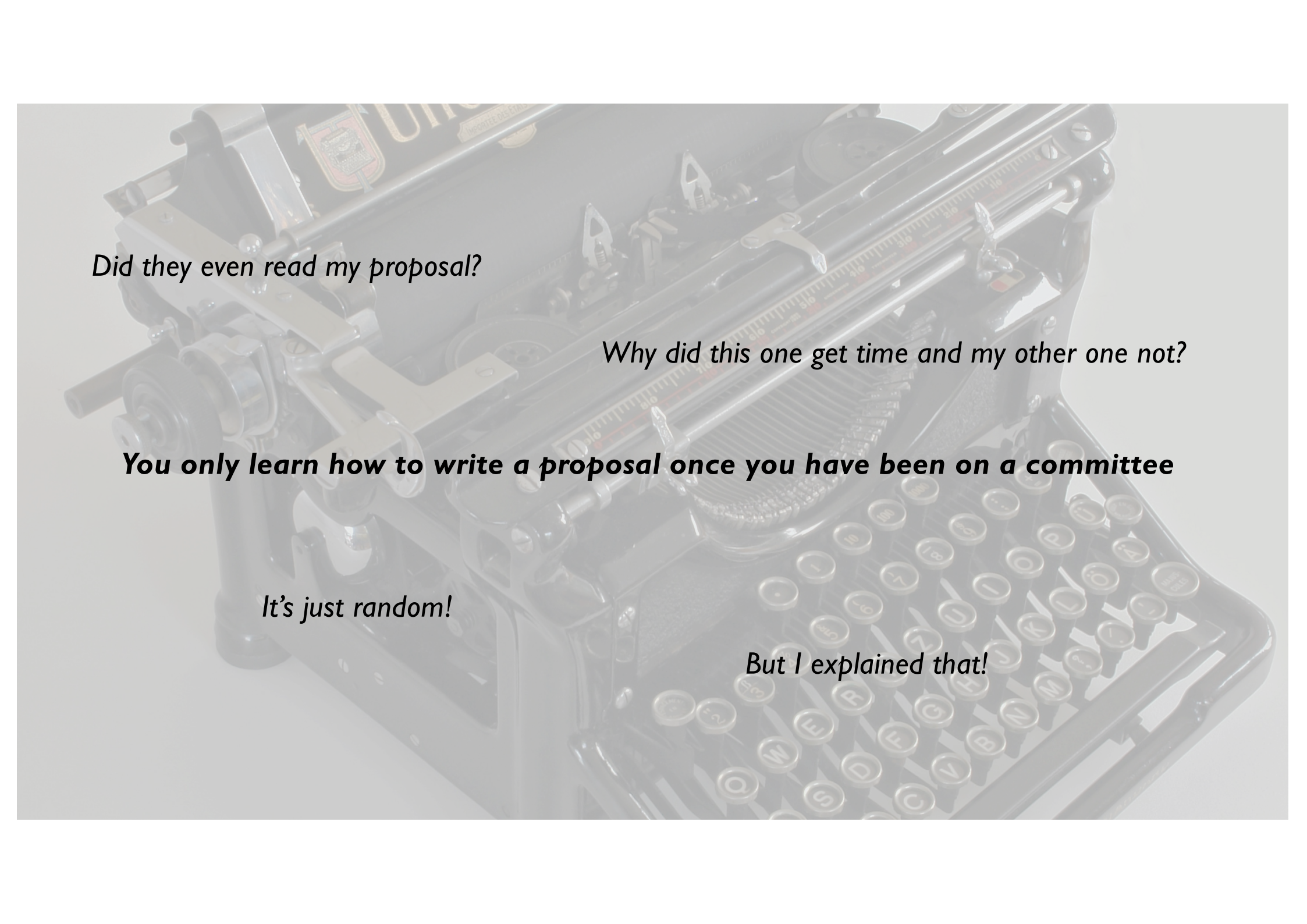


A vintage typewriter, likely a Remington model, is shown in a faded, semi-transparent style. The typewriter is dark-colored with a light-colored keyboard. The text 'Proposal writing' is overlaid in the center in a large, black, sans-serif font. The background is a light, neutral color.

Proposal writing

David Champion
Fundi Seminar 12/2/25

A vintage typewriter, possibly a Remington model, is shown in a faded, grayscale-like appearance. The text is overlaid on the image. The typewriter has a dark body with lighter-colored keys and a carriage. The text is in various styles, including italics and bold.

Did they even read my proposal?

Why did this one get time and my other one not?

You only learn how to write a proposal once you have been on a committee

It's just random!

But I explained that!

Proposal writing



- The review process
- What are they looking for?
- Know your audience
- Proposal components
 - Context
 - Scientific justification
 - Technical justification
 - Primary and secondary goals
 - Publication plan
- References
- Additional
- A few examples of don'ts
- An outline of my preferred style
- Summary



Disclaimer

- There are numerous equally valid ways to write a proposal.
- Different committees will have different expectations and will react differently.
- There is an element of randomness to any committee decision, particularly when there are large numbers of proposals.
- These are my thoughts based on many years on the Effelsberg committee, as well as reviewing GMRT, Parkes, XMM and other proposals.



The review process

- Facilities are usually over subscribed by factors of 3 to 10. Within a facility specific array configurations, frequencies or RAs may be more over subscribed than others.
- The purpose of the review process is to make the best scientific use of the telescope time available.
- This broadly means publications, including impact factor (citations) but often also includes PhD work.
- Usually there is a form for observational (sources, freqs, obs time, cadence) and personel (observers, authors, affiliations, students) details. There is usually a free-form space for the scientific justification (2-4 pages).

The review process

- Dependent on the facility
- Dependent on the frequency
- At least two reviewers and a committee
- Not all forms will be seen by all parties
- Make sure sections are self-contained



The review process - examples

GMRT

- Proposals are assigned to a broad grouping (e.g. pulsars).
- Proposals are sent to expert two reviewers and reports returned.
- Reviewers only review a handful of proposals.
- The reviews are used by the committee to rank the proposals.
- The ranking is used to allocate time.

Effelsberg

- All PKE members read all proposals (>50).
- Two (non-specialist) members do a detailed review of each (>10).
- In the meeting the detailed reviews are presented to the committee and discussed.
- A ranking and a percentage of the time are agreeded on (with comments).
- The rankings are used to allocate time

What are they looking for?

- The context of this work in the larger field. How will these results relate to other work already done? How will it advance the field as a whole?
- What specifically are you going to do and how? You need to convince them that what you are planning will have an impact.
- Novelty. Are you doing something new, or is it more of what's been done before?
- Show that it is publishable and in a reasonable timescale. What happens if the result is not what you expected?
- Justify the number and type of sources you have in your proposal.
- Justify the observation time and frequencies.
- Why use this telescope? Could you do it with a smaller one?
- Show that you and your team are capable of observing (if needed) and processing the data. Do you need help? – **But some applications require anonymity!**
- There may be specific questions that the TAC want addressed (e.g. outreach work, open data policy).



Know your audience

- Typically, reviewers will have 10s of proposals to review in detail, and the committee may well have over 100 to read.
- Reviewers do this as a service to the community, they are not paid.
- Clarity is critical. Be explicit, do not expect the reviewers to ‘join-the-dots’.
- Will your proposal be reviewed by a general or an expert panel? Make sure you have enough background information to cover your panel type. Do not assume too much, but don’t send them to sleep!

A vintage typewriter, likely a Remington model, is shown in a faded, semi-transparent style. The typewriter is positioned diagonally, showing its keyboard, carriage, and various mechanical components. The text "Proposal components" is overlaid in the center of the image in a bold, black, sans-serif font. The background is a plain, light color.

Proposal components

A vintage typewriter, likely a Remington model, is shown in a faded, grayscale background. The typewriter is positioned diagonally, with the keyboard in the lower right and the carriage in the upper left. The keys are visible, and the overall image has a soft, ethereal quality.

Context

- What is the ‘big science’ that you’re working towards. E.g. Neutron star masses can place limits on the equation of state, nHz GWs measure the SMBH binary merger rate.
- What is the ‘state of the art’ in this field? How does your work relate to it?
- How does your work compare to other work that has been done? What is novel here?
- **What work have you done in this area?**



Scientific justification

- What are you going to do and how does it relate to the ‘big science’ question?
- Explain how this technique works. Convince the reader that it is indeed possible.
- Go through the mathematics.
- You might want to show simulations or use comparisons with other work as evidence.
- (Simulations are often required for X-ray proposals.)

Technical justification

- How have you selected the sources?
- How many sources do you need to observe? Will the result be statistically significant? Can you get by with fewer sources?
- Which frequencies do you need any why? Make sure that you know the technical specifications of the receivers you request.
- Which backends are needed? **Do you know how to use them?**
- How much time do you need? Show the calculation (e.g. radiometer).
- How much overhead do you need? There is often an estimate in the documentation – other values need to be justified.
- Show the overall calculation,
e.g. $((5 \times 20 \text{ min}) + (3 \times 40 \text{ min})) \times 1.1 \text{ overhead} = 242 \text{ min}$



Primary and secondary science goals

- You can often do than one type of science with the data.
- Make it clear what the primary science goal is.
- You can be briefer about any secondary science goals.
- If you need additional time or setup for a secondary goal (e.g. flux calibration to look for variations) you should justify them and include them in the time calculation separately.
- Try not to mix primary science goals, even if they are using the same setup (e.g. Timing for PTA and timing for gravity tests). The TAC usually wants to evaluate goals independently. (Although this is telescope dependent.)

A vintage typewriter is shown in a faded, grayscale background. The typewriter is a classic model with a visible keyboard, carriage, and paper support. The text 'Publication plan' is overlaid on the upper left portion of the image.

Publication plan

- Some telescopes ask specifically for a publication plan. Even if they do not, it is worth putting one in (even if it is not explicitly described as such).
- Is it part of a thesis? When is that thesis expected to be published?
- When do you expect to publish a paper on these results?
- What happens if the results are not what you expect? Can you still publish?
- Fishing expeditions (obs where a negative result might be expected and won't necessarily lead to a publication) are possible but need to be small amounts of time.

References

The proposal must be self-contained.

References in a proposal do three things:

- They provide background for the interested reader and allow the reader to confirm what you are saying.
- They show other activity in the field. Use recent publications (not yours) to show there is broad interest in the area of astronomy.
- They show that you publish in the field. Use your own publications to show that you know how to reduce the data and that you publish your work regularly.

References can be in the text, or a list of associated publications

Additional

- The style is generally that of a paper but can be looser.
- Make sure you address every aspect requested in the instructions.
- Make sure you address the comments from the previous proposal (if it is a continuation). Do so explicitly.
- Generally, you can use **bold** and *italics*, but don't overdo it.
- Stick to rules about page limits, font sizes, margin spacing, images etc. Use a template if available.
- Give yourself time to fill in the form properly. Don't rush it.
- If it is your first use of a telescope, include someone with experience. Some observatories provide 'observer friends' for this purpose.
- Get co-authors involved early on. Don't surprise them with a last-minute proposal.
- Not all parts of the proposal (e.g. the form) will be seen by all parties.
- Spellcheck your document! Ask co-authors to read it.
- Some proposals (e.g. Parkes) are published and ADS searchable.

Don't do this – I

We have a project to observe sources with an x-ray telescope. We found this weird thing.

We observed one day and it was hard spectrummed. Then on another day it was softer and weaker, but then it hardened again when we observed it with a different telescope... Nothing was visible in the gamma-rays but...

So we would like to observe in the radio to see if the object is a pulsar.

- The proposal is actually the last line in the scientific justification.
- There is just a long story of observations and results in chronological order (including blind alleys) rather than a summary.
- How does this link to larger scientific questions?

Don't do this – 2

We've been observing two blobs for the past 10 years.

They've been getting closer together. Now they are so close that they're merging. [Many images showing the blobs merging over time]

We want to observe at higher frequency so we can see them as two blobs again.

- What is the scientific goal?
- How does this link to larger scientific questions?
- What will be gained by increasing the timeline?
- There is only really a technical justification.

A vintage typewriter, likely a Remington model, is shown from a high-angle perspective. The machine is dark-colored with a prominent semi-circular keyboard. The carriage and paper support mechanism are visible at the top. The text "My preferred style" is overlaid in a large, black, sans-serif font. Below it, the text "Other equally good styles are available" is overlaid in a smaller, black, sans-serif font. The background is a light, neutral color.

My preferred style

Other equally good styles are available

Context

- The merger rate of galaxies (and therefore the supermassive black holes at their centres) is one of the key parameters in galaxy evolution but is very poorly constrained. Pulsar timing arrays are already constraining this number by...
- The equation of state at the highest densities and pressures cannot be tested on the Earth, instead we have to use the extreme densities of neutron stars as our laboratories. Measuring pulsar masses...
- Despite the extraordinary success of Einstein's theory of General Relativity it can only explain the rotation curves of galaxies by invoking dark matter. Some theories attempt to modify Newtonian gravity to... By using pulsar-white dwarf systems we can...

Scientific justification

- So that we can improve the precision of our pulsar timing arrays, and therefore our sensitivity to GWs we need to account for the effect of the interstellar medium. In this project we propose a series of observations to...
- The discovery of a pulsar mass greater than 3 solar masses would dramatically limit the number of equations of state that are currently proposed... This pulsar system has a mass function of ?? which implies a high combined mass. By measuring the Shapiro delay we can...
- Several MOND theories hypothesise dipolar GW emission, in contrast to GR. The mass difference between the NS and WD means that this dipolar emission would have a significant and different effect on the orbit than that from GR. An intense observational campaign would allow us to...

Explain the technique you will use.



Secondary science

- In addition to improving limits on the GW background the same data can be used to improve the orbital parameters of many of the pulsar systems. This may include new detections of relativistic parameters.
- These observations can also be used to monitor the variation in flux density known in this system. To do so we need an additional 10 min flux cal observation per session.

Technical justification

- In figure 2 we have simulated observations with S/N of 20 over one year allowing us to make a 4-sigma detection of Shapiro delay.
- **Our observations to-date** (see fig 3) suggest that we will need 15 minutes to reach a S/N of 20.
- In order to account for variations in the ISM (explained earlier) we request the use to the C-X band receiver.
- **Our experience** with the C-X band receiver suggests that we will need 15 minutes of setup time due to the complexity of the backend. Thus we have used this number rather than 10% in our overhead calculation.

A vintage typewriter, likely a Remington model, is shown in a faded, grayscale background. The typewriter is positioned diagonally, with the keyboard in the lower right and the carriage in the upper left. The keys are visible, and the overall image has a soft, semi-transparent appearance.

Publications

- **Since our previous proposal** the following publications have been published... are in preparation...
- These observations will provide constraints on... and will be published in a collaboration wide paper that is expected towards the end of next year.
- Even if the observations do not provide evidence of nHz GWs the limits will be very strong and constrain the models that are used to describe galaxy evolution...

Summary

- Reviewers have large numbers of proposals to read and telescopes are oversubscribed.
- You need to be clear.
- You need to make it interesting without over-selling it.
- Aim the proposal at those who will read it (experts / non-experts).
- Give context and details about what you are going to do.
- Show your calculations.
- Show you will publish.
- Listen to the committee (even when they're taking rubbish).
- You will have to compromise to make it fit.
- *Make sure you can do what you're promising!*