usable security (part b)

credit: olly (fotolia)

1 - User Capability (& Limitation)

We will cover bias as a separate lecture as it is such a large and important topic but for now when considering physical and mental aspects the key takeaway is **giving a human a task which exceeds their capability essentially sets them up to fail.**

Humans are really **synchronous** - it's hard to near impossible to do multiple things at the same time (try patting head and rubbing stomach - it requires a lot of mental concentration).

And this can be particularly acute with things like recognising security signals - both masked (phishing) and deliberate (status indicators from devices). It can lead to alert fatigue.

lgeorge25 "Tree of life" - pt with LVAD, septic, on pressors and CRRT

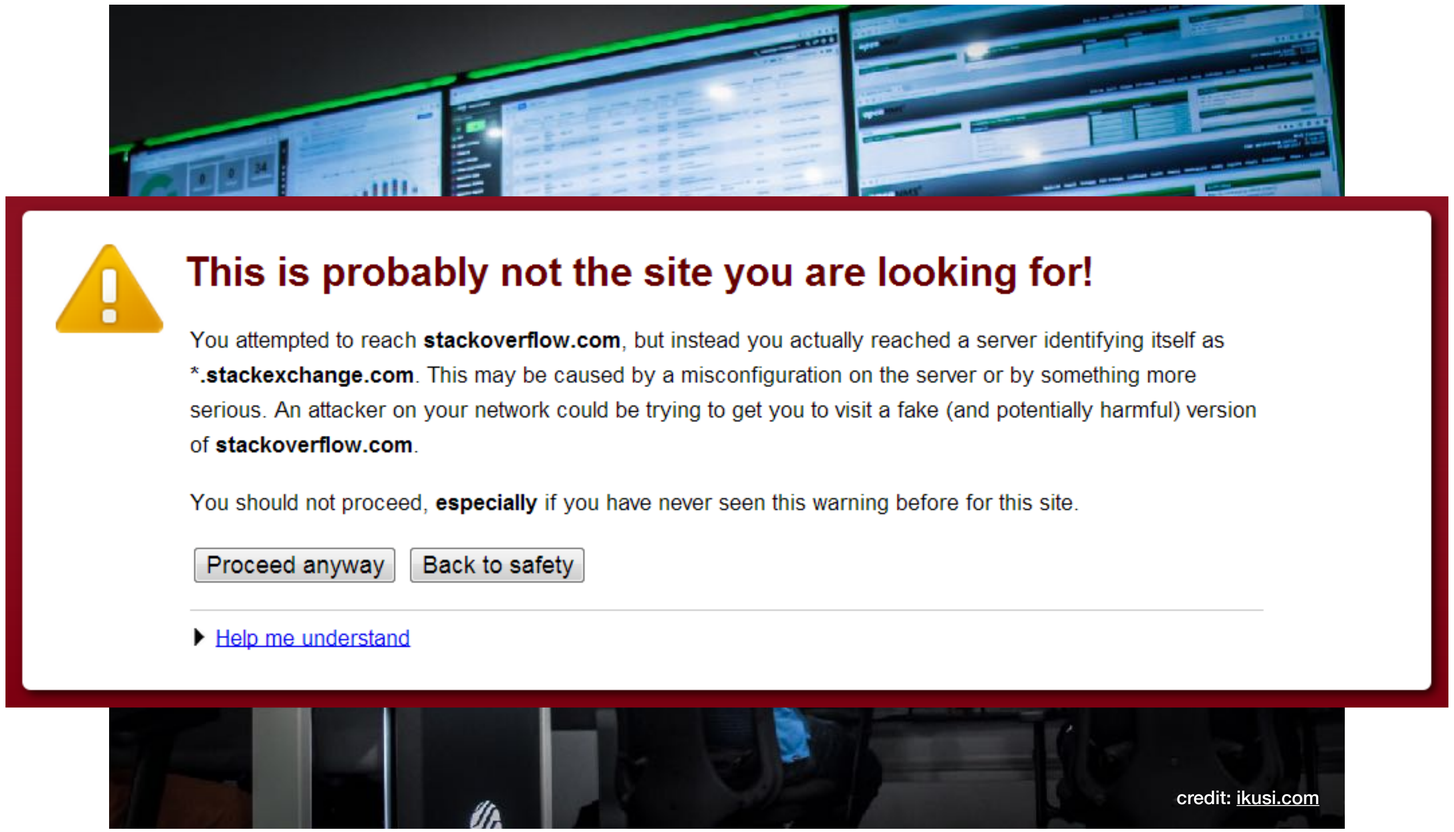
Alarm fatigue can be very real

Imagine sitting in a security operations centre, monitoring dozens of screens and hundreds of different measures to keep an eye out for alerts.

There are plenty of false positive alerts that for the human to filter out is a very high cognitive load, so eventually we almost become blind to those we see frequently.

This is one area where a lot of work has gone into better filtering through techniques like machine learning.

BUT alarm fatigue can hit us all…



Useful Stuff

Buczak, A. & Guven, E. 2015 A Survey of Data mining and machine learning methods for cyber security
https://ieeexplore.ieee.org/abstract/document/7307098

Pietraszek, T. 2004
Using Adaptive Alert Classification to Reduce False Positives in Intrusion Detection
https://link.springer.com/chapter/10.1007/978-3-540-30143-1_6

The challenge of mental encoding

Another key aspect of capability is the crucial difference between short and long term memory. You need to mull on things in short term memory to code to long term memory - it's a repetitive thing.

Remember when you had to recall your student ID and how for the first few times you needed to look it up?? What about your student number or email address?

It’s all xx###### or ######## or xx######@bristol.ac.uk or is it name@bristol.ac.uk?

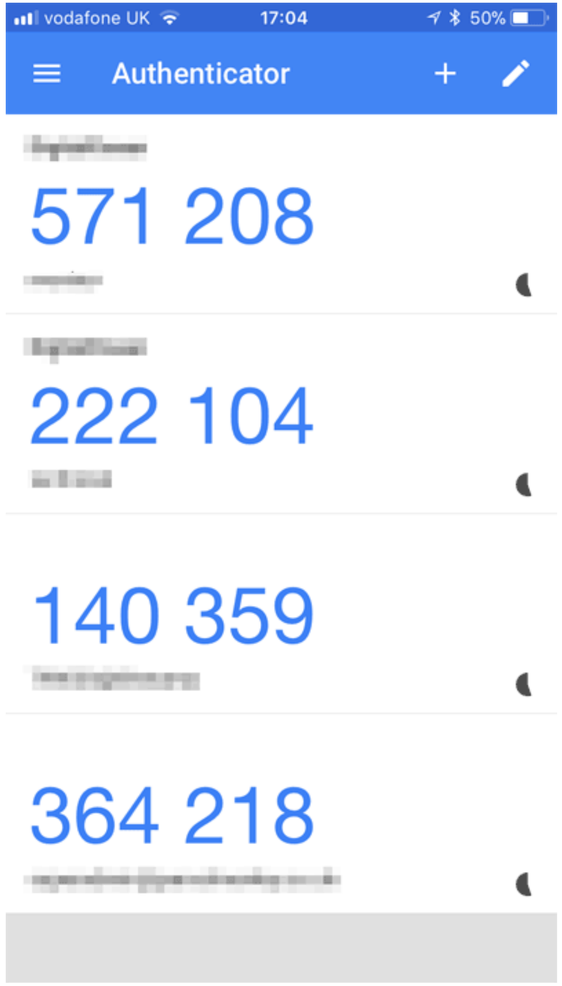
This leads into biases, and how we access memory - but that's for another day.

Short term and long term memory

Passwords are a great example of where STM and LTM are at play.

Most will have used a one-time-passcode, possibly one of those provided by an authenticator app. You only remember it for as long as is needed to use it once. No point encoding it in memory as 60 seconds later it is invalid.

BUT as with those StudentIDs, think of passwords you regularly use, and if you are super sensible and use a password wallet for extra specially long and complex passwords - the master key for that wallet. It is well encoded to LTM as without it.... :/

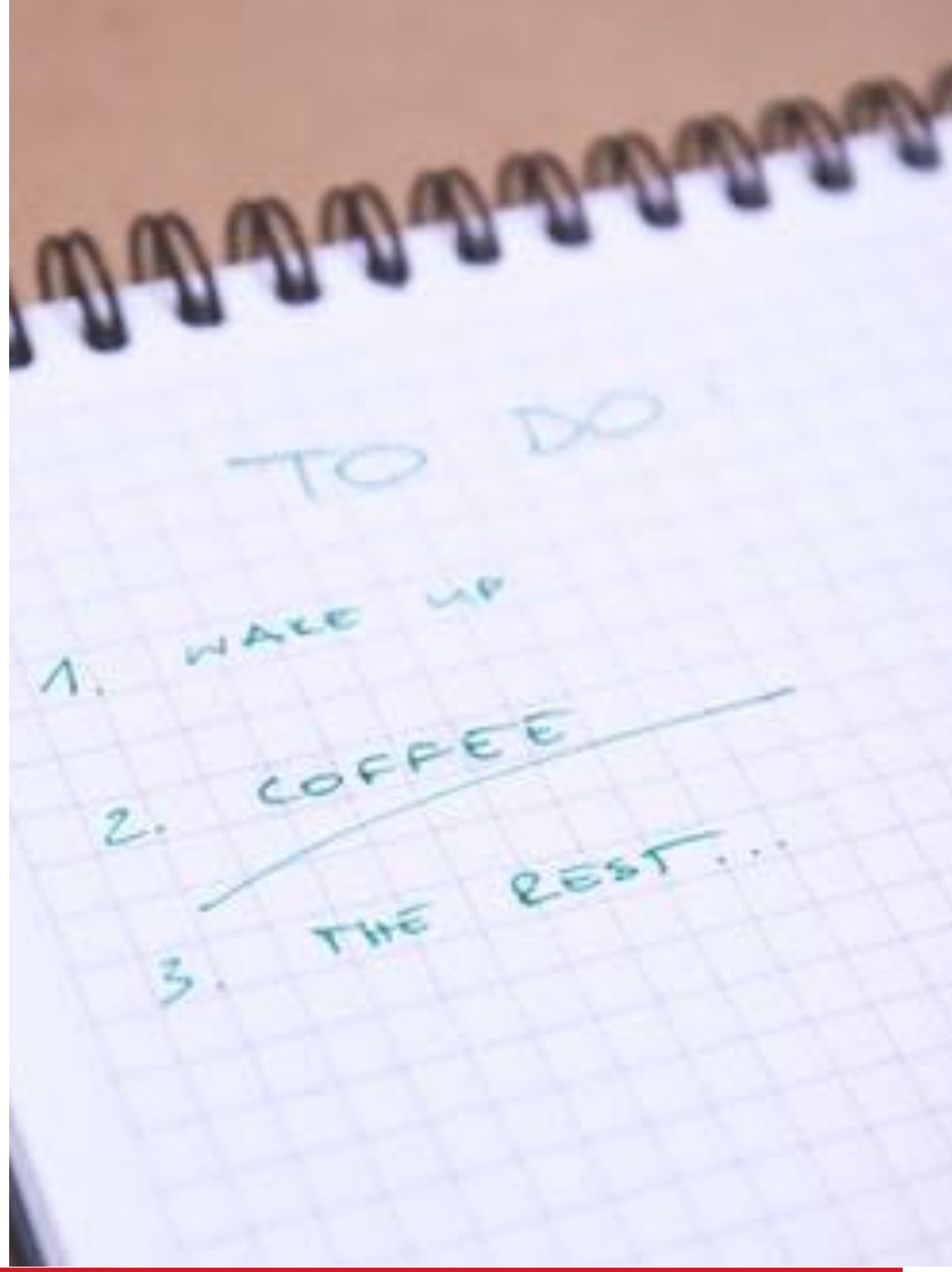


2 - Goals and Tasks

Human behaviour is goal-driven, and we tend to split goals into tasks which we work through (synchronously). These are our “production” tasks, the things we are looking to accomplish, **the job**.

But they are supported by “enabling” tasks which are the things we need to do to be able to undertake those “production” tasks - the infrastructure if you will. Unless you are building or operating security tools, then cyber security would normally be considered, enabling.

So it is a secondary task, that can allow for work to happen, but can also get in the way. And as such humans can view security as counter-productive to a key work task, and be reluctant to undertake it, or even find workarounds for it.



Workarounds are why we fit the task to the human

Employees when asked to focus on production tasks, and are rewarded thusly, impacts negatively on security compliance. The enabling task is driven so far back that it just isn't considered in pursuit of the work. Just like pretty much every Privacy T&Cs, or GDPR cookie you just click to get to the website or app you were seeking.

So to avoid those workarounds for security we must make then primary (production) tasks.

How does this fit with human in the loop and can you see the challenge between production & enabling tasks in the HiL example for the spread of Mirai?

(clue: what type of task was changing credentials, and is the same true for getting connected & online?)

Achieving a good *fit* examples:

- Automating security, for instance, using **implicit authentication** to recognise authorised users, instead of requiring them to enter passwords many times over.
- If explicit human action is necessary in a security task, we should **minimise the work-load** and the disruption to the primary task.
- Designing processes that trigger security mechanisms such as authentication **only when necessary**.
- Design systems that are **secure by default** so that they do not push the load of security configurations and management on to the users.

[note: usable security talks mainly to users, we discuss this push back to designers in error]

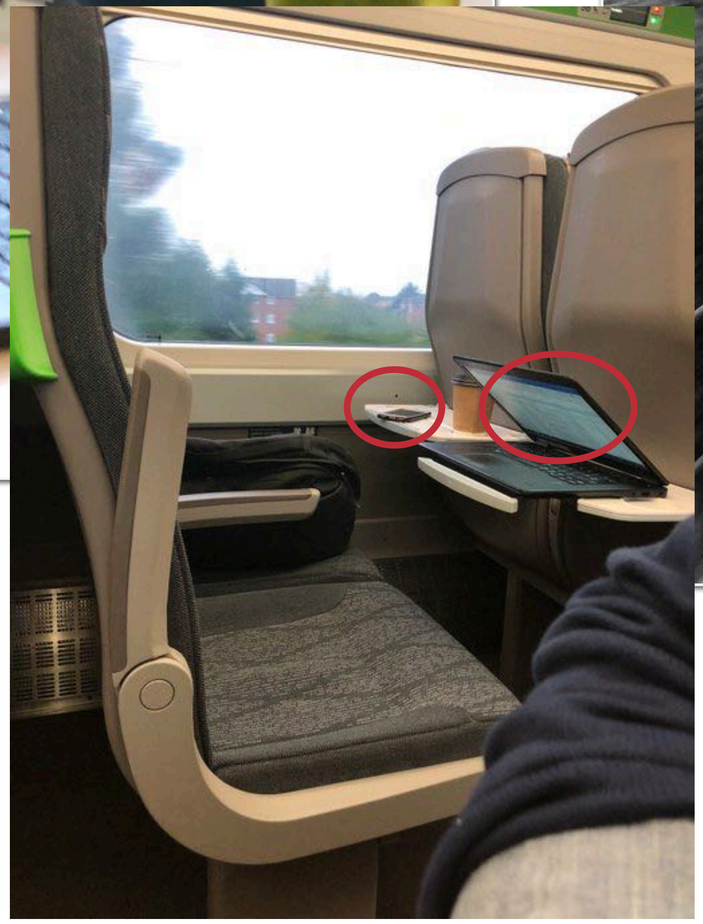
3 - The context

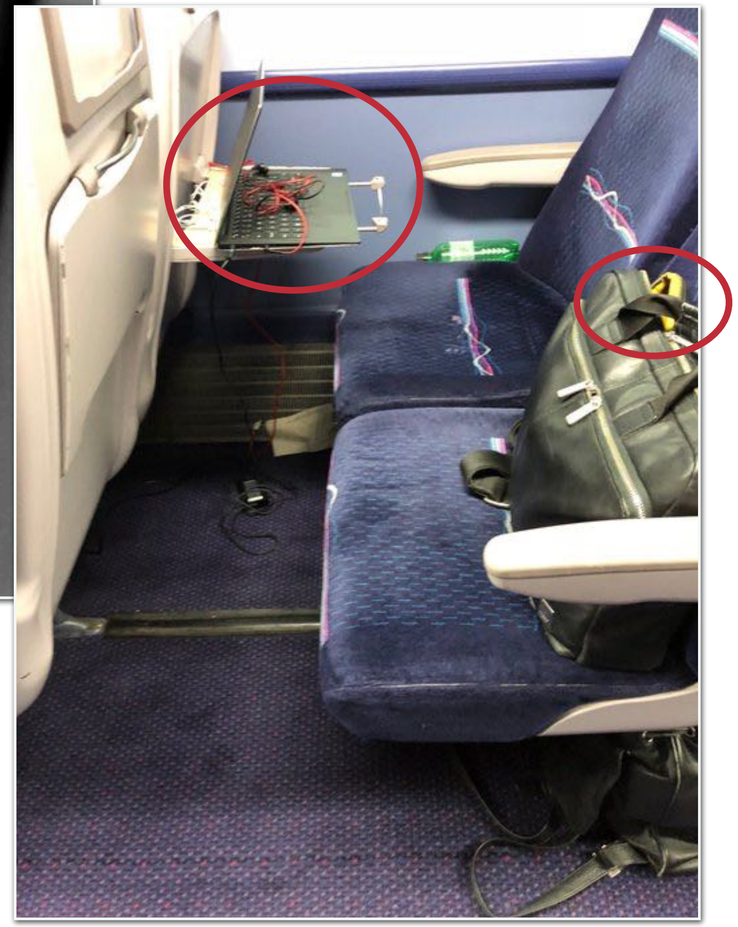
“Both the physical surroundings and the social environment in which people have to perform security tasks affect performance and security.

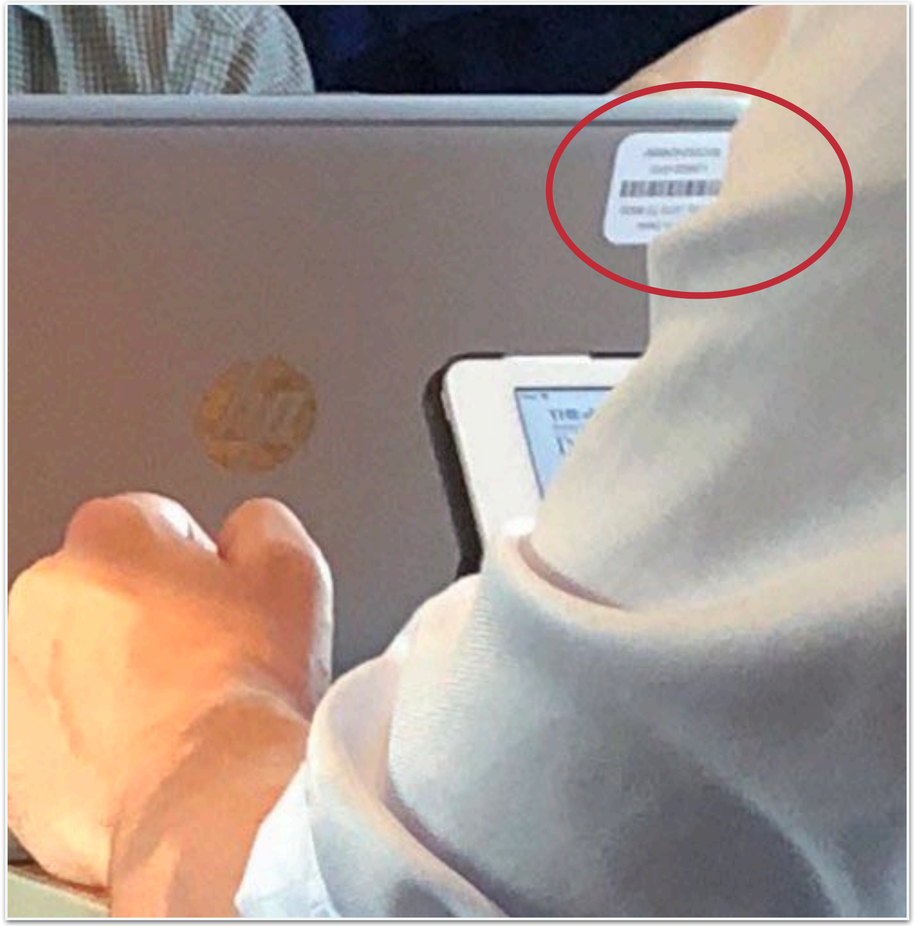
Most working age people now interact with technology on the move more frequently than at the desk traditional working environments.

This change in the context of use affects a number of security mechanisms, not least of being overheard when on the phone – the case of former CIA Director Michael Hayden being overheard giving an off-the-record interview on board a train being a particularly spectacular one.”

CyBOK





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Be more aware of physical context

The usability of security mechanisms can be affected by the following physical characteristics:

- Light: In bright light, displays can be hard to see, which can affect graphical authentication in particular. Biometric systems such as iris and face recognition rely on input from cameras. Bright light can lead to glare, which means the images captured are not good enough to process.

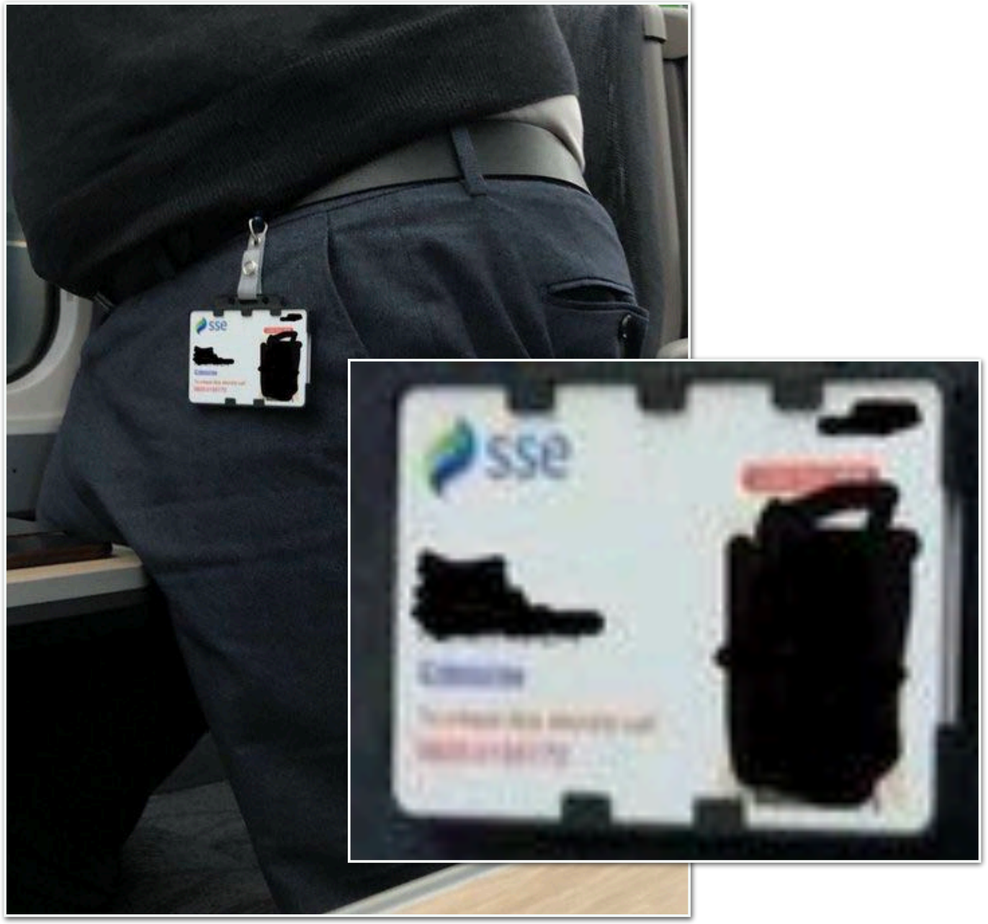
- Noise will most obviously interfere with the performance of voice recognition systems. But high levels of noise also impact human performance in general due to increased stress and, in turn, increased likelihood of error. Unexpected loud noises trigger a human startle response, which diverts attention away from the task.

- Ambient temperature can affect the performance of both technology and humans. Fingerprint sensors can stop working when it is cold, and humans are slower at pointing and selecting. They may also need to wear protective clothing such as gloves that make physical operations of touchscreens impossible or difficult. Similarly, too hot an environment can lead to discomfort and sweat can interfere with sensors.

- Pollution can impact equipment operated outdoors. This is a particularly concern for fingerprint sensors and touchscreens. The lipids left behind combine with the particles and the resulting dark grease can clog sensors or leave a clearly visible pattern on the touchscreen.

CyBOK

We need to cater for the social context



"The social context in which people find themselves **strongly influences behaviour though values**:

shared beliefs about what is **important** and **worthwhile**, and **norms**:

rules and expectations about actual behaviour.

If the expected security behaviour is in conflict with day-to-day behavioural norms, we can expect problems.

For instance, if an organisation values customer satisfaction, and employees are told to be friendly towards customers at all times, a security policy that requires staff to treat any customer enquiry as a potential attempt to extract information will not fit."

CyBOK

4 - Device Capability

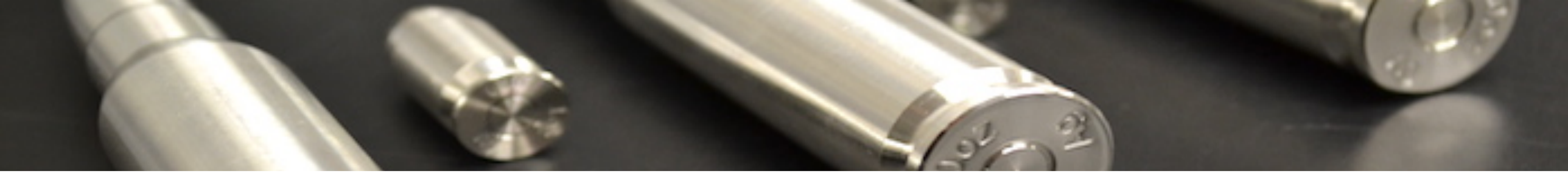
“Some characteristics of the device can result in security mechanisms becoming difficult to use in any circumstance. Entering long and complex passwords on soft keyboards on a mobile phone takes far longer and is more error-prone than on a regular keyboard”

We’ve already briefly mentioned how passwords managers can make diverse passwords more usable. Similarly we talked about the ephemeral nature of one-time authenticators & the link to STM.

Now think to the user entering a long password on an **E.161 keypad!**

Quick worked example

- 15 random char pw = rlrdF@!u06Sx!90
- replace symbols & no uppercase = rlrdf34u06sx590
- 77 5 333 3 3333 4444 88 0 6666 777 99 5555 9999 0000 **(39 characters!)**



Is Usable Security the Silver-Bullet?

In my opinion usable security **alone** isn't going to address many of the challenges in human-centred security behaviours **BUT** it plays a very significant role.

Whilst usable security is clear in it's aim to push towards security "*delivering the required levels of security and also user effectiveness, efficiency, and satisfaction*" it does clearly talk to the user's needs and how developers need to take these in to account. However, little is made of the role that developers, themselves, have in also being users of the very tools which they are using to build things.

Another critique points to the lack of user motivation and how merely being "usable" can mask security challenges for the human - remember these from HiL?

(clue: think back to Mirai again and the usable tools that masked something)

Useful Stuff

Caputo, D et al. 2016
Barriers to Usable Security? Three Organizational Case Studies
https://ieeexplore.ieee.org/abstract/document/7676139

Theofanos, M. 2020
Is Usable Security an Oxymoron?
https://csrc.nist.gov/CSRC/media/Projects/usable-cybersecurity/images-media/Is%20Usable%20Security%20an%20Oxymoron.pdf

Complimentary “…by Design” frameworks

Many of the critiques of Usable Security are based around it being treated as in some way standalone, or an unbending doctrine.

However, the reality is Usable Security can work well especially when combined with one or more of the ‘be Design’ frameworks which look more broadly and holistically.

Privacy by Design
Guidelines developed in the 1990s by the then privacy commissioner of Ontario, Ann Cavoukian. The movement seeks to embed privacy "into the design specifications of technologies, business practices, and physical infrastructures".

Security by Design
Guidelines to implement security from the ground up resulting in software has been both designed and built to minimise flaws that could compromise security.

Security Ergonomics by Design
Guidelines that empower software engineers to pragmatically take into account how users (including themselves) make informed security choices about their data and information when building safe and secure cyber physical systems.

Useful Stuff

Cavoukian, A. 2009
Privacy by Design: The 7 foundational principles
http://dataprotection.industries/wp-content/uploads/2017/10/privacy-by-design.pdf

NCSC
Secure Design Principles
https://www.ncsc.gov.uk/collection/cyber-security-design-principles

Craggs, B & Rashid, A. 2017
Beyond Usable Security to Security Ergonomics by Design.
https://ieeexplore.ieee.org/iel7/7965809/7967966/07968021.pdf

A Task

Pick **ANY** security tool (other than a password manager!) and, based on your **own** experience, see if you can answer the three usability measures for it:

- **Effectiveness** "Can users achieve their goals?”
- **Efficiency** "What resources are expended to do so?”
- **Satisfaction** "What is the user level of comfort and acceptability?"

next time…
Inclusive Security