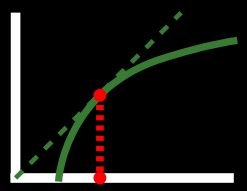
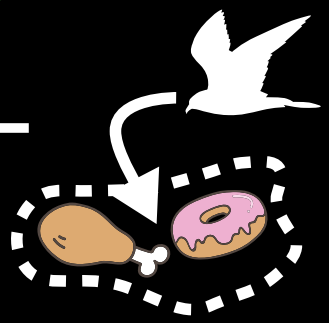
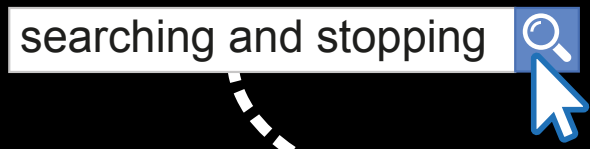
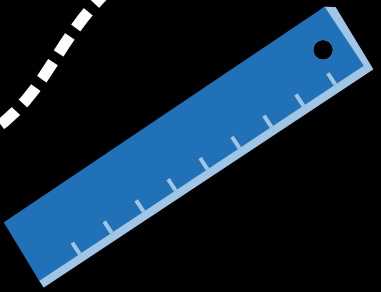






TU Delft

Searching, Stopping and User Modelling



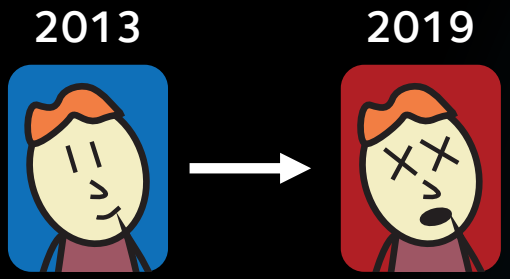
David Maxwell *(@maxwelld90)*

November 25th, 2020

The Recent Past

2013-2019

- **University of Glasgow**
- PhD in **IIR**
- Supervised by **Dr Leif Azzopardi**



2020-

- **TU Delft**
- Postdoc Researcher
- Working with **Dr Claudia Hauff**

Lambda Lab

The Recent Past

2013-2019

- University of Glasgow
- PhD in **IIR**
- Supervised by **Dr Leif Azzopardi**


University of Glasgow

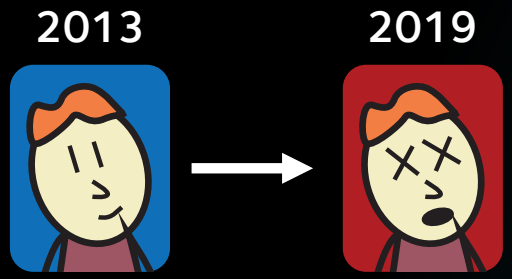
Modelling Search and Stopping in Interactive Information Retrieval

David Martin Maxwell

School of Computing Science
College of Science and Engineering
University of Glasgow
Scotland

A thesis submitted for the degree of
Doctor of Philosophy (PhD)

© David Martin Maxwell



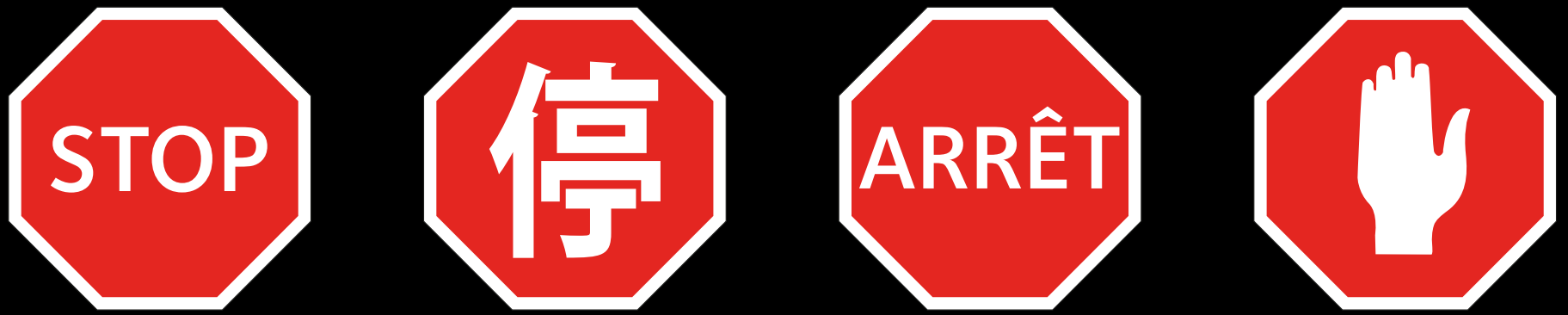
2020-

My 2020: Lockdown and Stroopwafels

BCS Informer, October 2020

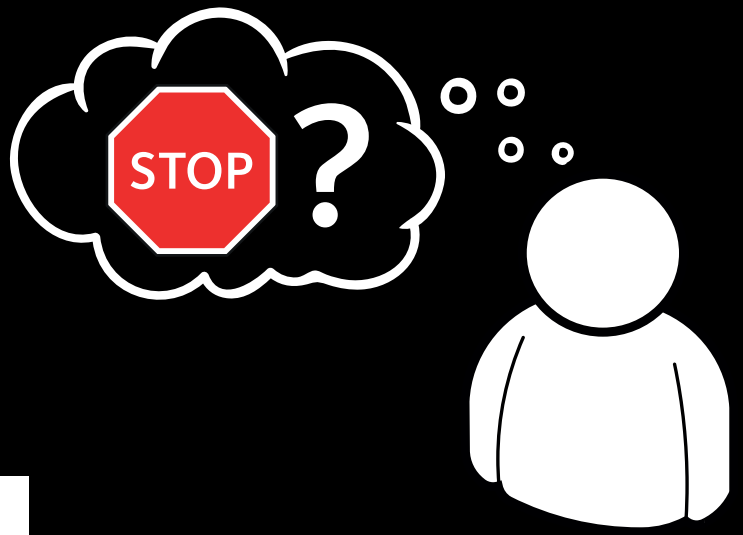
Stopping Behaviour

“All good things must come to an end”



Searching and Stopping

- Search is an **inherently interactive process**[1]
  - Searchers **adapt their interactions** based upon the **perceived quality of a presented ranked list** of results[2]
- They must also decide when to **stop their interactions, too!**



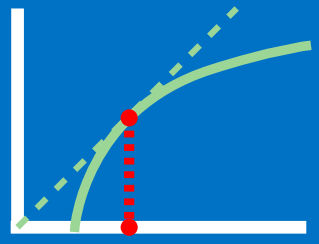
[1]Ingwersen and Järvelin, 2005, [2]Moffat et al., 2013

Searching and Stopping

- Despite importance, only a **limited number** of studies have examined this phenomenon
  - People stop because what they find feels **"good enough"**[1] – but is that good enough for us?

Looking at Empirical Observations

Examining Theoretical Models



[1]Zach (2005); echoed by other studies like Dostert and Kelly (2009)

Stopping Heuristics

- Many different heuristics have been proposed
  - From several scientific research areas

Number and **Give-Up** Heuristics

- Devised from an examination of **foraging behaviour** of Chickadees in the wild
  - Considers aspects/models of **Optimal Foraging Theory (OFT)**[1]

[1] Stephens and Krebs (1986)

Stopping Heuristics

Number Heuristic

- **Stop after finding x item(s)**
- Simple…but flawed?

Stopping Heuristics

ADAPTIVE

Give-Up Heuristic

- Stop when **I've not found anything after x second(s) have elapsed** since the last find

Stopping Heuristics

- **Many other** (more complex) **heuristics have been proposed/observed** over time

Difference Threshold

Mental List (Items)

Magnitude Threshold

Representational Stability

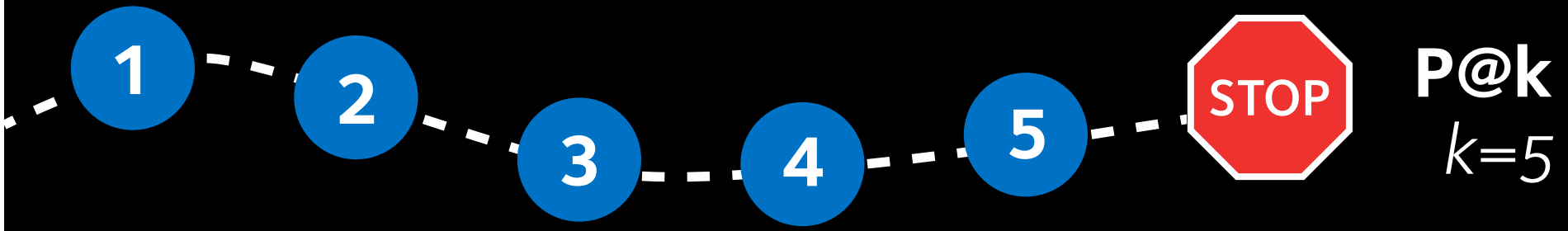
Satisfaction (Satiation)

- Check Section 3.2 of my thesis for a **comprehensive survey** of these heuristics

(I)IR Measures

FIXED

- Think about our measures in (I)IR, too!
- Whether to evaluate a system or user, they use **some form of stopping model.**



Intuitive-ness and Patches

Search highland whiskies

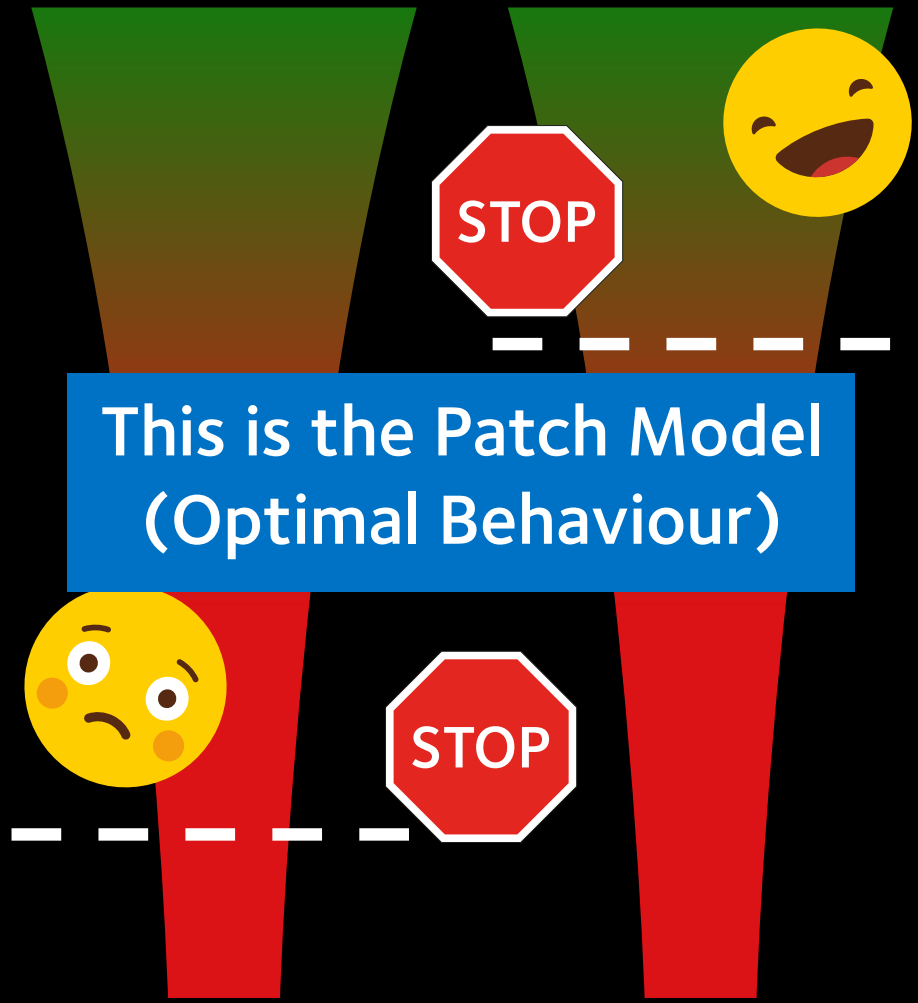
Dalwhinnie Distillery | Dalwhinnie Malt Whisky | Malts
https://www.malts.com/distilleries/dalwhinnie/
Dalwhinnie Distillery stands in the Cairngorm National Park at the heart of the Scottish **Highlands** in the village of Dalwhinnie. Finest scotch...

Laphroaig: Home
https://www.laphroaig.com/
Laphroaig Single Malt peated **Whisky** from Islay. The most richly flavoured scotch whisky in the World.

Scapa Whisky | Scapa The Orcadian
scapawhisky.com/
Scapa is an artisanal single malt **whisky** forged by the extreme elements of Orkney, Scotland.

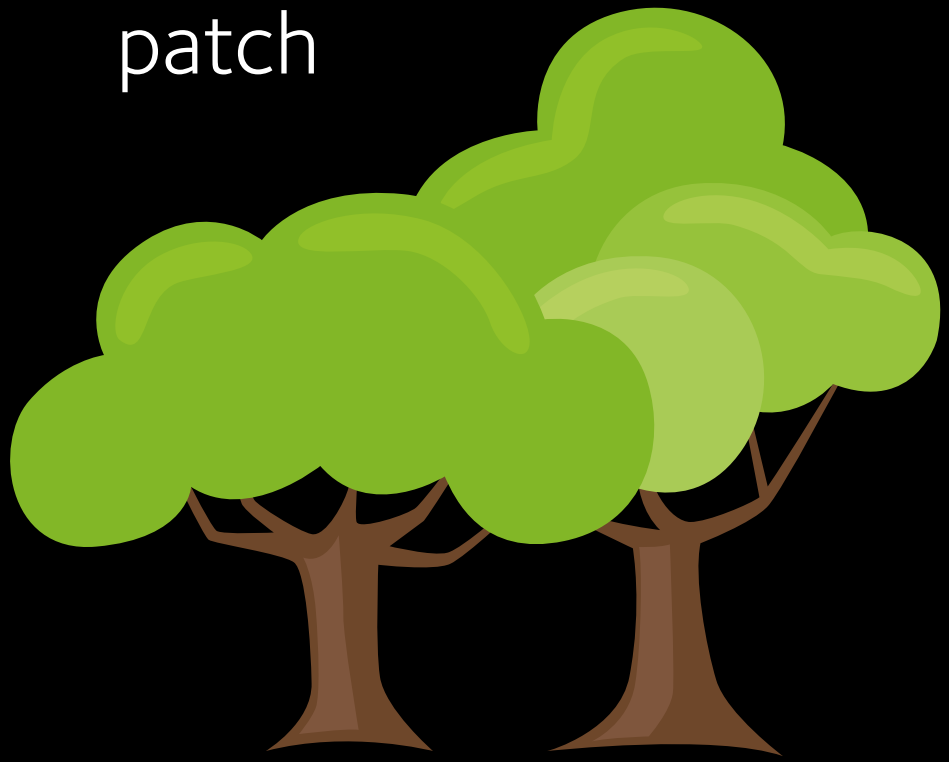
Scotch whisky - Wikipedia
en.wikipedia.org/wiki/Scotch_whisky
Scotch **whisky** (Scottish Gaelic: uisge-beatha na h-Alba; often simply called **whisky** or Scotch) is malt **whisky** or grain **whisky** (or a blend...

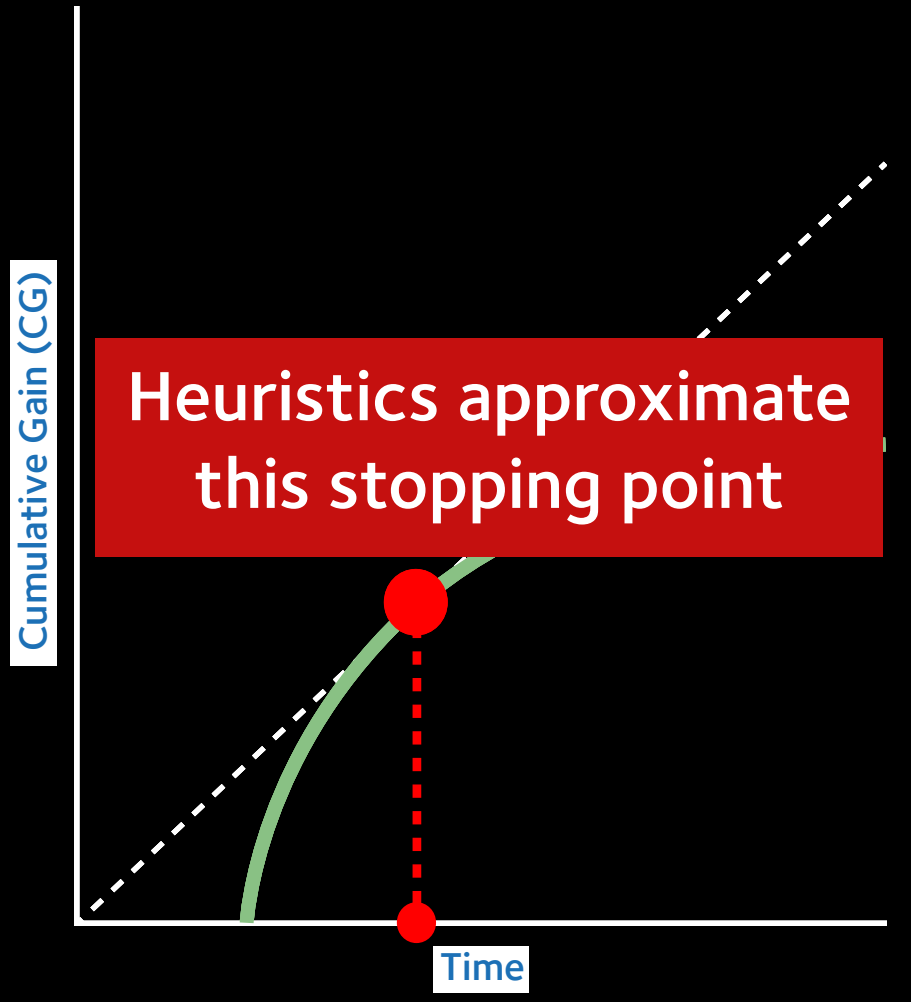
Irish Whiskey - Wikipedia
en.wikipedia.org/wiki/Irish_whiskey
Single malt Irish **whiskey Whiskeys** made entirely from malted barley distilled in a pot still within a single distillery are referred to as single...



The Patch Model

- Describes **what happens** in the patch

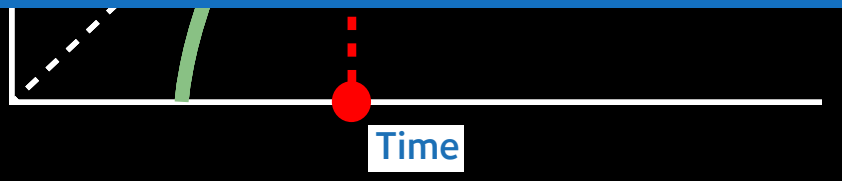




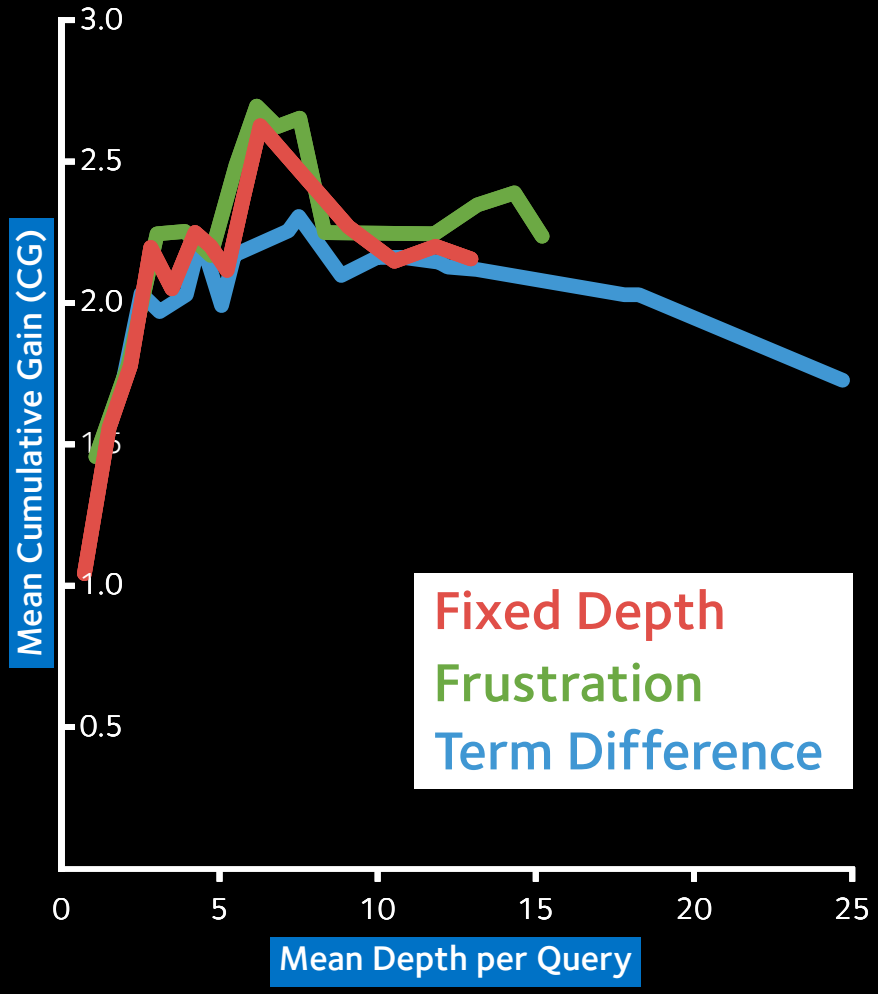
The Patch Model

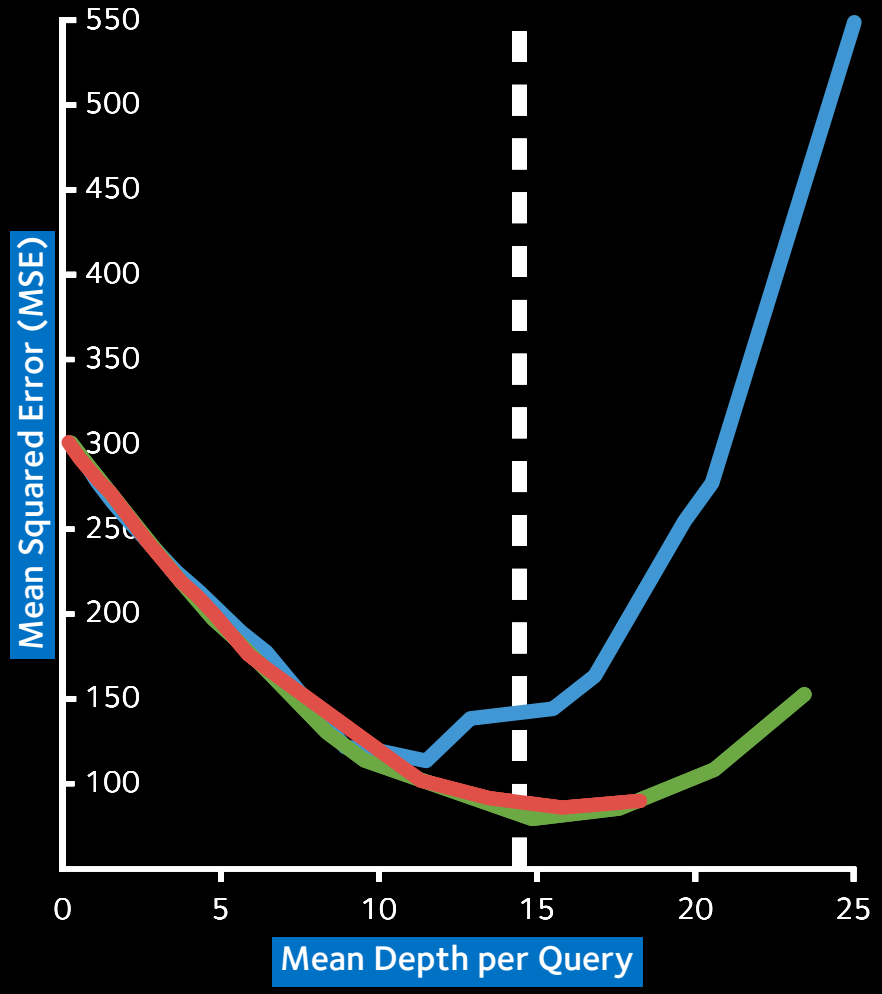
User Studies + Simulated Analyses

Heuristic Performance + Real-World Comparisons



Performance Approximations

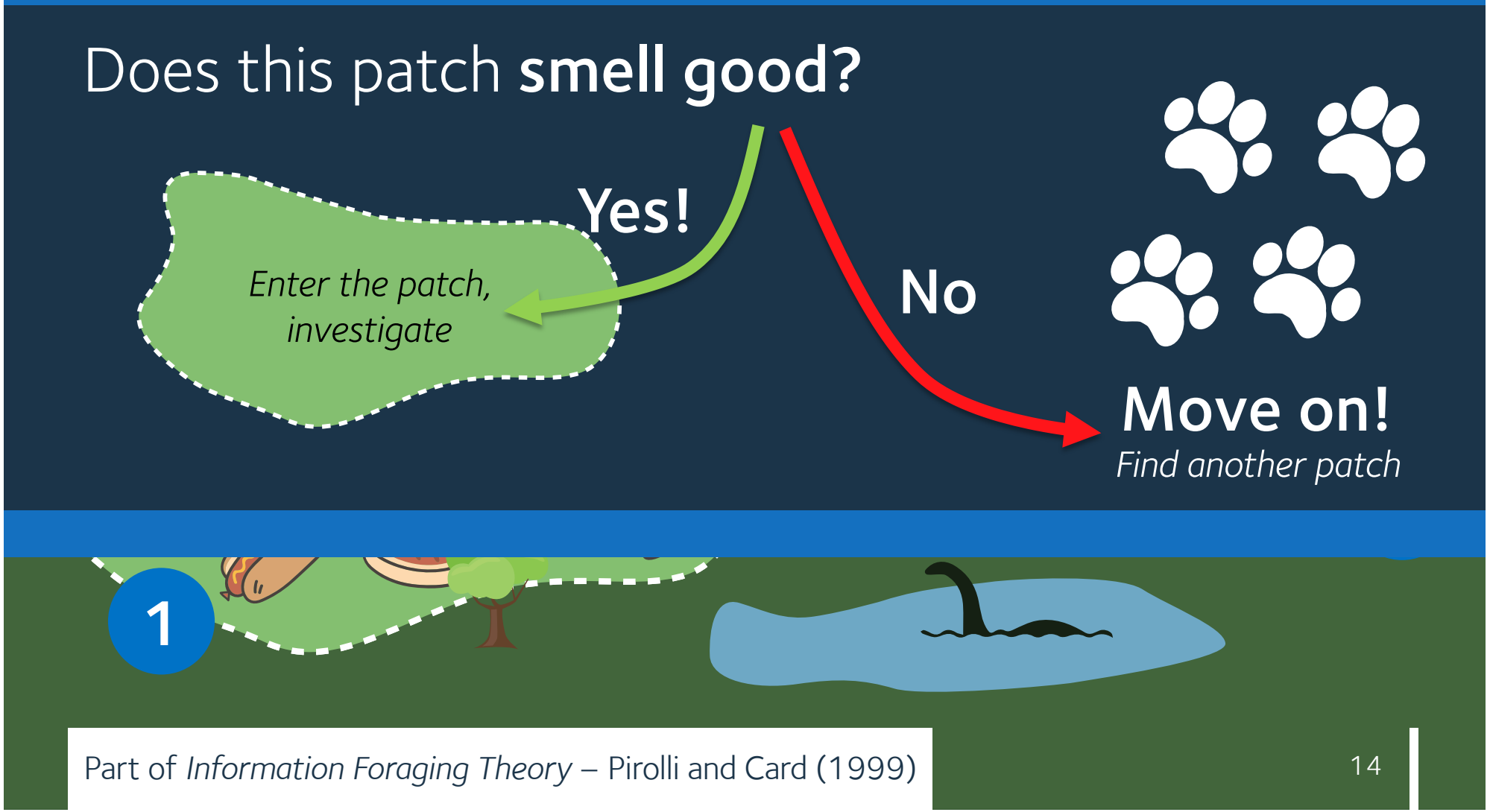




Following the Scent

Part of *Information Foraging Theory* – Pirolli and Card (1999)

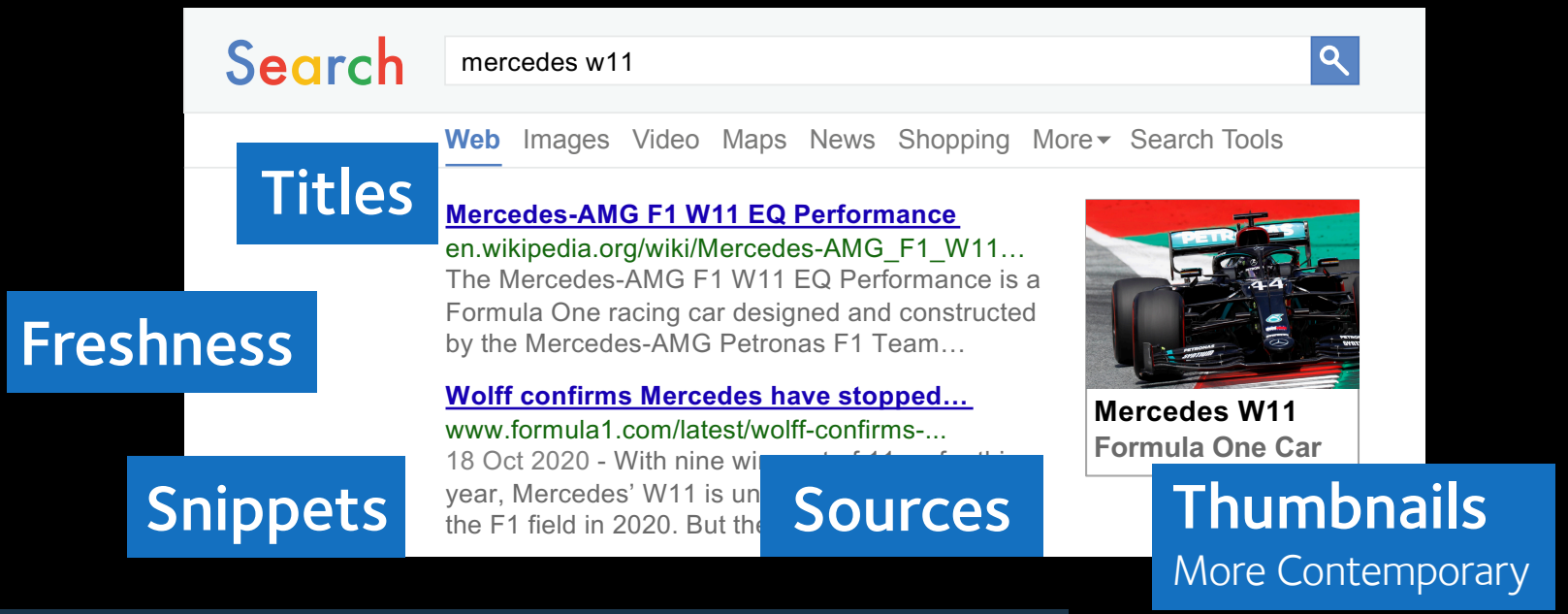
Following the Scent



Part of *Information Foraging Theory* – Pirolli and Card (1999)

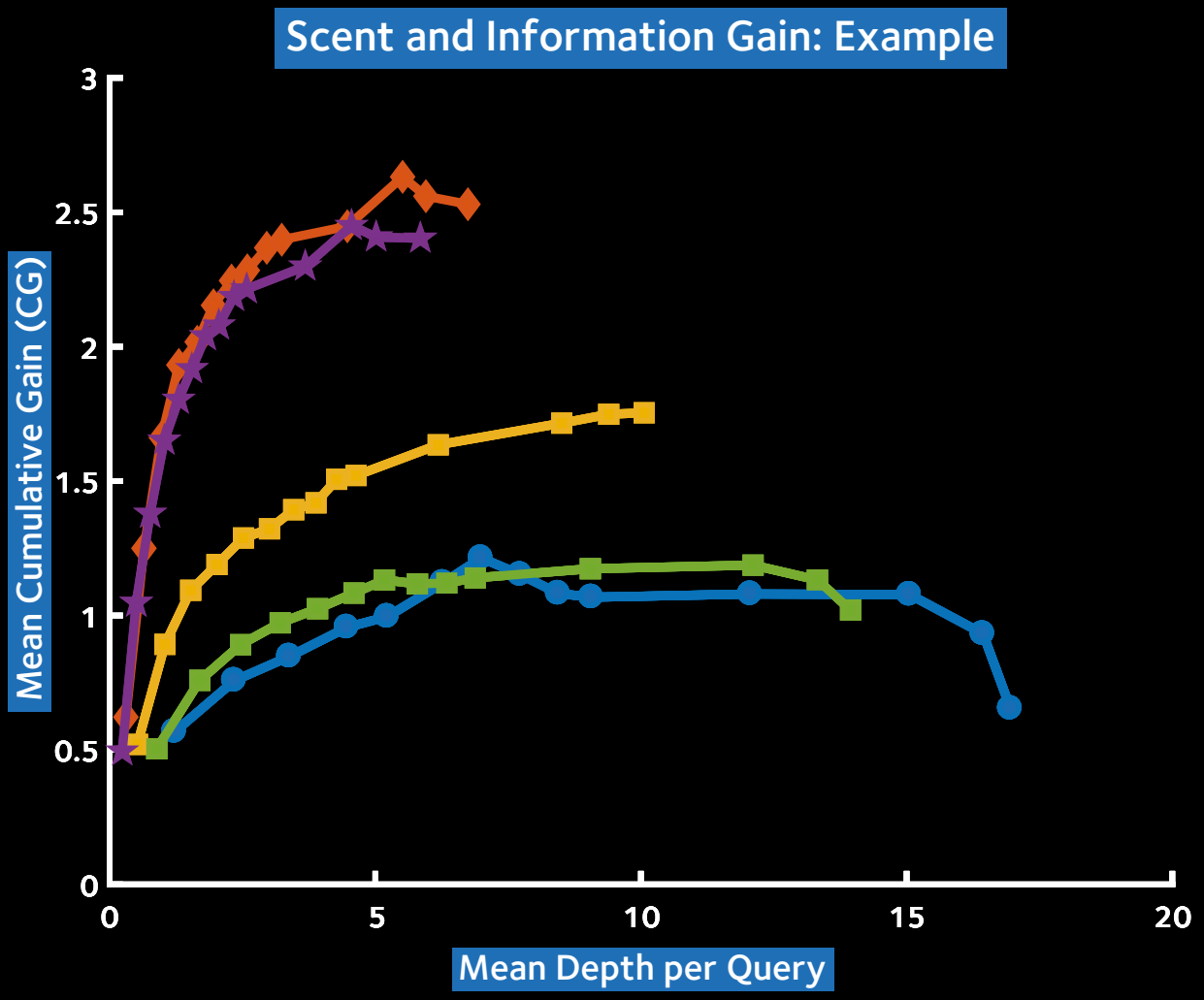
Information Scent and Cues

- **Patches** (typically) **modelled as a SERP**[1]
- **Scent** determined by a series of **proximal cues presented on the SERP**[2]



[1] *For example, look at* Ong et al. (2017), [2] Pirolli & Card (1995)

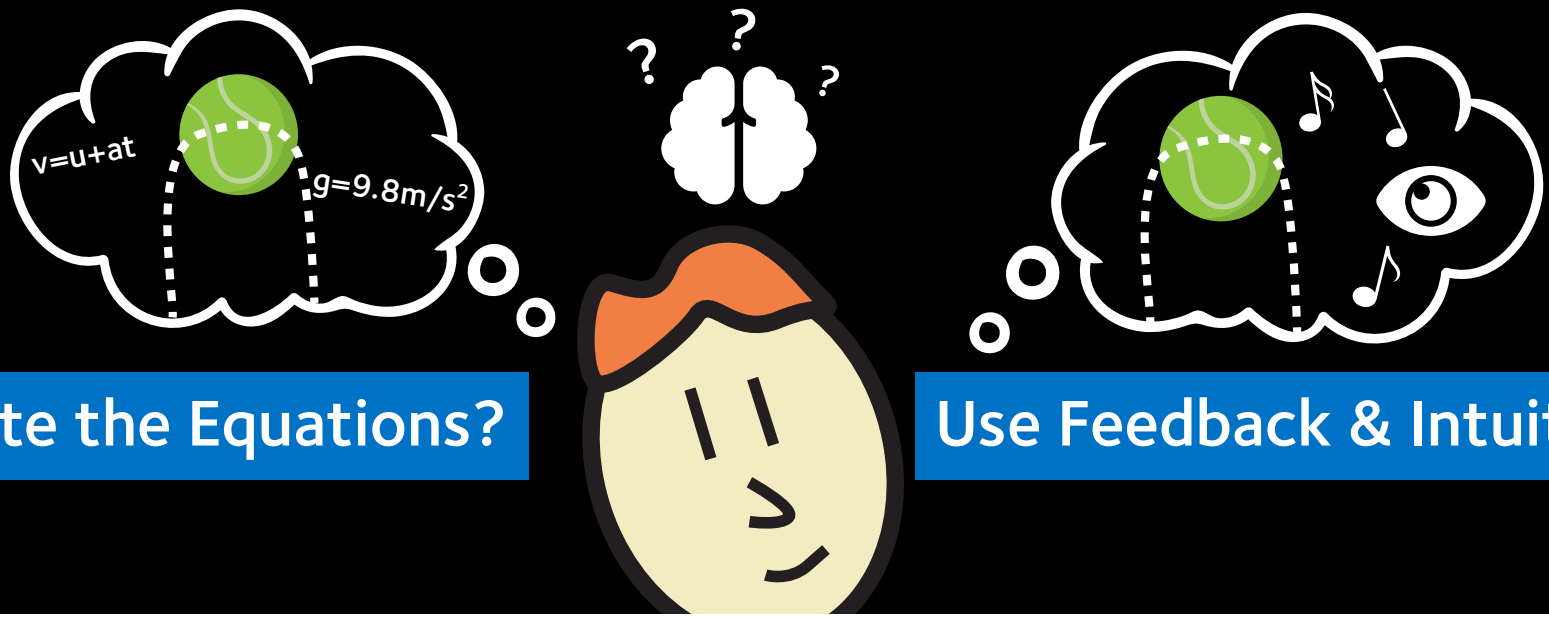
Modelling Information Scent



User	CG D/Q
Upper Good scent only	2.63 5.52
Savvy Top 15	2.45 4.55
Average 53 subjects	1.75 10.06
Naïve Bottom 15	1.19 12.11
Lower Baseline	1.21 7

Intuition vs. Cold, Hard Logic

- **Do we really expect people to compute their gain as they search/forage?**
- Or is stopping more aligned to **some kind of internal tolerance?** Or **intuitiveness**…



Calculate the Equations?

Use Feedback & Intuition?

Concluding Thoughts

- **People undoubtedly have different strategies and tolerances to stopping**
- **Scent also has an impact** on searching – and individuals pick up scent better than others

- **With different learning tasks, how would behaviours change?**
  - **Biases could affect behaviours** (e.g., paradox of choice, sunken cost fallacy)[1]

[1]As hypothesised in my SIGIR 2017 study

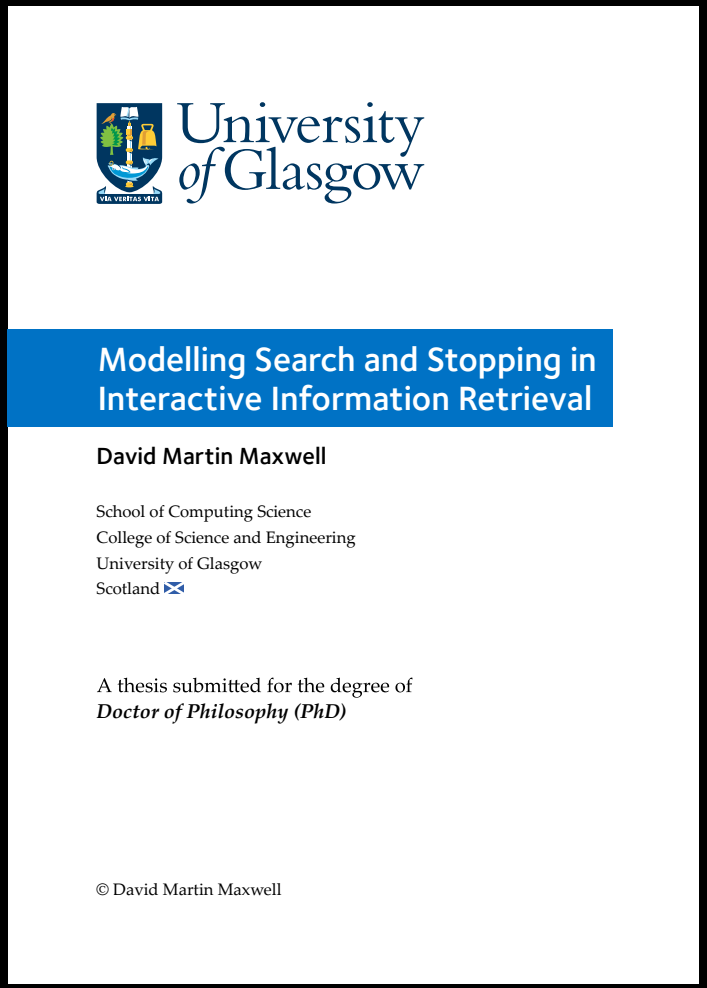
Concluding Thoughts

- **Evaluation is also important**
  - How do you turn a naïve searcher into a savvy searcher? **What can we do to help?**
  - What makes a user good at sniffing a scent?
- **What if you actually want people to keep going rather than stop? ☺**
  - More eyeballs = more ad revenue!

Thanks!

- Interested in this research?
  `www.dmax.org.uk/thesis`
- E-mail me at
  `maxwelld90@acm.org`

- Postdoc research is starting to **examine interactions within a heterogeneous SERP** – pertaining to **complex learning tasks**



University of Glasgow

Modelling Search and Stopping in Interactive Information Retrieval

David Martin Maxwell

School of Computing Science
College of Science and Engineering
University of Glasgow
Scotland

A thesis submitted for the degree of
Doctor of Philosophy (PhD)

© David Martin Maxwell