

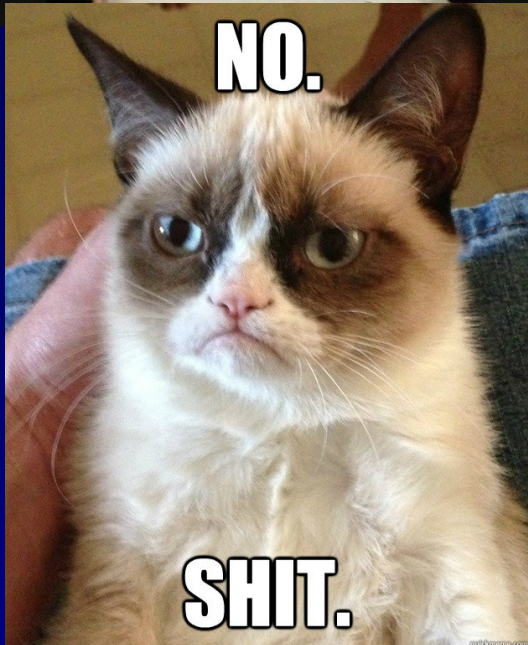
“Murphy, Murphy, Murphy...”: IT, risks, and ergonomics

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Once upon a time...

- ... in the first year of IT College, there was a course titled “Risk and Safety Management” ...
- ... that drove the students nuts
- So they started to yell and throw things at the prof (well, not really – but they were profoundly pissed)
- So the course got replaced with this one here
- In 2008, another prof (who had been a student back then) held the anniversary speech - and said something like “Howdy guys – remember how we had to measure the height of the damn stool?”

Erm...



- The course dealt with important issues – but failed to convey the importance in the IT context
- When a plane hits a skyscraper, it is a disaster. When a server goes down, it is “some IT geek problem”...
- ... but what if the server went down and **CAUSED** the plane to hit that building...?
- IT risks form a wide circle of issues, only a part of them are purely technological. And even “the height of that damn stool” may well play a role

PIBKAC (and not only in IT)

- Technology evolves at a great speed (e.g. Bugatti cars)
- Problem 1: The humans are not much wiser than before
(Ex: a 2022 Bugatti Mistral + a 0.5l whisky + a concrete wall)
- Problem 2: Ubiquity breeds dependency and vulnerability (e.g. 9/11)
- Problem 3: Let's quote a classic again...

Repetition is the key... (to what?)

"A flying saucer creature named Zog arrived on Earth to explain how wars could be prevented and how cancer could be cured. He brought the information from Margo, a planet where the natives conversed by means of farts and tap dancing.

Zog landed at night in Connecticut. He had no sooner touched down than he saw a house on fire. He rushed into the house, farting and tap dancing, warning the people about the terrible danger they were in. The head of the house brained Zog with a golfclub."

- Breakfast of Champions by Kurt Vonnegut

The Art of Risk Reduction

- Never at zero (says Mr Murphy)
- Risk management – historically a mix of environmental issues and workplace safety
- In IT: tech + human factors (human factors engineering) – but also connects to the large area of HCI (human-computer interaction)
- Note: the more widely a technology gets adopted, the more important the human aspects become!
- Ergonomics: Greek *ἔργον*, "work", plus *νόμος*, "natural law"
- Much in common, some specific features

An important factor

- Time – or lack of it
- Learning is a major reducer of risks, but it takes time
- Haste is a major risk factor (in almost every field)
- Is also an enemy of learning!
- More Greek: σχολή (*skolē*) <= “school” (source of learning!)
- original meanings “leisure” and “pastime” (something done in leisure time, outside work)
- essentially, having control over one’s time
- difference between free people and slaves

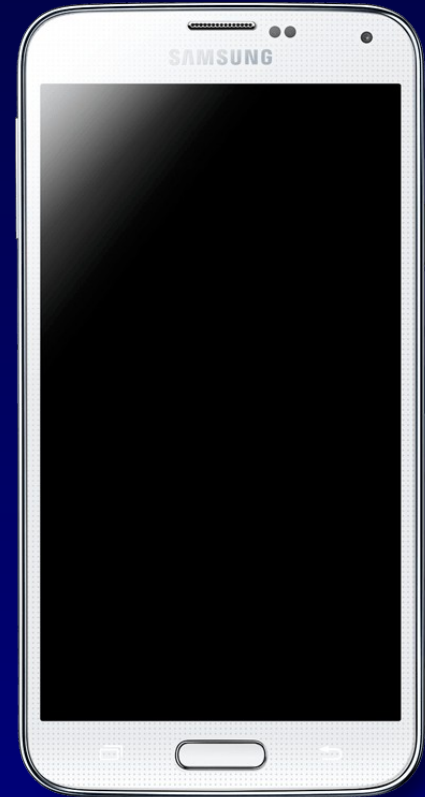
IT risks

- everything about electronic/online elections - the infamous Diebold machine in the US, the first years of Estonian e-elections having been "Microsoft exclusive" (the software only worked on IE) etc
- the world of social engineering and online scams
- exposure of directly dangerous information (bomb-building instructions, torture/murder techniques etc)
- malware
- cyberwar and terror in its many forms
- ...

Comfort

- Ergonomic furniture is comfortable (functional, durable and aesthetically pleasing)
- So are ergonomic clothes (fit the person well, use quality materials)...
- ... and ergonomic IT (easy to learn, well-documented, unambiguous)
- NB! This is often just what is needed to reduce risks!

How to use a computer (different ages)



Source: Wikimedia Commons

Aspects of ergonomics

- **Physical** – adjusting the object according to the features of human body, e.g. height of chair, shape of the mouse
- **Cognitive** – considering the processes in human brain (perception, memory, attention, stress, decision-making), e.g. traffic signs, alarms, user interfaces in IT
- **Organizational** – involving various aspects of human cooperation, e.g. communication, staff management, quality control, telework, e-learning...

A human-machine system

- Which ones can be counted as one?
 - A cyborg
 - An Internet addict, 24/7 online
 - Auntie Tilly, uses a PC ½ hours a day, needs help with inserting a memory stick
- Correct answer: all three
- Risks are different, yet exist in all cases!

“Stop, the light went red!”

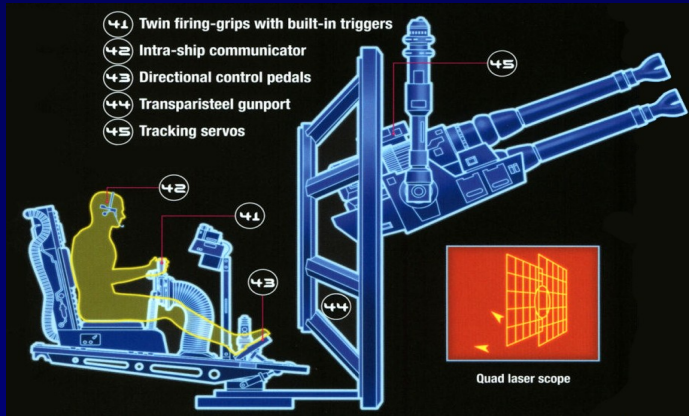
- Most information is usually acquired visually
- Striving to universality: pictograms
- Conditions:
 - Optimal space
 - Optimal lighting
 - Optimal size
- Intuitiveness and understandability

The same things in IT

- Customizing the visual output and/or maximizing the audience
- Space \leq distance from display
- Lighting \leq outer and inner, effects
- Size \leq display size, resolution, fonts
- Intuitiveness \leftarrow focus on main elements, unambiguity of metaphors

Control

- Machine => human: (typically) visuals
- Human => machine: switches or pointers
- Man in the Machine



Source:

https://starwars.fandom.com/wiki/AG-2G_quad_laser_cannon

- But also: mouse, spacebar, power switch

In IT...

- Work environment (including lighting and furniture)
- Choice of peripherals (mouse vs trackball vs joystick)
- Clear alternatives: on/off, Enter/Esc/Space
- Location
- Colour
- Shape
- ...

Three important concepts

- **Availability** - the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (essentially – if the stuff keeps working or not!)
- **Usability** - the ease of use, agreeableness and learnability of the object; making it accessible to a wide circle of users (including elderly or disabled people, children etc)
- **Standards compliance** - allows use of objects of the same class interchangeably, making them easy to replace and promoting better usability (if the user can use one, he/she can likely use objects in compliance with the same standard)

The 5+1 components of usability (by Jakob Nielsen)

- **Learnability:** How easy is it for users to accomplish basic tasks the first time they encounter the design?
- **Efficiency:** Once users have learned the design, how quickly can they perform tasks?
- **Memorability:** When users return to the design after a period of not using it, how easily can they re-establish proficiency?
- **Errors:** How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
- **Satisfaction:** How pleasant is it to use the design?
- **Additional - Usefulness:** Does it deliver what it promises?

Machine/computer vs human (adapted from Alan Dix)

- Human
 - Information processing capacity is limited
 - Different channels (senses)
 - Sensory, short- and long-term memory
 - Deduction, problem-solving, reason, learning, error-handling
 - Impact of emotions
 - Personality
- Computer
 - Information processing capacity much greater
 - Different channels (I/O)
 - Short and long-term memory (somewhat limited)
 - Various peripherals, including sensors
 - Speed is affected by hardware and networks

Talking to a machine

- Goal-oriented
- I/O suitable for the task
- Non-linear
- Commenting
- I/O chosen by human
- Suitable for user
- Robust
- Polite
- Instructive
- Using suitable language

Two extra points

- Recalling the Internet communication topic:
Communication = participants + information channel
- People with special needs (incl disabilities) are a good indicator of usability (or lack thereof) – as a rule of thumb, accessibility implies overall good usability

“Alarm, alarm!”

- Risk = potential hazard
- Sometimes becomes real
- More than often, the results depend on reaction
- Two sample messages:
 - "Alarm!!!! You computer has a virus!!! Switch off the machine AT ONCE or you will lose EVERYTHING!"
 - "Attention! The CIH-4092 virus has been discovered in your computer. It can attack the file system and make a part of the disk unreadable. Try to run F-Secure or Eset, be sure to inform the tech department at 555-2424."
- Which one would you prefer?

The signal

- Clearly identifiable and distinguishable (not easily mistaken and preferably hard to produce without authorization)
- Addressing different senses (most commonly visual + sound)
- Sometimes, used selectively:
 - “Mr Skylight to number one and two” (MS Estonia 1994)
 - “Red Parties, Red Parties, Red Parties” (Disney Cruise fire alarm)
 - “Zulu, Zulu, Zulu” (fight started onboard)

Conclusion

- Technology evolves fast, humans do not -> most risks are human-related (also in IT!)
- The impact of IT risks on society is growing -> reduction skills become more vital
- Ergonomics -> usability -> risk reduction (-> security!)
- The border between tech and social stuff is hazy – social skills will be demanded more (also from IT staff)
- Training will be a main focus

Thanks