

COMP320: Research Practice

1: Intro to the final year project

Learning outcomes

- ▶ **Explain** the aims and expectations of the final year project
- ▶ **Select** appropriate methodologies to conduct scholarly research
- ▶ **Recall** Falmouth University's policy on research ethics and the procedure for obtaining ethics approval

Final year project

BCS guidelines

It is expected that within an undergraduate programme, students will undertake a **major computing project**, normally in their final year and normally as an individual activity, giving them the opportunity to demonstrate:

- ▶ their ability to apply **practical and analytical skills** present in the programme as a whole
- ▶ **innovation** and/or **creativity**
- ▶ **synthesis** of information, ideas and practices to provide a **quality solution** together with an **evaluation** of that solution
- ▶ that their project meets a **real need** in a wider context
- ▶ the ability to **self-manage** a significant piece of work
- ▶ **critical self-evaluation** of the process

Final year project assignments

- ▶ The final year project is made up of **four** separate assignments
- ▶ In COMP320 (this study block):
 - ▶ Prototype research artefact
 - ▶ Research review and proposal
- ▶ In COMP360 (next study block):
 - ▶ Research artefact
 - ▶ Dissertation

Deliverables

- ▶ Week 2: Brief project proposal
- ▶ Week 4: Research ethics Approval Form
- ▶ Week 7: Presentation on Literature Review
- ▶ Week 8: Research Review and Proposal — Peer Review
- ▶ Week 10: Submit Research Review and Proposal
- ▶ Week 13 (after xmas): Submit Prototype Research Artefact
- ▶ Week 13 (after xmas): Presentation on Proposal, Prototype, and Preliminary Results
- ▶ Formative deadlines: check MyFalmouth

Note on Presentations

The submission of the literature review and proposal in **Week 10** is worth 70% of the module. Or, 11.6% of the overall degree classification. Please do not neglect it!

It will require considerable effort to read the literature, refine your question, and propose a sound research design!

Note on Presentations

Presentations will be delivered to 'non-domain' experts. These are research-active staff who will be outside of your field. Present your materials as-if writing for a competent computing professional who is unfamiliar with your specific field.

Research Review and Proposal

- ▶ Essentially the **first half** of your **dissertation**
- ▶ Maximum **six pages**, in **IEEE Transactions** format
 - ▶ Same format as an academic journal paper
 - ▶ Page limit **excludes** figures, tables, references and appendices
 - ▶ 6 pages \approx 6000 words

Research review and proposal

- ▶ Give a thorough **literature review** of your chosen topic
- ▶ Suggest and justify one or more **research questions**
- ▶ Describe your proposed **methodology**
- ▶ Present any **preliminary results** you obtain this study block

Prototype research artefact

- ▶ Some kind of **software** artefact — depends on your project
- ▶ For example:
 - ▶ A game or app that you will use to gather data from human testers
 - ▶ A testbed for computational experimentation
 - ▶ A case study for a particular design approach
 - ▶ A tool to be evaluated
- ▶ Discuss with your supervisor to decide what is appropriate

Research ethics

Research ethics

Research involving people is premised on a fundamental moral commitment to advancing human welfare, knowledge, and understanding, and to examining cultural dynamics

Research ethics: Why

- ▶ Historically, human participants have not been well-protected from researchers
- ▶ Need to protect people from dangerous and naïve research practices
- ▶ Conflicts of interest (e.g., financial gain, big business)
- ▶ Monitoring of controversial issues (e.g., gene editing with CRISPR)
- ▶ Privacy and data protection
- ▶ Promoting high quality research

Falmouth University research ethics policy

- ▶ Find and read the following documents on LearningSpace:
 - ▶ Falmouth University Research Ethics Policy
 - ▶ Research Ethics Approval Application Form

Important!

- ▶ Failure to adhere to the Research Ethics Policy is **academic misconduct**
- ▶ In particular, you **must** fill in and submit an Ethics Approval Form **before** carrying out any research
- ▶ You **must** fill the form in, even if your project does **not** involve human subjects (though in this case it will be easy to fill in)

Next steps

- ▶ You must meet your supervisor **next week** (week 2)
- ▶ You will meet at least **once every 2 weeks** thereafter
- ▶ **Mandatory** to attend
- ▶ Bring a draft of your **ethics approval form** to the meeting in Week 4

What is science?

*“Science and everyday life cannot
and should not be separated.”*

Rosalind Franklin (1920 – 1958)
English Chemist and X-ray crystallographer



What is science?

Some common misconceptions

- Science is a collection of facts; ✗
- Science is the creation of new gadgets; ✗
- Scientific ideas are absolute and unchangeable; ✗
- Scientific ideas are subject to change, therefore unreliable; ✗
- Observations give answers directly to the scientists; ✗
- Science **proves** stuff; ✗
- Science can only **disprove** stuff; ✗
- The scientist works to **show** that his/her theory is right; ✗

- Facts vs hypotheses vs theories vs laws;

STAND BACK



I'M GOING TO TRY

SCIENCE

What is science?

A good operational definition



“What do you think science is?

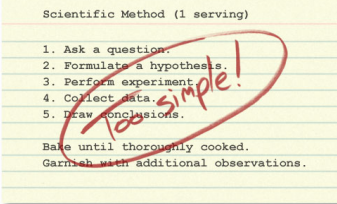
There’s nothing magical about science.

*It is simply a systematic way for carefully
and thoroughly observing nature and
using consistent logic to evaluate results.”*

– Steven P. Novella

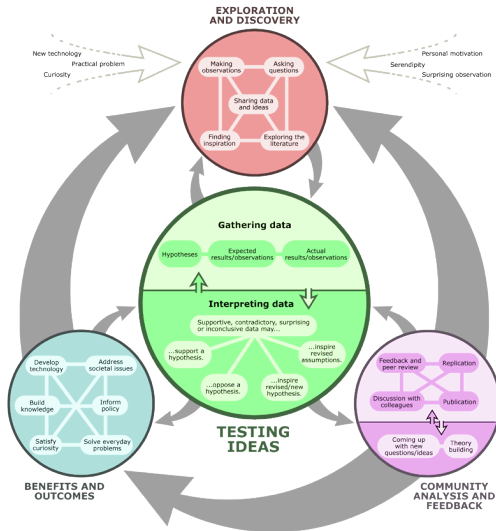
What is science?

The scientific process

- Normally shown as a flowchart or a sequence of steps;
 - Oversimplification of a complex and iterative process;
 - Suggests an “end” to the process.
- 
- Actually includes:
 - Several activities, performed at different stages;
 - Interaction with the scientific community;
 - Creative, “outside the box” thinking;
 - Preliminary conclusions, subject to revision as new and better data become available;
 - Learning from failures as much as from successes.

What is science?

The scientific process

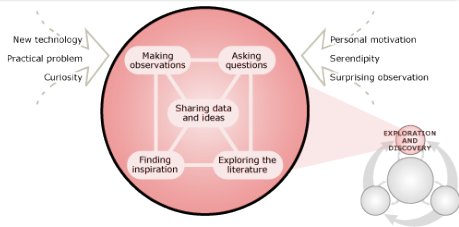


What is science?

The scientific process

“Dans les champs de l’observation le hasard ne favorise que les esprits préparés.” – **Louis Pasteur** (Univ. Lille, France, 1854).

- Observations → **questions**;
- Exploratory experimentation;
- Preparation + serendipity.



Benzene (1865)



Kekule

Radioactivity (1896)



Becquerel

Penicillin (1928)



Fleming

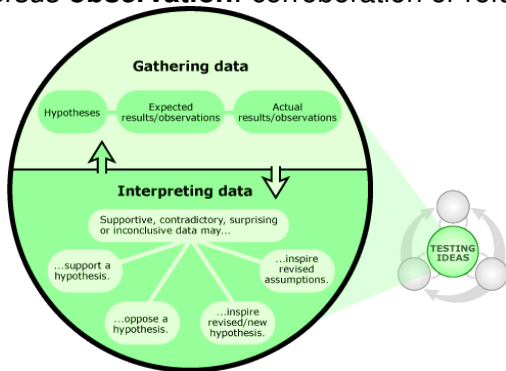
Top image: <http://goo.gl/fy8G1h> - (c) Understanding Science, 2015. Used with permission.

Scientists: <http://goo.gl/SG6sgp> | <http://goo.gl/rhLC9C> | <http://goo.gl/CFj8M1>

What is science?

The scientific process

- Drawing and testing hypotheses;
- Comparing alternative explanations;
- Accepting / rejecting ideas based on **evidence**;
- **Predictions** *versus* **observation**: corroboration or refutation?

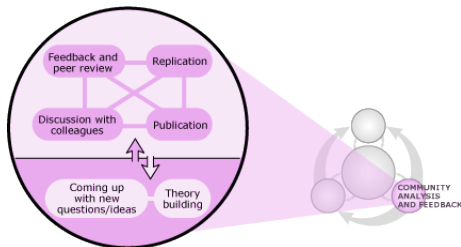


What is science?

The scientific process

Interaction with the scientific community is **fundamental**:

- Colleagues;
- Collaborators;
- Reviewers;
- Rivals;

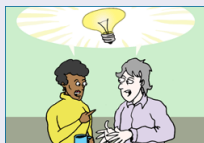


This interaction plays essential roles for the progress of research:

Criticism



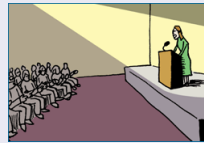
Inspiration



Vigilance



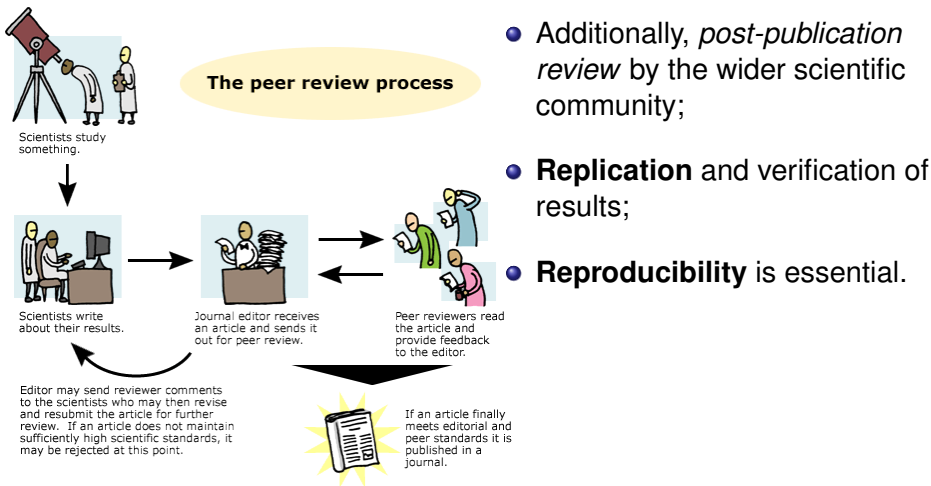
Motivation



What is science?

The scientific process

Publication and peer review.

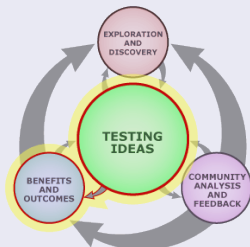
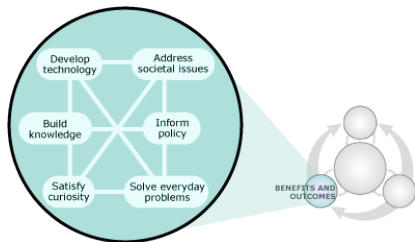


What is science?

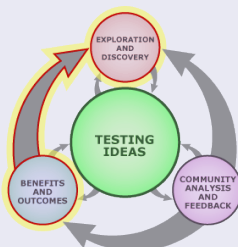
The scientific process

The scientific process is a way of building knowledge:

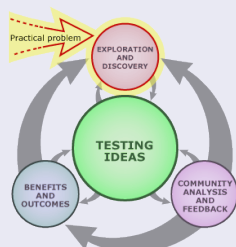
- Generate and test new ideas about how the world works;
- Iteratively increasing the reliability of the knowledge;



Knowledge → Applications



Technologies → Discovery



Applications → Investigation

Bibliography

Required reading

- 1 *Understanding Science*. 2014. University of California Museum of Paleontology. 3 January 2014. - <http://www.understandingscience.org>
- 2 F.L.H. Wolfs, *APPENDIX E: Introduction to the Scientific Method*. - <http://goo.gl/osGpU>

Recommended reading

- 1 Carl Sagan, *The demon-haunted world: science as a candle in the dark*, Random House, 1996.
- 2 The Skeptics Guide to the Universe. - <http://www.theskepticsguide.org>

About this material

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Felipe Campelo (2018), *Lecture Notes on Design and Analysis of Experiments*.

Online: <https://github.com/fcampelo/Design-and-Analysis-of-Experiments>
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Next Week

- ▶ **Locate and read** at least **TEN** academic papers from your research area (using ACM DL and IEEE eXplore)
- ▶ **Search** for potential gaps in the literature which you think your work could fill—try to articulate it explicitly
- ▶ **Refine** your research question into something clear and succinct
- ▶ **Setup** an IEEE-style document on Overleaf, and Slack the link to your supervisor
- ▶ **Prepare** a draft proposal of 500-or-so words to take to Ed's workshop next week