Developers are Researchers

Improve the work you love with Research Driven Development

Phil Winder

Visit http://WinderResearch.com

@DrPhilWinder

phil@WinderResearch.com

MACHINE LEARNING

Winder Research

CLOUD

1 **Developers are Researchers**

2 **Great Researchers**

3 **Research Patterns**

📌 What is research?

"R&D comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications." - University Collage London

An attempt to improve or advance

"[r]esearch is a process of steps used to collect and analyze information to increase our understanding of a topic or issue" - Creswell, J. W. (2008). Educational Research

"The systematic investigation into and study of materials and sources in order to establish facts and reach new conclusions." - Oxford English Dictionary

" a detailed study of a subject, especially in order to discover (new) information or reach a (new) understanding" - Cambridge English Dictionary

Research attracts a 10–30% return on investment

Stats note: highly stochastic, long tails.

Hall, Bronwyn H., Jacques Mairesse, and Pierre Mohnen. "Measuring the Returns to R&D." NBER Working Paper. National Bureau of Economic
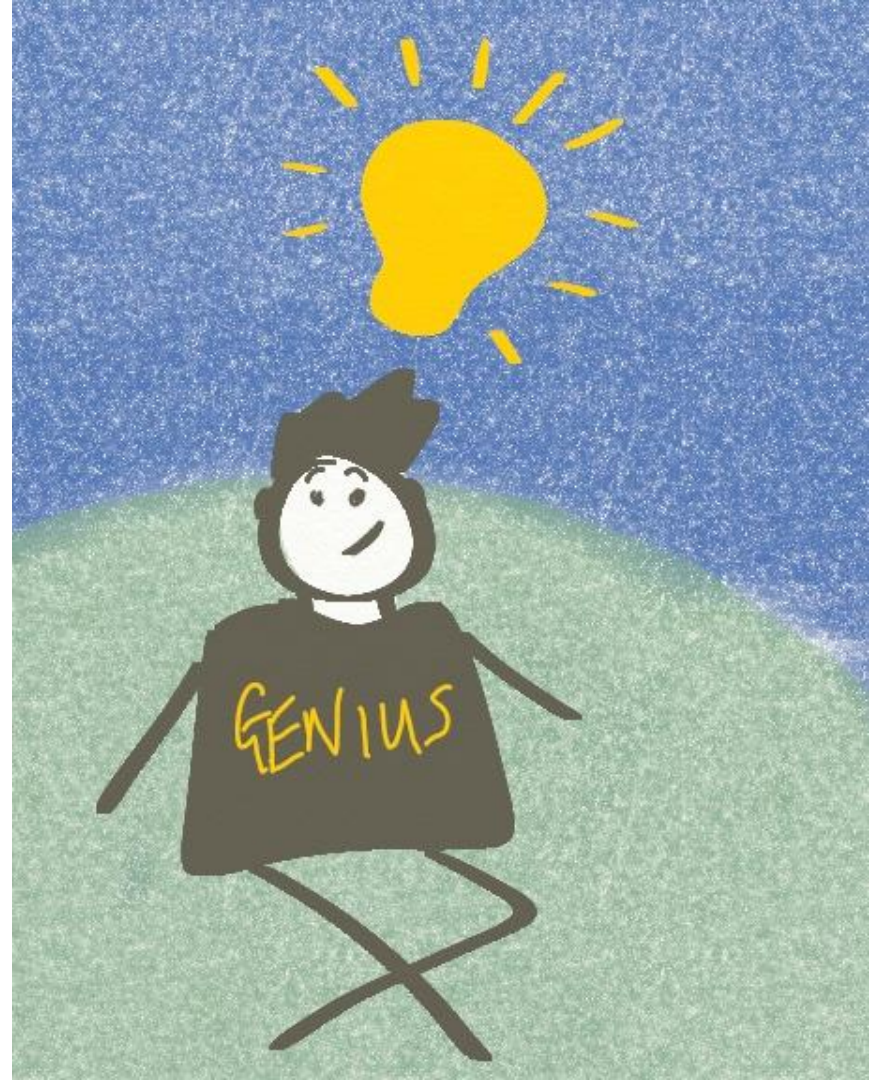
Innovation breeds enthusiasm

1 Developers are Researchers

📌 **What is a researcher?**

- Someone who works in a university?
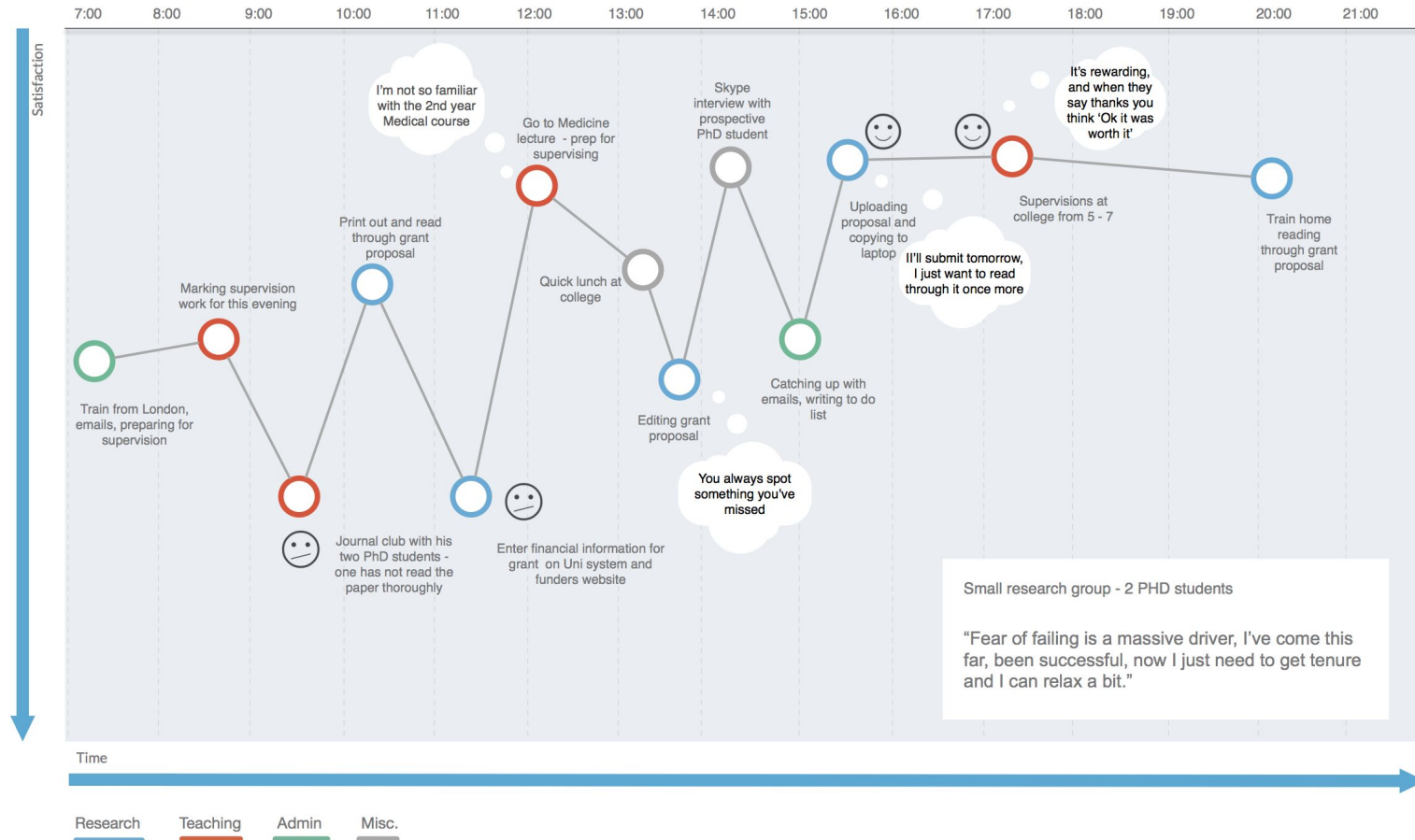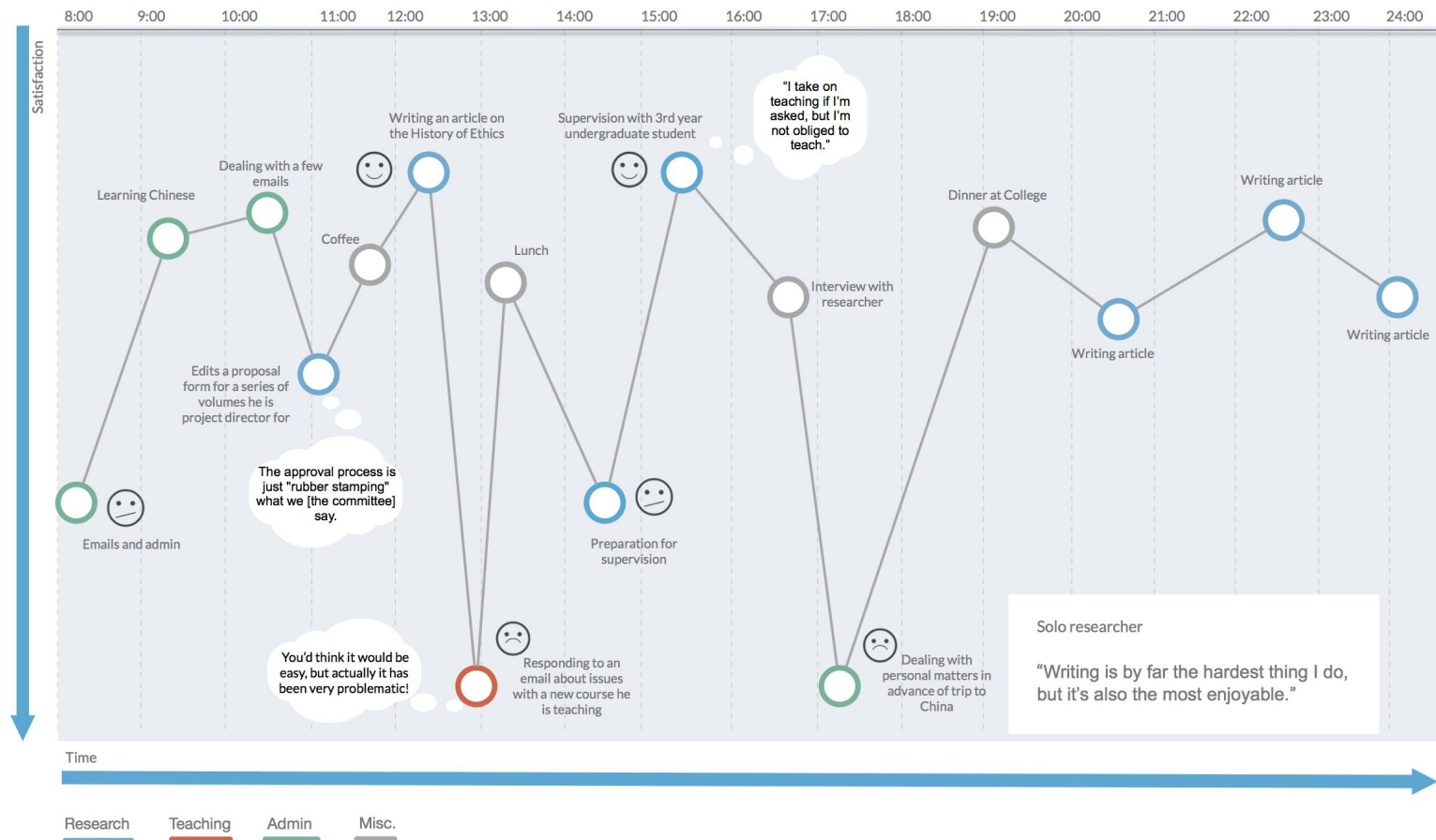- A scientist?

Common Misconceptions

- "I don't have a Ph.D."
- "I'm not smart enough"
- ...
- "Only academics have time to do real research"

Early career, group researcher

Satisfaction

7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00

I'm not so familiar with the 2nd year Medical course

Go to Medicine lecture - prep for supervising

Skype interview with prospective PhD student

It's rewarding, and when they say thanks you think 'Ok it was worth it'

Print out and read through grant proposal

Quick lunch at college

Uploading proposal and copying to laptop

Supervisions at college from 5 - 7

Train home reading through grant proposal

Marking supervision work for this evening

I'll submit tomorrow, I just want to read through it once more

Train from London, emails, preparing for supervision

Editing grant proposal

Catching up with emails, writing to do list

Journal club with his two PhD students - one has not read the paper thoroughly

Enter financial information for grant on Uni system and funders website

You always spot something you've missed

Small research group - 2 PHD students

"Fear of failing is a massive driver, I've come this far, been successful, now I just need to get tenure and I can relax a bit."

Time

Research   Teaching   Admin   Misc.

https://unlockingresearch.blog.lib.cam.ac.uk/?p=515

Senior research fellow

https://unlockingresearch.blog.lib.cam.ac.uk/?p=515

The Role of an Academic Researcher

The post requires a physical scientist with excellent communication skills who is comfortable conducting interdisciplinary and policy-relevant climate change mitigation research. The focus of the research must be on one of the following areas: climate science and mitigation of greenhouse gas emissions; mitigation of aviation and/or shipping CO_2 emissions; energy system decarbonisation scenarios. It is expected that you will have a strong publishing track record, lecturing and supervisory experience, demonstrable experience in attracting research funding, as well as experience in conducting knowledge exchange activity.

– Lecturer in Energy & Climate Change, University of Manchester

Academic summary

- Specialist knowledge
- Teaching
- Administration
- Meetings
- Sales
- Delivery

What is research?

- Pursuit of knowledge

- Develop new understanding

- Deliver or enact

📌 **What is research?**

⦿ ~~Pursuit of knowled~~

⦿ Develop new und

⦿ Deliver or enact

Questions Jobs Documentation Tags Users 🔍 Search...
BETA

Why does HTML think "chucknorris" is a color?

▲
5223
▼

How come certain random strings produce colors when entered as background colors in HTML? For example:

```
<body bgcolor="chucknorris"> test </body>
```

⭐
1373

▶ Run code snippet   Copy snippet to answer   ✖ Hide results   ↗ Full page

test

...produces a document with a **red background** across all browsers and platforms.

What is research?

- ~~Pursuit of knowledge~~

- ~~Develop new understanding~~

- Deliver or enact

DOUBLE FACEPALM

FOR WHEN ONE FACEPALM DOESN'T CUT IT

DIY.DESPAIR.COM

What is research?

- ~~Pursuit of knowledge~~

- ~~Develop new understanding~~

- ~~Deliver or enact~~

If we accept that we are disguised researchers, can we do it better?

"

2 Great Researchers

Francis Crick (1916–2004)

British biophysicist.

Received the 1962 Nobel Prize for Physiology or Medicine for their determination of the molecular structure of deoxyribonucleic acid (DNA).

With James Watson and Maurice Wilkins.

'I do recall going home and telling [my wife] that we seemed to have made a big discovery. Years later she told me she hadn't believed a word of it. "You were always coming home and saying things like that"'

'… so that Jim [Watson] soon began to tire of my repetitious enthusiasm. In fact at times he had cold feet, thinking that perhaps it was all a pipe dream…'

"

'...we were able to take a <mark>long cool look</mark> at the structure, sorting out its accidental features (which were somewhat inaccurate) from its really fundamental properties...'

"

'...I enjoyed every moment of it, the downs as well as the ups. It certainly ==helped me in my subsequent propaganda== for the genetic code.'

"

'*The important thing is to be there when the picture is painted*'

– John Milton

'...is partly a matter of luck, partly good judgement, inspiration and **persistent application**.'

The best researchers are...

- Confident yet humble
- Critical yet collaborative
- Ambitious yet realistic
- Thorough yet know when to stop

'*Francis Crick's genius thrived on* <mark>*collaboration and conversation*</mark>'

"

Francis Crick: Discoverer of the genetic code, Matt Ridley, 2006

Software Engineer/Researcher qualities

Personal
Passion
Perseverance
Integrity
Self-confidence
Self-reflection
Responsibility

Working with others
Team working
Leadership
Respect
People management
Mentoring
Supervision

Knowledge base
Subject knowledge
Information seeking
Information literacy
Languages

Cognitive ability
Analysis
Synthesis
Critical thinking
Evaluation
Problem solving

Creativity
Inquisitive
Insightful
Innovative
Argument construction

INTERNAL

TECH

Technical ability
Basic CS skills
Languages
Practices
Technology

Communication
Speaking
Publishing
Writing
Collaboration
Public image
PR

EXTERNAL

BUSINESS

Business acumen
Strategic
Financial
Sales
Valuing
Marketing
Business development

Self-management
Prioritisation
Commitment
Time management
Work-life balance
Disciplined
Pragmatic

Research management
Strategy
Planning and delivery
Risk management

Professional conduct
Ethics, principals
Legal requirements
IPR and copyright
Respect
Confidentiality
Client work

Personal development
Career management
Learning
Opportunistic
Reputable
Networking

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3 Research Patterns

Hypotheses

A proposed explanation, usually based on prior experience, background knowledge, preliminary observations, and logic.
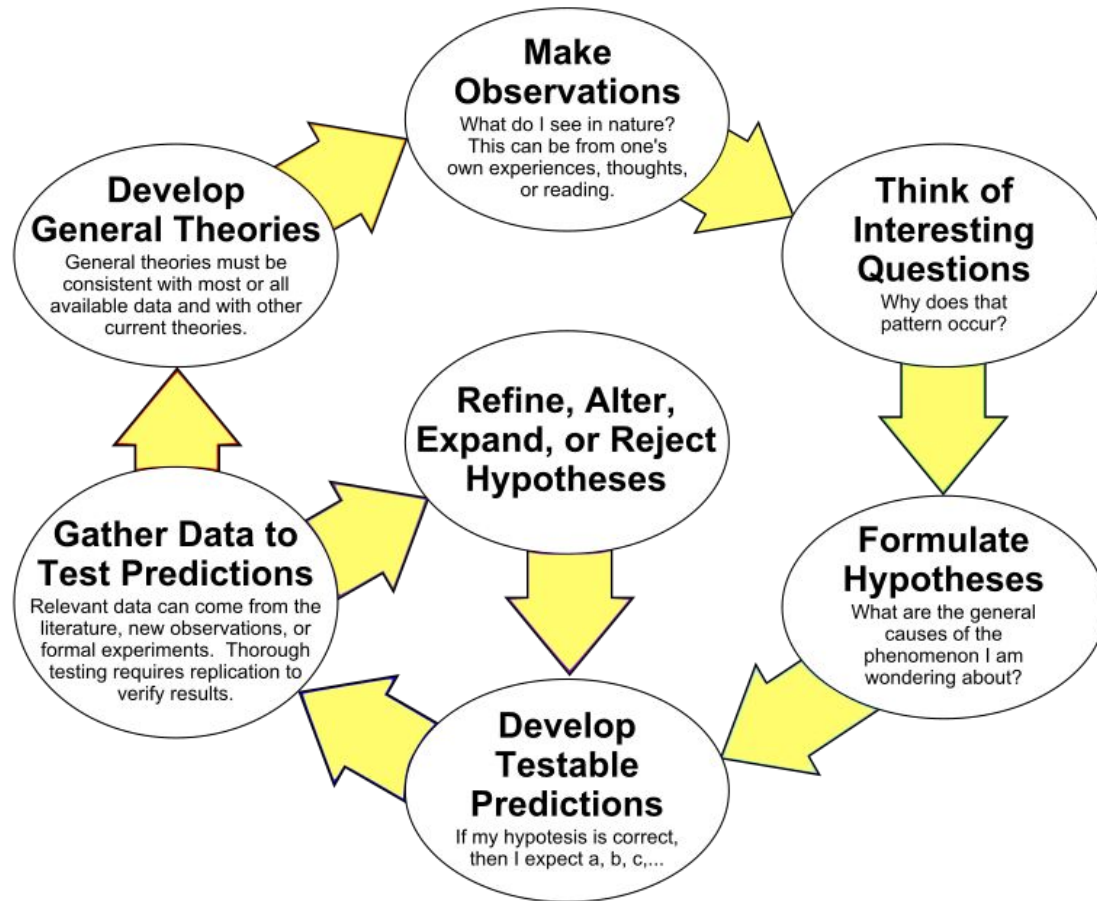
- Results of the research support or do not support the hypothesis

Scientific Method

systematic observation, measurement, and experiment, and the formulation, testing, and modification of hypotheses

"scientific method", Oxford Dictionaries: British and World English, 2016, retrieved 28 May 2016

The Scientific Method as an Ongoing Process

Make Observations
What do I see in nature?
This can be from one's
own experiences, thoughts,
or reading.

Think of Interesting Questions
Why does that pattern occur?

Develop General Theories
General theories must be consistent with most or all available data and with other current theories.

Refine, Alter, Expand, or Reject Hypotheses

Formulate Hypotheses
What are the general causes of the phenomenon I am wondering about?

Gather Data to Test Predictions
Relevant data can come from the literature, new observations, or formal experiments. Thorough testing requires replication to verify results.

Develop Testable Predictions
If my hypotesis is correct, then I expect a, b, c,...

By ArchonMagnus (Own work), via Wikimedia Commons

```
bool flag = false;

// Sometimes carry out the work \
if (flag)
  SomeWork();
```

```
bool flag = false;

// Sometimes carry out the work \
if (flag)
  SomeWork();
```

```
… some work
```
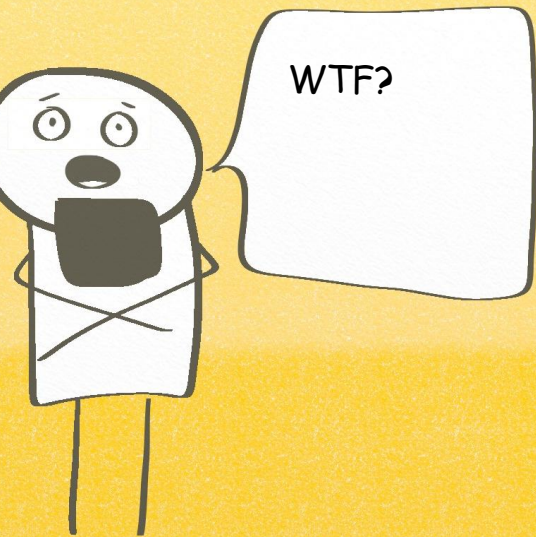
```
bool flag = false;

// Sometimes carry out the work \
if (flag)
  SomeWork();
```

```
… some work
```

Problem
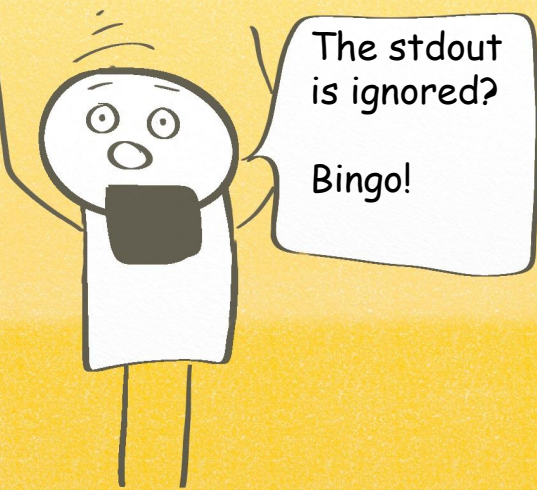
```
bool flag = false;

// Sometimes carry out the work \
if (flag)
  SomeWork();
```


Hypothesis?
Interesting
questions...

```
… some work
```

Hypothesis

```cpp
bool flag = false;

// Sometimes carry out the work \
cout << "Hello World!";
if (flag)
  SomeWork();
```

Testable prediction

```cpp
bool flag = false;

// Sometimes carry out the work \
cout << "Hello World!";
if (flag)
  SomeWork();
```

```cpp
bool flag = false;

// Sometimes carry out the work
cout << "Hello World!";
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```

Testable prediction

```cpp
bool flag = false;

// Sometimes carry out the work
cout << "Hello World!";
if (flag)
  SomeWork();
```

```
Hello World!
```

General theory!
(I'm an idiot)

Experimental Research

Performing controlled experiments to verify a hypothesis.

- ◉ Comparisons between competing designs
- ◉ Requires a robust metric
- ◉ Depending on repeatability, may require lots of data

Bell, Judith. Doing Your Research Project. Open University Press, 2005.

The Five 'Ws'

- What is the research?
- Why do I want to do the research?
- Who are the participants?
- Where can I perform the research?
- When am I going to do the research?

Dawson, Catherine. Introduction to Research Methods... Hachette UK, 2009.

The 'Why' is important

"Why is [state] so…"

@joshgreenman

Generally, any problem should...

- Make money
- Reduce costs
- Save time

Action Research

A problem involving people, tasks or procedures where a change can cause a more desirable outcome.

- Purpose
- Focus
- Relations
- Method
- Validation

Briggs, Ann R. J., and Marianne Coleman. Research Methods in Educational Leadership and Management. SAGE, 2007.
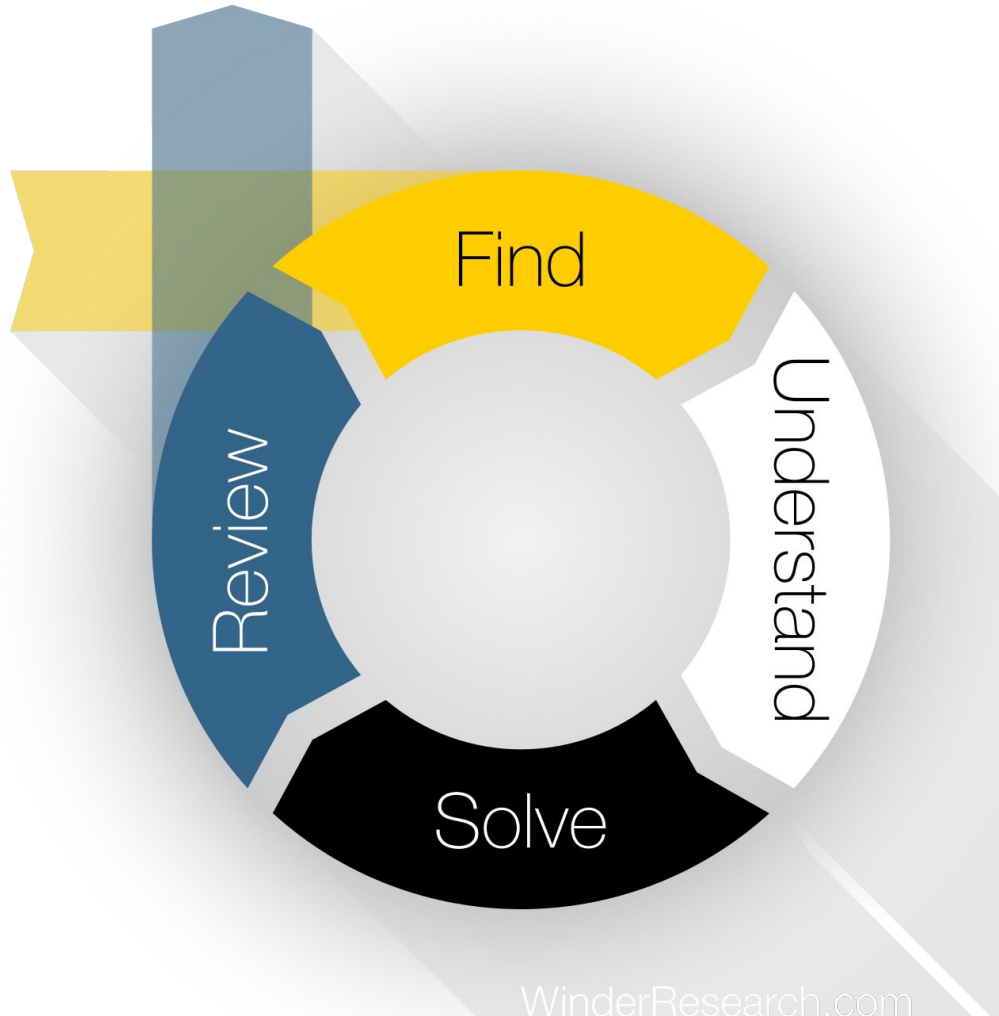
Working on a problem

Most problems are iterative in nature. They follow a distinctive pattern flowing from ignorance to knowledge.

Also see: OODA loop.

FIND

UNDERSTAND

REVIEW
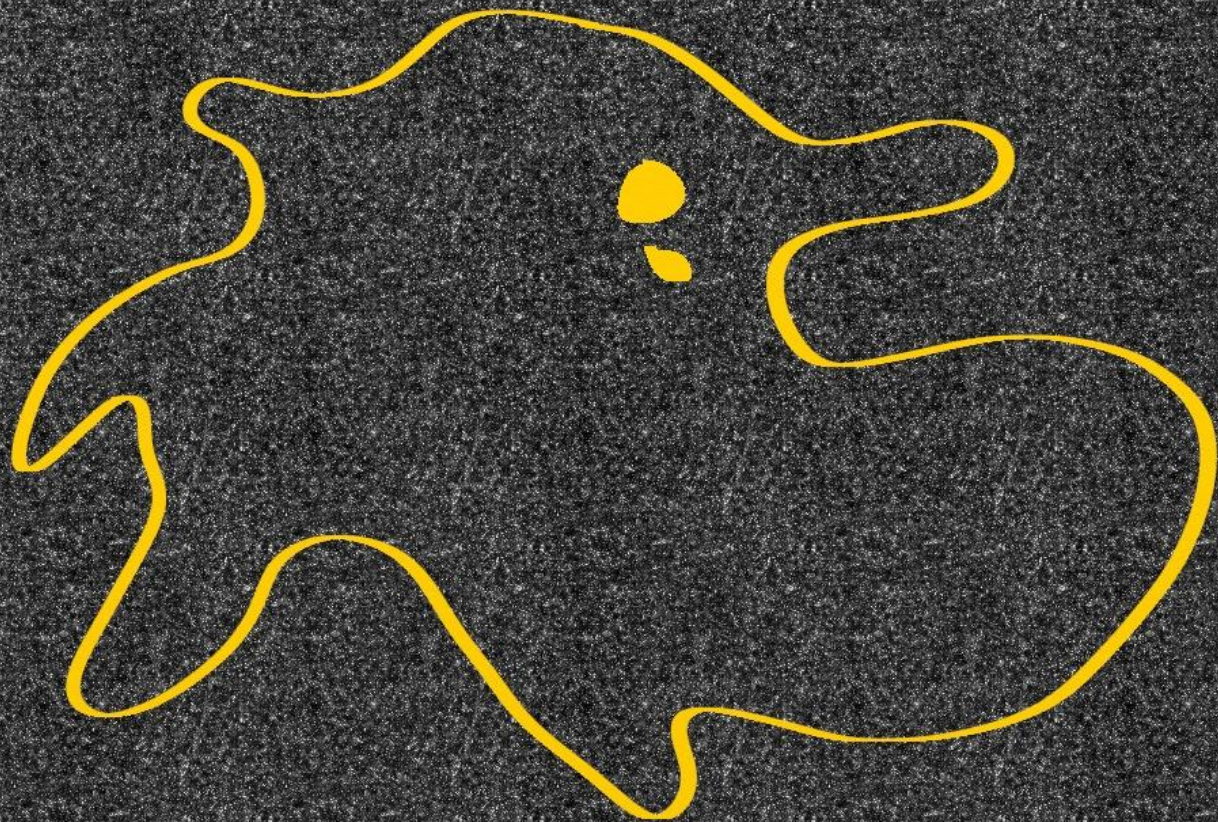
Find

- Improve front–end developer productivity
- Reduce lead time on new features

Key questions: Why? How long? How much?

Understand

- Improve front-end developer productivity
- Reduce lead time on new features

- Definition of "productive"?
- Which frameworks/languages?
- How to measure productivity and lead times?
- Baselines?
- Does this just related to front-end developers?

Solve

- Planning
- Teams
- Tasks
- Research
- ...

Review

- Report findings
- Present finding
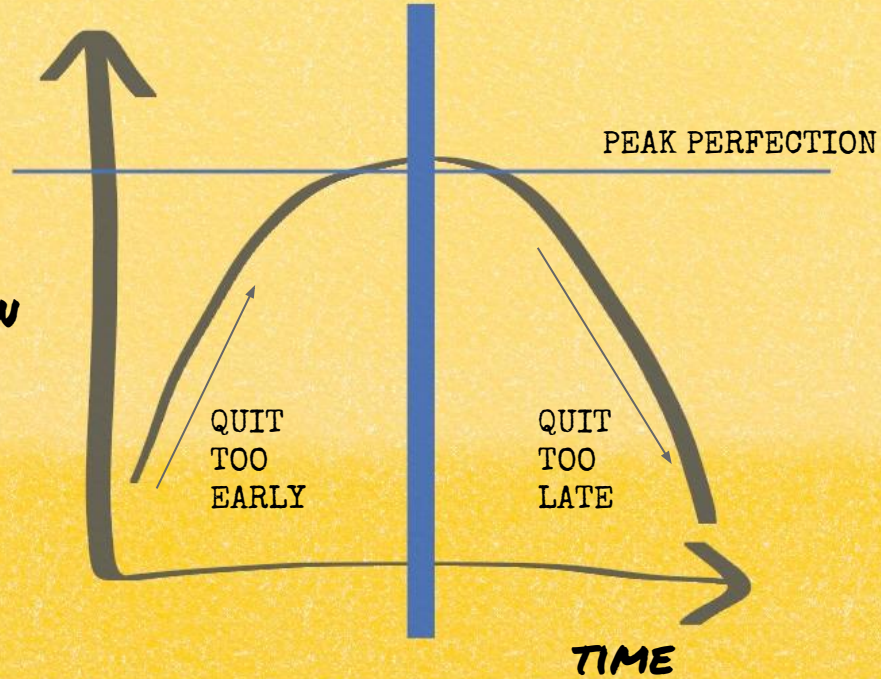- Implement actions
- Repeat

Fail fast

~~Fail fast~~

Stop smart

"

THE GOAL

PRODUCT
PERFECTION

TIME
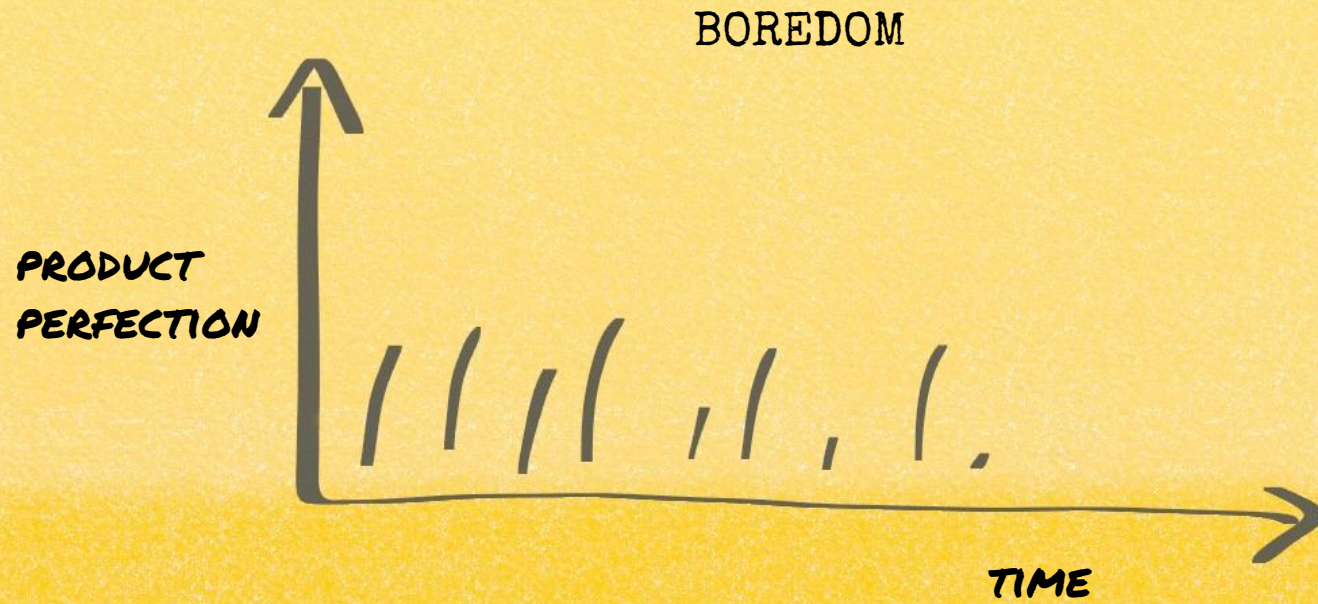
Persist until you have that sinking feeling.

Thanks!

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phil@WinderResearch.com

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