



Move fast and don't break things

Examining the inherent tension between Healthcare and Technology

About the author

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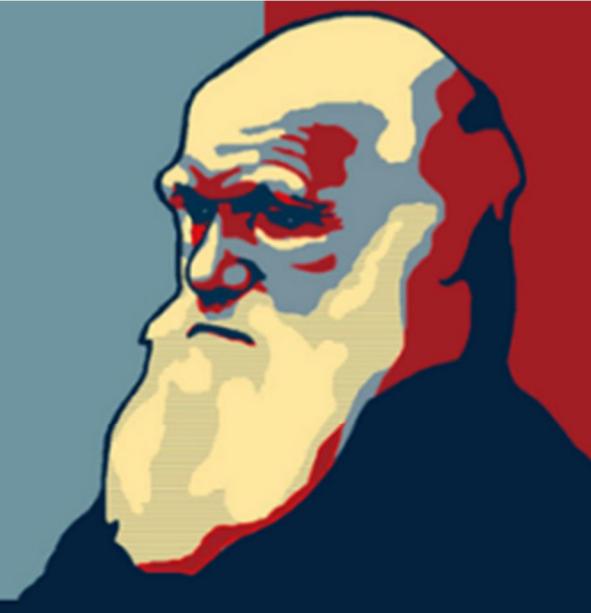
About the series

This series of insight papers reflect the insights and lessons learned from working with technology in healthcare. They are based on experience of real-world delivery of technology and lessons learned. The series of papers range from broad national level problems to specific technology challenges within healthcare systems.

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I do not fear
COMPUTERS
I fear a lack of them



VERY GRADUAL
CHANGE
WE CAN BELIEVE IN

Move fast and don't break things

Back in the old pre-COVID days of February 2020 We gave a talk at [Innovation Martlesham^{\[1\]}](#) about Edge computing and the UK National Health Service ([NHS^{\[2\]}](#)). We were reminded of this again when seeing the disappointing news recently that use of an obsolete version of software caused yet another incident in healthcare that impacted care delivery.

There is an inherent tension between healthcare and technology and their respective pace of change. This can be thought of as the interplay of Healthcare's "do no harm" and technology's "move fast and break things" philosophies.

Healthcare - Do No Harm

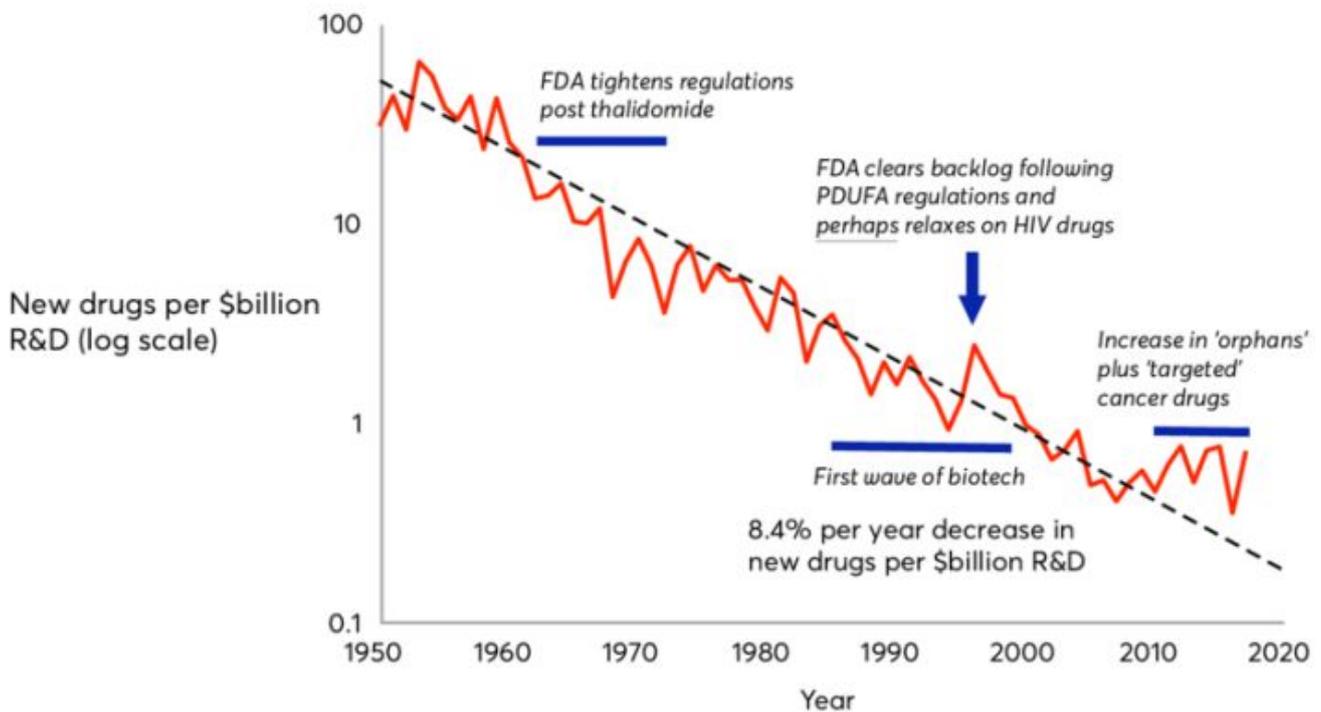
There is a reason that change in healthcare moves slowly. **Gradual change is good.** In healthcare we need to be sure. You want to do no harm. This gradual change is simply a reflection the pace of medical research, drug discovery & clinical practice improvement.

All therapies need to be tested for effectiveness and drugs usually take between 10 and 15 years to pass clinical trials. You can't rush good medical science.

"In healthcare, gradual change is good."

But, as standards and regulation improve and older drugs are de-commissioned, healthcare is now living in the era of [Eroom's law^{\[3\]}](#). This is an observation that drug discovery speeds halve and costs double every 9 years.

To put this gradual change it into perspective, there have been no new **classes** of [antibiotics discovered^{\[4\]}](#) since the 1980s. Remember with medicine, gradual change is good and do no harm.



Eroom's law – Drug discovery speeds half and costs double every 9 years



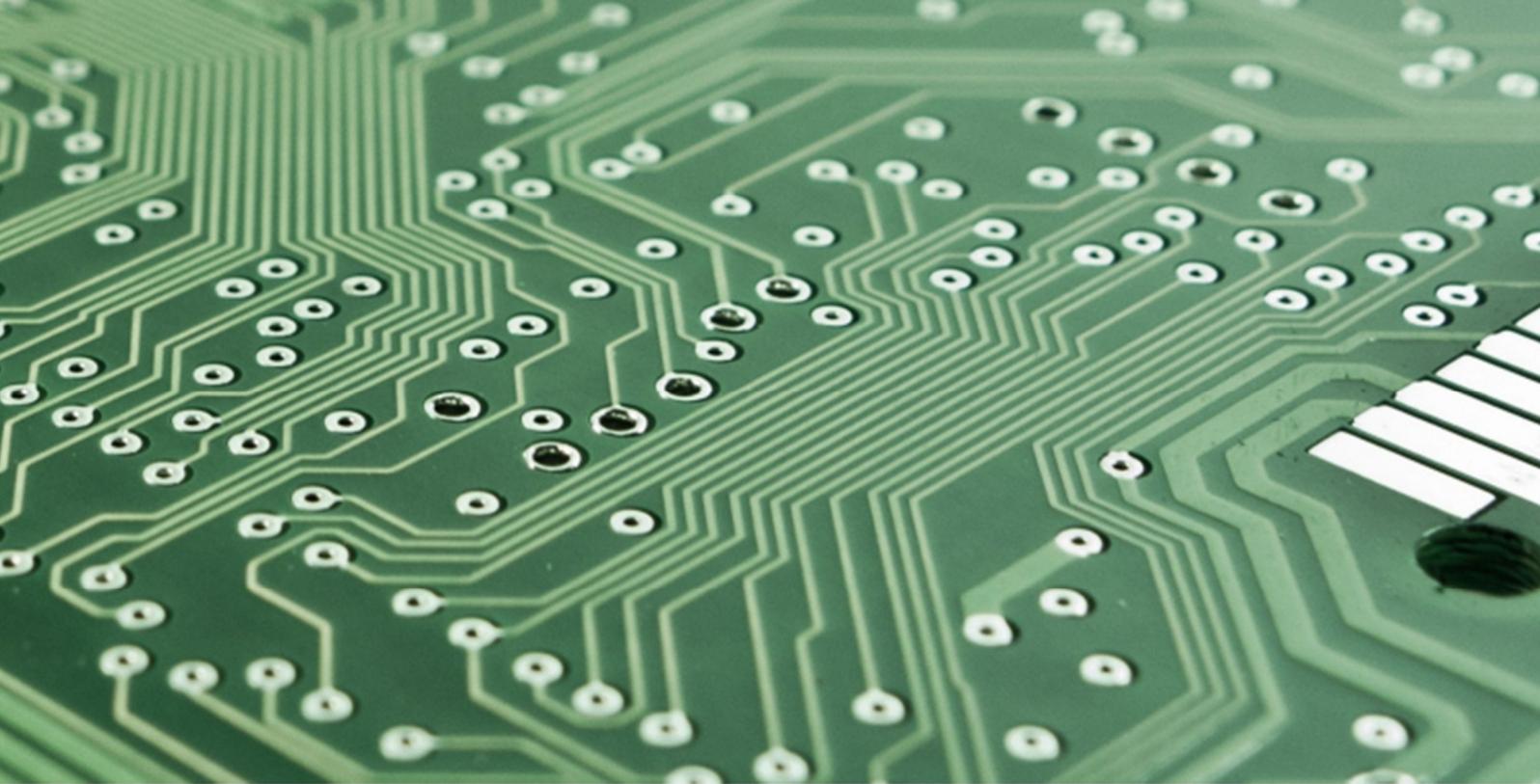
Along comes COVID-19

Healthcare's [global response^{\[5\]}](#) to the COVID-19 pandemic smashed Eroom's law, and proved that healthcare can move fast without compromising *patient safety* or *scientific rigour* when required.

The creation of the many current vaccines in record time is a testament to the scientists, clinicians and international co-operation to rise up to a serious global challenge while simultaneously maintaining clinical standards. With Eroom's law being demoted to an axiom, this gives hope that healthcare can move fast.

"There has been a surge in patients' uptake of remote health services"

Nuffield Trust



Technology - Move Fast

Technologists love to show [Moore's law^{\[6\]}](#), which drives the possibilities of computer technology. This is the observation that transistor density on a computer chip doubles roughly every 2 years. Software bloat aside, it means compute power (and to a similar extent network bandwidth and storage capacity) doubles every 2 years.

All computer technology power and capacity increases stem from this exponential improvement. This has allowed software to develop techniques that were impossible or prohibitively expensive even just a few years ago.

The explosion in AI in healthcare for example is more a consequence of cheaper data storage and increased compute power rather than any fundamental change in the underlying mathematics or algorithms. Moore's law's has facilitated the triumph of data over algorithm in the AI space.

With the fast pace of technology bringing ever more systems and tools, this also means technologies and software products come and go at a fast pace. Technology is always being replaced by something better, faster and invariably cheaper.

"In technology, gradual change is bad."

For technology, gradual change means technical debt and product obsolescence. Obsolescence is actively driven out of technology markets. The cost of disruption is lower in technology than in healthcare and also implies lower barriers to entry in the technology industry.

```

5 abort('The Rails environment is missing: <code>rails</code>')
6 require 'spec_helper'
7 require 'rspec/rails'
8
9 require 'capybara/rspec'
10 require 'capybara/rails'
11
12 Capybara.javascript_driver = :webkit
13 Category.delete_all; Category.create
14 Shoulda::Matchers.configure do |config|
15   config.integrate do |with|
16     with.test_framework :rspec
17     with.library :rails
18   end
19 end
20
21 # Add additional requires below this line.

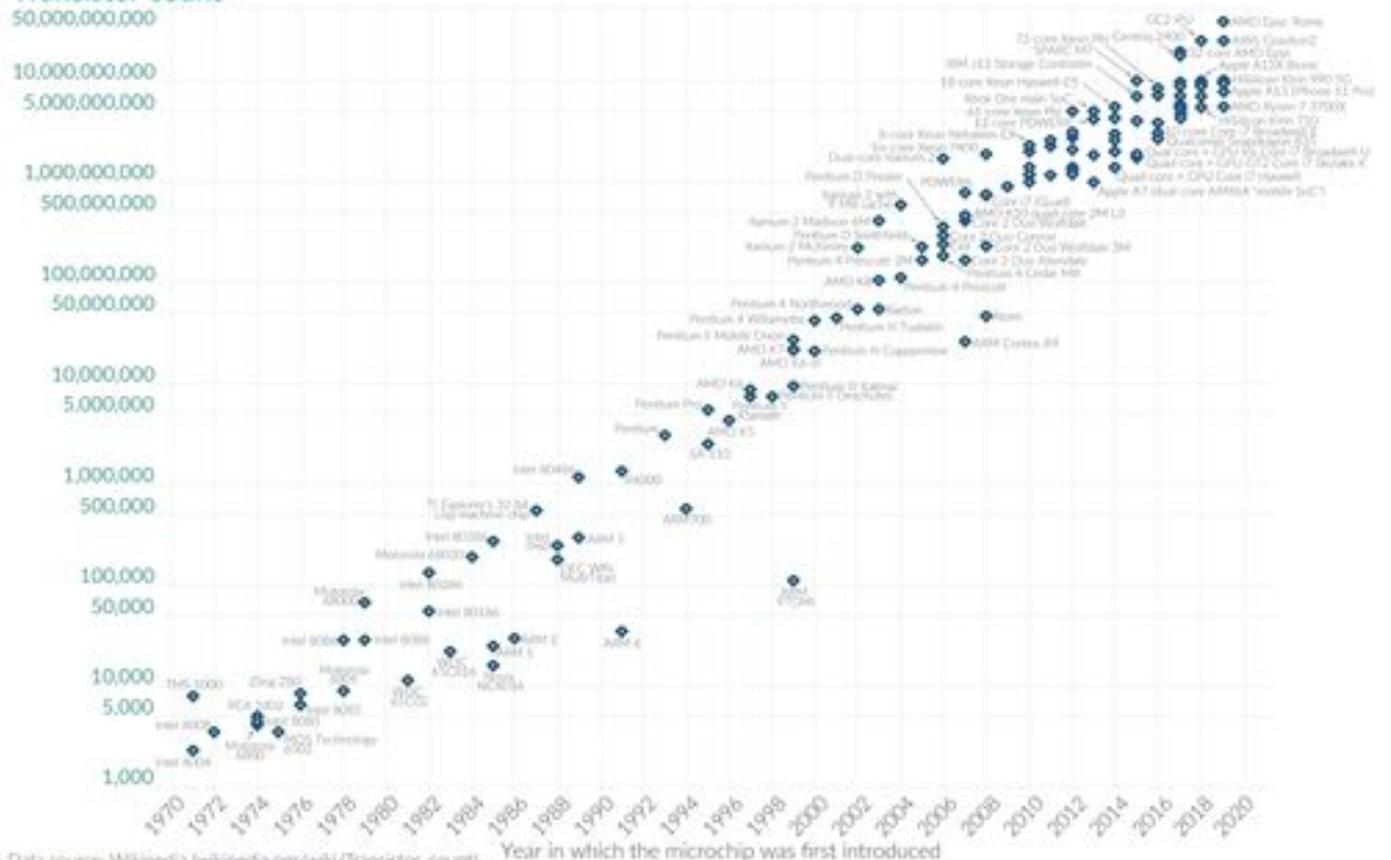
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Moore's Law: The number of transistors on microchips doubles every two years



Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important for other aspects of technological progress in computing - such as processing speed or the price of computers.

Transistor count



Data source: Wikipedia ([wikipedia.org/wiki/Transistor_count](https://en.wikipedia.org/wiki/Transistor_count))
 OurWorldInData.org - Research and data to make progress against the world's largest problems. Licensed under CC-BY by the authors Hannah Ritchie and Max Roser.

Moore's law – Computer power doubles every 2 years



And therein lies the tension. Technological progress works on a timescale of **months** while healthcare innovation operates on **years**. The use of technology in healthcare will only increase and therefore short-timescale obsolescence has to be addressed in care provision. As a general rule, the timescale for technological obsolescence is very short compared to medical science and what healthcare is used to. Typically it is:

- 3-5 years for hardware
- 6-8 years for software

The most obvious examples of obsolescence in technology are:

- Lack of replacement hardware (floppy disk anyone?)
- Ignored exposure to known security risks (WannaCry, Colonial Pipeline?)
- Continued use of now obscure protocols & file formats that no longer interoperate with other systems (perpetuating silo'd care delivery)

- Lack of now common and expected functionality that was unavailable initially but is now standard practice (still fit for purpose?)
- Lack of technical support from original hardware and software vendors (Windows XP?)

Now this might seem like an academic list of remote possibilities but obsolescence is cumulative in complex systems and everything will seem fine...right up until it isn't.

“How did you go bankrupt? Two ways. Gradually, then suddenly.”

Ernest Hemingway

The hard truth is that **all the above have occurred in healthcare**^[7,8] and put patient lives and care delivery at risk. With healthcare technology, being a laggard has serious consequences.



Towards a consensus

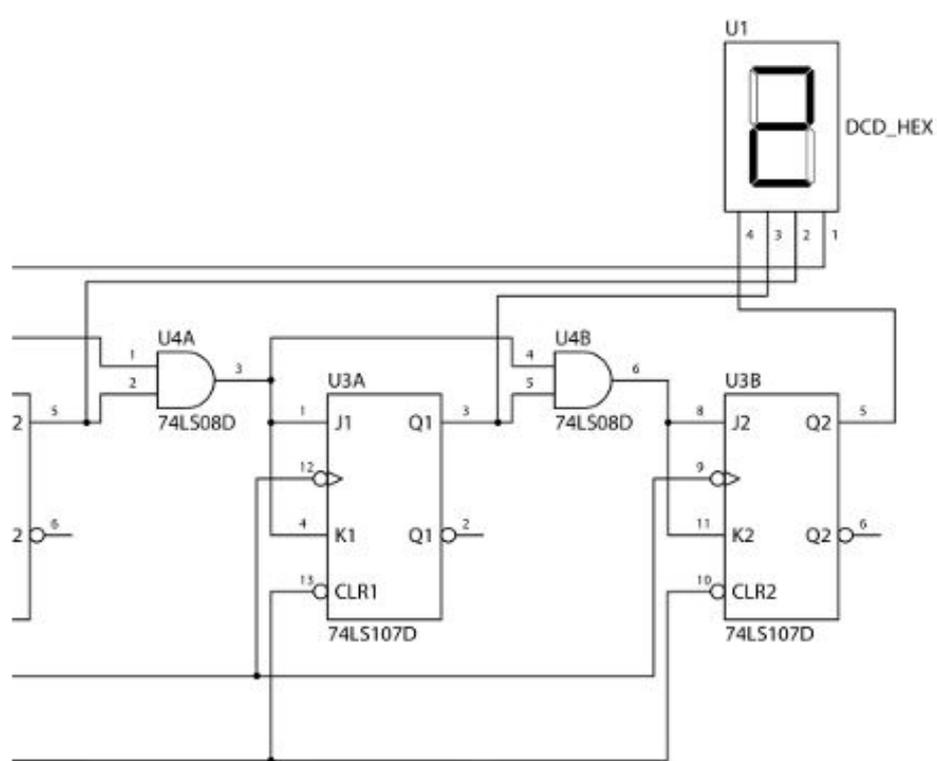
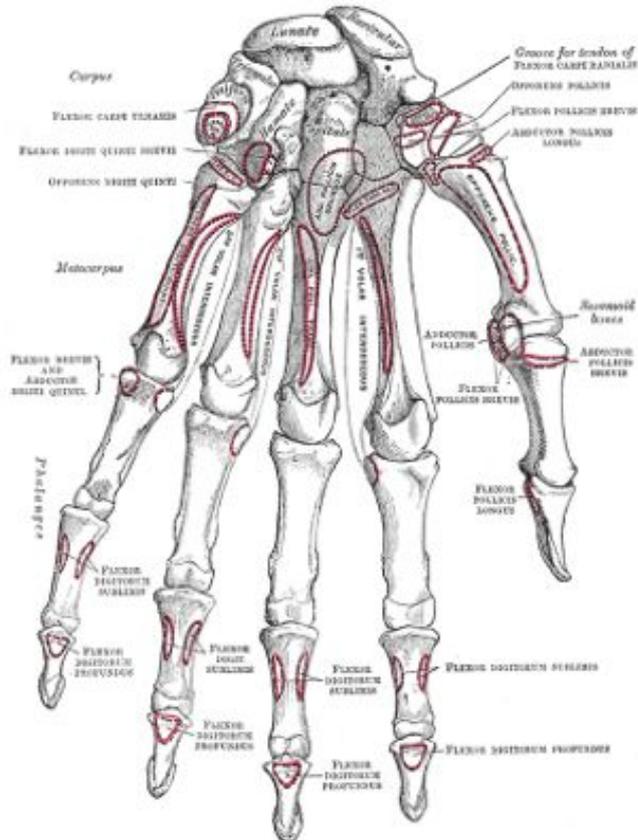
We have heard many times from healthcare professionals that they are “*different to every other industry*” when it comes to technology, that failure means patient death. While undoubtedly true that the results of technology failure in healthcare are extremely serious. We contend that **technology obsolesce in healthcare is just as serious**. Citing patient risk or privacy should not be an excuse for failure to implement healthcare innovation and eliminate technical debt.

Technologists also see this as a blunt instrument to maintain entrenched positions by incumbents, reinforcing barriers to entry and ultimately hinder innovation and ossifying care [pathways^{\[9\]}](#).

"The most damaging phrase in the language is 'We've always done it this way'."

Grace Hopper

The COVID-19 response by many healthcare systems showed drug discovery and clinical science at its finest. It also showcased how technology stepped up to implement remote care to non-COVID related healthcare delivery. In fact the pandemic has accelerated the use of technology in Primary & Acute care and we should not revert back to the old ways of doing things once this pandemic has subsided.



During this pandemic, technology has given us a hint at how **efficiency gains are possible** in the delivery of care. These efficiency gains should not be discarded and will be instrumental in maintaining universal healthcare in countries with an ageing population. Demographic pressures demand extreme efficiency gains in the near term to **maintain current levels of healthcare delivery** in national health systems. Technology will provide these efficiency gains that are needed to keep universal health systems sustainable.

"A crisis is a terrible thing to waste"
Paul Romer

Technologists and Healthcare professionals need to recognise that times have changed. Post COVID-19, there is no going back to the old ways of doing things. Technologists must realise the end user (patient) can't be rebooted if things go badly wrong. **This is mission critical^[10] technology in every sense of the word.**

Likewise healthcare must realise that people other than doctors and nurses are **now critical in the direct provision** of care. To deliver care that is fit for purpose in the 21st Century, clinicians and technologists need a **"move fast and don't break patients"** consensus.

Further reading:

- [1] - Innovation Martlesham <https://www.innovationmartlesham.com/>
- [2] - NHS the UK's universal healthcare system <https://www.nhs.uk/>
- [3] - Eroom's Law https://en.wikipedia.org/wiki/Eroom's_law
- [4] - <https://wellcome.org/news/why-is-it-so-hard-develop-new-antibiotics>
- [5] - <https://www.medicalnewstoday.com/articles/how-did-we-develop-a-covid-19-vaccine-so-quickly>
- [6] - https://en.wikipedia.org/wiki/Moore's_law
- [7] - <https://www.nature.com/articles/s41746-019-0161-6>
- [8] - <https://www.england.nhs.uk/wp-content/uploads/2018/02/lessons-learned-review-wannacry-ransomware-cyber-attack-cio-review.pdf>
- [9] - <https://www.healthcareitnews.com/news/eric-topol-ehrs-have-taken-us-astray-ai-could-fix-healthcare-meaningful-and-positive-way>
- [10] - <http://www.harold.thimbleby.net/killer.pdf>