

AI Master Class, 14/09/2021

Welcome to DART – Introduction to the AI Master Class

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DART – Data & Artificial Intelligence Group

- ❖ People

- ❖ 25 faculty, 19 PhD students, 1 post doc, 5 scientific assistants, 7 associated

- ❖ Labs

- ❖ Norwegian Open AI Lab

- ❖ Norwegian Research Centre for AI innovation

- ❖ A bunch of externally funded research projects and cooperations

AI Master Class

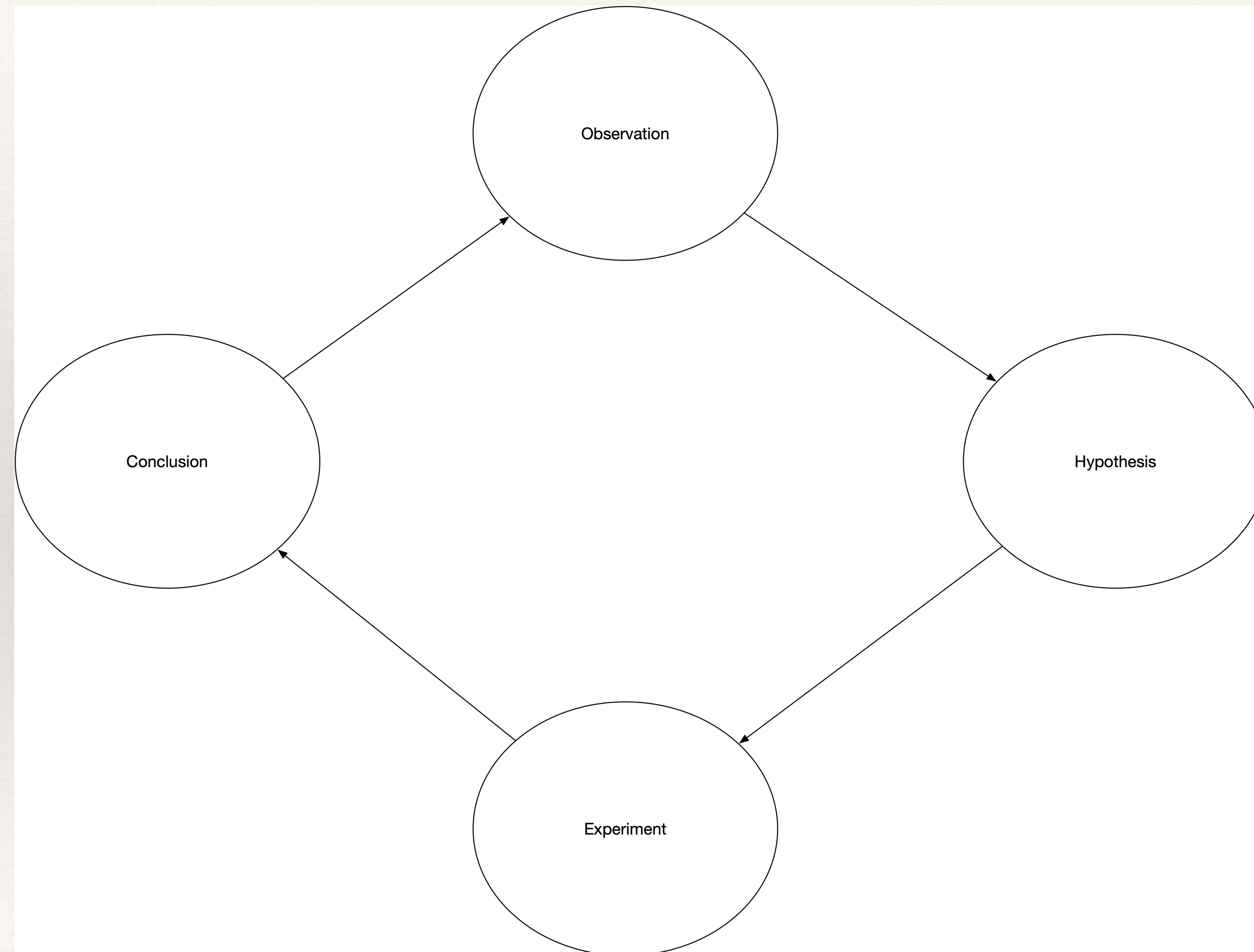
- ❖ We do computer **science**
 - ❖ Science is about method over results
 - ❖ Science is about theory over belief
- ❖ We need to
 - ❖ know what we know
 - ❖ be thorough in our approach
 - ❖ be able to argue our results
- ❖ This is what the AI Master Class is about: you doing the best possible work

Overview of the Master Class, 2021

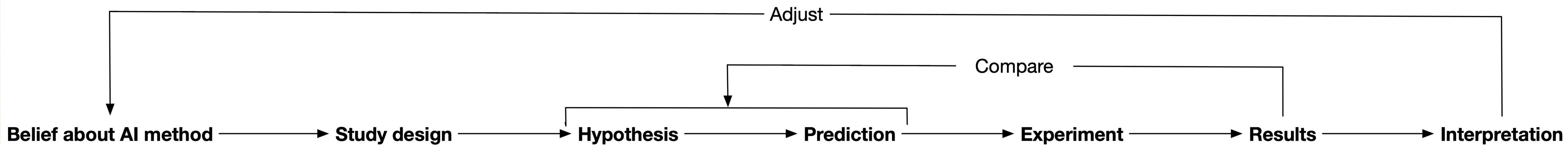
- ❖ 14 / 09 / 2021 — *Welcome to Dart, introduction and how to do research questions*
- ❖ 28 / 09 / 2021 — *Doing structured literature reviews and how to read and write a research paper*
- ❖ 12 / 10 / 2021 — *How to write a thesis*
- ❖ 26 / 10 / 2021 — *Using HPC at NTNU and Reproducibility*
- ❖ 09 / 11 / 2021 — *How to do qualitative empirical research (Might change)*

<https://research.idi.ntnu.no/aimasters/>

The Scientific Method



Scientific Method in AI Research



Your thesis

- ❖ You might save the planet
 - ❖ However, if you do not know *how* and *why*, and can't describe it — it has little value
- ❖ What do you aim for?
 - ❖ The average student can **reproduce knowledge**
 - ❖ The above average student can **add to knowlede**
 - ❖ The good student can **reflect on said addition**
- ❖ All of this goes into your thesis!

How to grade ‘science’

- ❖ **A — Excellent**

- ❖ An excellent performance, clearly outstanding. The candidate demonstrates **excellent judgement** and a **high degree of independent thinking**.

- ❖ **B — Very Good**

- ❖ A very good performance. The candidate demonstrates **sound judgement** and a **very good degree of independent thinking**.

- ❖ **C — Good**

- ❖ A good performance in most areas. The candidate demonstrates a **reasonable degree of judgement** and **independent thinking in the most important areas**.

- ❖ **D — Satisfactory**

- ❖ A satisfactory performance, but with significant shortcomings. The candidate demonstrates a **limited degree of judgement and independent thinking**.

- ❖ **E — Sufficient**

- ❖ A performance that meets the minimum criteria, but no more. The candidate demonstrates a **very limited degree of judgement and independent thinking**.

- ❖ **F — Fail**

- ❖ A performance that does not meet the minimum academic criteria. The candidate demonstrates an **absence of both judgement and independent thinking**.

Method is our friend

- ❖ Say this every morning when you look in the mirror: “Method is our friend!”



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How to Formulate a Research Question

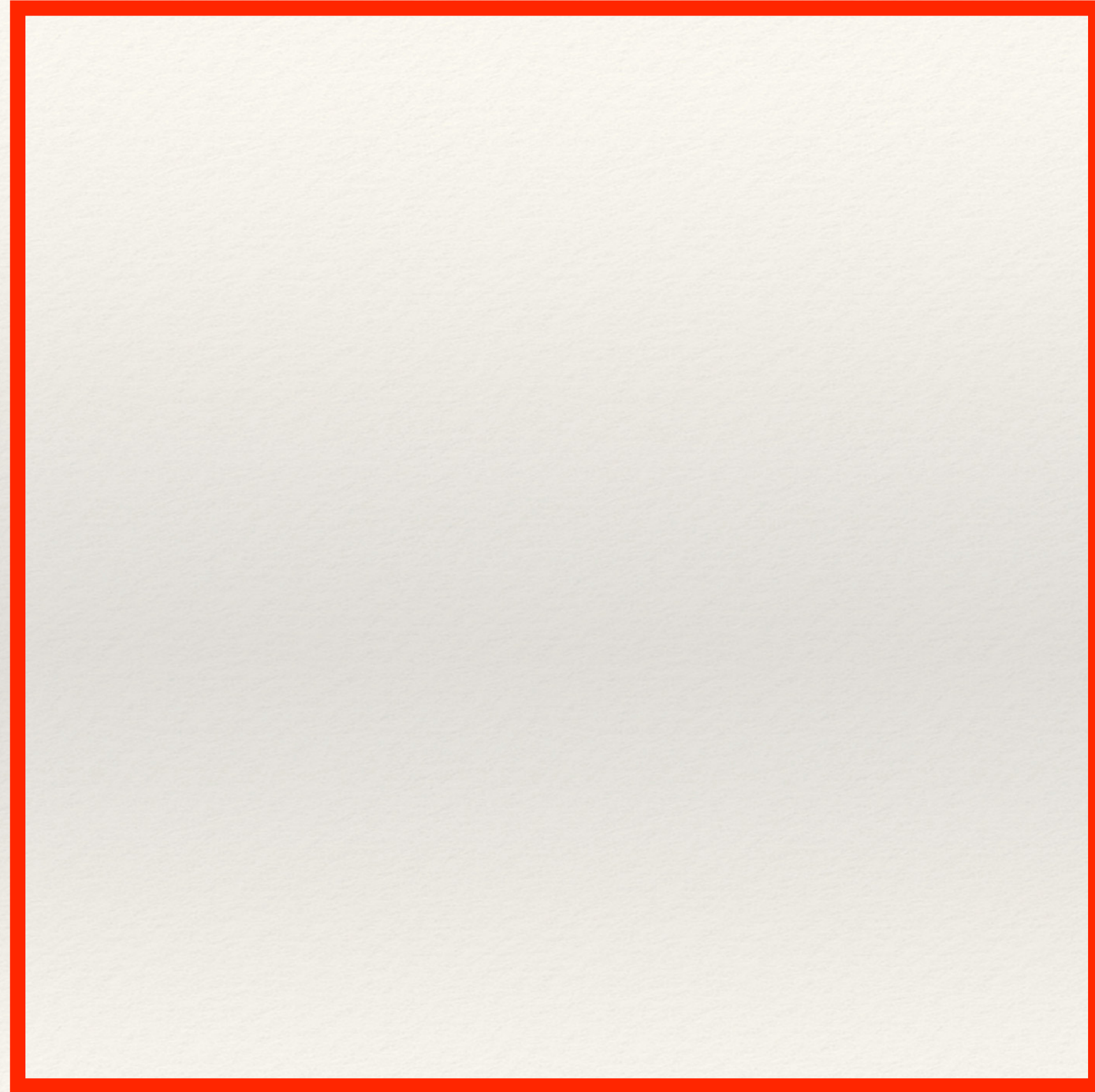
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What are Research Questions

- ❖ These are the questions that your work should answer
- ❖ These are the questions you are evaluated on
- ❖ These are the questions your thesis answers
- ❖ These are the questions that guide your choice of methods or problem
- ❖ They guide your choice of evaluation method, which guides your choice of research questions

The Research Box



Research Questions

- ❖ How to choose your research question
- ❖ There is a very difficult(*) and interesting(**) problem that needs to be solved
- ❖ There is a very interesting(*) and promising(**) method that could be applied on an existing problem
- ❖ There are some flaws or issues with an existing method
- ❖ Research questions are all pointing towards the same goal

What is your Goal?



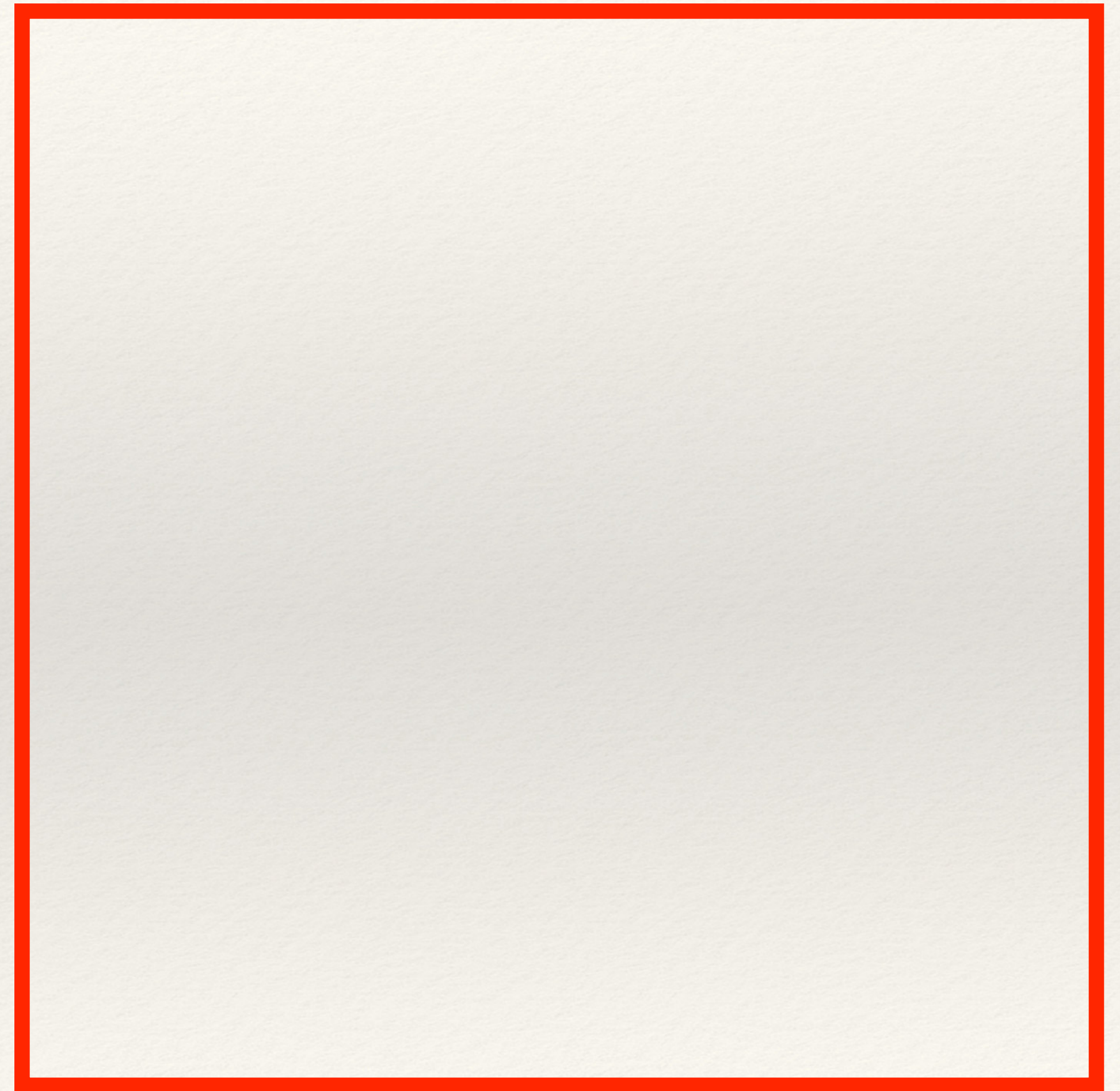
What are your Research Questions?



Going Forward

First Question ...

- ❖ ... is always: *“have anybody been doing something similar before?”*
- ❖ The answer is (almost) always yes!
- ❖ How to evaluate?



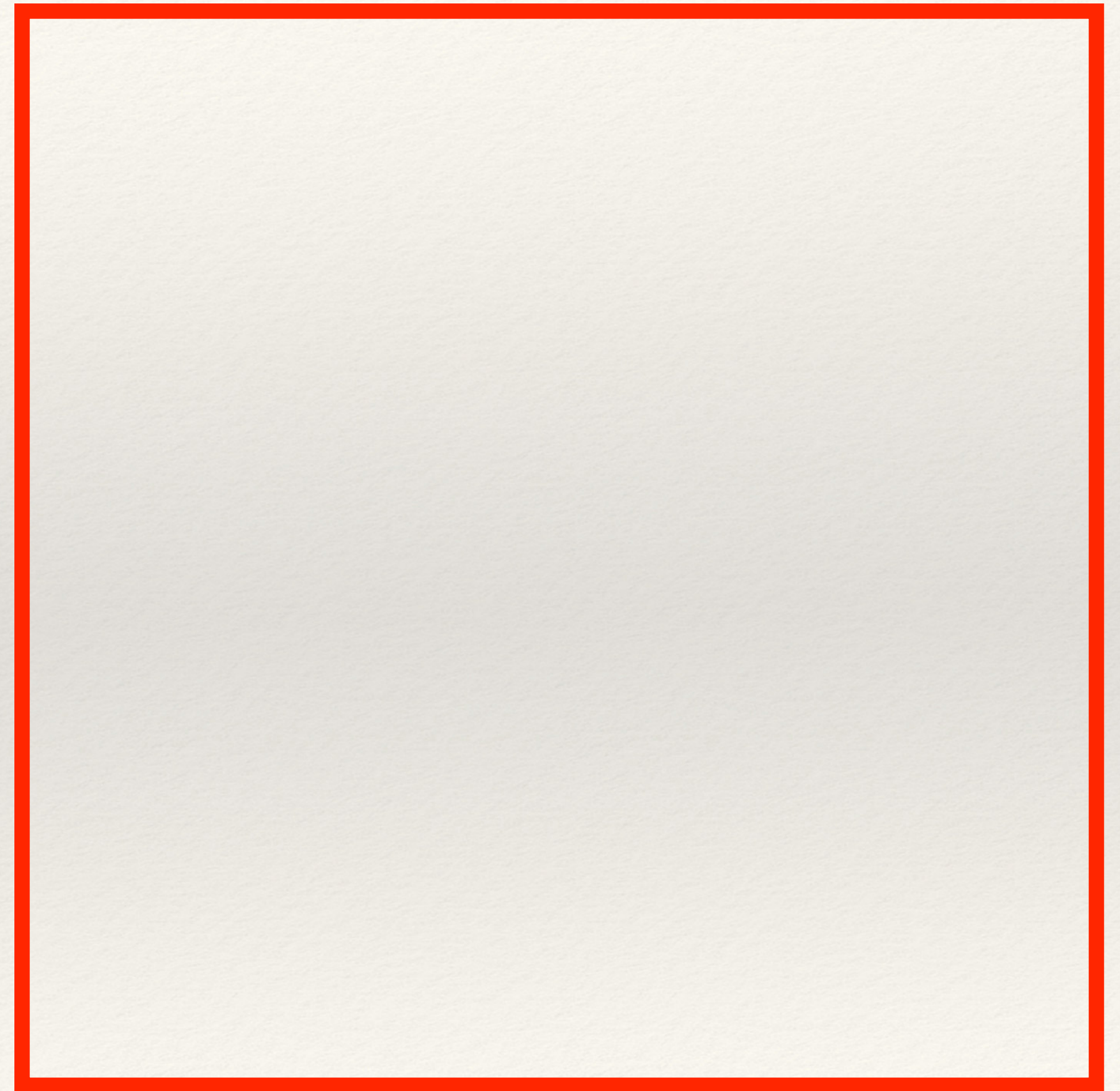
Method is our Friend

- ❖ In this case we can approach figuring out *who* did *what* and *how* in a systematic manner.
- ❖ Stay tuned for September 28th

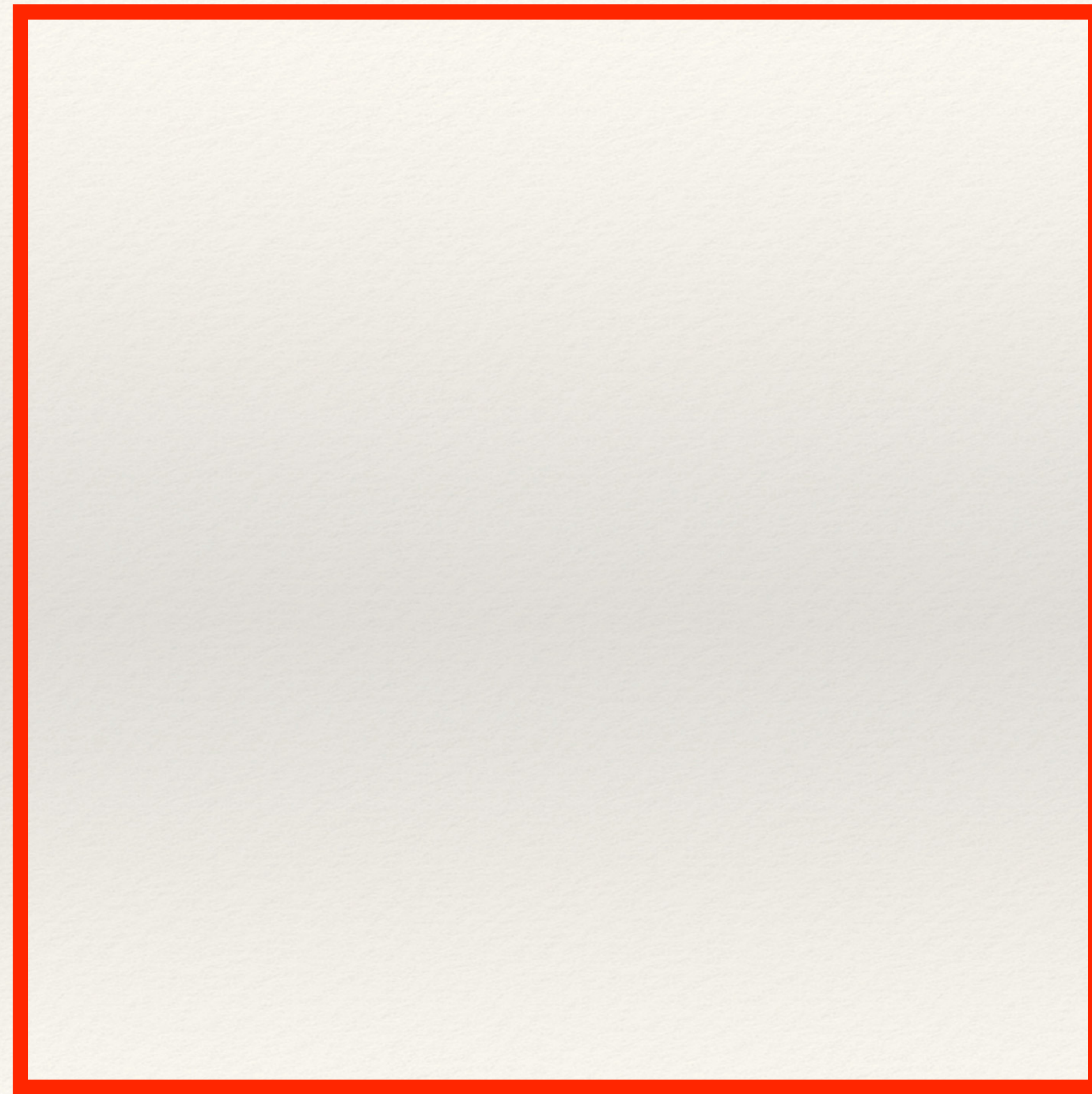


Second Question ...

- ❖ ... is always: “*what is my contribution?*”
- ❖ This is formally not a research question.
- ❖ How to evaluate?



Third Question ... and beyond



Example: From Single-objective to Multi-objective

- ❖ **Goal** Create a multi-objective meta-heuristic algorithm based on a single-objective algorithm from the literature.
- ❖ **RQ1** Which single-objective algorithm has the best potential for multi-objective extension?
- ❖ **RQ2** Which multi-objective techniques are most suitable for extending the selected algorithm to multi-objective?
- ❖ **RQ3** How does the proposed algorithm's performance compare to other competitive algorithms from the literature?

Example: Telenor Watchdog

- ❖ **Goal** Create an application that increase users ability to maintain privacy on an Android device by informing about actual and possible threats for disclosure of sensitive information.
- ❖ **RQ1** Which techniques can be used to detect possible malicious behaviour of third-party applications based on real-time system monitoring and application analysis on an unrooted Android device?
- ❖ **RQ2** What is the best way to inform users about threats in installed third-party applications on an Android device and provide them with incentives to uninstall these applications?
- ❖ **RQ3** Which user interaction patterns can be employed to make users aware of their privacy-related behaviour?

Example: Sliding Door

- ❖ **Goal1** Design a model of features, human behaviour and intentions.
- ❖ **Goal2** Design a mechanism for capturing and extracting features according to the model.
- ❖ **Goal3** Design a reasoning mechanism for inference of intention.
- ❖ **Goal4** Implement software comprising the results from Goal 1, 2 and 3 Develop a complete software application for the operation of a door equipped with sensors giving it the ability to reason.
- ❖ **Goal5** Build a motorised sliding door
- ❖ **RQ1** What set of computer vision algorithms will meet Goal 2 efficiently?
- ❖ **RQ2** What is a well suited reasoning mechanism for this task?

What is your Poison?

