Learn from the mistakes of others...
...you won't live long enough to make all of them yourself.

Alison Lloyd
Introduction

• About me

• Aims of the talk
  – Case studies
  – Slides will be simple (mostly)

• Please ask questions!
  – Technical discussions welcome in the bar
Study 1: Oral Rehydration Salts (ORS)
Diarrhoea kills approximately 580,000 children per year, world-wide – 9% on average (Unicef)

Before 2000, over 1.2m deaths per year in under-5s

Percentage of deaths in under-5s attributed to diarrhoea
Oral Rehydration Salts (ORS)

- Basically a mixture of salt and sugar to be added to water
- Used as treatment for people suffering severe dehydration
- Based on research in the 60s:
  - Glucose-sodium co-transport mechanism
- Entered wide usage in the 70s
Disease statistics

- Only 30% to 40% of children under 5 with diarrhoea treated with ORS
- Improvement in numbers has stalled since 2000
- Better coverage in urban areas
- Better coverage among wealthy
ORS Usage

Percentage of under-5s with diarrhoea treated with ORS

Sub-Saharan Africa: 38% Urban, 31% Rural
Eastern and Southern Africa: 43% Urban, 36% Rural
West and Central Africa: 36% Urban, 36% Rural
Middle East and North Africa: 39% Urban, 31% Rural
South Asia: 39% Urban, 39% Rural
East Asia and Pacific*: 47% Urban, 44% Rural
Latin America and Caribbean: 52% Urban, 45% Rural
Least developed countries: 46% Urban, 40% Rural
World*: 41% Urban, 33% Rural
Improvements...

- Very successful program in Bangladesh
  - Used women to go out into rural areas
  - “...Good water, a litre, pinch of salt with a fistful of gur...” - Bangladeshi postmark, 1993

- Using the Coca-cola distribution network

- Unicef numbers show some improvements recently
Thoughts

• Sometimes clever, qualified people get it wrong
• Learn from what works
  – Bad practice or ignorance?
• Consider the whole problem
  – No such thing as a simple problem
• “Take the science to the problem”
Study 2: Altimeters
Internal workings

Aneroid wafers

1,000 ft. pointer

100 ft. pointer

10,000 ft. pointer

Static port

Crosshatch flag
A crosshatched area appears on some altimeters when displaying an altitude below 10,000 feet MSL.

Barometric scale adjustment knob

Altimeter setting window
Analogue altimeters

• 'Modern' 3-needle altimeter introduced around 1935
  – Early versions in aviation use around 1913
• Electronic versions using servos in use in 60s
• Accurate to within +/- 80 feet
• ...but UX has stayed roughly the same throughout
  – Various attempts to make them harder to misread
  – Still prone to misreading, especially under stress
What happens when altimeters are misread?

• Maybe nothing...

• United Airlines flight 389, 16 August 1965, Lake Michigan – no survivors, 30 fatalities

• BOAC G-AOVD, 24 December 1958, Dorset – 3 survivors, 9 fatalities

• 'Human factors' / Controlled Flight Into Terrain (CFIT)
So what can we do?

- Addition of cross-hatch area
- Addition of rotating numerals
- Updated procedures to require cross-checks of altitudes
- Require 2 pilots for (commercial) IFR operations
- Train pilots to beware of errors

OR...
Improve the UI!

AW139 Primary Flight Display (PFD)
Improved UI – A320 PFD
Thoughts

• UI matters!

• Consider the users of your system
  (Please, please, please...)

• Consider the worst case scenario your system will be used in
Study 3: Early commercial helicopter ops
Helicopters at work

● First commercial operations in late 1940s
  – Crop dusting, whaling, ferrying
● Most pilots were ex-military, trained in WW2

● Vietnam war (1955 – 1975) – first major use of attack helicopters
● Boom in commercial operations in '70s on back of demobbing pilots
Risk factors

- Military flying is very different from commercial flying
- Many helicopter operations were in remote areas
  - Logging in Canada
  - Whaling / tuna boats
- 'Getting the job done'
- Commercial pressures
Result
What went wrong?

- “Rule 43: If you do something stupid and it works, it's still stupid and you're lucky.” - Howard Taylor, Schlock Mercenary

- Swiss cheese theory of accident causation

- Ignoring the risk factors because “everyone knows...” or “he did it and was ok...”

- Rebels without a clue

- Modern operational safety required a change in mindset
Thoughts

- Humans are really bad at risk assessment
- People are better at risk assessment when they understand the risks
- It's not enough to design safe systems, you have to allow for human operators
- In technology, the human aspect is at least as important as the technical ones
More about people and stats
I heard this song...

- What do you expect to happen when you press 'shuffle' on a music player?
  - Actually random vs. 'perceptively' random
- Fisher-Yates algorithm
Spotify

• People are bad at stats...
• ...but very good at pattern recognition
• Also not bad at making stuff up
• Spotify adjusted their shuffle algorithm in 2014 to produce a more 'human-friendly' random shuffle
Study 4: UI part 2 - changes
What happens when UI changes?

• Users complain
• Some users will leave
  – ...if they can
• Most people care more about what changed than why it changed
• Two case studies:
  – MS Office (ribbon UI)
  – Firefox (Australis)
MS Office ribbon

To
MS Office ribbon

- In many ways, a good example of change
- Changed for the right reasons
  - Users had problems finding stuff, found the UI overwhelming
- Lots of user research and serious thought and effort went into the redesign
  - Multiple trials and discarded possibilities
MS Office ribbon - results

• New users are fine
• 'Basic' and casual users generally happier, once they get used to new design
• Power users generally unhappy
  – ...until they get used to it
• Hard to get a clear idea of number of users, but MS suggest 1 in 7 computer users now use Office, with numbers continuing to increase
Firefox

• Release 29 made numerous changes to browser look (Australis UI)
• Many changes were minor, but some major
• Many previously-available settings and customisations no longer available
• Much wailing and gnashing of teeth
Firefox post-release

• Plug-in to return most aspect of UI to old look was made available
• Public clashes and general snottyness
• Many users felt forced into the changes
• “It took me an hour to fix this...”
• Most reactions were emotional rather than intellectual
Firefox Australis - results

- Continued loss of market share
  - Approximately 1% drop with v29
- Anecdotal evidence that many people disabled automatic updates
- General negativity surrounding Firefox community
Thoughts

- Change is hard
  - Users grow attached to the familiar
- When changing UI, be prepared for emotional fall-out
- Gradual vs. sweeping change
- Here be dragons...
Other UI change examples

- Windows 8 Metro
  - Changing UI for wrong reasons?

- Every time Facebook changes something...

- ...or Google does...

- ...etc...
Study 5:
Getting the engineering right
Concorde

- Developed by joint French – British team
- Amazing feat of engineering
- First commercial aviation use of:
  - Fly-by-wire engines
  - Digital computer control of critical systems
  - Carbon brakes
  - Hybrid circuits
- “…an absolute delight to fly, it handled beautifully.” - John Hutchinson, Concorde Captain
Engineering problems solved

• Very fine control required on engine intake
  – Digital processors controlling intake ramp

• Heating issues
  – Novel heat sinking (fuel), reflective paint, testing, visor

• Possible radiation due to altitude

• Visibility at landing and take-off
  – Droop nose
Outcome

• Concorde proved an economic loss
• Retired in 2003 after 27 years of commercial operations
• Uneconomical to maintain
• Higher fuel costs, 11 September 2001 downturn
• Competition from subsonic airliners in first class
• Big advances in numerous fields as a result of Concorde program
Thoughts

- With sufficient effort (and money), solutions can be found to almost any problem
- ...but really good engineering isn't enough on its own
- Projects have to be technically AND commercially successful
  - ...and one doesn't guarantee the other
Ultimately...

It's all about people!
Coda

“Nothing is truly idiot proof because idiots are so ingenious” - unknown
The decompressing dive computer
Health and safety at work