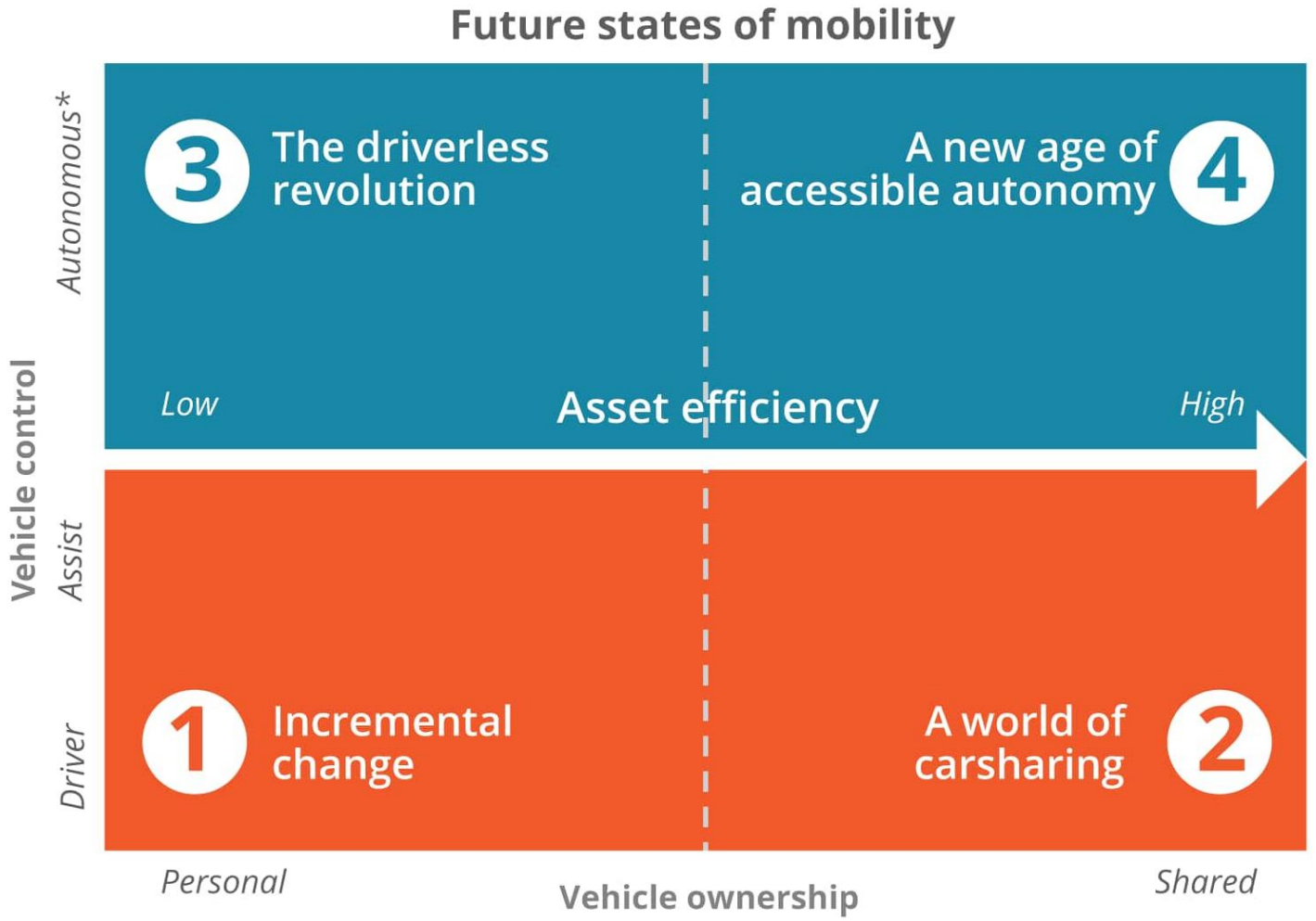
Important to focus on understanding the benefits and limitations of existing technologies

Need to engage all stakeholders to ensure coordination and cooperation in planning and development of future mobility solutions

We must remember the human factor!

- How do people perceive the technology?
- Do people understand the technology?
- How are people going to use the technology?

People's perception of **safety** and their **trust** in technology, as well as their **understanding** of the technology is crucial for success.



https://www.deloitte.com/insights

Boeing 747 Max crash near Bishoftu, Ethiopia on March 20 2019

WERE PILOTS GIVEN ADEQUATE TRAINING?

Short answer: no. When the Max jet was under development, regulators determined that pilots could fly the planes without extensive retraining because they were essentially the same as previous generations, according to *The New York Times*. This saved Boeing a lot of money on extra training, which aided the company in its competition with Airbus to introduce newer, more fuel-efficient airplanes. The FAA didn't change those rules after Lion Air 610 crashed.

So rather than hours-long training sessions in giant, multimillion-dollar simulators, many pilots instead learned about the 737's new features on an iPad. Pilots at United Airlines put together a 13-page guide to the 737 Max, which did not mention the MCAS.

According to *Reuters*, the doomed Lion Air cockpit voice recorder revealed how pilots scoured a manual in a losing battle to figure out why they were hurtling down to sea.

AS THE PLANE PLUMMETED, THE DOOMED LION AIR PILOTS SCOURED A MANUAL IN A LOSING BATTLE

- Changes to the engine design affects flight
- «Fix» creates uncertainty & frustration for pilots
- Extra safety features not installed
- Pilots not adequately trained on new system
- 189 people killed in Indonesia; 157 in Ethiopia

https://www.theverge.com/2019/3/22/18275736/boeing-737-max-plane-crashes-grounded-problems-info-details-explained-reasons

We **cannot** forget the human factor

Image from: https://blog.ferrovial.com/en/2017/08/humans-vs-machines-revolution/

Understanding and evaluating the human perspective is essential for developing safe, useful, usable, trustworthy technology

Institute for Energy Technology

Thank you!

Dr. Claire Blackett

claire.blackett@ife.no