S/GMR Skill Building session

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How to give a good scientific talk

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Outline of this talk

1. The structure of a good scientific talk.
2. Some meta - ideas about communication
3. Some specific ideas communicating scientific ideas and results
4. Some examples
5. Conclusions

Talk Structure:

Tell ‘em what you’re going to tell ‘em;

Next, tell ‘em;

Next, tell ‘em what you told ‘em

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Tell 'em what you're going to tell 'em;
Next, tell 'em;
Next, tell 'em what you told 'em

1. **What you're going to tell 'em:**
   - **Outline**
   - **Abstract** (For archival purposes!)

2. Tell 'em:
   - Motivation: Why should they care?
   - The story of your work:
     - context ... prior work on topic, framing your questions
     - methods ... how it was done
     - results ... what you found
     - connections ... comparisons with other work
     - ramifications ... practical consequences
     - future plans ... what are the next steps?

3. What you told 'em:
   - Conclusions

4. Acknowledgements: people, funding sources

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Advice about giving a talk ...
Remember it's about communicating your science

1. Communicating
   - Know your audience
   - Know the parameters of the talk
     Duration? (Rule: 1- 3 min = 1 slide)
     AV Setup Are you mic'ed? Need vocal warmup? Water?
     Q&A during or after? Save time for questions.
   - Practice your talk.
     Memorize key phrases within an outline, especially ones that have ideas that are subtle to convey.
     Memorize your first few sentences, to get yourself off to a great start.
2. Your science ... let your enthusiasm show ☺
3. Getting scientific ideas across: tip of iceberg on next slide ...

Tips and tricks about getting science across with words and slides:

1. Provide highlight, not minute detail.
   - Give URL, email address, QR symbol where folks can look for supplementary info and math details.
   - If environment permits, be ready to write on (real or virtual) whiteboard for questions involving derivations or sketches.

2. Avoid jargon unless you are sure the audience expects it. Explain any term you think is new to the majority of listeners.

3. Slide skills -Mika Kostic (CrossTalk, 2017)
   - One message per slide
   - The most important part of your slide should be the biggest.
   - Use contrast to focus the viewer's attention , and help them parse the text.
   - No more than six objects per slide

4. Presentation skills Practice the art of speaking while using a real world pointer, laser pointer (real or virtual world), highlighting or pencil (virtual world)

More tips and tricks about getting science across with words and slides:

The APS has some great additional advice ...
https://www.aps.org/meetings/policies/speaker.cfm

- don't use words if a graph or table or chart conveys information better

- Use line graphs to show trends; bar graphs to compare magnitudes; pie graphs to demonstrate relative portions of a whole

- Slides should be concise and uncluttered and readable from a distance (which depends on room you are in if it is real-world ... so find out) Use large enough fonts.

- *My advice about **graphs**:* Avoid rookie mistakes and ... label axes, give your graphs titles, provide legends, indicate length scales on images, ... give the numbers and words that help the viewer interpret your graphs.

Make these elements large and legible

Exercise for us …

Go to the Web and find an example of a good or bad slide … if bad, how you would improve it? Let's take 10 minutes for this? ☺

Example of Abstract ... for audience of general soft-matter physicists

Abstract

We perform simulations in 2d of soft particles and tiny pins which interact via harmonic, repulsive forces. Pins are either distributed randomly, or form square, triangular, or honeycomb lattices. While at low pin densities the jamming threshold, Φ_j, decreases linearly with pin density, independently of pin geometry; at higher densities it reflects lattice-specific constraints on particle packing. The distribution of bond angles becomes increasingly anisotropic with pin density. Contact force distributions develop super-exponential tails. Lattice geometry affects the scaling behavior of bulk and shear moduli near jamming. The Zener anisotropy ratio indicates that pins can break the mechanical isotropy of the jammed state

Example of Abstract ... for audience of STEM-interested people

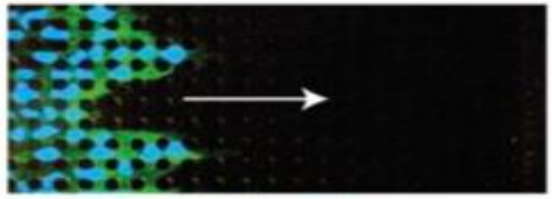
Abstract

Granular Materials are ubiquitous in daily life. By "granular" we mean not only hard objects like salt, rice, or sand; but also soft objects like bubbles, and living entities like cells. Dense granular materials can change dramatically under pressure, by suddenly solidifying into a disorderly "jammed" structure. Our research group has been using computer simulations to ask what is new and different about jamming when the mobile grains are in contact with a fixed scaffolding, like a lattice of diminutive "pins". Pins influence when the sudden, jamming transition occurs in a granular packing. They also affect the structure of the material and how it responds to stresses ... making pins a very useful part of the "recipe" to create a jammed solid with desirable properties.

Example of Motivation slide
Why care about jamming with pins?

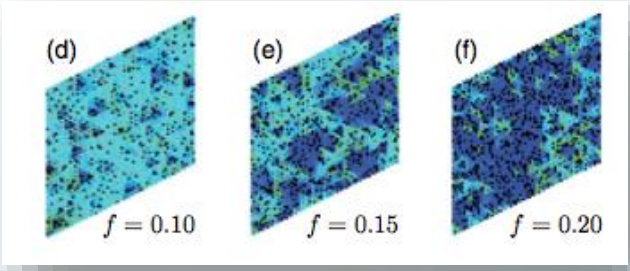
- arrays for sorting DNA, cancer cells, ...

Chen et al. (Oncology Lett., 2019)
Mohan and Doyle (PRE, 2007)



Wong et al (Nature Materials, 2014)

- in glass-forming systems: suppresses relaxation, slows dynamics

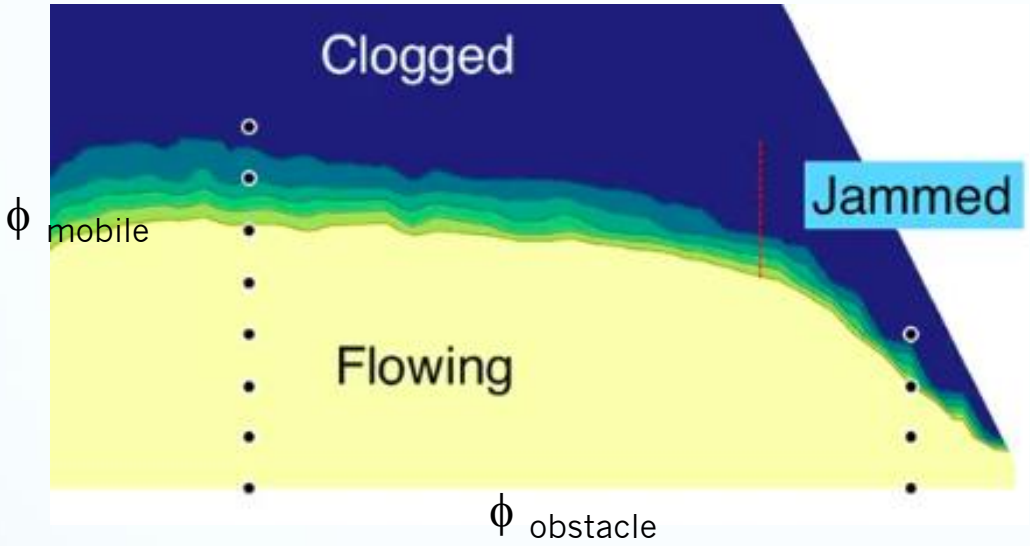


Jack and Berthier (PRE, 2012)

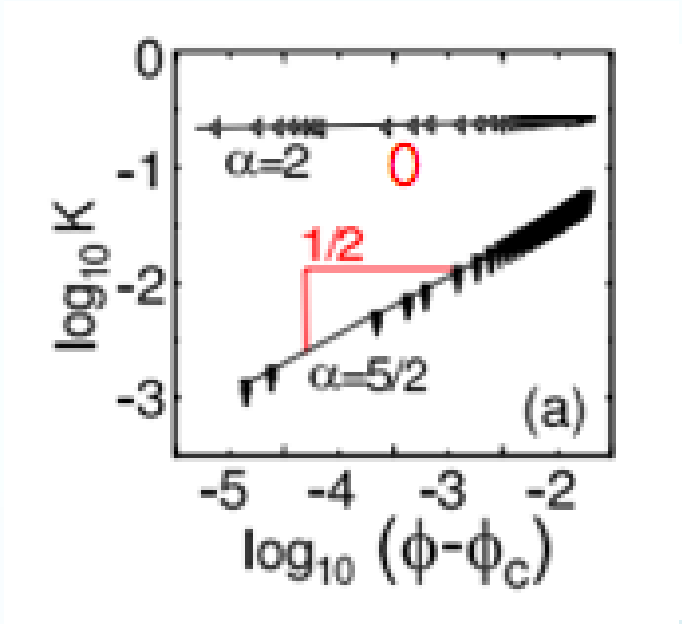
Kim (EPL, 2003)
Karmakar and Procaccia (arXiv, 2011)
Berthier and Kob (PRE, 2012)
Cammarota and Biroli (PNAS, 2012)
Brito, Parisi and Zamponi (Soft Matter, 2013)

Example of another Motivation slide

The Big Questions



Péter, Libai, Reichhardt & Reichhardt (Nature, 2018)



van Hecke (J Phys Cond Matt, 2010)

What geometrical arrangement of obstacles best facilitates jamming?

How are previously-known mechanical properties affected by pins?

Example of Conclusions
What we have found ...

- Jamming threshold is lattice-specific
  - can plateau (square lattice, bidisperse)
  - can increase (square lattice, polydisperse)
- Distribution of bond angles correlates with lattice symmetry
- Contact force distribution has ...
  - fat tails at high forces
  - increasing mean force and width of distribution of forces
- Bulk and shear moduli
  - conventional scaling with pressure near jamming
  - Pin geometry can produce mechanical anisotropy

Example of Acknowledgement Slide
The people who did this work

Penn
University of Pennsylvania

Sean Ridout

...

Your names would all be listed here ...

Acknowledgements

- The National Science Foundation (DMR-1905474)
- Other funding source 1
- Other funding source 2

...

Thank you for your kind attention!

Conclusions

- I claimed every talk is supposed to have a conclusion. However the great David Mermin gave a talk where he finished this way:

  The ubiquitous heavy-handed concluding summary should be omitted; a talk should tell such a good story that a summary is uncalled for. Imagine War and Peace ending with a summary. There is no better way to make an audience happy than briskly finishing a talk five minutes earlier than it expected you to. Like this.

- Rules are meant to be broken. Communicate clearly. Enjoy doing it. So will your audience!

  - **Thank you for your kind attention!**