

# Automation

CS489

Shin Yoo

# Which street is safer?



**A**



**B**

**Things that pop up in your head  
when you hear “automation”**



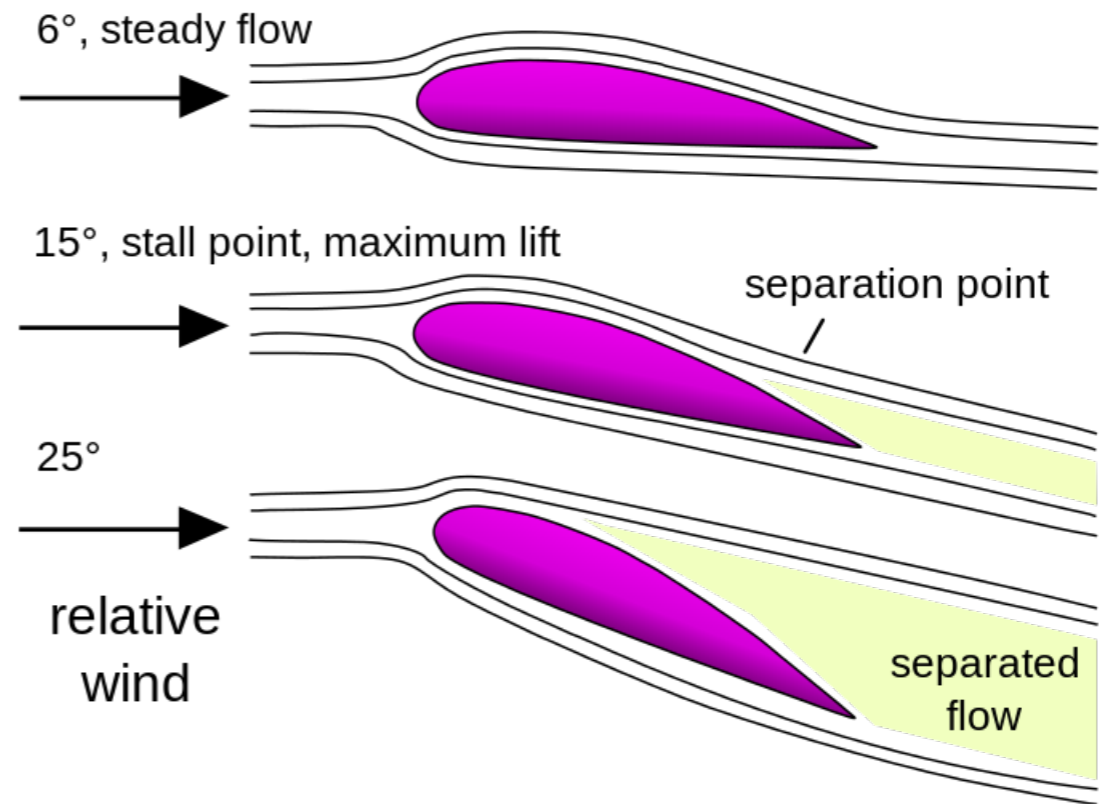
**Air France 447: crashed into the Atlantic on 1st June 2009,  
killing 228 passengers and crews**

# What Happened?

- Three crews: one inexperienced, one recently promoted to become a manager so no longer flying full time, one that had been on holiday and had little sleep
- One of the most advanced aircraft at the time: Airbus 330 - fly by wire system with superb safety record
- Thunderstorms in the Atlantic near equator

# Stall

- In aerodynamics: if the attack angle of your wing becomes too steep, you suddenly lose lift.
  - If an airplane tries to climb too steeply, it will stall and fall down.
- An evasive manoeuvre is actually to dive down, even if it feels like falling down: the plane regains speed, then the wing can generate lift once again.



# Fly-by-wire

- In older planes, the stick's movement is mechanically passed to the flaps and rudders.
- In fly-by-wire system, the stick movement is translated into electronic signal, eventually controlling flaps and rudders.
- Fly-by-wire will eliminate small shakes, and generate signal based on location.



# What Happened?

- Inexperienced pilot wanted to avoid the thunderstorm by climbing up.
- The plane began stalling.
- Due to high altitude, some sensors froze.
- This, in turn, resulted in fly-by-wire system being downgraded (emergency mode, give pilots more control).
- Pilots DID NOT REALISE THIS.





# What Happened?

- System send warning “STALL, STALL”, but pilots probably interpreted this as fly-by-wire trying to prevent STALL: they continued to pull the stick (i.e., climb)
- Later, the plan was hopelessly stalling, to the point that stall sensor gave up reporting the situation as stall. Occasionally, pilots dived down, and this resulted in “STALL” warning being back on! Total confusion on pilots.
- Just before crash, pilots finally realised what was going on, but it was too late to dive, gain speed back, and recover. It crashed.



# Paradox of Automation

- None of the pilots had recently flew without help of automation.
- They got so accustomed to fly using fly-by-wire / correction.
- It never occurred to them that the system was essentially off.

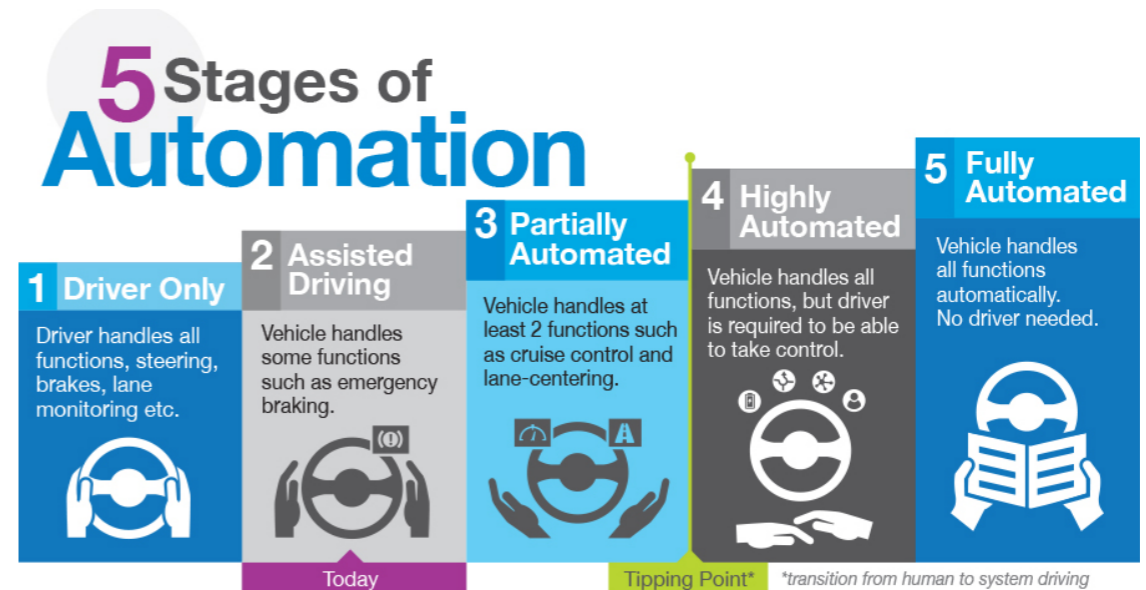


- “Digital devices tune out small errors while creating opportunities for larger errors” - Wiener’s Laws of aviation and human error, Earl Wiener, Aviation Safety Expert
- “Automation will routinely tidy up ordinary messes, but occasionally create an extraordinary mess” - Tim Harford
- Crash: how computers are setting us up for disaster, Guardian Long Read (<https://www.theguardian.com/technology/2016/oct/11/crash-how-computers-are-setting-us-up-disaster>), Tim Harford

- “The rarer the exception gets, as with fly-by-wire, the less gracefully we are likely to deal with it. We assume that the computer is always right, and when someone says the computer made a mistake, we assume they are wrong or lying.”
- “We fail to see that a computer that is a hundred times more accurate than a human, and a million times faster, will make 10,000 times as many mistakes.”
- “Decision experts such as Klein complain that many software engineers make the problem worse by deliberately designing systems to supplant human expertise by default; if we wish instead to use them to support human expertise, we need to wrestle with the system. GPS devices, for example, could provide all sorts of decision support, allowing a human driver to explore options, view maps and alter a route. But these functions tend to be buried deeper in the app. They take effort, whereas it is very easy to hit “Start navigation” and trust the computer to do the rest.”

# Autonomous Driving

- Level 3 can still alert the driver any time to take over.
- Harford: And when the computer gives control back to the driver, it may well do so in the most extreme and challenging situations. The three Air France pilots had two or three minutes to work out what to do when their autopilot asked them to take over an A330 – what chance would you or I have when the computer in our car says, “Automatic mode disengaged” and we look up from our smartphone screen to see a bus careening towards us?



- “When humans are asked to babysit computers, for example, in the operation of drones, the computers themselves should be programmed to serve up occasional brief diversions. *Even better might be an automated system that demanded more input, more often, from the human – even when that input is not strictly needed.* If you occasionally need human skill at short notice to navigate a hugely messy situation, it may make sense to artificially create smaller messes, just to keep people on their toes.”

- Suppose you are a road/traffic engineer. You are sent to a town, because traffic accidents involving children's death occurred recently. You measure the speed of cars driving through the town, and they are indeed driving too fast. What road design fixes would you suggest?

# Hans Monderman

## (1945 ~ 2008)

- A Dutch road engineer, who was actually sent to investigate Oudehaske in mid 80s for the same problem.
- His solution:
  - remove all traffic signs
  - replace asphalt road with red brick, with curves and flush pavement
- Guess what happened?





- “The signs might ostensibly be asking drivers to slow down. However, argued Monderman, *because signs are the universal language of roads everywhere, on a deeper level the effect of their presence is simply to reassure drivers that they were on a road – a road like any other road, where cars rule.* Monderman wanted to remind them that they were also in a village, where children might play.”

# Squareabout, or Shared Space

- Monerman removed all traffic lights from a junction, and turned it into a square.
- Now cars are not protected by the traffic lights: they have to slow down.
- Survey shows locals think it looks dangerous; but the number of accidents has been halved.
- [https://www.youtube.com/watch?time\\_continue=127&v=wn2NfUH0G-Q](https://www.youtube.com/watch?time_continue=127&v=wn2NfUH0G-Q)
- <https://www.youtube.com/watch?v=puj-loPKBh4>





The long read

# Collision course: why are cars killing more and more pedestrians?

For drivers, roads are safer than ever – but for people on foot, they are getting deadlier. Car companies and Silicon Valley claim that they have the solution. But is that too good to be true? By [Peter C Baker](#)

<https://www.theguardian.com/technology/2019/oct/03/collision-course-pedestrian-deaths-rising-driverless-cars>

- “Americans are driving more than ever, more than residents of any other country. More of them than ever are living in cities and out in urban sprawl; a growing number of pedestrian fatalities occur on the fringes of cities, where high-volume, high-speed roads exist in close proximity to the places where people live, work, and shop.”
- “American road engineers tend to assume people will speed, and so design roads to accommodate speeding; this, in turn, facilitates more speeding, which soon enough makes higher speed limits feel reasonable.”
- “More fundamentally, the US is the country in the world most shaped, physically and culturally, by the presumption that the uninterrupted flow of car traffic is an obvious public good, one that deserves to trump all others in the road planning process. Many of its younger cities are designed almost entirely around planning paradigms in which pedestrians were either ignored or factored only as nuisances.”

# Automation hiding little glitches

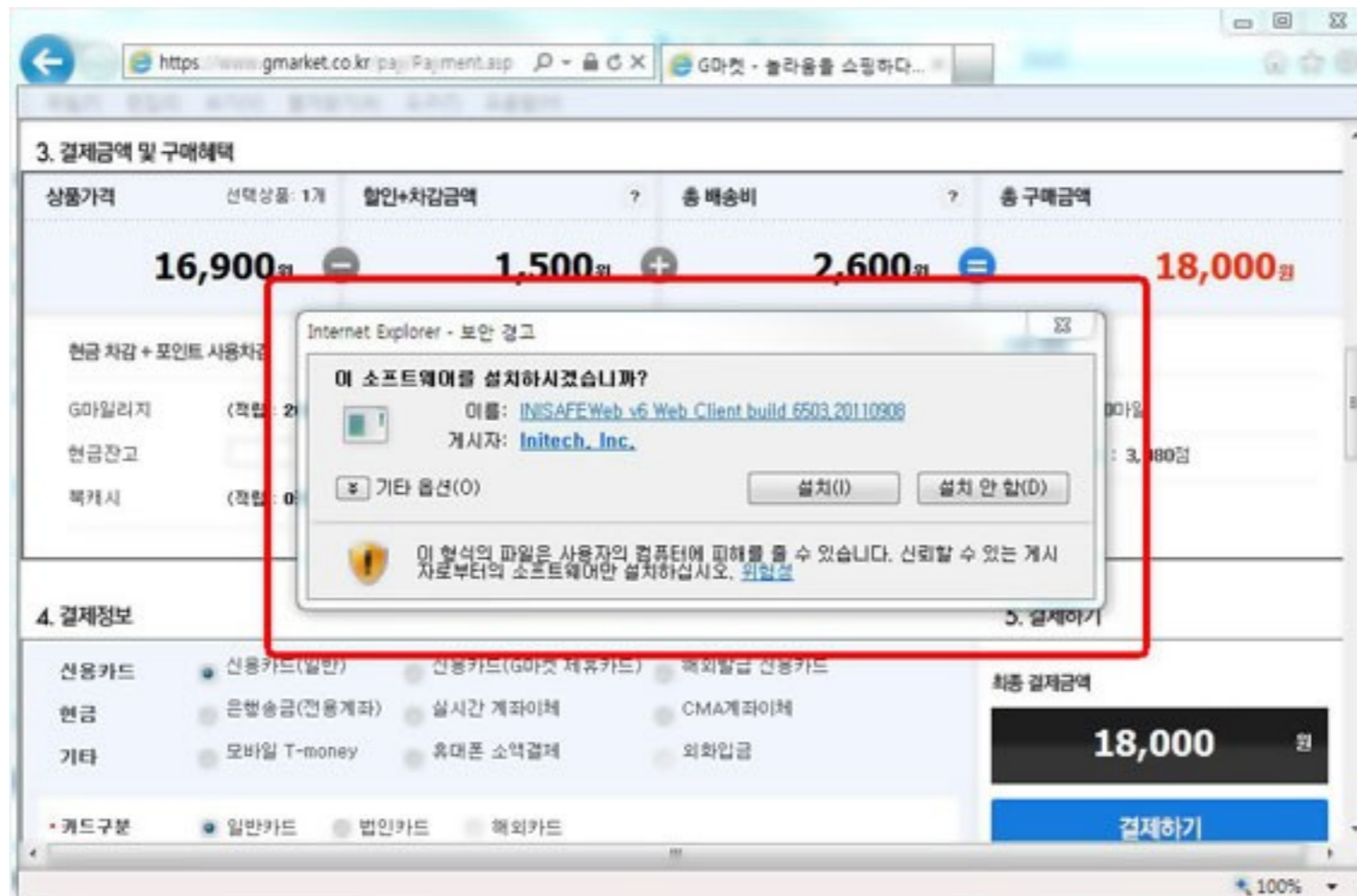
- A special series is running on Guardian: “Automating Poverty”
- AI is being applied to make welfare decisions
  - Efficient and fair?
  - Inhumane and unable to override?



- Lucy Morris, a 32-year-old mother of one in Rochdale, was scraping by on her beauty therapist's wage topped up with UC when she failed to check a box on the benefit's online form and lost a £400 payment.
- Mark Abraham, a married father of twins in south London, was denied a month's benefits because an automated system linking salary data from HMRC with the Department for Work and Pensions misreported his previous income from a TV production job. *He showed wage slips that proved the pay was reported wrong, but jobcentre staff could do nothing.*
- (India) Motka Manjhi paid the ultimate price when the computer glitched and his thumbprint – his key into Aadhaar (personal identification number) – went unrecognised. His subsistence rations were stopped, he was forced to skip meals and he grew thin. On 22 May, he collapsed outside his home and died.

# It is not just automation.

- Any repetition that desensitise you and puts you on autopilot can be equally bad, I claim.



# Concluding Thoughts

- Is it more ethical to make your system completely fool proof?
- If total autonomous driving is possible, it is also desirable?