Presenting your research 1: Academic posters and PowerPoint slides

Dr Pamela Styles
(pamela.styles@swansea.ac.uk)

Presenting your research

Academic posters

PowerPoint slides

Conference presentations

Poster presentations

Presenting to the public

Presenting your research

Academic posters

PowerPoint slides

Conference presentations

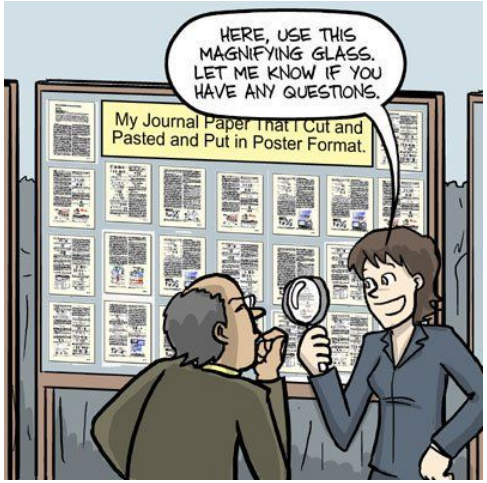
Poster presentations

Presenting to the public

Professional posters and slides are **concise**.

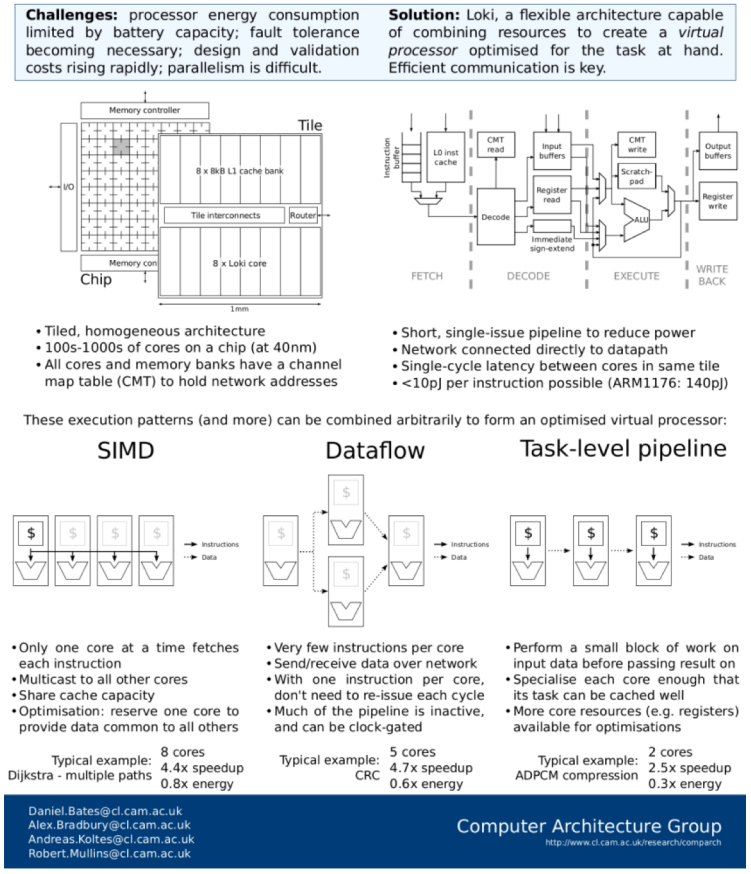
Bullet points	Icons and symbols	Data visualisation

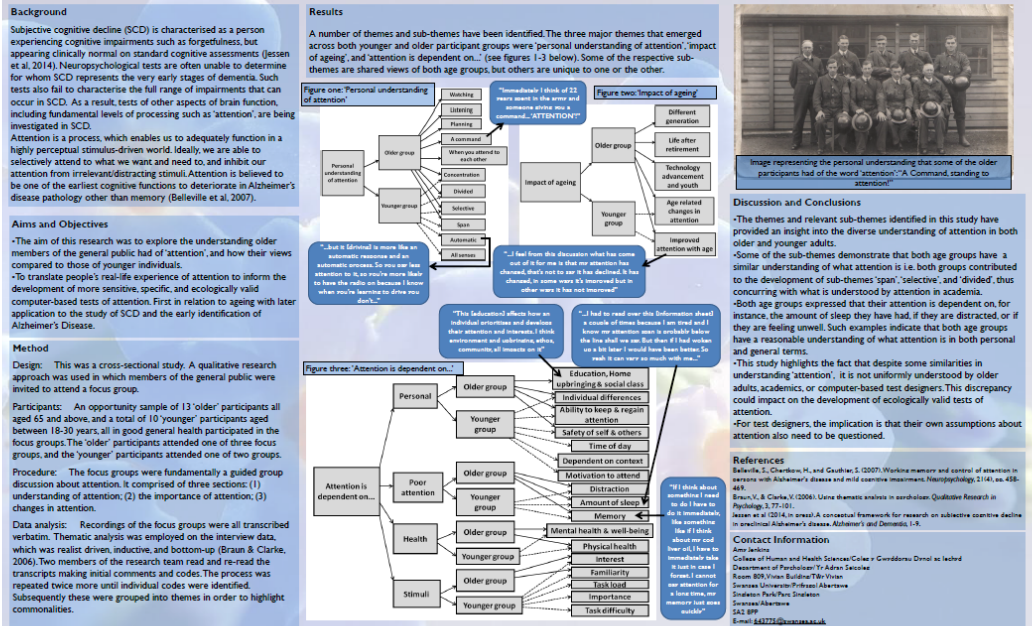
- Bullets
  - Bullets and Numbering
    - Picture
      - Import



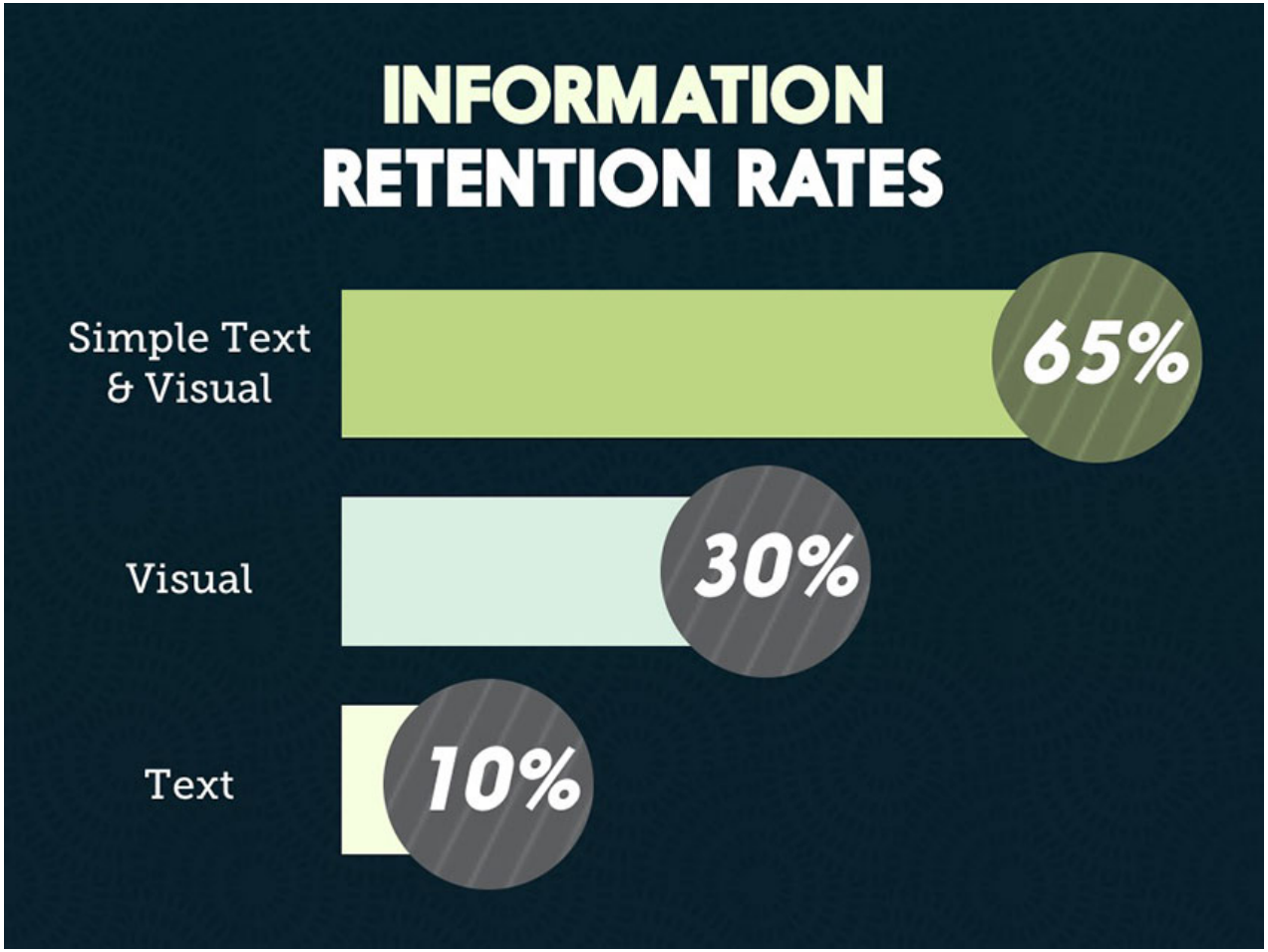
PHD Comics

Professional posters and slides are **concise**.



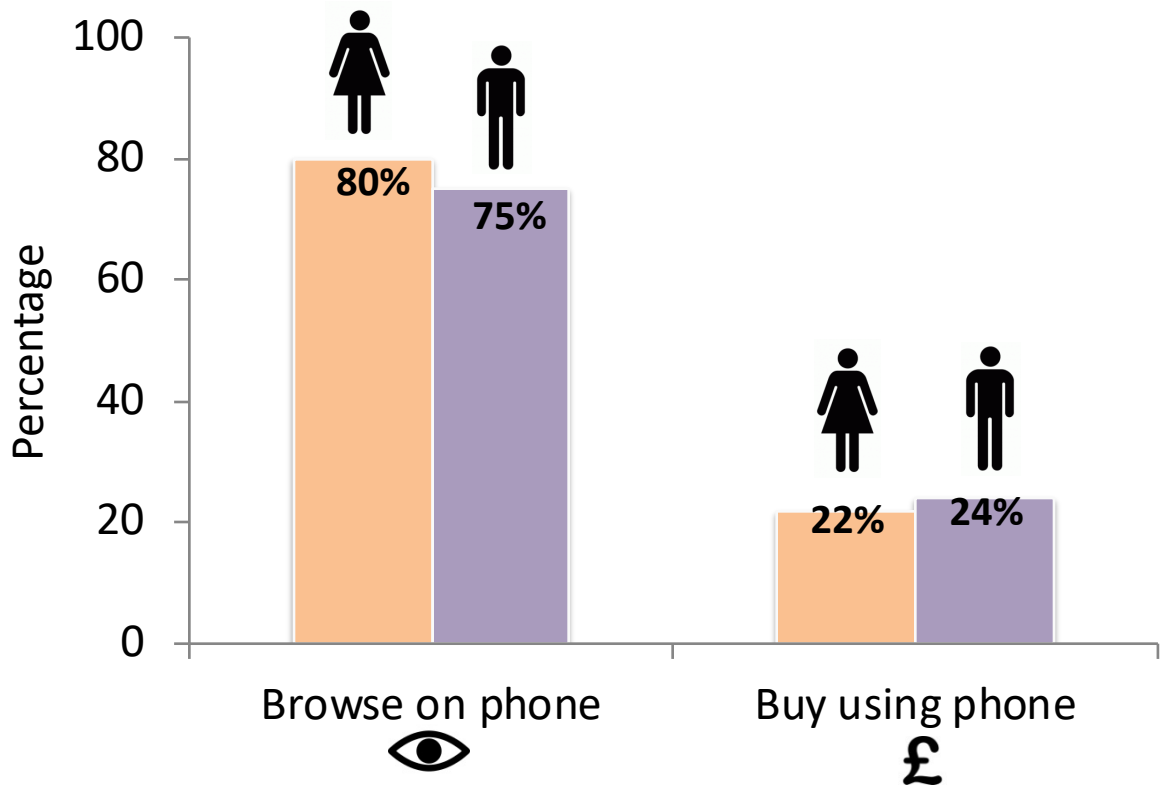


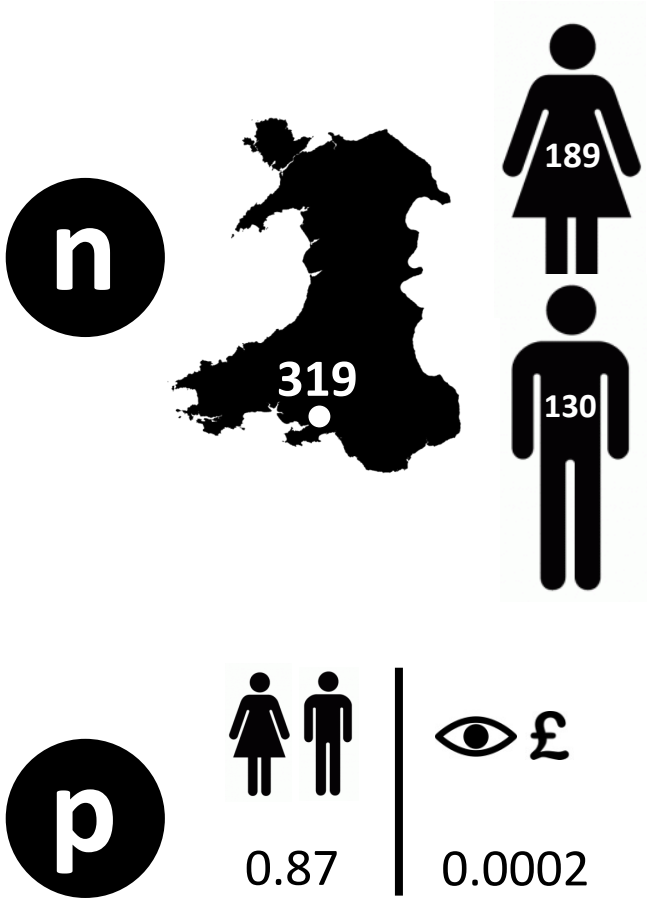
Slides are more memorable when they contain images and simple text.



https://thepresentationdesigner.co.uk/improve-presentation-retention-rates/

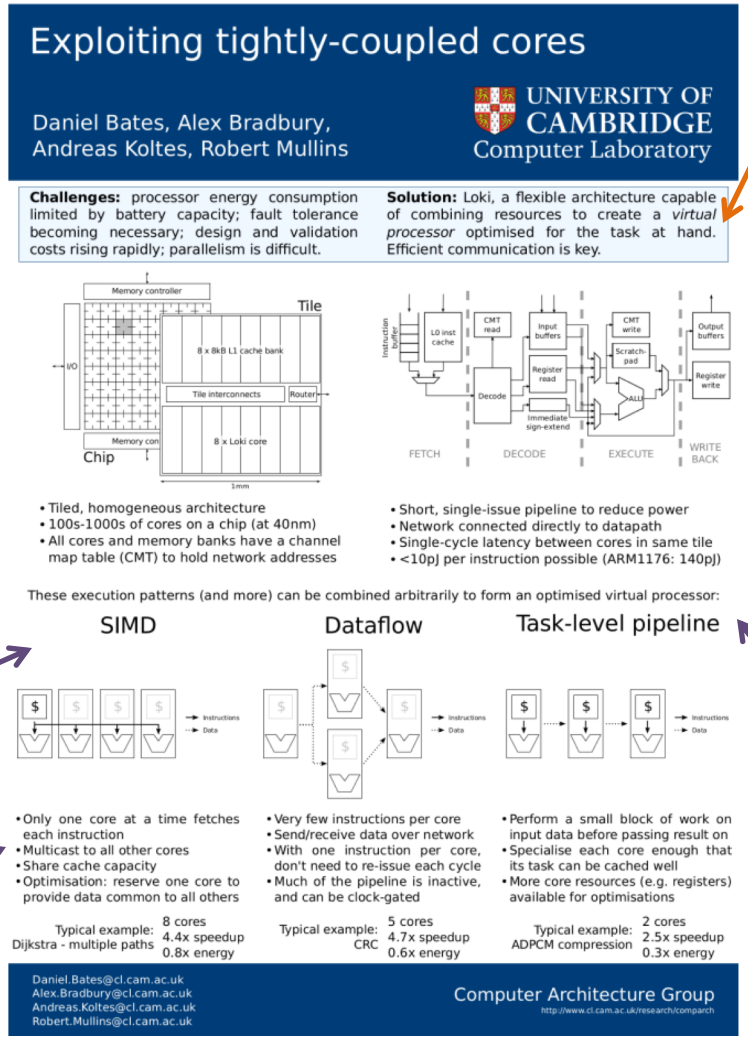
Consumers use their phones to browse but not to buy.





Posters and slides should be easily **legible**.

Arial
Verdana
Tahoma
Century Gothic
Helvetica
Trebuchet
Calibri



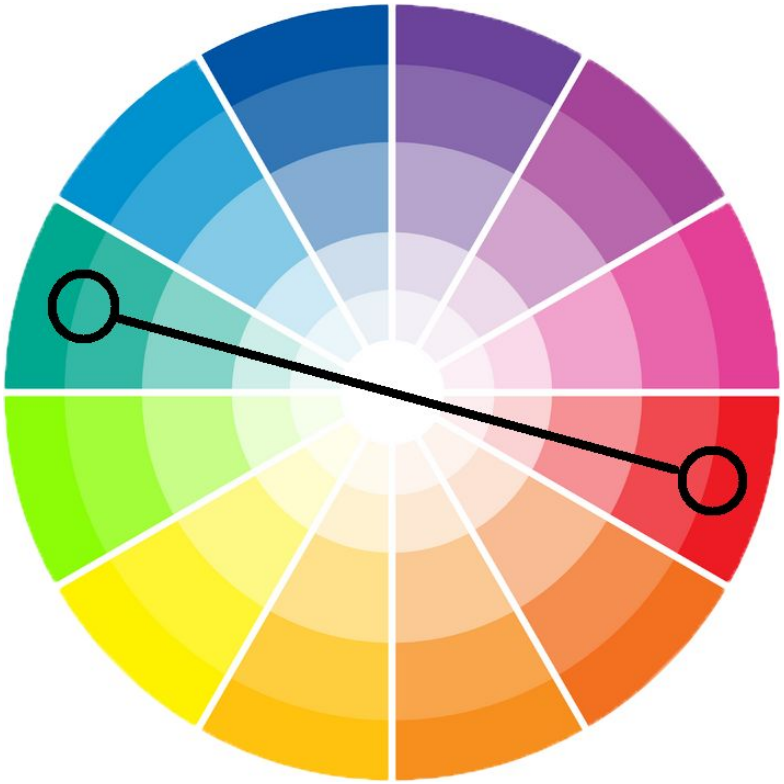
Avoid justified text

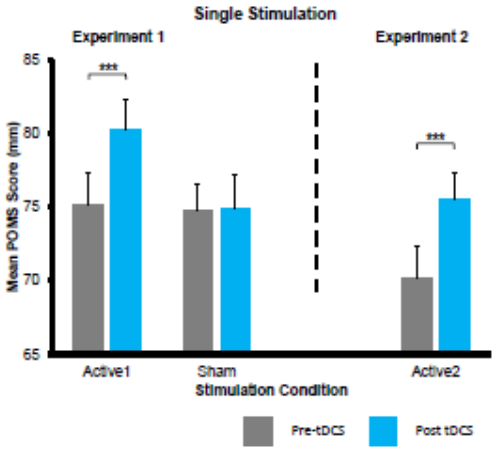
Large title (~85pt) and headings (~36pt)

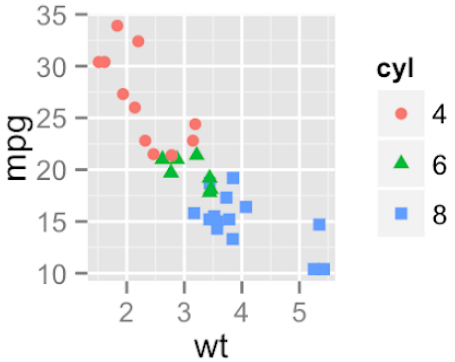
Empty space

Sans serif font

Choose **colours** that work well together and are visually accessible.

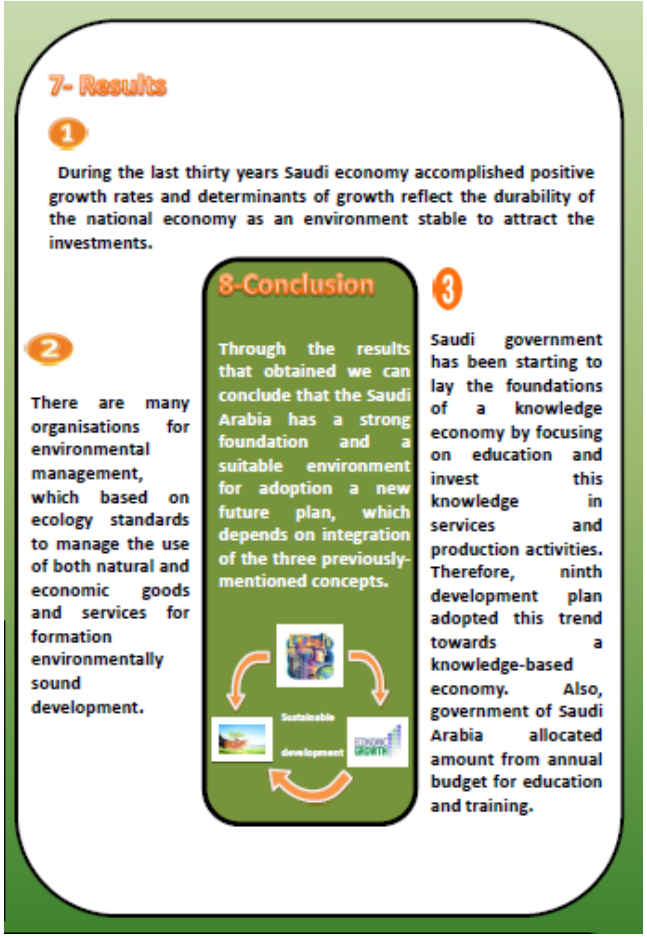






color-blindness.com/coblis-color-blindness-simulator/

Professional posters and slides are **consistent**.



Posters and slides should be…

Concise

Consistent

Legible

Accessible

Posters

What makes a good academic poster?

Muffins are an integral part of any academic conference

Effective posters have logical organisation and flow

Wireless Communications In Vehicles

Steven Herbert[1,2]; Ian Wassell[1]; Tian Hong Loh[2]

Introduction

Whilst driverless cars and vehicle-to-vehicles communications have been grabbing the headlines recently, a quiet revolution has been going on in the field of communications within in the vehicle itself. The smart-phone generation demand constant access to media, and when in their vehicles this is no different. So called infotainment systems are now commonplace in high-spec modern cars, as well as sophisticated sensor networks to control environmental conditions such as temperature and CO_2 levels.

With vehicles already creaking under the weight of hundreds of metres of cabling, wireless communications are becoming an increasingly attractive prospect for manufacturers, not to mention having desired property of allowing users to wirelessly connect their smart devices such as tablet computers and phones to the vehicle's systems. But there is a problem- a good analogy can be made between the radio propagation in a vehicle cavity, and that of a reverberation chamber- a controlled environment designed specifically to make the electric field (and hence wireless communications) as random as possible. How can we deploy effective wireless communication systems in such a harsh radio propagation environment?

We assert that the best way to solve this problem is through a bottom up approach- starting with a rigorous analysis of the propagation of electromagnetic waves in the vehicle cavity, then calculating the theoretical information capacity of the in-vehicle channel, and finally using this to deploy communications systems. Figure 1 shows a test vehicle; figure 4 shows an example deployment using horn antennas.

Electromagnetic Wave Propagation

We can separate the electromagnetic wave propagation into two components: an instantaneous impulse response, and the Doppler spread caused by the random motion of the cavity occupants. Together these two quantities fully describe the propagation.

In reverberation chambers the average energy, *<E>*, decays exponentially with time, *t*, after an impulse:

$$< E > = ke^{-t/\tau},$$

where *k* is a constant and τ is the time constant. We observe this is also a good model for the impulse response of the vehicle cavity, as shown in figure 2.

Regarding the Doppler spread, for our purposes it is sufficient to observe the maximum frequency, f_d, at which a Doppler shift occurs (i.e., before the shifted signal becomes indistinguishable from noise). This is shown in figure 3, and has a value of approximately 40Hz.

Figure 1: Test Vehicle.

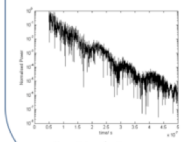


Figure 2: Impulse Response.

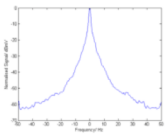


Figure 3: Doppler Spread.

Information Capacity of the In-Vehicle Channel

Conventional wisdom states that if the coherence time (equal to $1/f_d$) is much greater than the time constant, τ, then the channel is underspread and its capacity will be approximately that of the additive white Gaussian noise (AWGN) channel:

$$C = E(\log(1 + |h|^2 SNR))\ bits\ s^{-1} Hz^{-1},$$

where *C* is the capacity, *E(.)* is expectation, *log(.)* is the logarithm to the base 2, *h* is the channel response and *SNR* is the signal to noise ratio. In contrast to the slightly vague wording of the existing underspread approximation, we can show a condition on the product $\tau \times f_d$ sufficient to apply the underspread approximation to a given tolerance (say 99% of the AWGN capacity).

Figure 4: Typical Antenna Deployment.

Effective Communications

To use our insights regarding the propagation channel and information capacity to deploy effective communication systems, we must address three further areas:

1. Channel estimation- i.e., of the parameters τ, f_d and *h*.
2. Channel coding to approach capacity.
3. Resource allocation (i.e., spectrum and time) to the links.

If done correctly this will allow us to deploy an effective communication system for any application. Remaining challenges will be concerned with integrating many different systems in one cavity, sharing the same spectrum.

1. Computer Laboratory, University of Cambridge.
2. National Physical Laboratory.

All material is published or submitted for publication, please visit http://www.cl.cam.ac.uk/~sjh227.

NPL National Physical Laboratory

Computation in Bacterial Metabolism

Claudio Angione
claudio.angione@cl.cam.ac.uk

UNIVERSITY OF CAMBRIDGE
The Computer Laboratory
Celebrating 75 years

Abstract

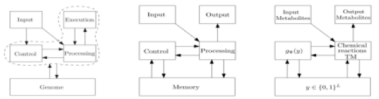
Biologically inspired computation has been recently used with mathematical models towards the design of new synthetic organisms. In a biochemical pathway, an enzyme reads the amount of reactants (substrates) and converts them into products. Therefore, in this work we consider the metabolism as a living computer, and we program it in order to obtain desired outputs.

We propose and exploit a mapping between the metabolism and a register machine (RM) to show that bacteria could have computational capability and act as **molecular Turing machines (TM)**. The reactions in the bacterium constitute the increment/decrement instructions, while the registers count the number of molecules of each metabolite. The RM is equivalent to the TM, being a multi-tape TM with the tapes restricted to work as simple counters.

We report that the density and gradient of the Pareto curve are useful tools to compare models and understand their structure, while modelling organisms as computers proves useful to carry out computation using biological machines with specific input-output conditions.

Bacteria as von Neumann architectures

Inspired by Brent and Bruck [1], who studied similarities and differences between biological systems and von Neumann computers, we propose a mapping between the von Neumann architecture and bacteria. This mapping suggests thinking of the metabolism as a Turing machine (TM).



Comparison among biological systems (a), von Neumann architecture (b), and bacteria (c).

The bacterium takes as input the substrates required for its growth and, through its chemical reaction network, produces desired metabolites as output. The string y acts as a program stored in the RAM. Let Y be the multiset of the bits of y, and $P(Y;p)$ be the set of all partitions of Y with p blocks. We formalise the control unit by defining the function

$$g_\Phi : \{0,1\}^L \longrightarrow \bigcup_{y \in \{0,1\}^L} P(Y;p)$$

$$\bar{y} \in \{0,1\}^L \longmapsto \Pi \in P(\bar{Y};p).$$

Each element of the partition Π is the submultiset b_s of all the gene sets that play a role in the reactions belonging to the sth pathway. In other words, g_Φ turns syntax into semantics.

Chemical reaction networks and computation

We map the chemical reaction network to the **Minsky's Register machine (RM)**, i.e. a finite state machine augmented with a finite number of registers. The RM has been proven to be equivalent to the TM [2]. We define:

- The set D of state species $\{D_i\}$, where each D_i is associated with the state i of the RM;
- The set H of register species $\{H_r\}$, where each H_r is associated with the register r of the RM, and therefore represents the molecular count of species r;
- $\varphi : D \backslash \{i_0\} \longrightarrow \{(H_r, i), (H_r, j, k) \mid H_r \in H,\ j, k \in D\}$ a multivalued mapping.

The RM executes two basic **increment/decrement instructions** [3]:

- $inc(i, r, j)$ to increment register r by 1 and move from state i to state j according to $\varphi(i) = j$;
- $dec(i, r, j, k)$, with $H_r > 0$, to decrement register r by 1 and move from state i to state j ($\varphi(i) = j$).

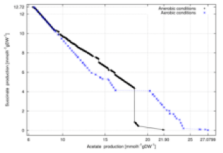
Initial and halting states: $i_0, i_1 \in D$.
Register H_r: left-handed tape that stores positive integers by writing stacks of marks on the tape.
If $H_r = 0$, the machine moves from state i to state k ($\varphi(i) = k$) **(test for zero)**.
Halt instruction: halts the operation of the machine, setting the state i_1 (equivalent to the cell death, no further chemical reactions take place [4]).

- $inc(i, r, j)$ mapped to the chemical reaction $D_i \rightarrow D_j + H_r$;
- $dec(i, r, j, k)$ mapped to $D_i + H_r \rightarrow D_j$ if $H_r > 0$, or to $D_i \rightarrow D_k$ if $H_r = 0$.

Optimal molecular machines

We program molecular machines using *Genetic Design through Multi-Objective optimisation* (**GDMO**) [5].

- Through a specific optimal code stored in the "memory" of the organism, we are able to simultaneously maximise the yield of two or more metabolites of interest.
- The genetic code, i.e. the "computation instructions" given to the machine [6], is represented by a Pareto-optimal string of bits $y \in \{0,1\}^L$.



Maximisation in anaerobic and aerobic conditions with glucose uptake rate 10 $mmolh^{-1}\ gDW^{-1}$.

Conclusion

- Since the simulated TM can be universal, the proposed mapping between metabolism and TM allows to perform any kind of computation, through a set of species and chemical reactions characterised by their flux [7].
- In principle, bacteria can carry out at least any computation performed by a computer.
- A program embedded in a bacterium, whose metabolism works like a TM, could be able to implement the knockout strategy found by GDMO.
- The minimisation of the number of knockouts ensures a low-effort, reliable and reproducible result, allowing cells to become programmable manufacturers of biochemical products of interest.

References

[1] R. Brent and J. Bruck. 2020 computing: Can computers help to explain biology? *Nature*, 440(7083):416–417, 2006.

[2] M.L. Minsky. *Computation*. Prentice-Hall, 1967.

[3] D. Soloveichik, M. Cook, E. Winfree, and J. Bruck. Computation with finite stochastic chemical reaction networks. *Natural computing*, 7(4):615–633, 2008.

[4] V. Manca. The metabolic algorithm for p systems: Principles and applications. *Theoretical Computer Science*, 404(1):142–155, 2008.

[5] J. Costanza, G. Carapezza, C. Angione, P. Lió, and G. Nicosia. Robust design of microbial strains. *Bioinformatics*, 28(23):3097–3104, 2012.

[6] C. Angione, P. Lió, and G. Nicosia. How to compute with metabolism in bacteria? *ERCIM News*, 91:12, 2012.

[7] C. Angione, G. Carapezza, J. Costanza, P. Lió, and G. Nicosia. Computing with metabolic machines. In Andrei Voronkov, editor, *Turing-100*, volume 10 of *EPiC Series*, pages 1–15. EasyChair, 2012.

Computation in Bacterial Metabolism

Claudio Angione
claudio.angione@cl.cam.ac.uk

UNIVERSITY OF CAMBRIDGE

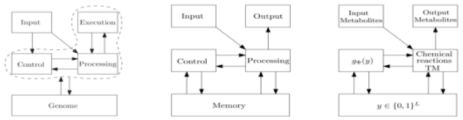
The Computer Laboratory
Celebrating 75 years

Abstract

Biologically inspired computation has been recently used with mathematical models towards the design of new synthetic organisms. In a biochemical pathway, an enzyme reads the amount of reactants (substrates) and converts them into products. Therefore, in this work we consider the metabolism as a living computer, and we program it in order to obtain desired outputs.
We propose and exploit a mapping between the metabolism and a register machine (RM) to show that bacteria could have computational capability and act as **molecular Turing machines (TM)**. The reactions in the bacterium constitute the increment/decrement instructions, while the registers count the number of molecules of each metabolite. The RM is equivalent to the TM, being a multi-tape TM with the tapes restricted to work as simple counters.
We report that the density and gradient of the Pareto curve are useful tools to compare models and understand their structure, while modelling organisms as computers proves useful to carry out computation using biological machines with specific input-output conditions.

Bacteria as von Neumann architectures

Inspired by Brent and Bruck [1], who studied similarities and differences between biological systems and von Neumann computers, we propose a mapping between the von Neumann architecture and bacteria. This mapping suggests thinking of the metabolism as a Turing machine (TM).



(a) (b) (c)

Comparison among biological systems (a), von Neumann architecture (b), and bacteria (c).

The bacterium takes as input the substrates required for its growth and, through its chemical reaction network, produces desired metabolites as output. The string y acts as a program stored in the RAM. Let Y be the multiset of the bits of y, and $P(Y;p)$ be the set of all partitions of Y with p blocks. We formalise the control unit by defining the function

$$g_\Phi : \{0,1\}^L \longrightarrow \bigcup_{y \in \{0,1\}^L} P(Y;p)$$

$$\bar{y} \in \{0,1\}^L \longmapsto \Pi \in P(\bar{Y};p).$$

Each element of the partition Π is the submultiset b_s of all the gene sets that play a role in the reactions belonging to the sth pathway. In other words, g_Φ turns syntax into semantics.

Chemical reaction networks and computation

We map the chemical reaction network to the **Minsky's Register machine (RM)**, i.e. a finite state machine augmented with a finite number of registers. The RM has been proven to be equivalent to the TM [2]. We define:

- The set D of state species $\{D_i\}$, where each D_i is associated with the state i of the RM;
- The set H of register species $\{H_r\}$, where each H_r is associated with the register r of the RM, and therefore represents the molecular count of species r;
- $\varphi : D \backslash \{i_0\} \longrightarrow \{(H_r, i), (H_r, j, k) \mid H_r \in H,\ j, k \in D\}$ a multivalued mapping.

The RM executes two basic **increment/decrement instructions** [3]:

- $inc(i, r, j)$ to increment register r by 1 and move from state i to state j according to $\varphi(i) = j$;
- $dec(i, r, j, k)$, with $H_r > 0$, to decrement register r by 1 and move from state i to state j ($\varphi(i) = j$).

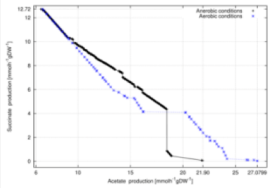
Initial and halting states: $i_0, i_1 \in D$.
Register H_r: left-handed tape that stores positive integers by writing stacks of marks on the tape.
If $H_r = 0$, the machine moves from state i to state k ($\varphi(i) = k$) (**test for zero**).
Halt instruction: halts the operation of the machine, setting the state i_1 (equivalent to the cell death, no further chemical reactions take place [4]).

- $inc(i, r, j)$ mapped to the chemical reaction $D_i \to D_j + H_r$;
- $dec(i, r, j, k)$ mapped to $D_i + H_r \to D_j$ if $H_r > 0$, or to $D_i \to D_k$ if $H_r = 0$.

Optimal molecular machines

We program molecular machines using *Genetic Design through Multi-Objective optimisation* (**GDMO**) [5].

- Through a specific optimal code stored in the "memory" of the organism, we are able to simultaneously maximise the yield of two or more metabolites of interest.
- The genetic code, i.e. the "computation instructions" given to the machine [6], is represented by a Pareto-optimal string of bits $y \in \{0,1\}^L$.



Maximisation in anaerobic and aerobic conditions with glucose uptake rate 10 mmolh^{-1} gDW^{-1}.

Conclusion

- Since the simulated TM can be universal, the proposed mapping between metabolism and TM allows to perform any kind of computation, through a set of species and chemical reactions characterised by their flux [7].
- In principle, bacteria can carry out at least any computation performed by a computer.
- A program embedded in a bacterium, whose metabolism works like a TM, could be able to implement the knockout strategy found by GDMO.
- The minimisation of the number of knockouts ensures a low-effort, reliable and reproducible result, allowing cells to become programmable manufacturers of biochemical products of interest.

References

[1] R. Brent and J. Bruck. 2020 computing: Can computers help to explain biology? *Nature*, 440(7083):416–417, 2006.

[2] M.L. Minsky. *Computation*. Prentice-Hall, 1967.

[3] D. Soloveichik, M. Cook, E. Winfree, and J. Bruck. Computation with finite stochastic chemical reaction networks. *Natural computing*, 7(4):615–633, 2008.

[4] V. Manca. The metabolic algorithm for p systems: Principles and applications. *Theoretical Computer Science*, 404(1):142–155, 2008.

[5] J. Costanza, G. Carapezza, C. Angione, P. Lió, and G. Nicosia. Robust design of microbial strains. *Bioinformatics*, 28(23):3097–3104, 2012.

[6] C. Angione, P. Lió, and G. Nicosia. How to compute with metabolism in bacteria? *ERCIM News*, 91:12, 2012.

[7] C. Angione, G. Carapezza, J. Costanza, P. Lió, and G. Nicosia. Computing with metabolic machines. In Andrei Voronkov, editor, *Turing-100*, volume 10 of *EPiC Series*, pages 1–15. EasyChair, 2012.

Opportunistic Positioning

Ramsey Faragher & Rob Harle

UNIVERSITY OF CAMBRIDGE
Computer Laboratory

Motivation

We rely heavily on Global Navigation Satellite Systems (GNSS) such as GPS for Aviation, Emergency Services, Defence, Academia, Mining, Agriculture, Telecommunications and even Banking. In 2011 it was noted that around €800 billion of the European economy is dependent on GNSS [1]. A study by the Royal Academy of Engineering in March 2011 entitled "Global Navigation Space Systems: reliance and vulnerabilities" provided an examination of society's strong dependence on GNSS and discussed twenty four failure modes of GNSS systems [2]. This research programme addresses the major concerns of this report by improving the reliability and availability of GNSS, without needing new infrastructure or devices.

1. What's wrong with GPS?

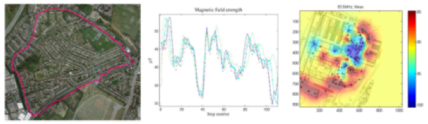
- 50 Watt transmissions from over 20,200 kilometres away
- Received signals are extremely weak (a *quadrillionth* of a Watt)
  - Affected by buildings, space weather, radio interference
  - GPS Jammers are cheaply available on the internet
- All GNSS suffer the same failure modes

Galileo GNSS satellite *Urban canyon* *A £30 GPS Jammer* *Coronal Mass Ejection*

- GNSS need to be enhanced to protect our dependencies
  - Needs better availability, robustness, integrity
- The incorporation of opportunistic signal processing within a GNSS receiver can provide a robust tracking system capable of global operations without or without satellite signals, but requiring no extra infrastructure construction or maintenance costs.

2. Opportunistic Sensing

- GNSS are so successful because of their global availability at low cost (to the end user)
- The most desirable enhancement will also be low cost, provide high availability and require no new infrastructure
- We are surrounded by *opportunistic* signals
  - Radio signals such as DAB, DVB, 2G, 3G, 4G, WiFi
  - Millions of times stronger on reception than GNSS signals
  - Deep penetration into buildings and other GNSS "blindspots".
  - Protection from jamming and space weather events
  - Also magnetic anomalies can provide stable position signatures

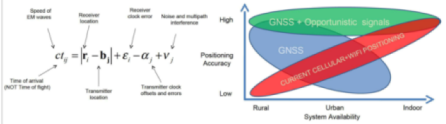


A track produced using GSM 2G cellular mobile phone signals *Excellent repeatability of magnetic signatures down a corridor on four separate days* *A VHF FM radio "heat map" showing the signal complexity indoors exploited by the indoor positioning system*

- Previous opportunistic positioning systems have all depended on differential corrections from reference receivers or extensive prior knowledge (e.g. databases of transmitter locations).
- Here we exploit machine learning algorithms to permit stand-alone (non-differential) terrestrial positioning without any prior knowledge of the types or locations of the opportunistic signals.
- Outdoor positioning – timing and phase measurements
- Indoor positioning – signal strength and magnetic anomalies
- Simultaneous Localisation and Mapping and sensor fusion [3]

3. How does Opportunistic positioning work?

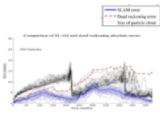
- Outdoors, opportunistic positioning can typically operate in a similar manner to GNSS given modern digital signals with certain properties.
- Opportunistic radio signals were not designed for this purpose and this must be considered to exploit these signals fully.
- Timing broadcast stability and transmitter locations are initially unknown.
- Machine learning algorithms called "Simultaneous Localisation and Mapping" (SLAM) were adapted to permit the use of unstable signals from initially-unknown locations.
- This new flexibility increases the robustness and availability of opportunistic radio positioning and has provided a big step forward in its practical deployment.



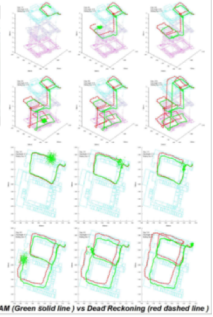
4. SLAM on a Smartphone

- We have developed an Android app that provides GPS-like positioning performance in any indoor environment.
- The system exploits magnetic anomalies, cellular signals, and WiFi
- The system needs no prior knowledge of the signals in the environment before use – it learns about the environment itself and gets better with use.
- At the core of the system is the smartphone's accelerometer, gyro, compass and barometer (providing 3D "dead reckoning" positioning).
  - These sensors provide the initial position estimates, which are improved over time as the system learns about the indoor signal and magnetic anomaly environment

The app in action – the white line is without opportunistic sensing and SLAM, the blue line is the full SLAM solution



SLAM constrains and correct the dead reckoning errors



SLAM (Green solid line) vs Dead Reckoning (red dashed line)

Contact: rmf25@cam.ac.uk

1."Report from the commission to the European Parliament and the Council, Mid-term review of the European satellite radio navigation programmes"
2."Global Navigation Space Systems: reliance and vulnerabilities." The Royal Academy of Engineering.London, UK
3.Faragher R. M. et. al, "Opportunistic Radio SLAM for Indoor Navigation using Smartphone Sensors" IEEE ION PLANS 2012 Conference paper

Digital Technology Group
http://www.cl.cam.ac.uk/research/dtg

An application of machine learning to RCF decision procedures

Zongyan Huang
zh242@cam.ac.uk

Abstract

Machine Learning has been applied to the problem-dependent selection of the most efficient decision procedure in the theorem prover MetiTarski. The machine-learned selection process did better than any fixed decision procedure (Z3, Mathematica and QEPCAD).

Introduction

- MetiTarski is an automatic theorem prover which can prove logical statements involving special functions (log, sin, cos, etc.,.) During its proof search, MetiTarski generates sequences of subproblems in the decidable theory of RCF.
- The theory of Real closed fields (RCF) concerns boolean combinations of polynomial equations and inequalities over the real numbers. No single RCF decision procedure always gives the fastest runtime
- Machine learning uses statistical methods to extract information from supplied training examples, which it can then apply to new problems
- The Support Vector Machine (SVM) was used to do the classification in this work (Joachims' SVM-Light)

Methodology

For each decision procedure, MetiTarski was run on all problems. Then for each problem, the best decision procedure is the one for which MetiTarski solved the problem in least time.

Three main tasks:

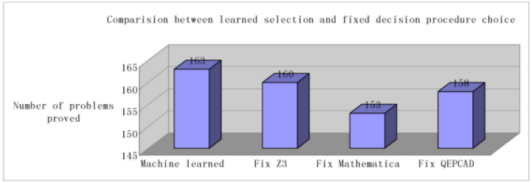
- Identify features of the MetiTarski problems that might be relevant to the correct choice of the RCF decision procedure (which special functions, number of variables, etc.,.)
- Select the best kernel function and parameter values for SVM-Light based on F_1-score maximization
- Combine the models for the decision procedures and compare the margin values produced by three decision procedure classifiers. The classifier with most positive (or least negative) margin was selected.

UNIVERSITY OF CAMBRIDGE
Computer Laboratory

Results

The experiment was done on 825 MetiTarski problems in the TPTP format. The data was randomly split into a learning set (418 problems), a validation set (213 problems) and a test set (194 problems). A time limit of 60 CPU seconds was set for each proof attempt. The total number of problems proved out of 194 test problems was used to measure the efficacy of the machine learned selection process.

Using machine learning to select the best decision procedure yields better results than any individual fixed decision procedure.



Future work

- Extend to the heuristic selection within decision procedures
- Extend the range of features used and apply feature selection
- Provide feedback for development of RCF decision procedures

DOME: Delaying and Overcoming Microprocessor Errors

Negar Miralaei | Jyothish Soman | Timothy Jones | Alan Mycroft | Computer Laboratory, University of Cambridge

Project Overview

The project explores the mechanisms required, both in hardware and software, to delay the occurrence of errors and, once the error has occurred, to continue working while tolerating those errors.

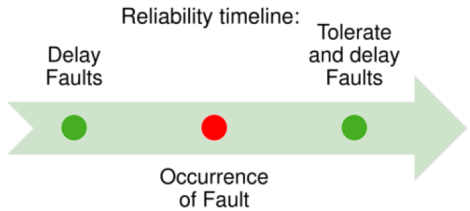
The project started in September of 2012 and will finish in April of 2016. This project is a collaboration between the University of Manchester and the University of Cambridge.

Background

Power inefficiency of current transistors has lead to an increased focus on power management, making traditional error handling schemas such as redundant hardware increasingly infeasible. Additionally transistors are taking less time to wear out, thus becoming more prone to errors. The trend of reducing transistor sizes and increasing their number on a single chip, makes reliability challenges more critical than ever. Hence alternate designs of hardware and software are needed.

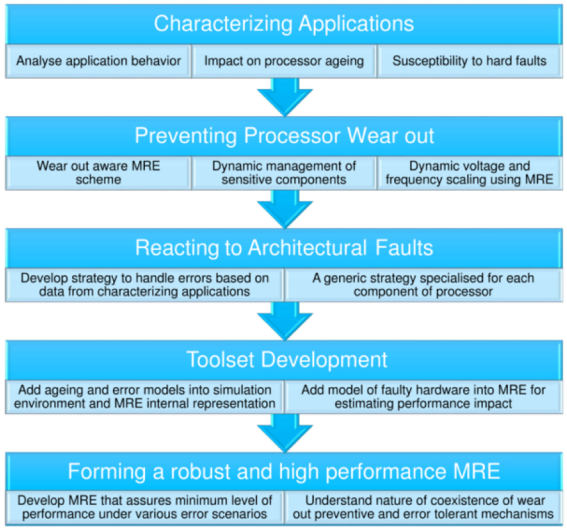
We are taking a novel approach to these challenges by leveraging managed runtime environments (MRE). MREs can be made aware of the wear out and faulty behaviour of the processor, assisting runtime monitoring and altering of applications to increase chip lifetime.

Managing Reliability

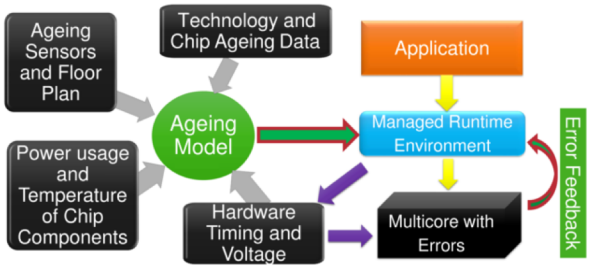


Reliability strategies are pre-fault and post-fault.

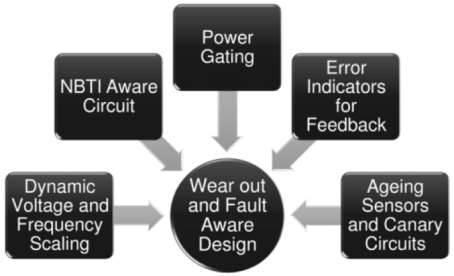
Timeline of Project



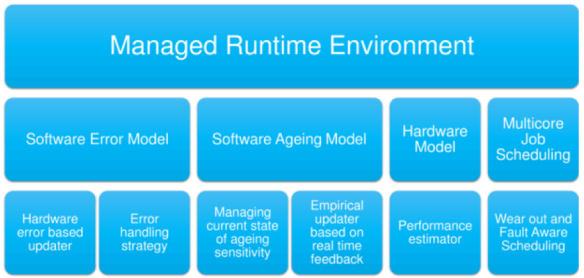
Software Architecture



Hardware Design Directions



MRE Architecture Overview

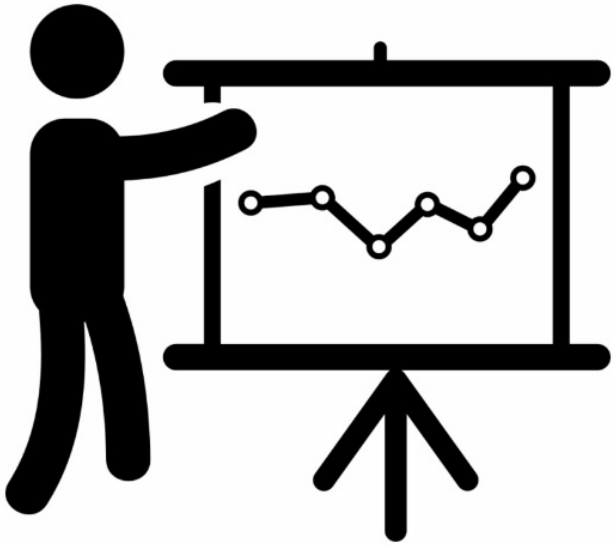


Generalised Aims of the Project

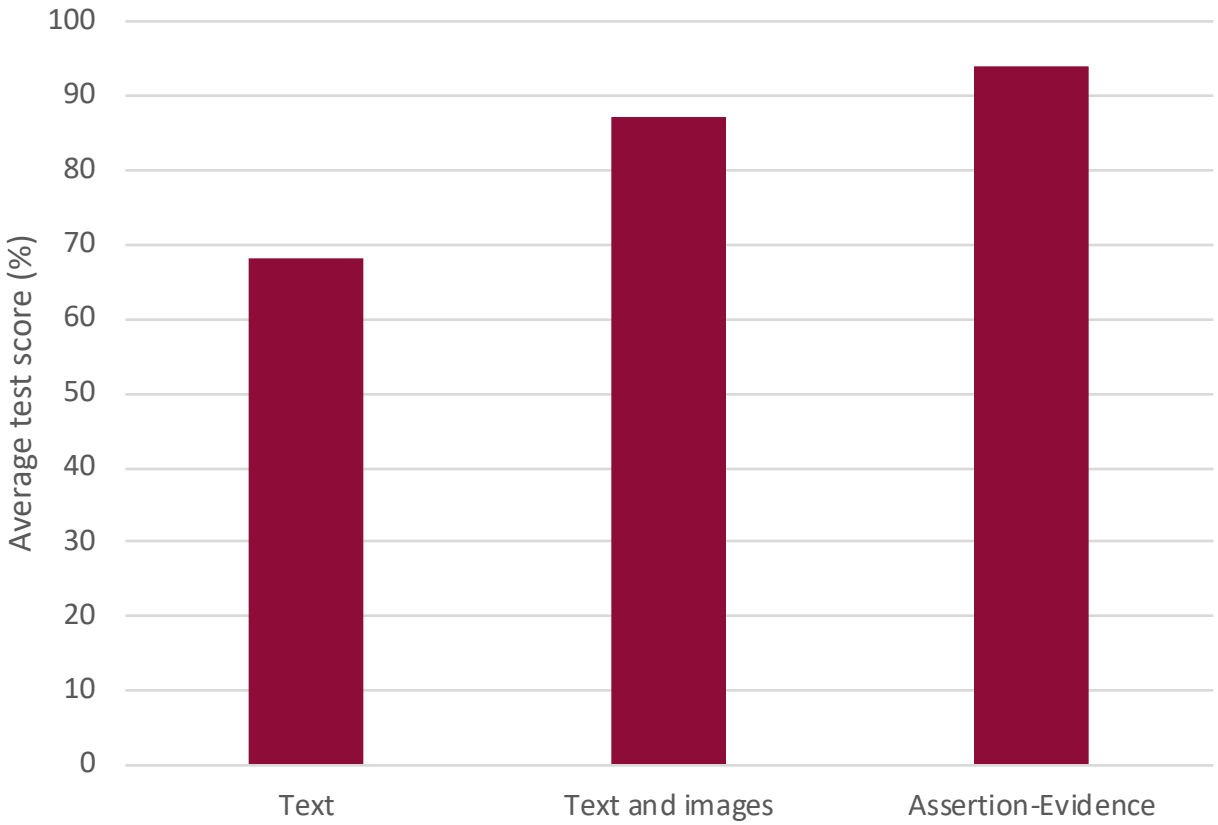
- Our aim is to create a general wear out and fault-aware framework that is suitable for most processor architectures.
- The generality extends also to the applications ran on the system. The project though also focuses on finding general trends in behavior of the system across various applications which can assist in creating a practical design.

UNIVERSITY OF CAMBRIDGE

Slides

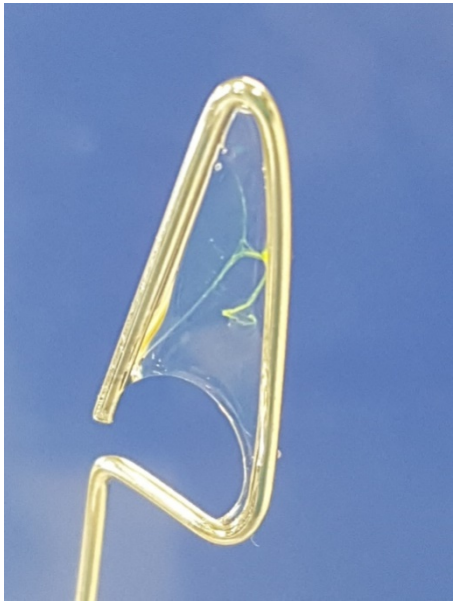


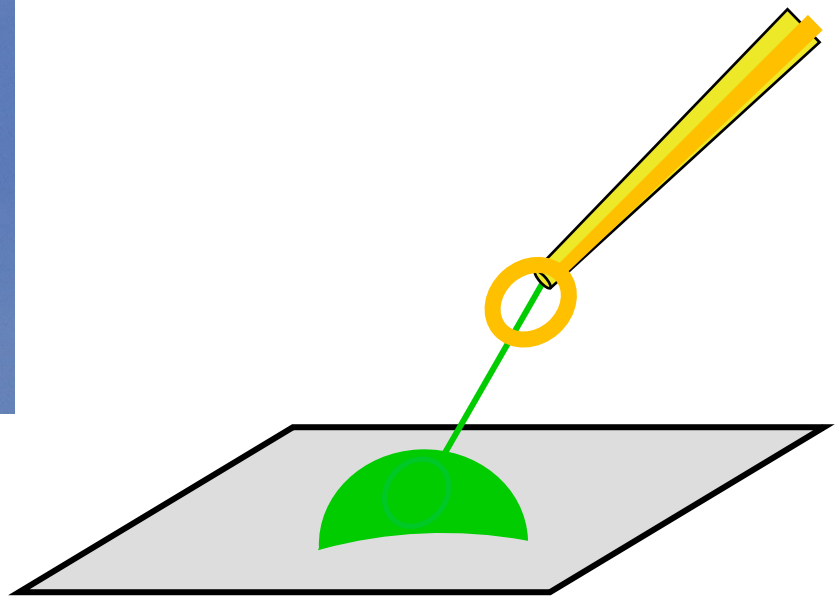
Key points are more memorable if slides follow “Assertion-Evidence” format

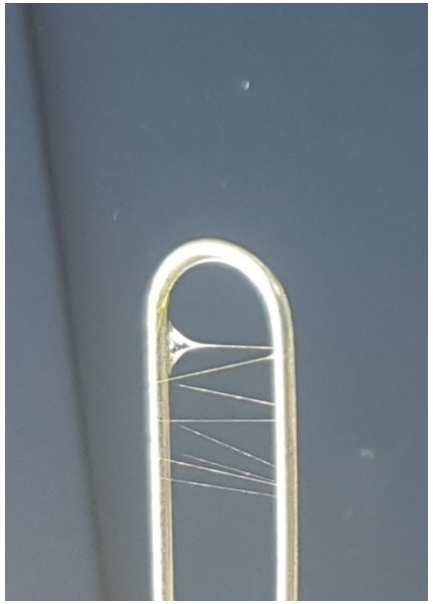


D’Angelo, 2018

Animations can be useful to help the audience visualise a process







Valeria Italia

Presenting your research 2: Presentation skills

Dr Pamela Styles
(pamela.styles@swansea.ac.uk)

Presenting your research

Academic posters

PowerPoint slides

Conference presentations

Poster presentations

Presenting to the public

Presenting your research

Academic posters

PowerPoint slides

Conference presentations

Poster presentations

Presenting to the public

Prepare as much as possible!

Audience

Practice

Notes

Venue

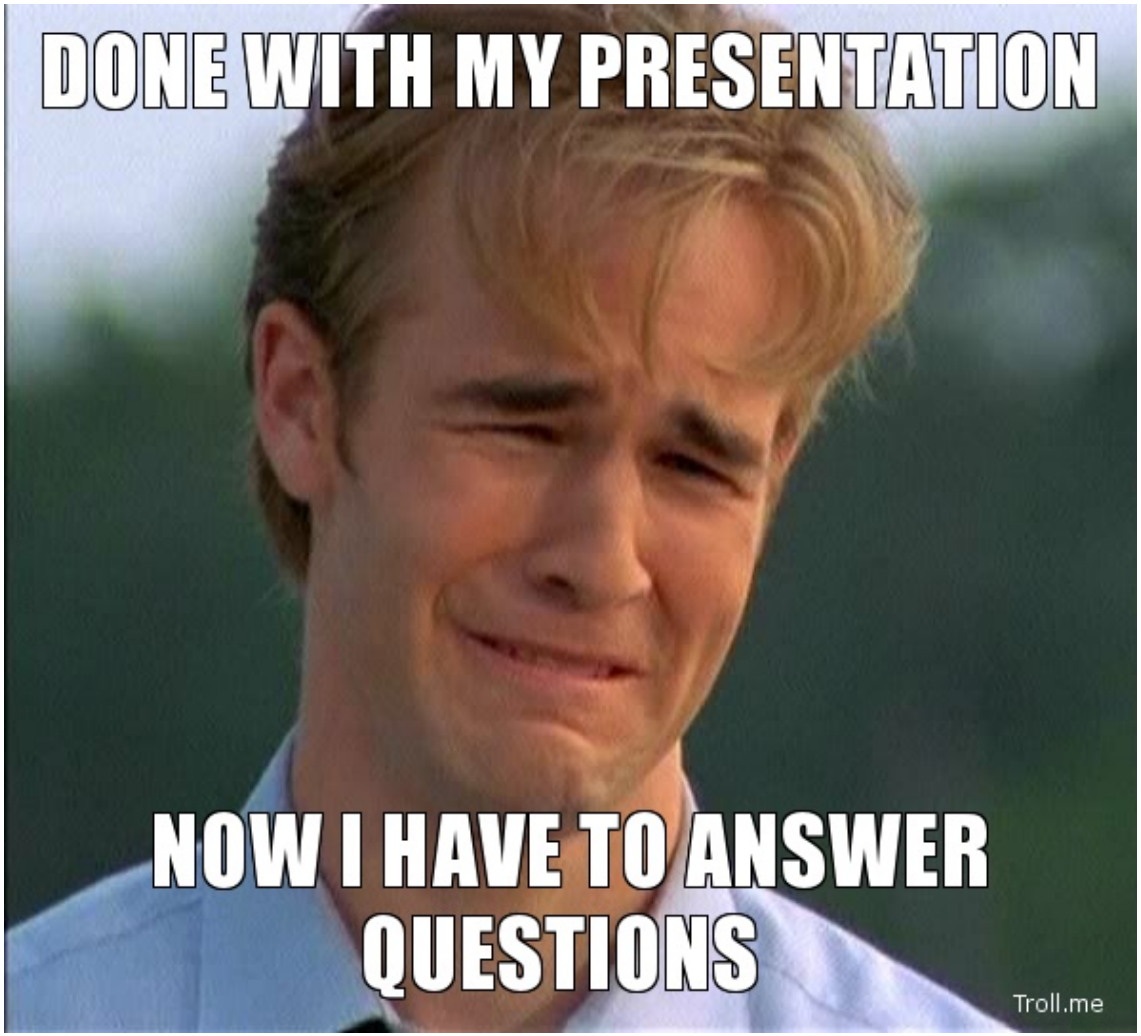
Back-up plans

Open body language, eye contact, and enthusiasm will help engage your audience.

Preparation and experience will help you to manage presentation nerves.

Presenting an academic poster

Techniques to manage questions.



Practice

"Revise"

Anticipate

B W

12 ↵

Make your presentation more accessible by using a microphone and facing the audience.

Presenting your research to the public will help develop your skills and confidence

What does a good presentation for a general audience look like?

- Audience
- Gestures
- Eye contact
- Body language
- Pace
- Clarity
- Enthusiasm
- Emotion
- Key points