SAMBa SLS 2023

The Poster Session

Jenny Power
Carmen van-de-l'Isle

What we will discuss

1. What is a Poster Session

2. Making your Poster

3. Presenting your Poster

1. What is a Poster Session

The Poster Session

- A staple at most conferences
- Purpose is to capture the attention of a passerby and communicate a clear message quickly.
- One page of information.

Why should you go?

... and participate!

- Good opportunity to network!
- Easy way to get your research out there
- You don't have to start the conversation
- Good way to present without being the centre of attention
- You might get feedback and ideas for your future research
- Potential to find friends to sit with at the conference dinner

What is it like?

What is it like?

Depends where you're going...

Intradepartmental

EXAMPLE SAMBa Conference, Ada Lovelace Day

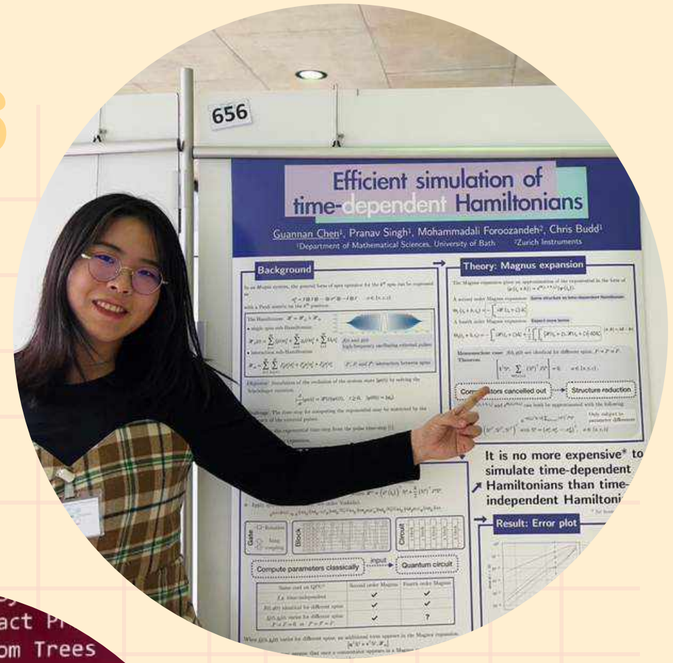
- Audience are your peers
- Could be a good time to practice in front of a friendly crowd
- Can get more experimental

Specialised Conferences

EXAMPLE

whatever exists in your subfield

- Audience are more likely to be familiar with projects like yours
- Could be a good time to gather feedback and new ideas
- Need to be prepared for specialised questioning



General Conferences

EXAMPLE BAMC, BMC, GPSD, SPA, SIAM

- Audience will be mathematical but not necessarily in tune with the specific of your project

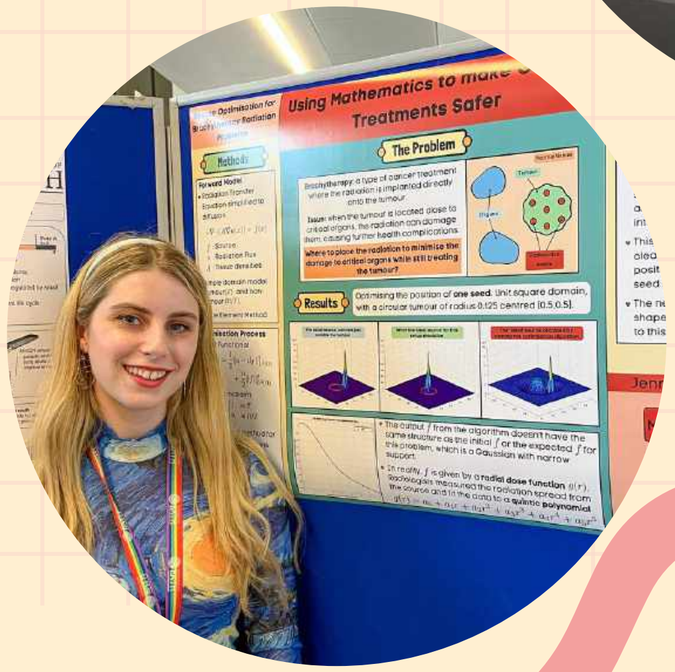
- Could be a good time to practice explaining the general concepts

- Needs to appeal to a wide audience

Non-Mathematical Audience

EXAMPLE STEM for Britain, Doctoral College, Science Fair

- Audience will not necessarily be mathematical
- Often better to concentrate on impact and application
- Needs to appeal to an even wider audience



What do you want to Say

~~What do you want to Say~~

What do you want your audience to learn

2.

Making your Poster

Content

Remember your One Takeaway

If your audience are to walk away with **one thing** from your poster, what is it

Don't put things on your poster that people will ignore

People will ignore most things

Don't put things on your poster that people will ignore

People will ignore most things

- Mike Morrison

How to create a better research poster in less time...

146K views • 2 years ago

How to choose what goes on your poster

Method 1: Removing Content

Start with a paper/ report etc

Remove until you have the bare minimum

Poster

Method 1: Removing Content

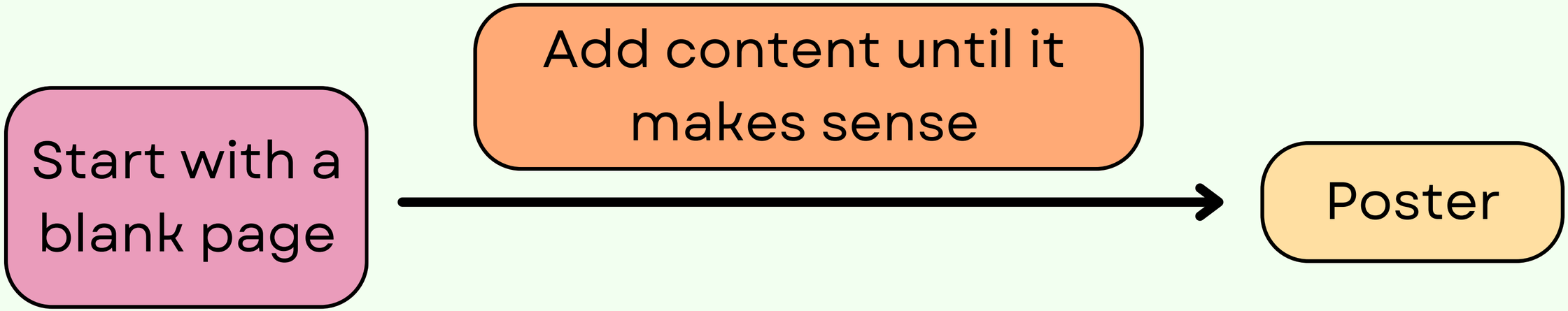
Start with a paper/ report etc

Remove until you have the bare minimum

Poster

Can lead to clunkier posters

Method 1: Adding Content



Checklist of Must Haves

- [x] Your name
- [x] Sponsors Logos (e.g EPSRC, SAMBa, Uni of Bath)

UKRI Engineering and Physical Sciences Research Council

SAMBa

UNIVERSITY OF BATH

- [x] Supervisors name(s)
- [x] References
- [x] QR code → Website, Paper, Linktree

Link-Tree

@thejennypowerhour

Mathematician | PhD student University of Bath

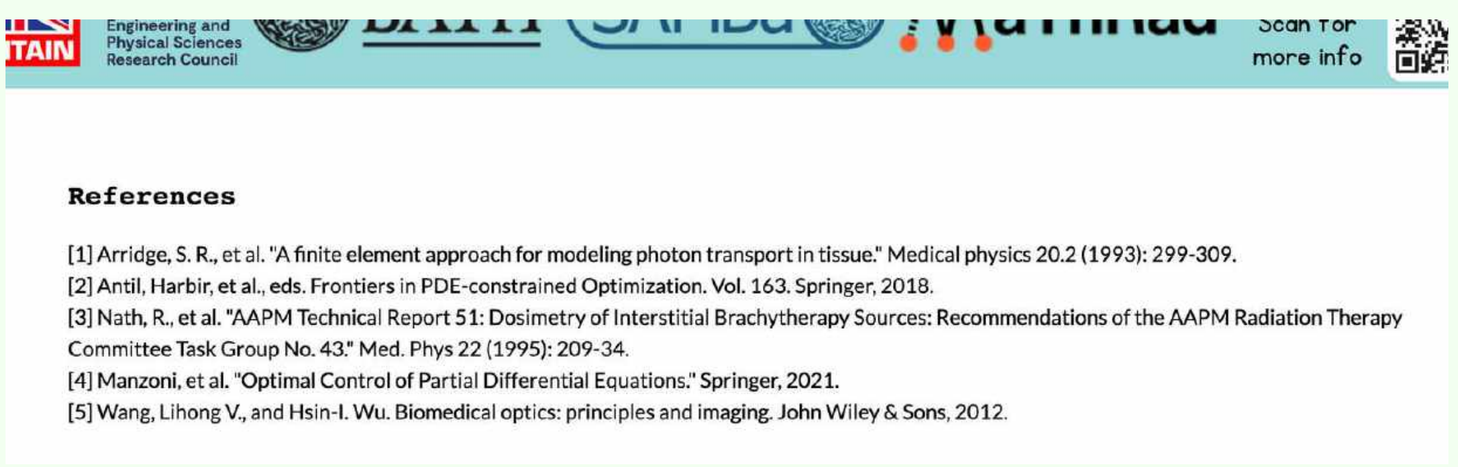
My Research

Social Media

LinkedIn

Instagram

Twitter

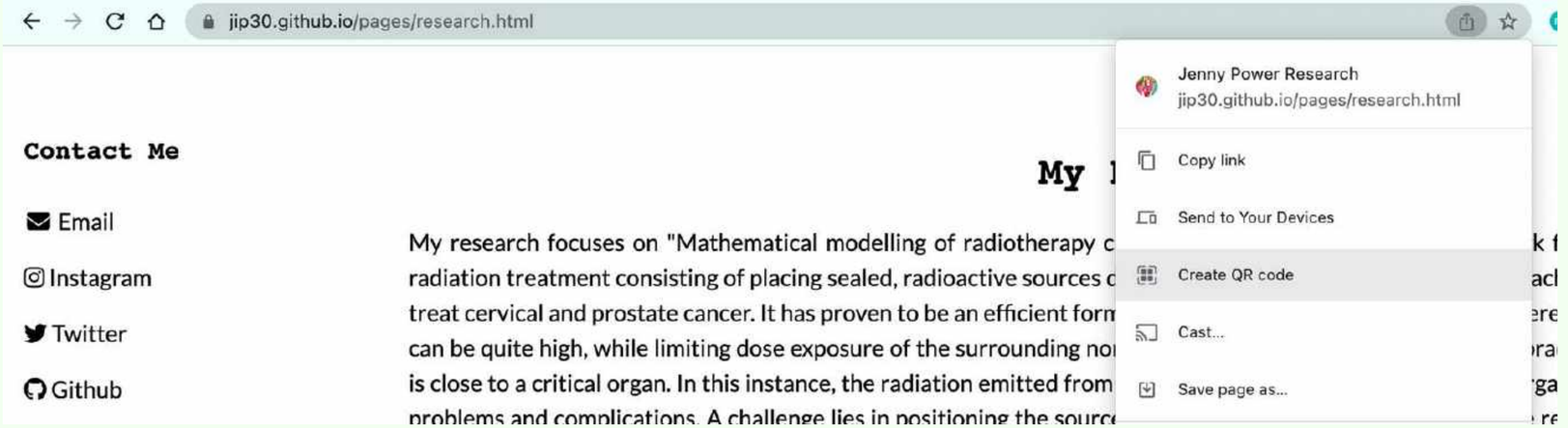


References

[1] Arridge, S. R., et al. "A finite element approach for modeling photon transport in tissue." Medical physics 20.2 (1993): 299-309.
[2] Antil, Harbir, et al., eds. Frontiers in PDE-constrained Optimization. Vol. 163. Springer, 2018.
[3] Nath, R., et al. "AAPM Technical Report 51: Dosimetry of Interstitial Brachytherapy Sources: Recommendations of the AAPM Radiation Therapy Committee Task Group No. 43." Med. Phys 22 (1995): 209-34.
[4] Manzoni, et al. "Optimal Control of Partial Differential Equations." Springer, 2021.
[5] Wang, Lihong V., and Hsin-I. Wu. Biomedical optics: principles and imaging. John Wiley & Sons, 2012.

How to make a QR code

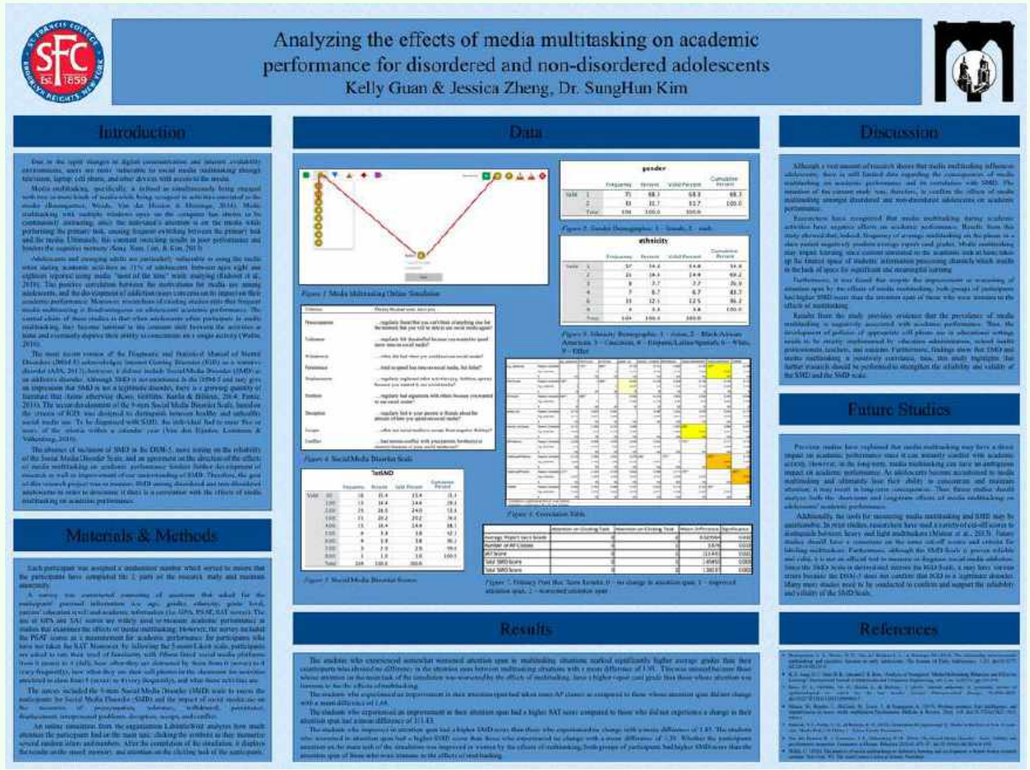
Can make a free one with chrome!

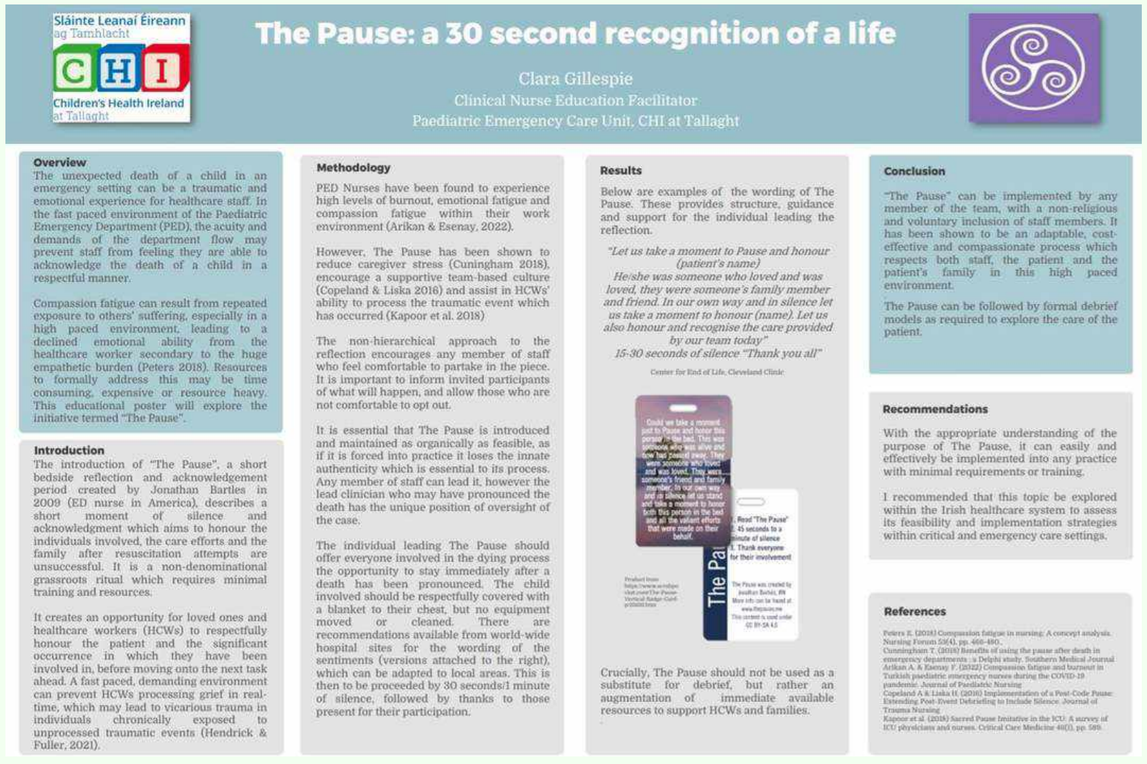


Avoid the Wall of Text!

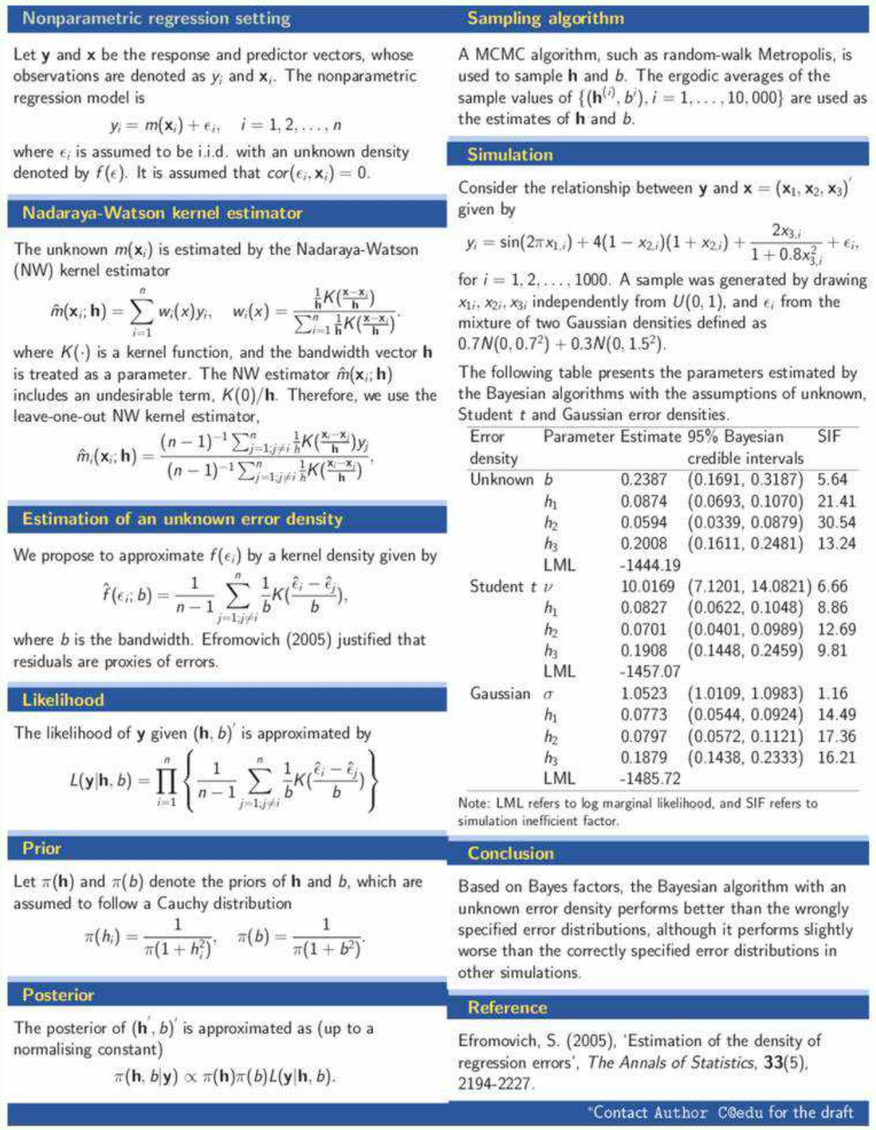
Studies have shown that walls of texts lead to **negative attitudes** towards your poster

High Interaction Cost + Weak Information Draw in + Time Pressure





Minimise Equations



Nonparametric regression setting

Let $\mathbf{y}$ and $\mathbf{x}$ be the response and predictor vectors, whose observations are denoted as y_i and $\mathbf{x}_i$. The nonparametric regression model is

$$y_i = m(\mathbf{x}_i) + \epsilon_i, \quad i = 1, 2, \ldots, n$$

where ϵ_i is assumed to be i.i.d. with an unknown density denoted by $f(\epsilon)$. It is assumed that $cor(\epsilon_i, \mathbf{x}_i) = 0$.

Nadaraya-Watson kernel estimator

The unknown $m(\mathbf{x}_i)$ is estimated by the Nadaraya-Watson (NW) kernel estimator

$$\hat{m}(\mathbf{x}_i; \mathbf{h}) = \sum_{i=1}^{n} w_i(x) y_i, \quad w_i(x) = \frac{\frac{1}{\mathbf{h}} K(\frac{\mathbf{x}-\mathbf{x}_i}{\mathbf{h}})}{\sum_{i=1}^{n} \frac{1}{\mathbf{h}} K(\frac{\mathbf{x}-\mathbf{x}_i}{\mathbf{h}})}.$$

where $K(\cdot)$ is a kernel function, and the bandwidth vector $\mathbf{h}$ is treated as a parameter. The NW estimator $\hat{m}(\mathbf{x}_i; \mathbf{h})$ includes an undesirable term, $K(0)/\mathbf{h}$. Therefore, we use the leave-one-out NW kernel estimator,

$$\hat{m}_i(\mathbf{x}_i; \mathbf{h}) = \frac{(n-1)^{-1} \sum_{j=1; j \neq i}^{n} \frac{1}{h} K(\frac{\mathbf{x}_i - \mathbf{x}_j}{\mathbf{h}}) y_j}{(n-1)^{-1} \sum_{j=1; j \neq i}^{n} \frac{1}{h} K(\frac{\mathbf{x}_i - \mathbf{x}_j}{\mathbf{h}})},$$

Estimation of an unknown error density

We propose to approximate $f(\epsilon_i)$ by a kernel density given by

$$\hat{f}(\epsilon_i; b) = \frac{1}{n-1} \sum_{j=1; j \neq i}^{n} \frac{1}{b} K(\frac{\hat{\epsilon}_i - \hat{\epsilon}_j}{b}),$$

where b is the bandwidth. Efromovich (2005) justified that residuals are proxies of errors.

Likelihood

The likelihood of $\mathbf{y}$ given $(\mathbf{h}, b)'$ is approximated by

$$L(\mathbf{y}|\mathbf{h}, b) = \prod_{i=1}^{n} \left\{ \frac{1}{n-1} \sum_{j=1; j \neq i}^{n} \frac{1}{b} K(\frac{\hat{\epsilon}_i - \hat{\epsilon}_j}{b}) \right\}$$

Prior

Let $\pi(\mathbf{h})$ and $\pi(b)$ denote the priors of $\mathbf{h}$ and b, which are assumed to follow a Cauchy distribution

$$\pi(h_i) = \frac{1}{\pi(1+h_i^2)}, \quad \pi(b) = \frac{1}{\pi(1+b^2)}.$$

Posterior

The posterior of $(\mathbf{h}', b)'$ is approximated as (up to a normalising constant)

$$\pi(\mathbf{h}, b|\mathbf{y}) \propto \pi(\mathbf{h})\pi(b)L(\mathbf{y}|\mathbf{h}, b).$$

Sampling algorithm

A MCMC algorithm, such as random-walk Metropolis, is used to sample $\mathbf{h}$ and b. The ergodic averages of the sample values of $\{(\mathbf{h}^{(i)}, b^i), i = 1, \ldots, 10,000\}$ are used as the estimates of $\mathbf{h}$ and b.

Simulation

Consider the relationship between $\mathbf{y}$ and $\mathbf{x} = (\mathbf{x}_1, \mathbf{x}_2, \mathbf{x}_3)'$ given by

$$y_i = \sin(2\pi x_{1,i}) + 4(1 - x_{2,i})(1 + x_{2,i}) + \frac{2x_{3,i}}{1 + 0.8x_{3,i}^2} + \epsilon_i,$$

for $i = 1, 2, \ldots, 1000$. A sample was generated by drawing x_{1i}, x_{2i}, x_{3i} independently from $U(0, 1)$, and ϵ_i from the mixture of two Gaussian densities defined as $0.7N(0, 0.7^2) + 0.3N(0, 1.5^2)$.

The following table presents the parameters estimated by the Bayesian algorithms with the assumptions of unknown, Student t and Gaussian error densities.

Error density	Parameter	Estimate	95% Bayesian credible intervals	SIF
Unknown	b	0.2387	(0.1691, 0.3187)	5.64
	h_1	0.0874	(0.0693, 0.1070)	21.41
	h_2	0.0594	(0.0339, 0.0879)	30.54
	h_3	0.2008	(0.1611, 0.2481)	13.24
	LML	-1444.19		
Student t	ν	10.0169	(7.1201, 14.0821)	6.66
	h_1	0.0827	(0.0622, 0.1048)	8.86
	h_2	0.0701	(0.0401, 0.0989)	12.69
	h_3	0.1908	(0.1448, 0.2459)	9.81
	LML	-1457.07		
Gaussian	σ	1.0523	(1.0109, 1.0983)	1.16
	h_1	0.0773	(0.0544, 0.0924)	14.49
	h_2	0.0797	(0.0572, 0.1121)	17.36
	h_3	0.1879	(0.1438, 0.2333)	16.21
	LML	-1485.72		

Note: LML refers to log marginal likelihood, and SIF refers to simulation inefficient factor.

Conclusion

Based on Bayes factors, the Bayesian algorithm with an unknown error density performs better than the wrongly specified error distributions, although it performs slightly worse than the correctly specified error distributions in other simulations.

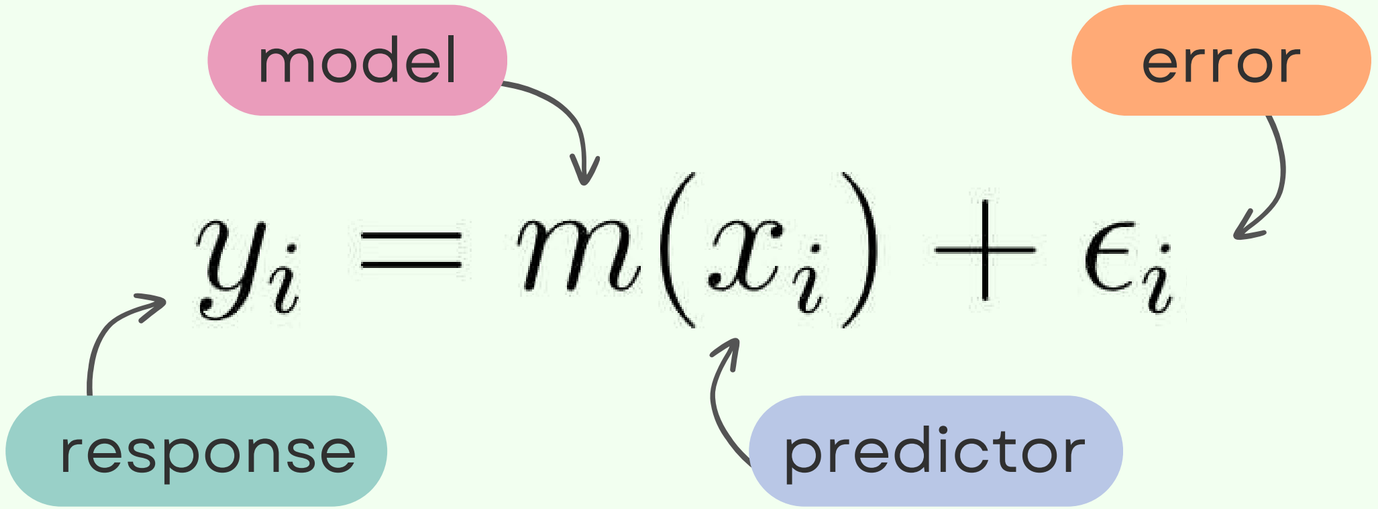
Reference

Efromovich, S. (2005), 'Estimation of the density of regression errors', *The Annals of Statistics*, **33**(5), 2194-2227.

*Contact Author C@edu for the draft

- Try to avoid 'maths talk' - *"let y be the response vector and x be the predictor vector"*

- You will be with your poster, you can explain what things are

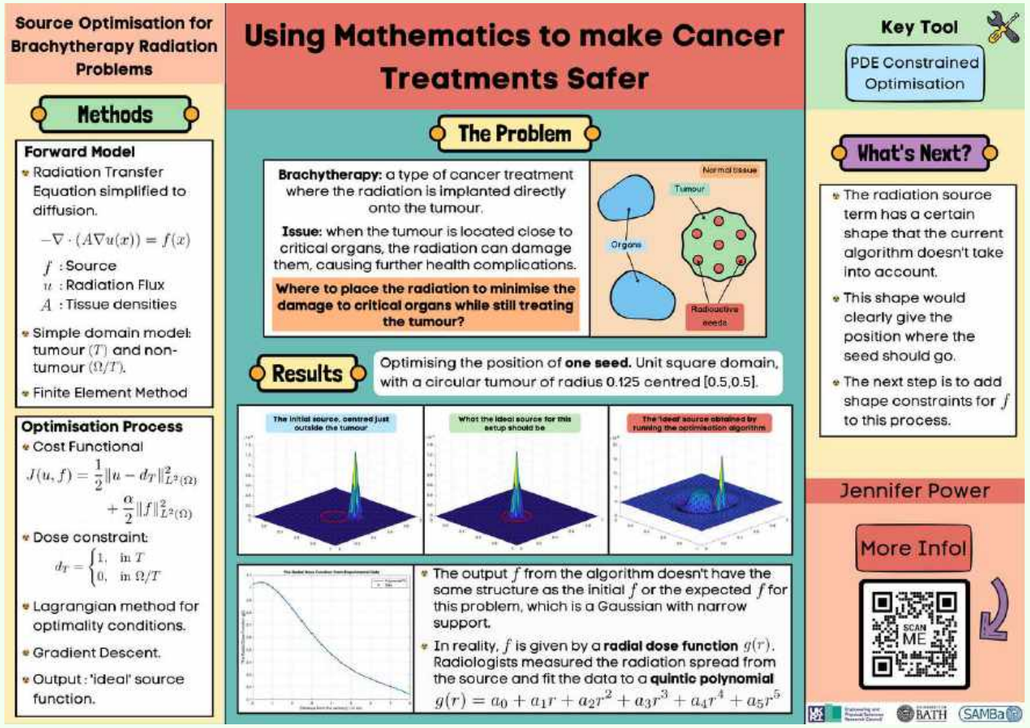


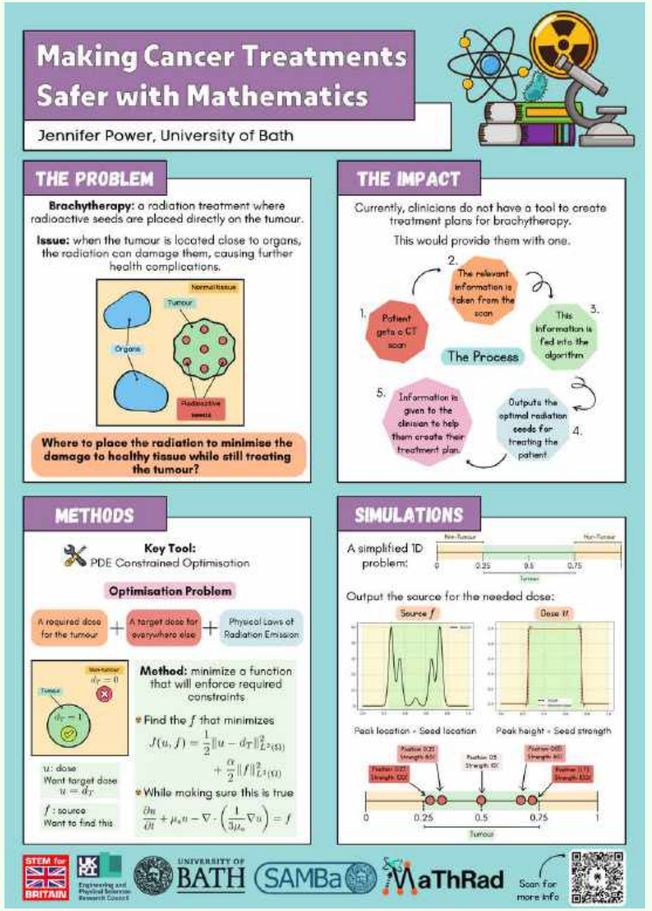
Check Your Images

- Scalable (no blurry images!)
- Your legend and axes are labelled correctly - avoid using math symbols if possible

Tools

Tools: Canva


Source Optimisation for Brachytherapy Radiation Problems
Methods
Forward Model
Radiation Transfer Equation simplified to diffusion.
$-\nabla \cdot (A\nabla u(x)) = f(x)$
f : Source
u : Radiation Flux
A : Tissue densities
Simple domain model: tumour (T) and non-tumour (Ω/T).
Finite Element Method
Optimisation Process
Cost Functional
$J(u,f) = \frac{1}{2}\|u - d_T\|^2_{L^2(\Omega)} + \frac{\alpha}{2}\|f\|^2_{L^2(\Omega)}$
Dose constraint:
$d_T = \begin{cases} 1, & \text{in } T \\ 0, & \text{in } \Omega/T \end{cases}$
Lagrangian method for optimality conditions.
Gradient Descent.
Output : 'ideal' source function.
Using Mathematics to make Cancer Treatments Safer
The Problem
Brachytherapy: a type of cancer treatment where the radiation is implanted directly onto the tumour.
Issue: when the tumour is located close to critical organs, the radiation can damage them, causing further health complications.
Where to place the radiation to minimise the damage to critical organs while still treating the tumour?
Normal tissue
Tumour
Organs
Radioactive seeds
Results
Optimising the position of one seed. Unit square domain, with a circular tumour of radius 0.125 centred [0.5,0.5].
The initial source, centred just outside the tumour
What the ideal source for this setup should be
The 'ideal' source obtained by running the optimisation algorithms
The output f from the algorithm doesn't have the same structure as the initial f or the expected f for this problem, which is a Gaussian with narrow support.
In reality, f is given by a radial dose function $g(r)$. Radiologists measured the radiation spread from the source and fit the data to a quintic polynomial
$g(r) = a_0 + a_1 r + a_2 r^2 + a_3 r^3 + a_4 r^4 + a_5 r^5$
Key Tool
PDE Constrained Optimisation
What's Next?
The radiation source term has a certain shape that the current algorithm doesn't take into account.
This shape would clearly give the position where the seed should go.
The next step is to add shape constraints for f to this process.
Jennifer Power
More Info!
SCAN ME
BATH
SAMBa

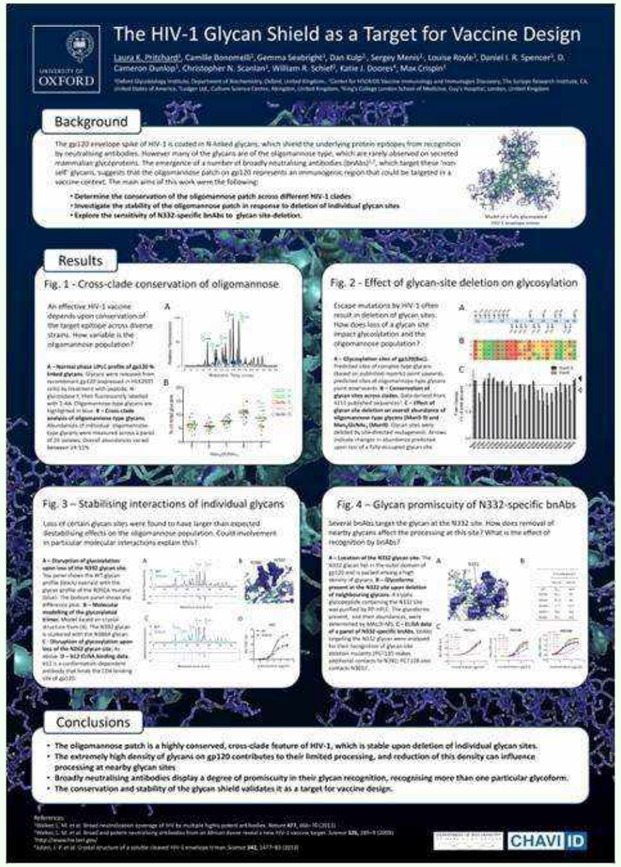

Making Cancer Treatments Safer with Mathematics
Jennifer Power, University of Bath
THE PROBLEM
Brachytherapy: a radiation treatment where radioactive seeds are placed directly on the tumour.
Issue: when the tumour is located close to organs, the radiation can damage them, causing further health complications.
Normal tissue
Tumour
Organs
Radioactive seeds
Where to place the radiation to minimise the damage to healthy tissue while still treating the tumour?
THE IMPACT
Currently, clinicians do not have a tool to create treatment plans for brachytherapy.
This would provide them with one.
1. Patient gets a CT scan
2. The relevant information is taken from the scan
3. This information is fed into the algorithm
The Process
4. Outputs the optimal radiation seeds for treating the patient
5. Information is given to the clinician to help them create their treatment plan
METHODS
Key Tool:
PDE Constrained Optimisation
Optimisation Problem
A required dose for the tumour
A target dose for everywhere else
Physical Laws of Radiation Emission
Method: minimize a function that will enforce required constraints
Find the f that minimizes
$J(u,f) = \frac{1}{2}\|u - d_T\|^2_{L^2(\Omega)} + \frac{\alpha}{2}\|f\|^2_{L^2(\Omega)}$
While making sure this is true
$\frac{\partial u}{\partial t} + \mu_a u - \nabla \cdot \left(\frac{1}{3\mu_s}\nabla u\right) = f$
u: dose
Want target dose $u = d_T$
f: source
Want to find this
SIMULATIONS
A simplified 1D problem:
Non-Tumour
Tumour
Output the source for the needed dose:
Source f
Dose u
Peak location - Seed location
Peak height - Seed strength
STEM for BRITAIN
Engineering and Physical Sciences Research Council
UNIVERSITY OF BATH
SAMBa
MaThRad
Scan for more info

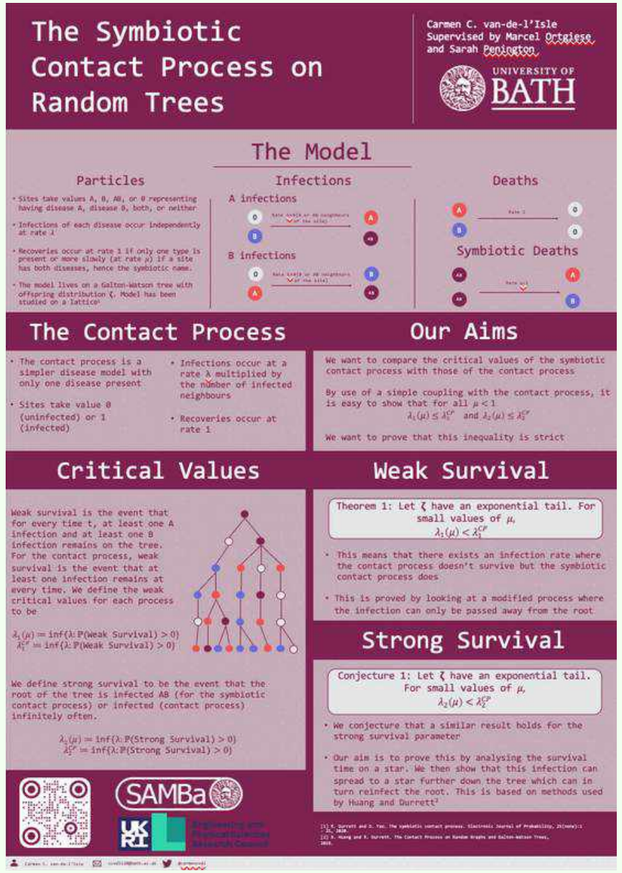
Tools: Canva

- Makes things look very pretty
- Lots of graphics that you can utilise
- What you see is what you get
- Nice fonts
- Very flexible

- No built in LaTeX support
- Some features behind a paywall
- Can lead to major procrastination
- New tool - new learning curve

Tools: Powerpoint





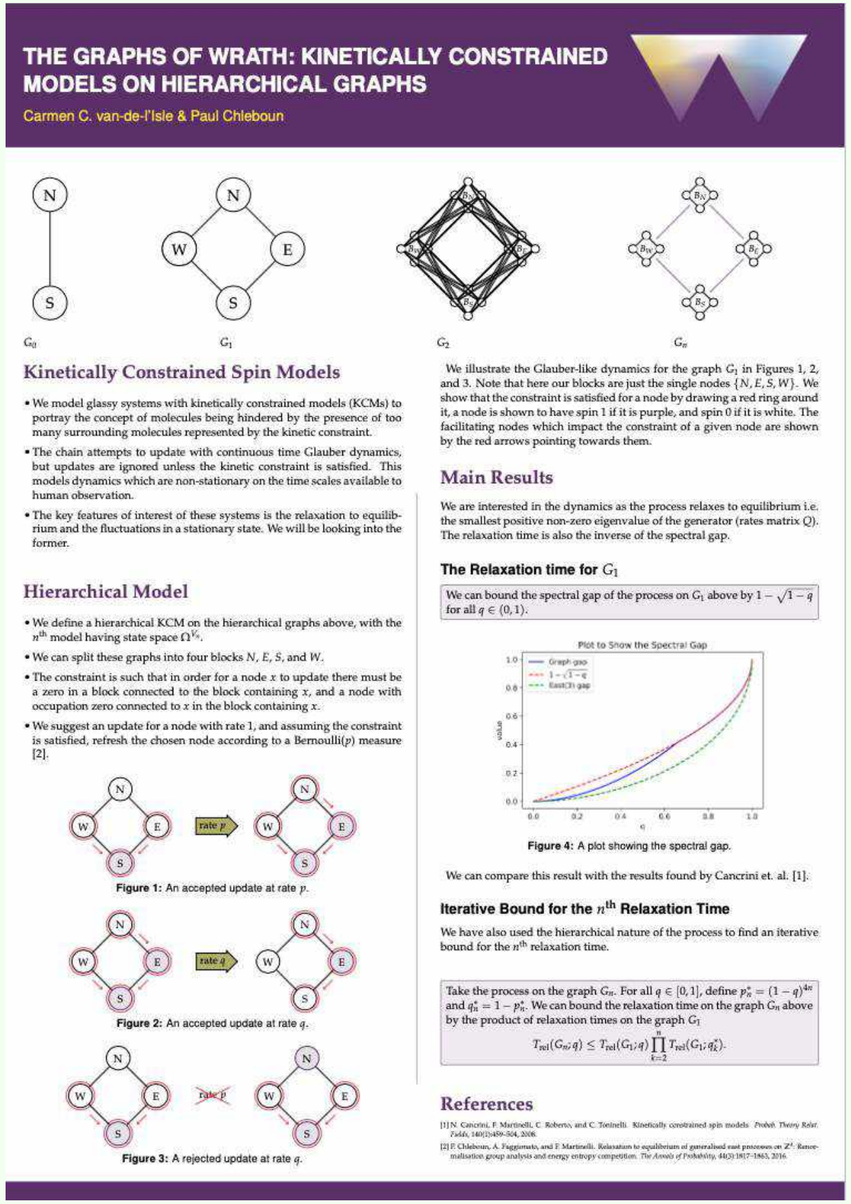
Tools: Powerpoint

- What you see is what you get
- Very flexible
- Easy - you've probably used it before

- Ugly
- Less equation support than beamer
- No tikzpictures :(
- Fewer in-app graphics
- Harder to align things

Tools: Beamer

You can make it look like this....



THE GRAPHS OF WRATH: KINETICALLY CONSTRAINED MODELS ON HIERARCHICAL GRAPHS

Carmen C. van-de-l'Isle & Paul Chleboun

G_0 G_1 G_2 G_n

Kinetically Constrained Spin Models

- We model glassy systems with kinetically constrained models (KCMs) to portray the concept of molecules being hindered by the presence of too many surrounding molecules represented by the kinetic constraint.
- The chain attempts to update with continuous time Glauber dynamics, but updates are ignored unless the kinetic constraint is satisfied. This models dynamics which are non-stationary on the time scales available to human observation.
- The key features of interest of these systems is the relaxation to equilibrium and the fluctuations in a stationary state. We will be looking into the former.

Hierarchical Model

- We define a hierarchical KCM on the hierarchical graphs above, with the n^{th} model having state space Ω^{V_n}.
- We can split these graphs into four blocks N, E, S, and W.
- The constraint is such that in order for a node x to update there must be a zero in a block connected to the block containing x, and a node with occupation zero connected to x in the block containing x.
- We suggest an update for a node with rate 1, and assuming the constraint is satisfied, refresh the chosen node according to a Bernoulli(p) measure [2].

Figure 1: An accepted update at rate p.

Figure 2: An accepted update at rate q.

Figure 3: A rejected update at rate q.

We illustrate the Glauber-like dynamics for the graph G_1 in Figures 1, 2, and 3. Note that here our blocks are just the single nodes $\{N, E, S, W\}$. We show that the constraint is satisfied for a node by drawing a red ring around it, a node is shown to have spin 1 if it is purple, and spin 0 if it is white. The facilitating nodes which impact the constraint of a given node are shown by the red arrows pointing towards them.

Main Results

We are interested in the dynamics as the process relaxes to equilibrium i.e. the smallest positive non-zero eigenvalue of the generator (rates matrix Q). The relaxation time is also the inverse of the spectral gap.

The Relaxation time for G_1

We can bound the spectral gap of the process on G_1 above by $1-\sqrt{1-q}$ for all $q \in (0,1)$.

Figure 4: A plot showing the spectral gap.

We can compare this result with the results found by Cancrini et. al. [1].

Iterative Bound for the n^{th} Relaxation Time

We have also used the hierarchical nature of the process to find an iterative bound for the n^{th} relaxation time.

Take the process on the graph G_n. For all $q \in [0,1]$, define $p_n^* = (1-q)^{4^n}$ and $q_n^* = 1 - p_n^*$. We can bound the relaxation time on the graph G_n above by the product of relaxation times on the graph G_1

$$T_{\text{rel}}(G_n; q) \leq T_{\text{rel}}(G_1; q) \prod_{k=2}^{n} T_{\text{rel}}(G_1; q_k^*).$$

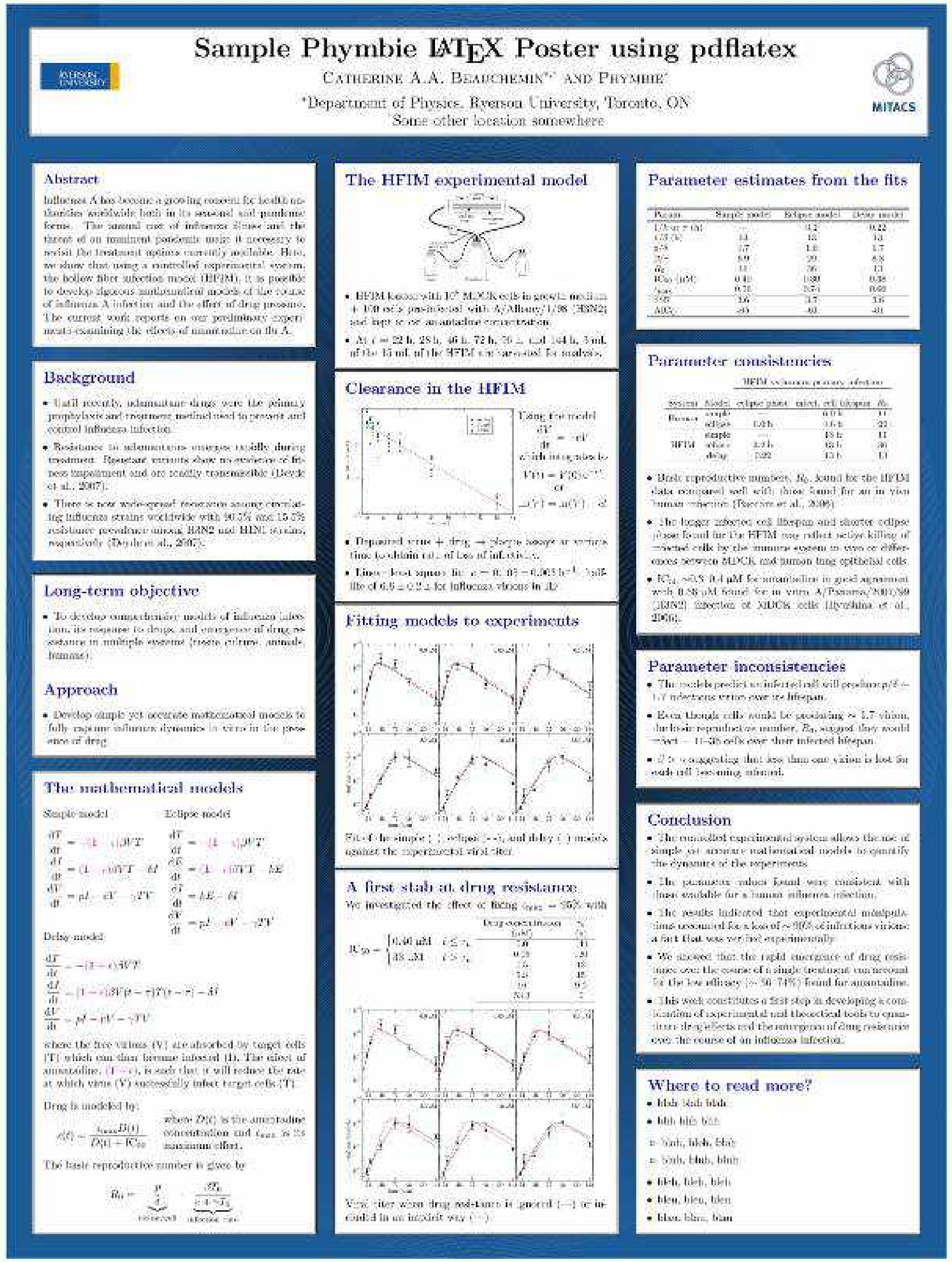
References

[1] N. Cancrini, F. Martinelli, C. Roberto, and C. Toninelli. Kinetically constrained spin models. *Probab. Theory Relat. Fields*, 140(1):459–504, 2008.

[2] P. Chleboun, A. Faggionato, and F. Martinelli. Relaxation to equilibrium of generalized east processes on $\mathbb{Z}^d$: Renormalization group analysis and energy entropy competition. *The Annals of Probability*, 44(3):1817–1863, 2016.

Tools: Beamer

But it will probably look like this....

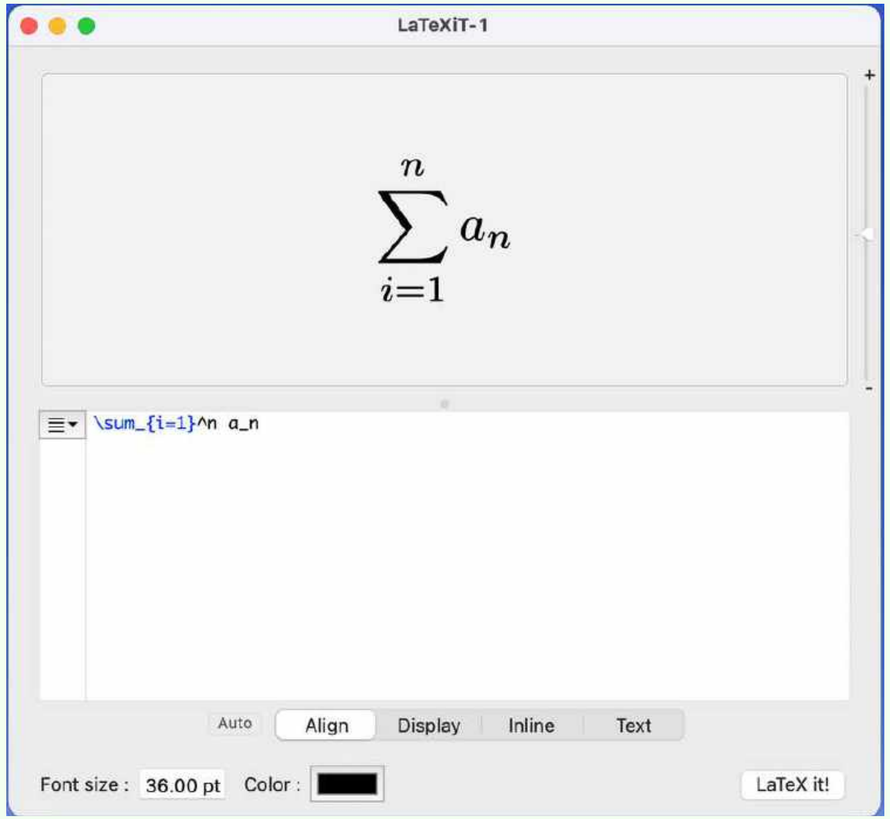


Tools: Beamer

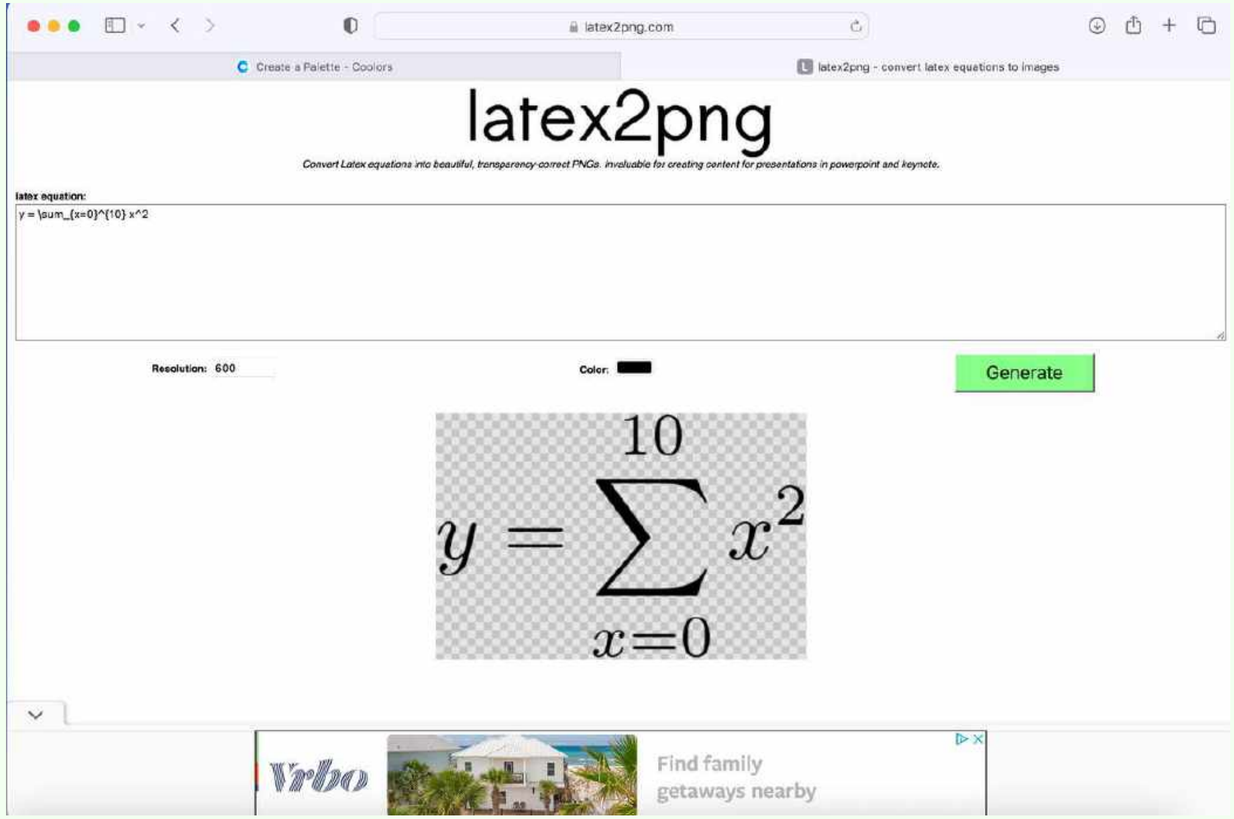
- Makes things look very pretty if you're a pro
- Can be coded to be exactly as you want it
- Easy to add equations
- Lots of templates available
- You'll fit in

- Makes things very ugly if you're not a pro
- Too easy to add too many equations
- Difficult to get the hang of
- You'll fit in

Tools: Extra

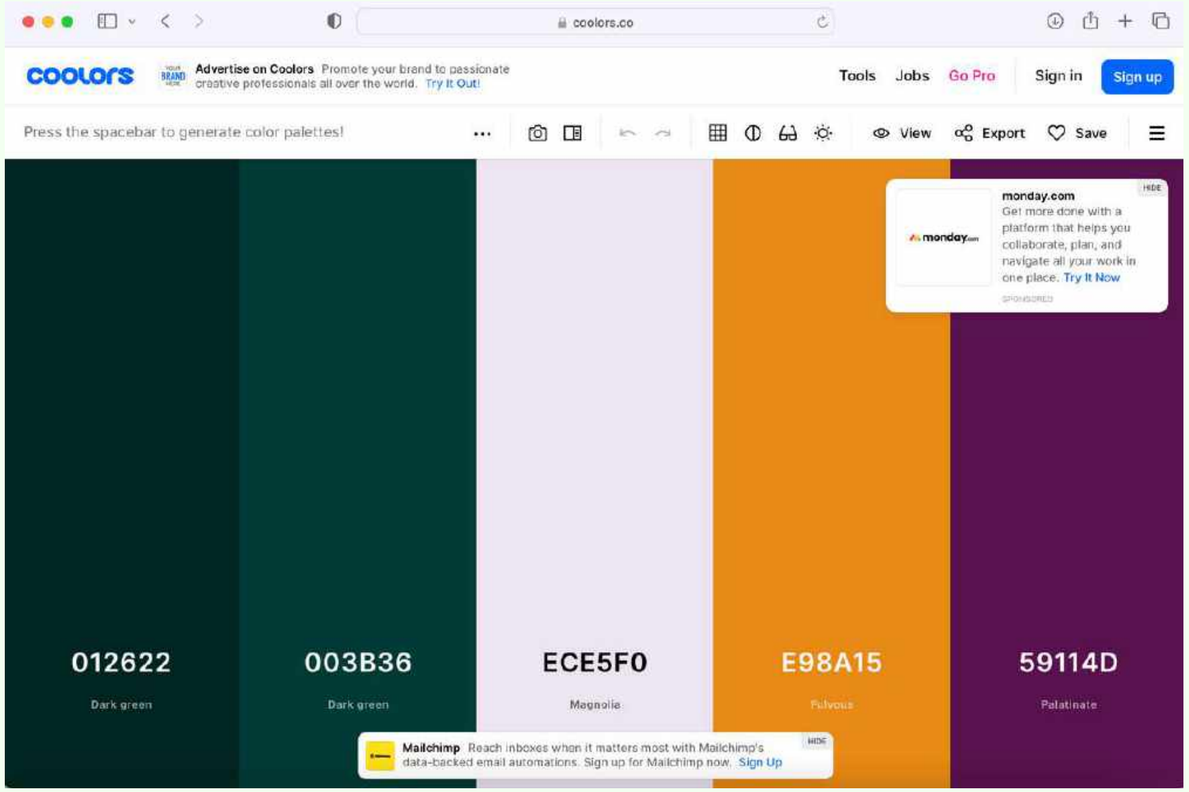


LaTeXiT (mac only)



latex2png.com

Tools: Extra



coolors.co

Design

Poster Size

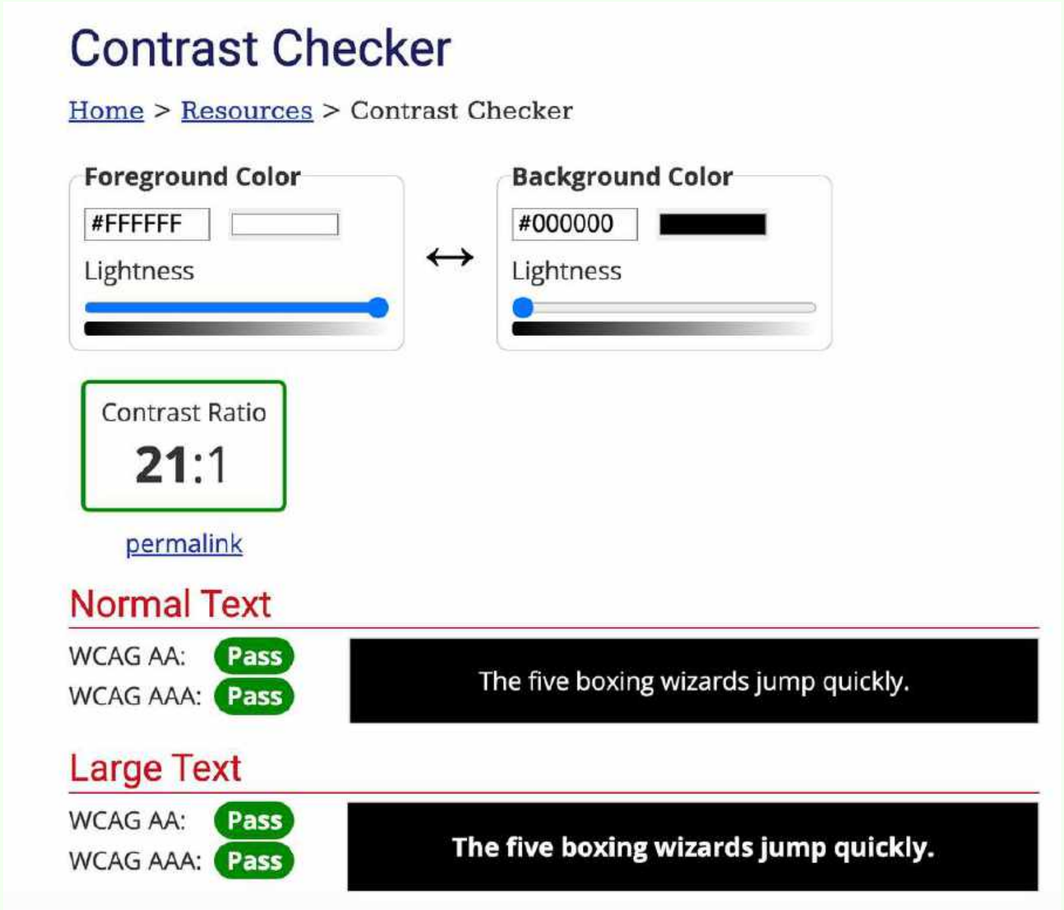
- Check the conference requirements!
- If in doubt, go for A1

Accesibility

- Not an exhaustive list!
- Lots of resources linked in the end slide
- Some things to consider...

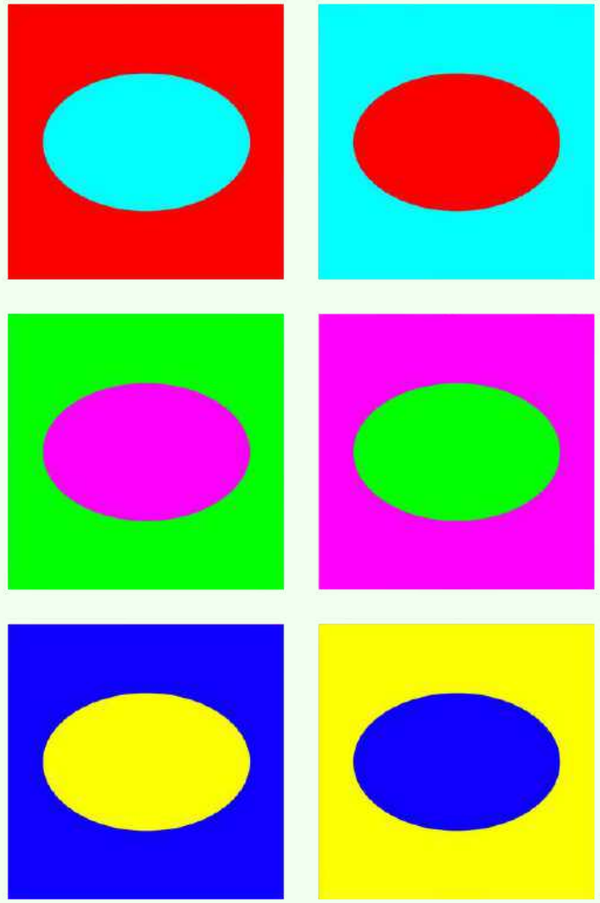
Accesibility

Use good colour contrasts and a readable font size



Accesibility

Avoid using **bright** contrasting colours



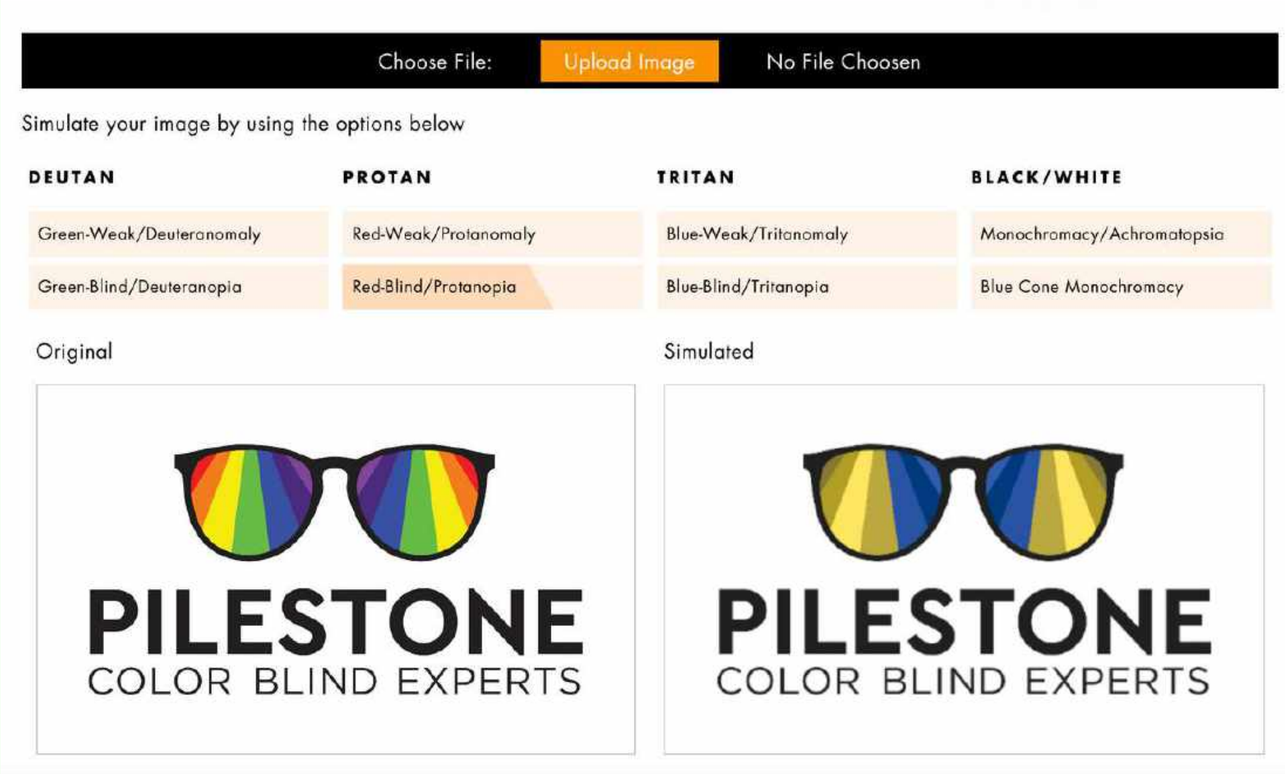
Accesibility

Avoid only using colour to convey meaning

Use a combination of colour, shapes and text

Accesibility

Check what your poster looks like for colourblind people



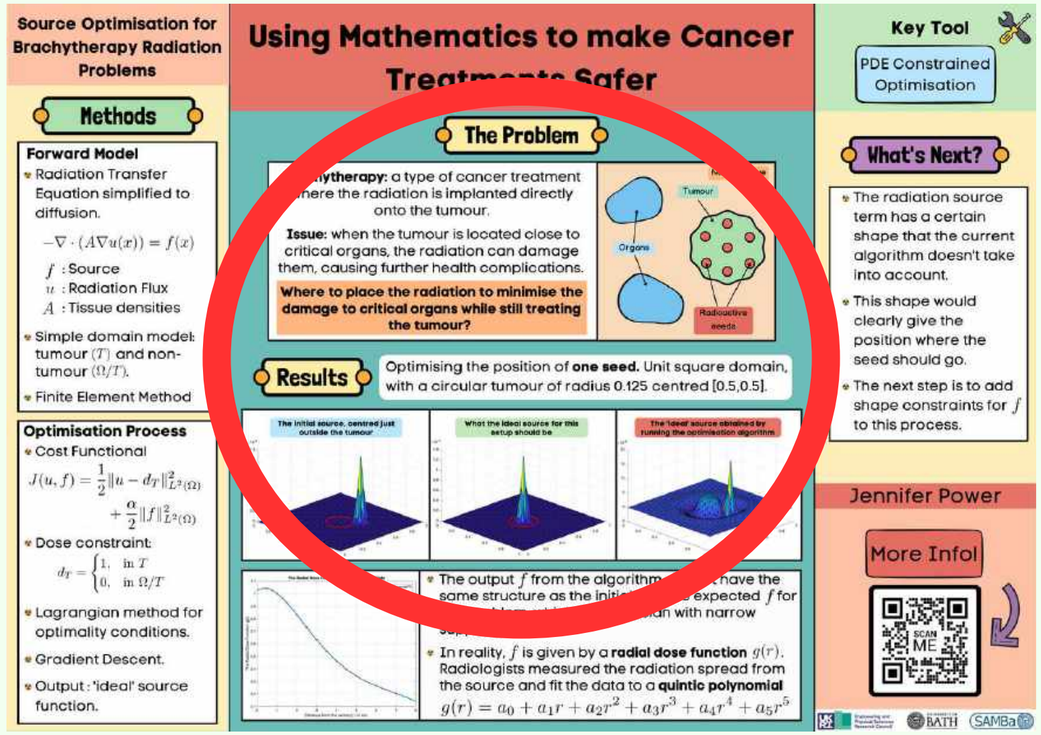
Accesibility

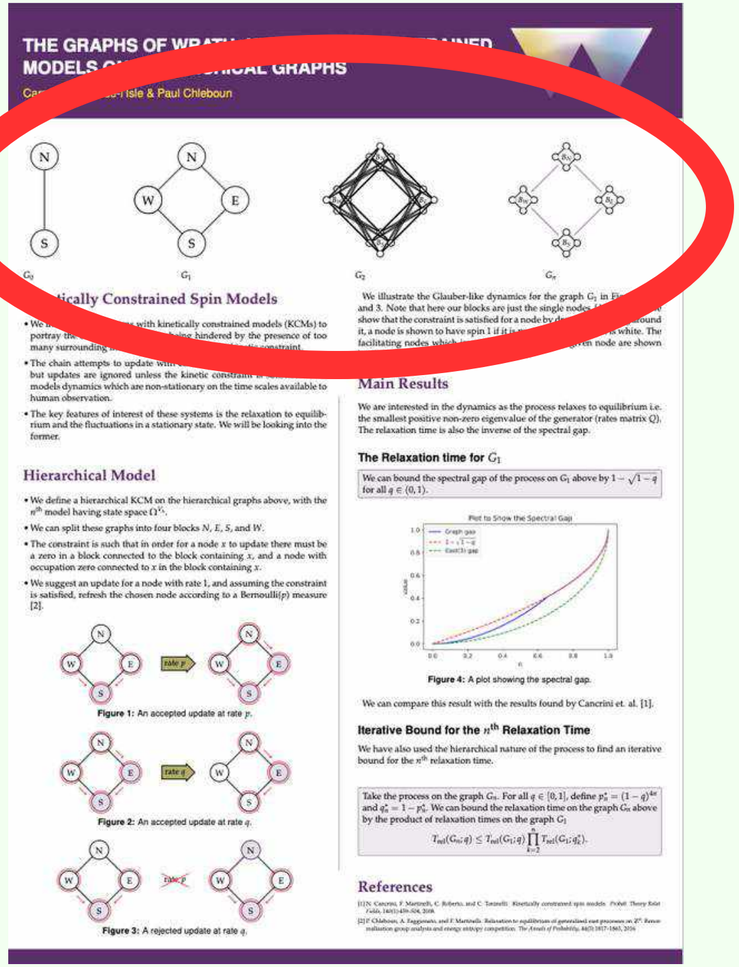
Use large, bold, sans serif fonts on plain backgrounds

Don't underline words.

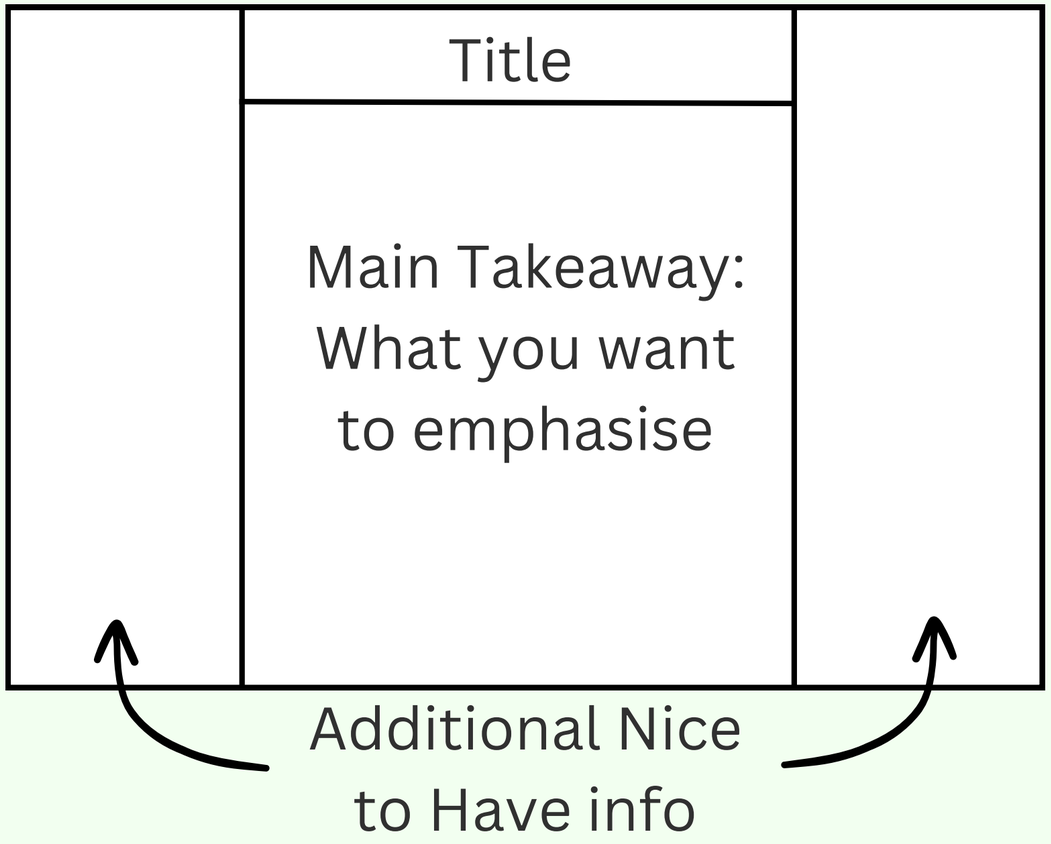
Orientation

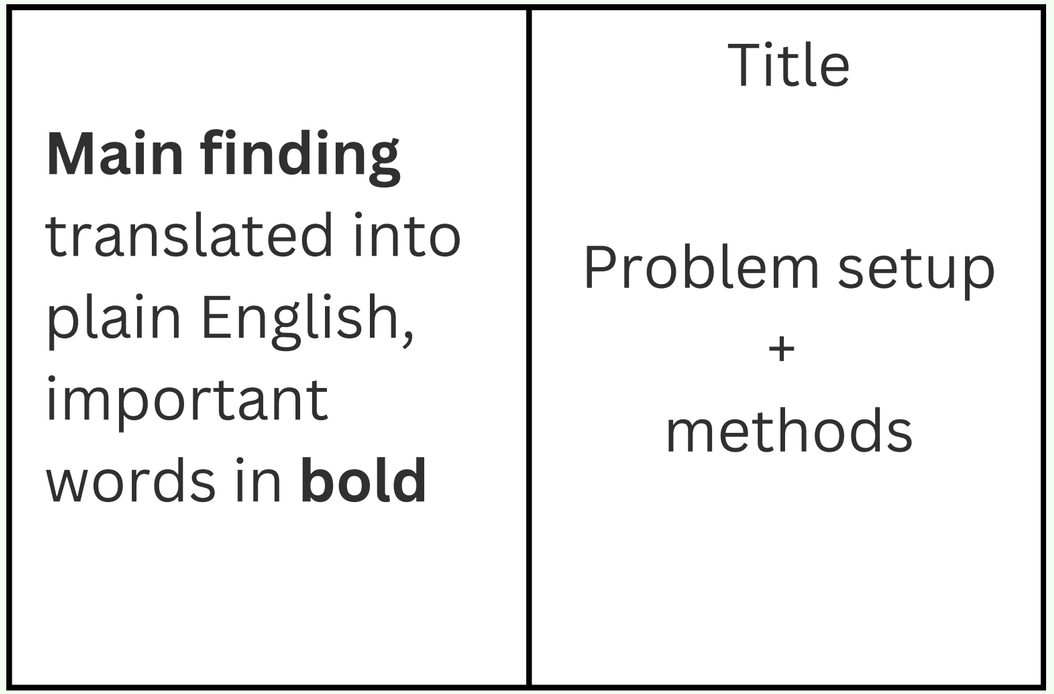
- Requirements of the conference
- Not as simple as you'd think
- Stressing your main point



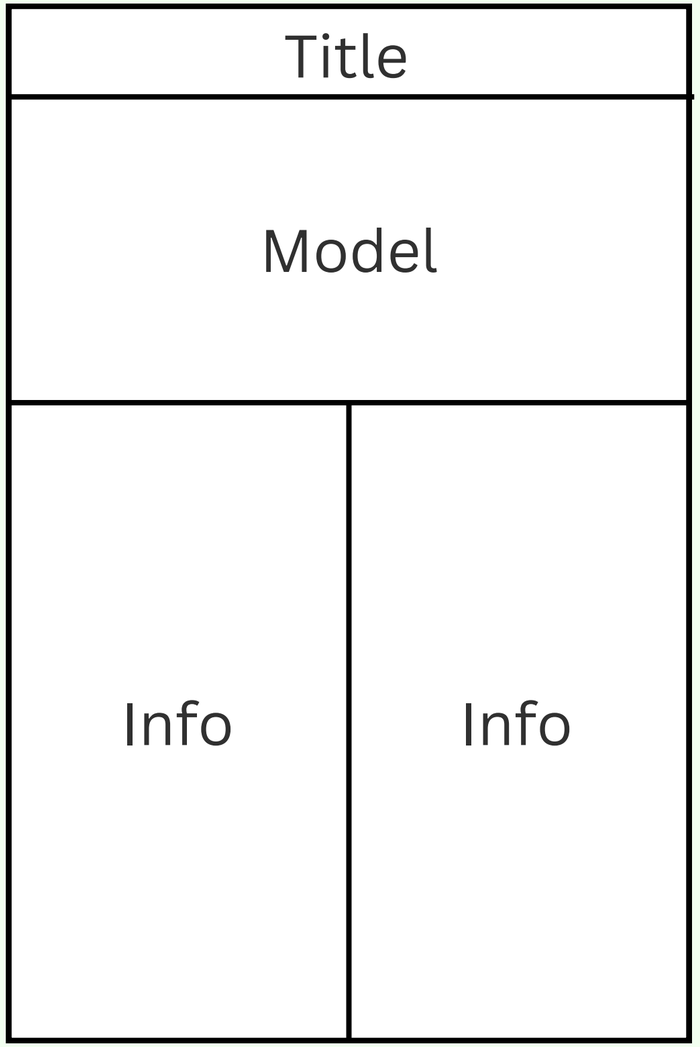


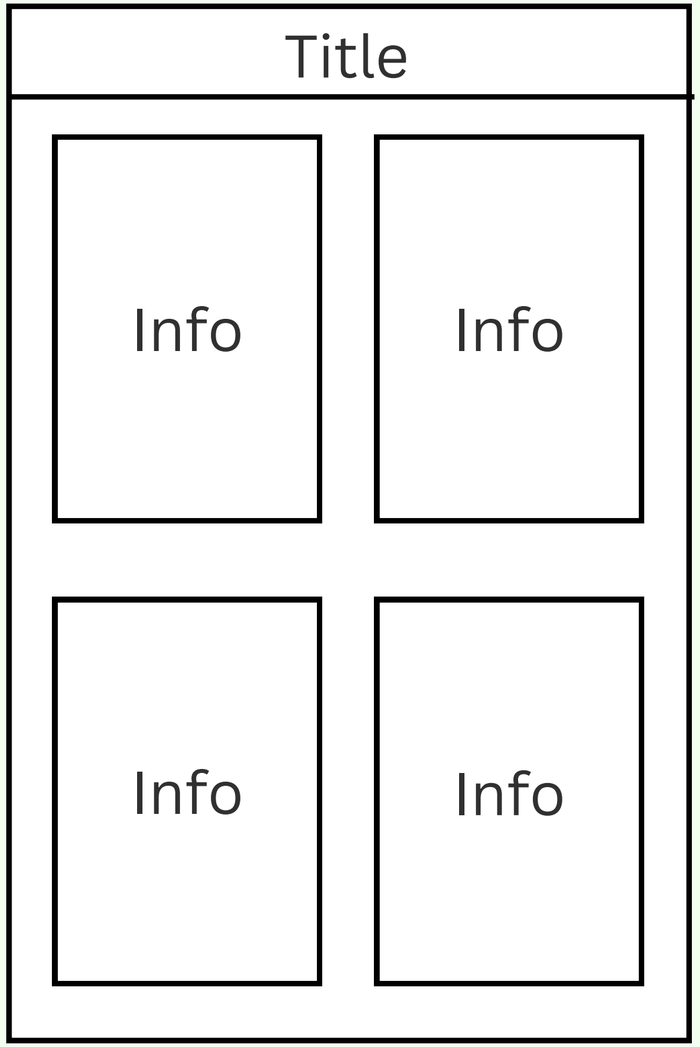
Horizontal


Title
Main Takeaway:
What you want
to emphasise
Additional Nice
to Have info


Main finding
translated into
plain English,
important
words in bold
Title
Problem setup
+
methods

Vertical





Template dangers

If you start with a rigid template you can get stuck into a specific design

Instead, start on paper, and find a template that matches you

Template dangers

Using Beamer templates can be confusing

Make sure you fully understand the template and change templates if you can't

Template dangers

Somtimes canva and powerpoint templates aren't appropriate for a scientific poster

Avoid these templates and find one that's more appropriate

Get a friend to check your poster!

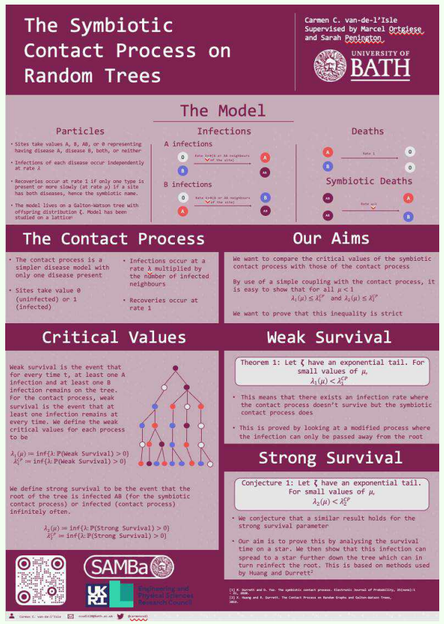
You should be ready at this point but you can always add...

Sparkle

Sparkle

Colour scheme:

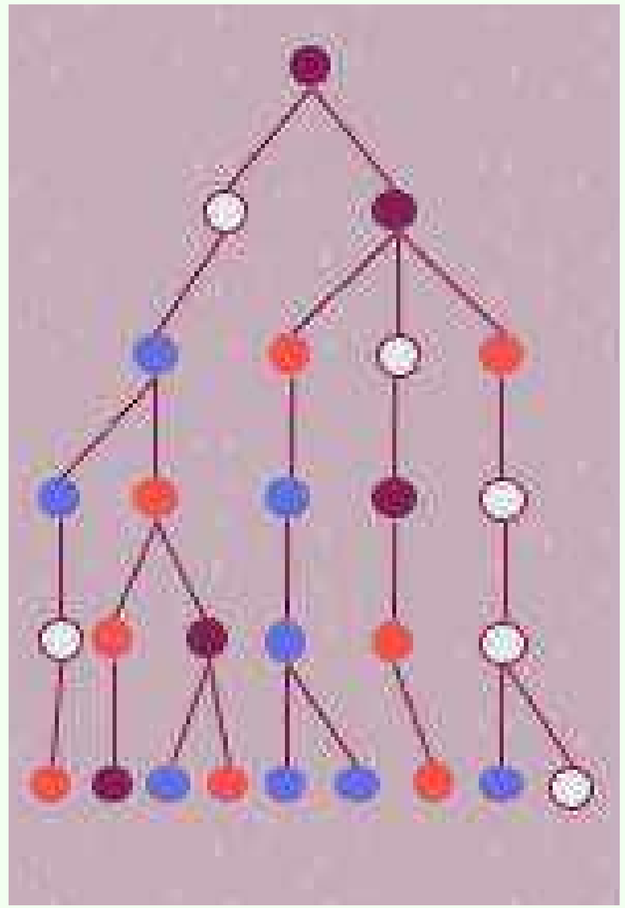
- Do you have a personal brand?



Sparkle

Colour scheme:

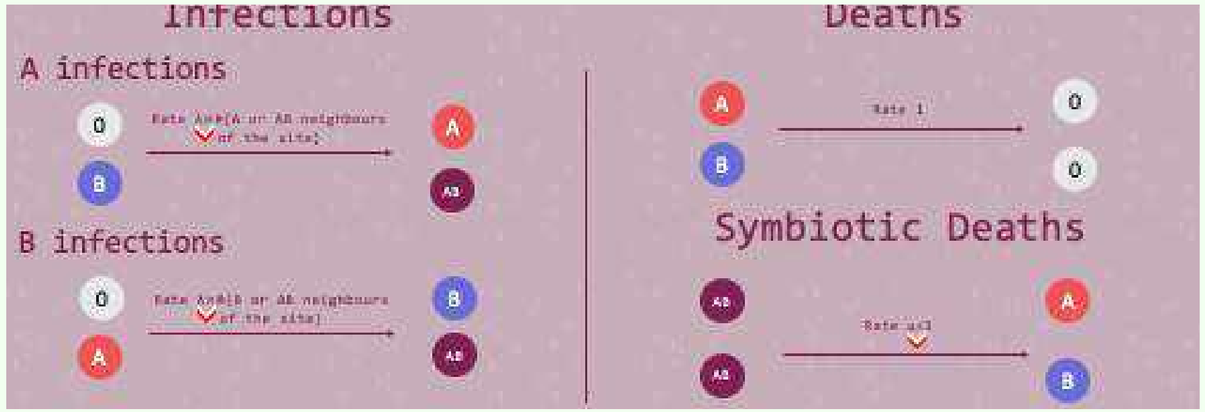
- Do you have a personal brand?
- Did you match your plots with your colour scheme?



Sparkle

Colour scheme:

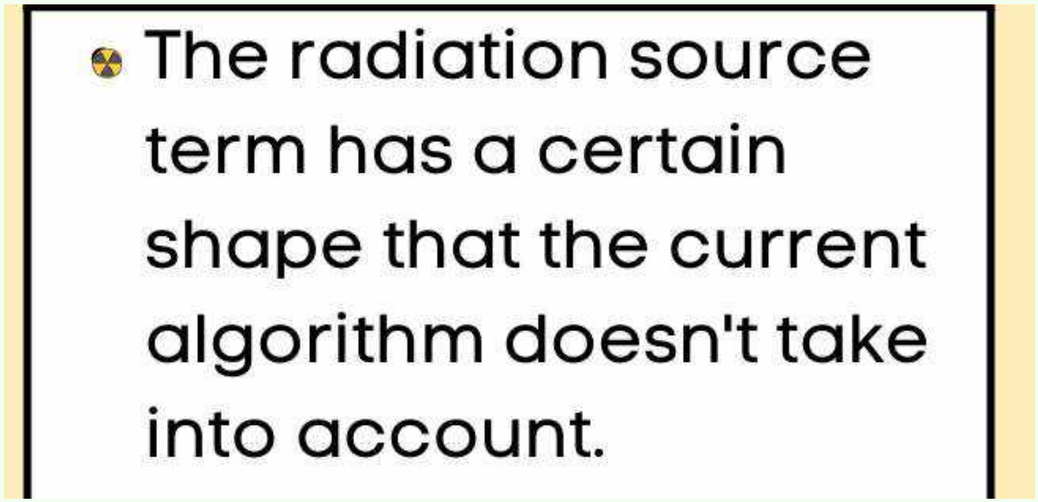
- Do you have a personal brand?
- Did you match your plots with your colour scheme?
- Do your small icons match?



Sparkle

Funky things:

- Can you have alternative bullet points?



Sparkle

Funky things:

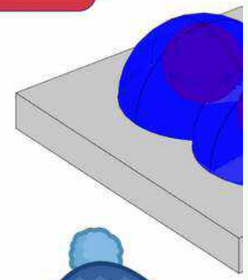
- Can you have alternative bullet points?
- Could you add any cute cartoons/icons?

Optimising embryo freezing

Vitrification (freezing) preserves embryos using liquid nitrogen for rapid cooling.

Faster cooling correlates with **better survival rates.**

However, vitrification protocol is open to interpretation. Clinicians can freeze **variable numbers** of embryos together, in **different arrangements.**



Is there an optimal setup for vitrification?

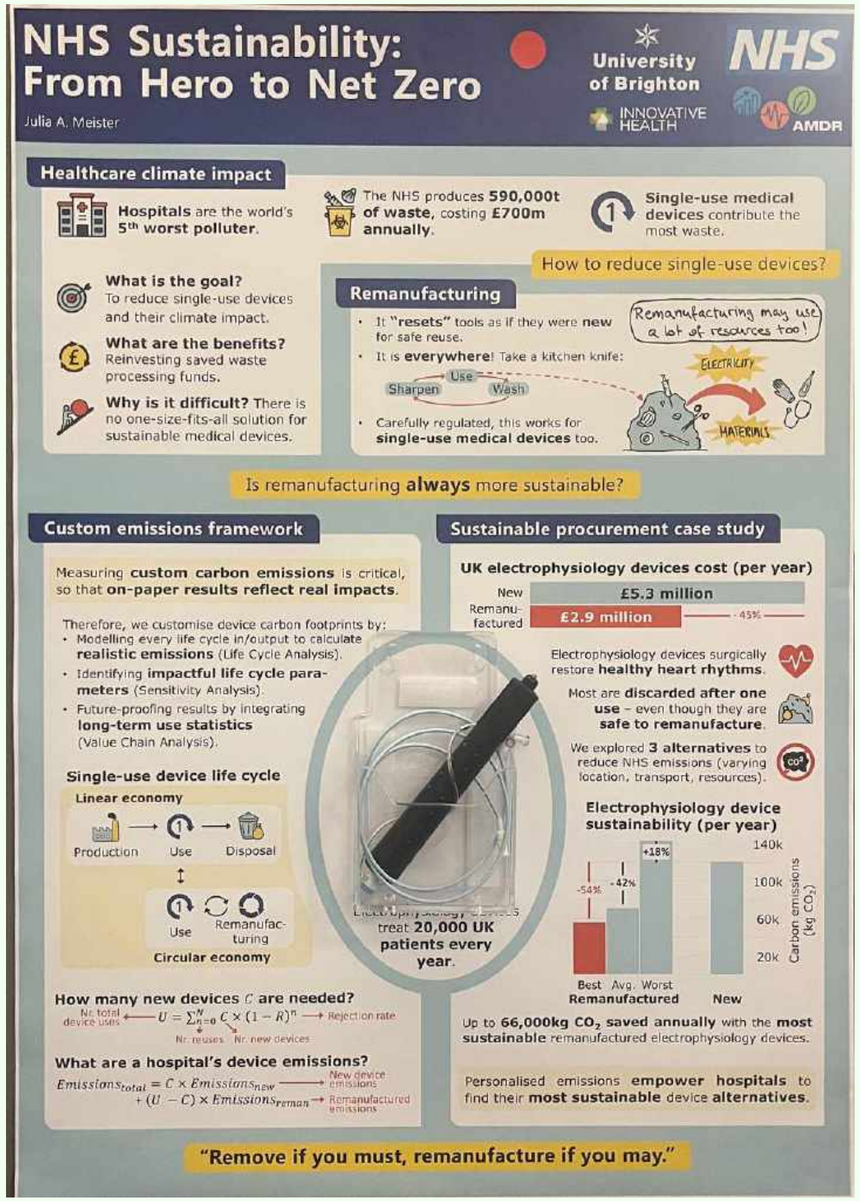
Key Tool

PDE Constrained Optimisation

Sparkle

Funky things:

- Can you have alternative bullet points?
- Could you add any cute cartoons/icons?
- Could you bring a prop?



3.

Presenting your Poster

How to Print your Poster

Full Info: www.bath.ac.uk/guides/printing-a-poster/

Email print@bath.ac.uk and include

- PDF of your poster
- The size you want
- How many copies
- Paper type (200gsm, 90gsm or fabric)
- When you need it by
- Agresso purchase order

If using your TSF to pay for the poster, you will need an Agresso PO. Only Lou can raise this. She will need to know the price.

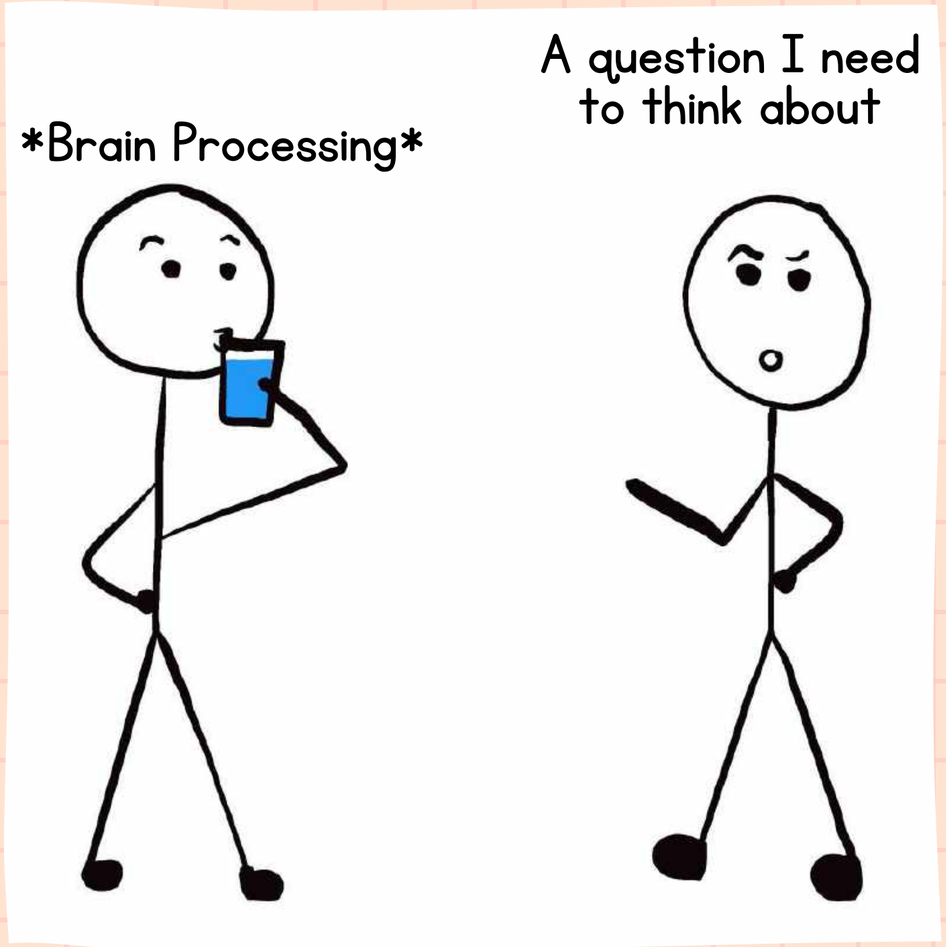
Size	Dimension	1-10
A0	841mm x 1189mm	£30.00
A1	594mm x 841mm	£20.00
A2	420mm x 594mm	£12.50
A3	297mm x 420mm	£5.00

We recommend:

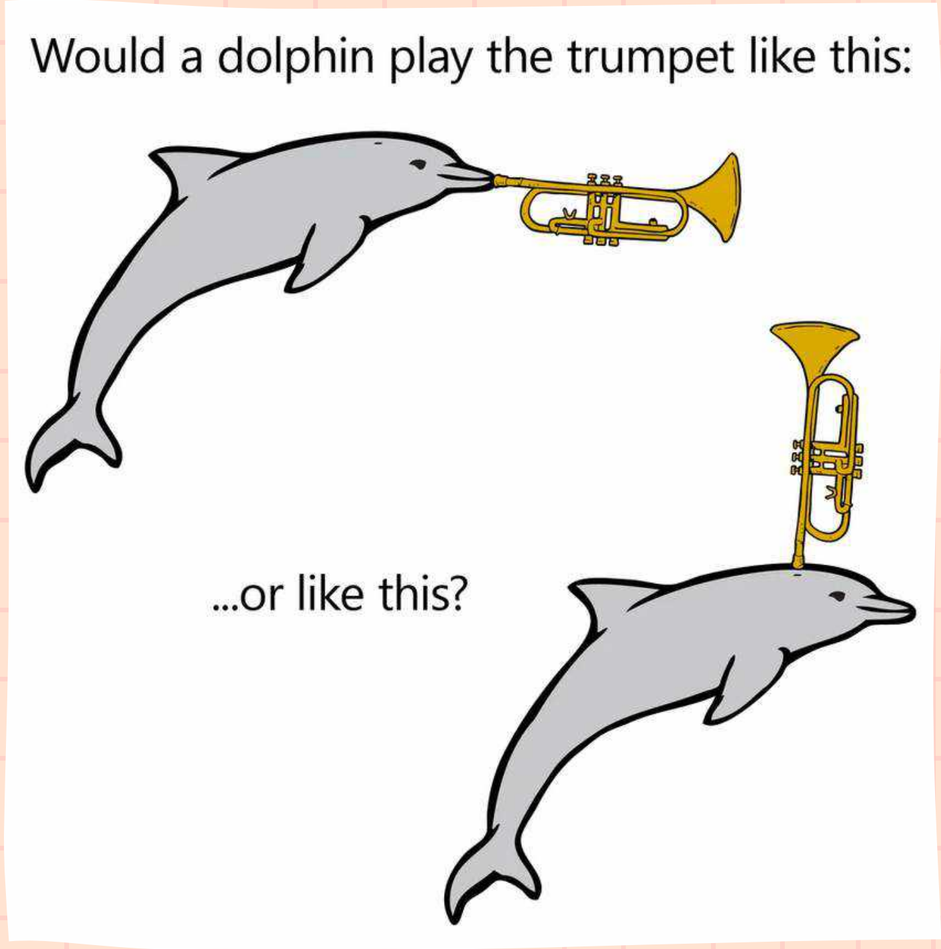
A Poster Tube

Carmen and Jenny's Top Tips

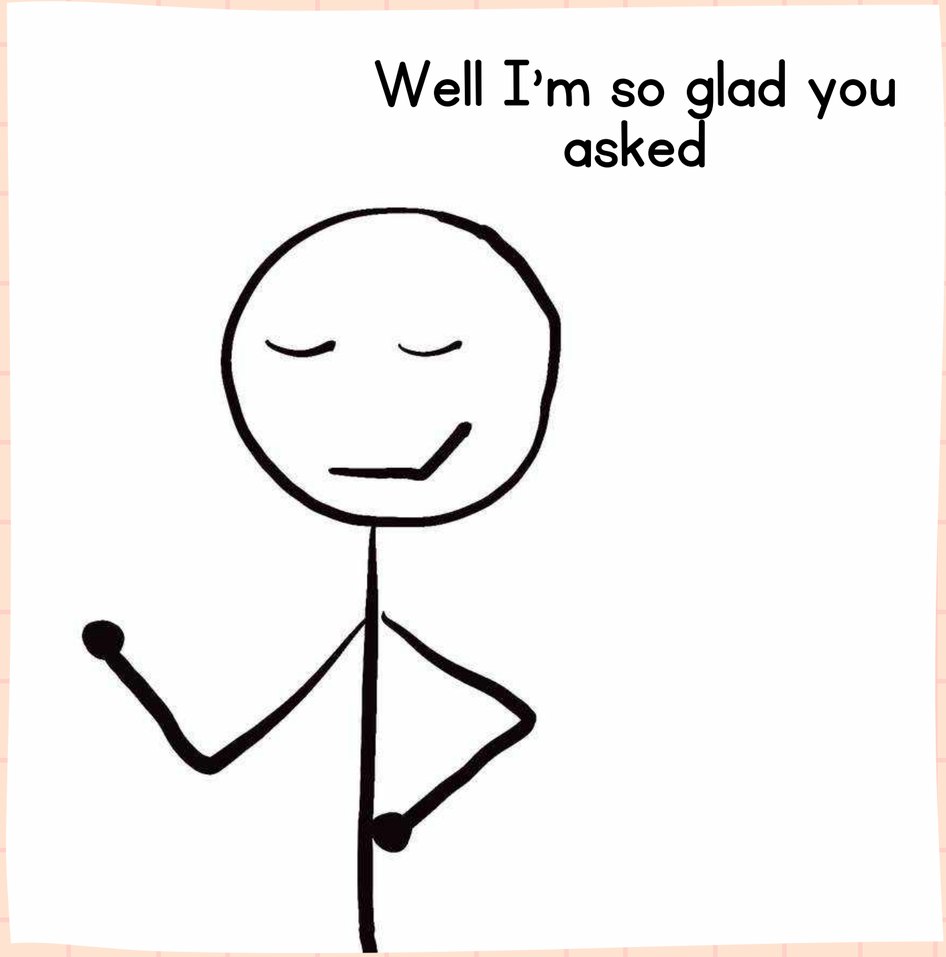
Have a drink with you



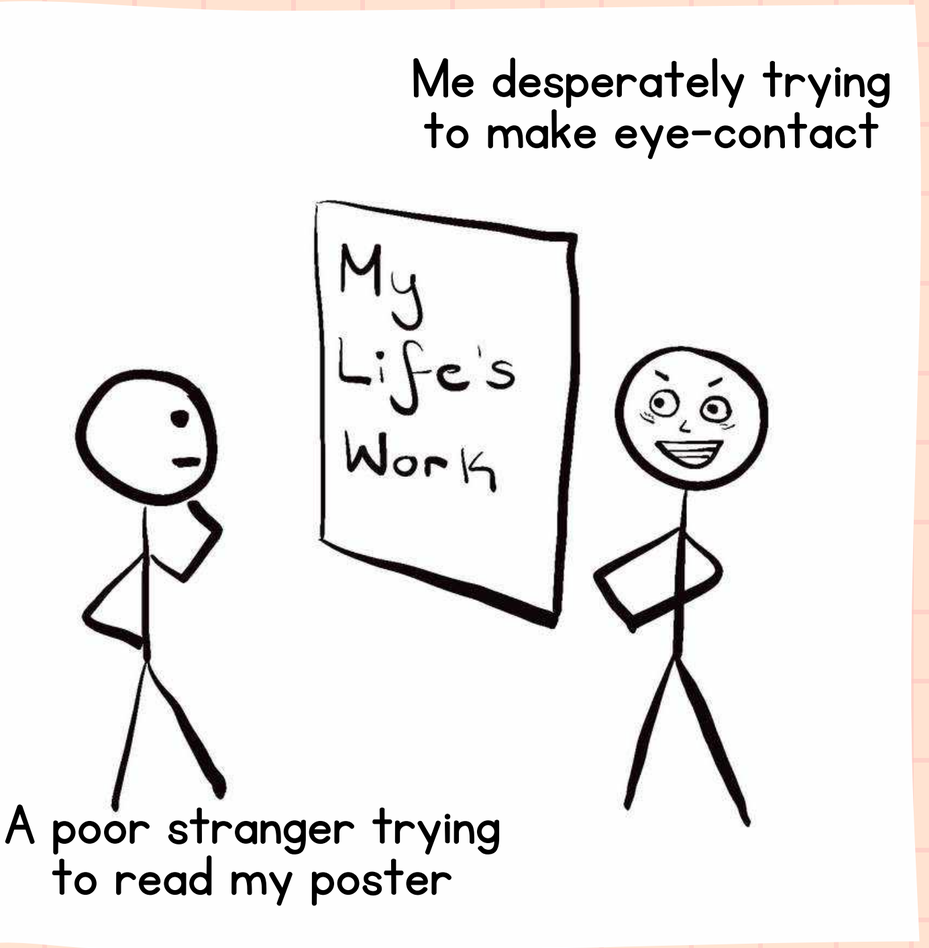
Have conversation starters



Prep the Tell me about your poster question



Don't be a creepy!

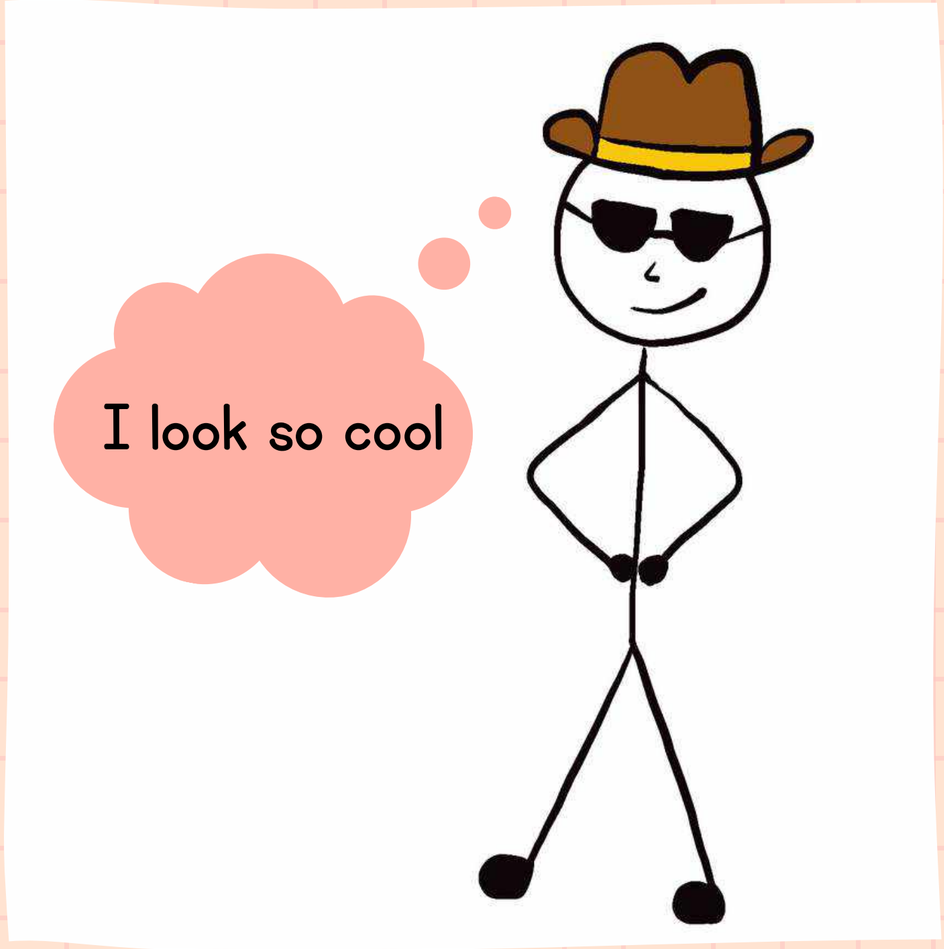


Don’t be on your phone

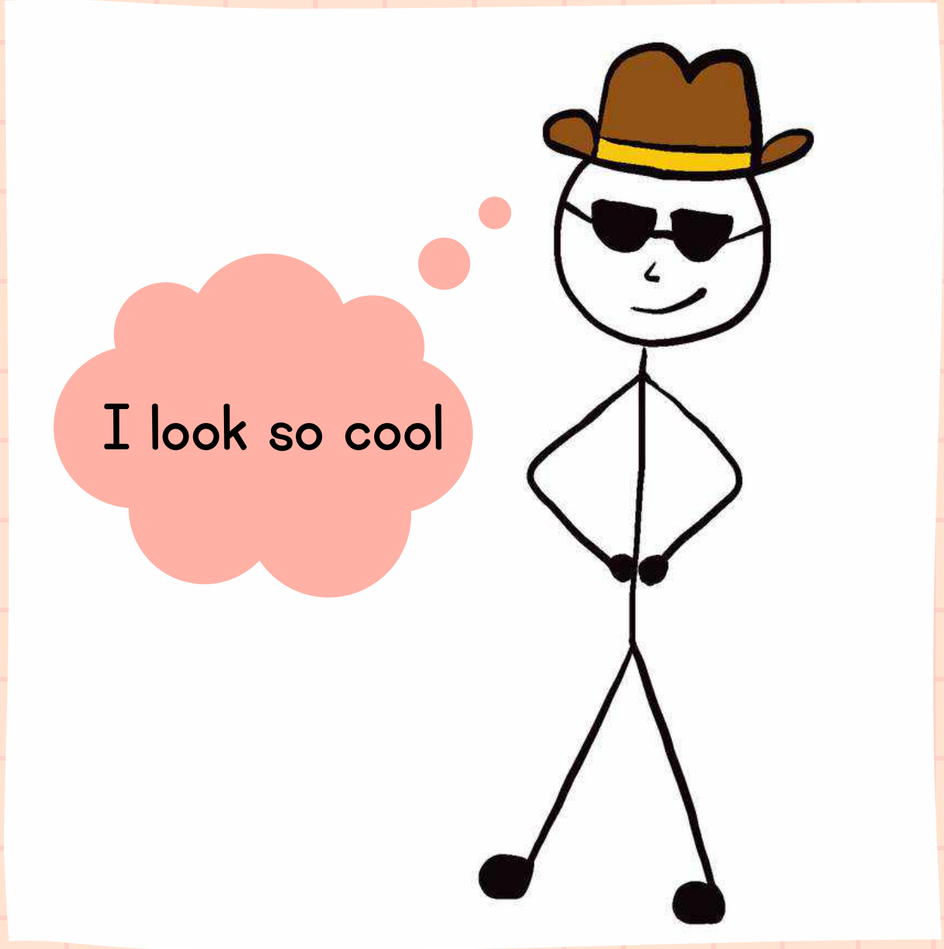
Remember you're the expert!

Don’t be afraid of questions - it’s okay to answer a question with an I don’t know

Wear something you feel confident in



Wear something you feel confident in

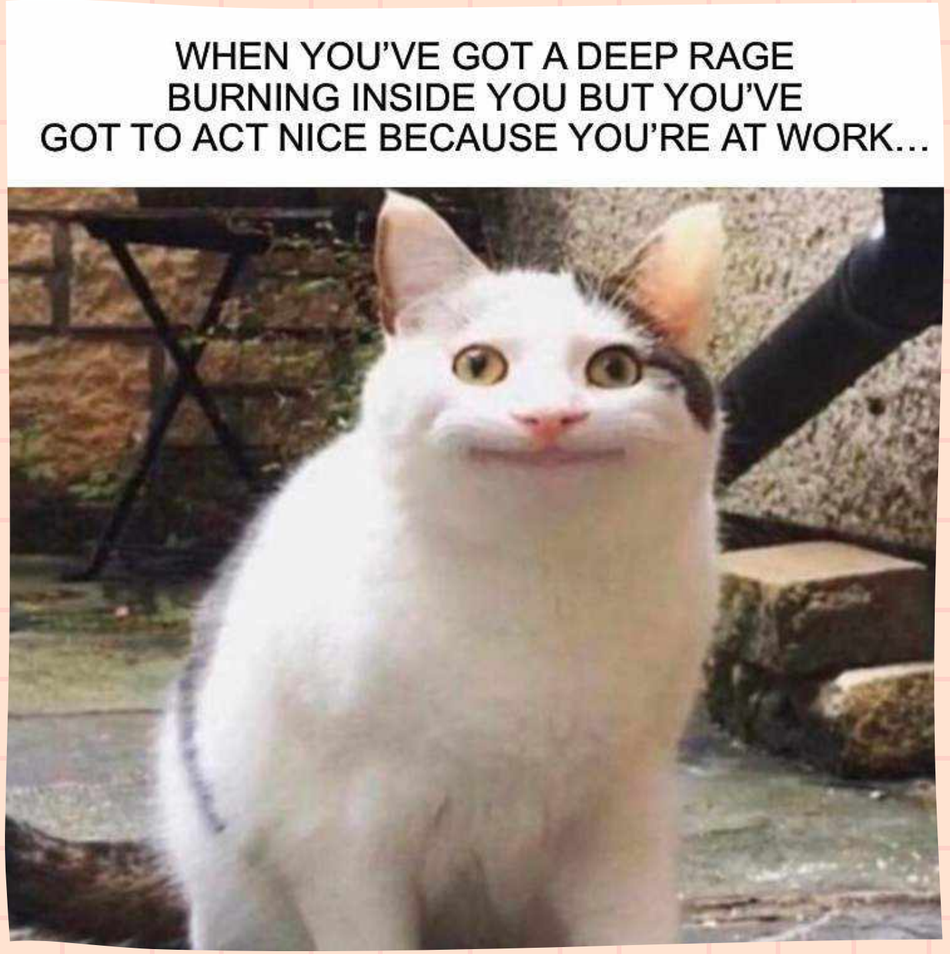


or even better...

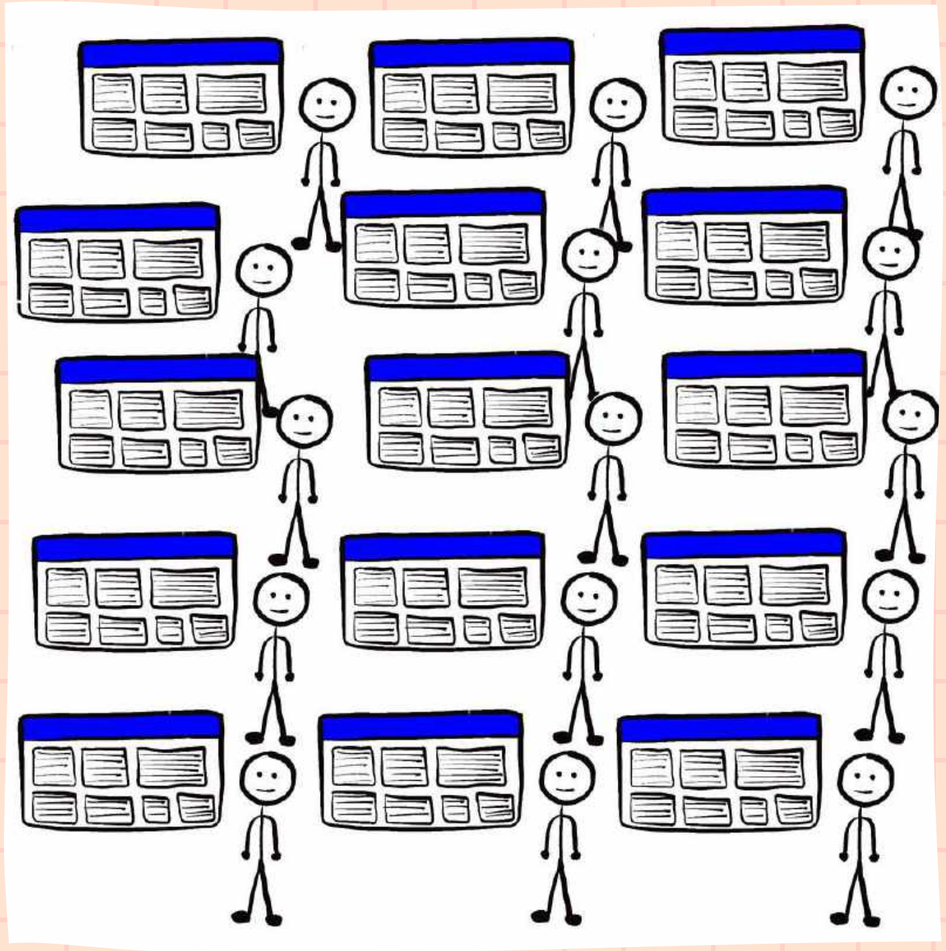
Match your poster!

Do not patronise

Don’t get frustrated



Remember Bath maths has a high standard of posters



So much Beamer Blue...

Try to reuse your poster

Enjoy yourself!

Resources

- **Colourblind simulator:** https://pilestone.com/pages/color-blindness-simulator-1
- **Designing for Accessibility Gov:** https://accessibility.blog.gov.uk/2016/09/02/dos-and-donts-on-designing-for-accessibility/
- **Diverse Learning:** https://www.cla.co.uk/blog/higher-education/practical-steps-for-accessible-content-designing-for-diverse-learners
- **Mike Morrison:** https://www.youtube.com/watch?v=SYk29tnxASs
- **Latex to Image:** https://latex2image.joeraut.com/
- **Colour Contrast Checker:** https://webaim.org/resources/contrastchecker/