

Scientific Knowledge Organized Through Question Network

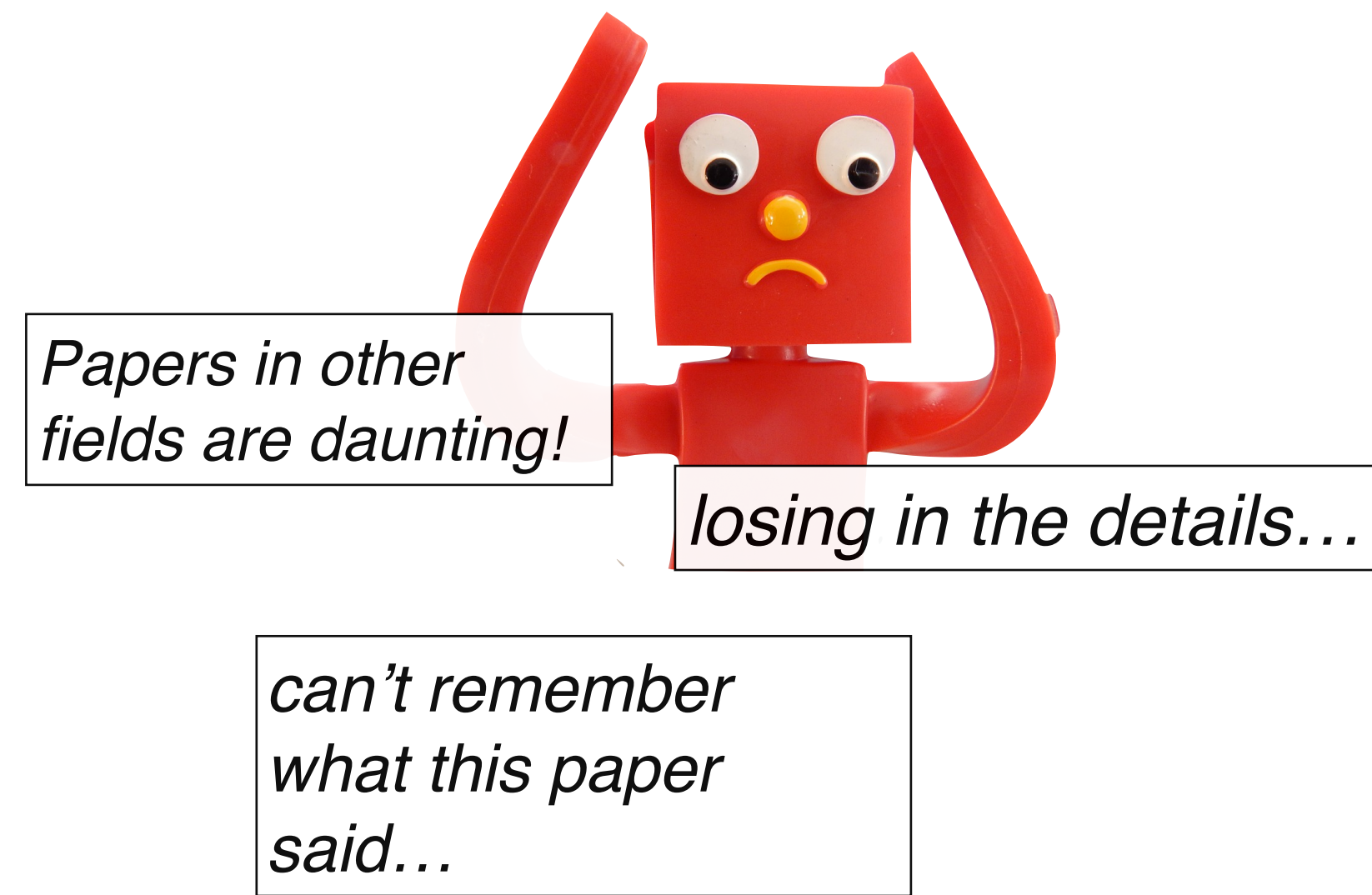
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Introduction

Papers are not the most accessible way to organize knowledge



New tool in beta...

- We show examples of questions networks for a single paper and multiple papers in the same field.
- As a proof of concept, we demonstrate possible analysis from the question networks.

If you find this useful...

- Thumb up :)
- Ask about our current pipeline for recording and visualizing question networks
- Volunteer to create question networks and share your data!

Translate research into questions

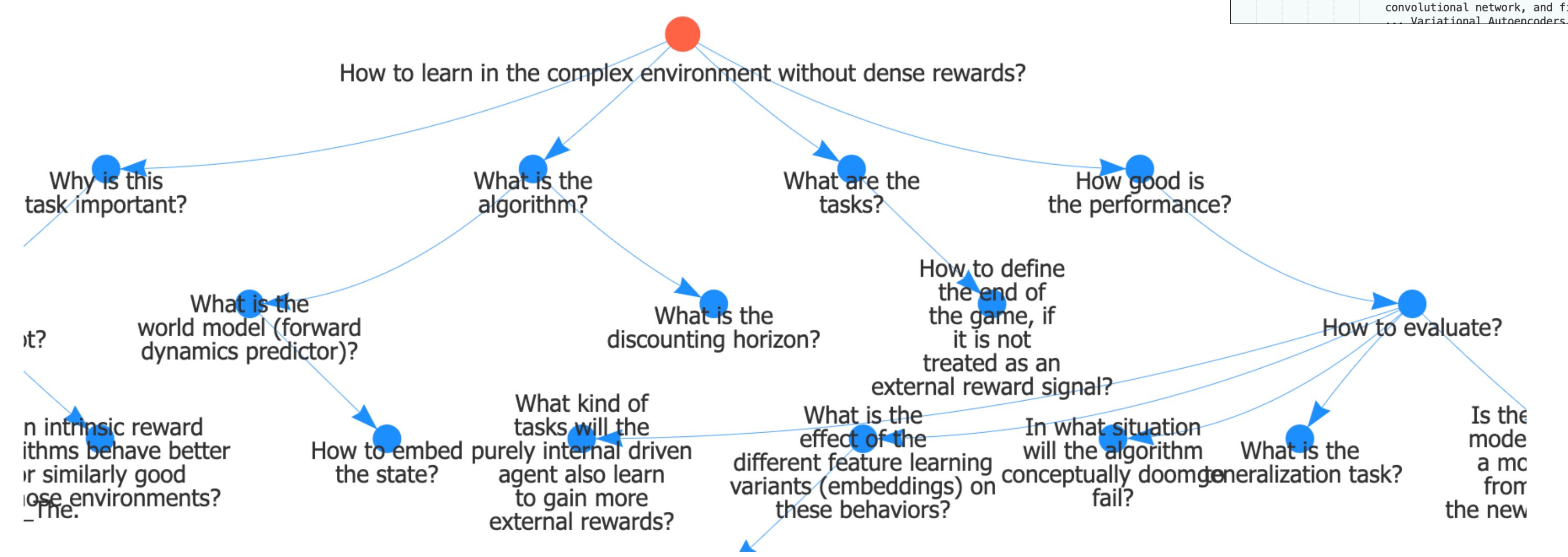
When we have big dataset to train on: automatic question extraction

Research paper → identify questions (hand-coded) → record questions into network structure

our pipeline

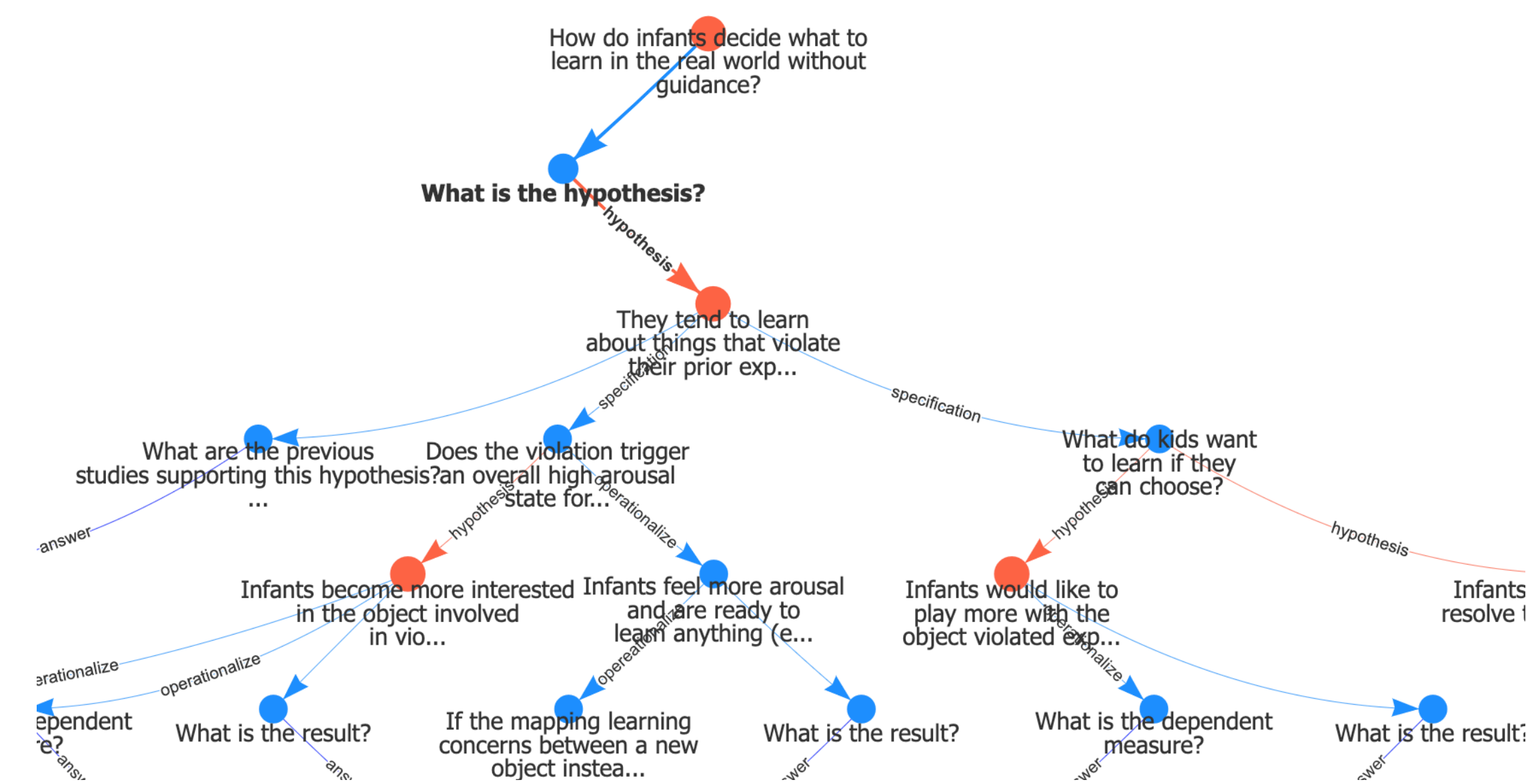
Example. 1

Burda et al (2018). "Large-scale study of curiosity-driven learning."



Example. 2

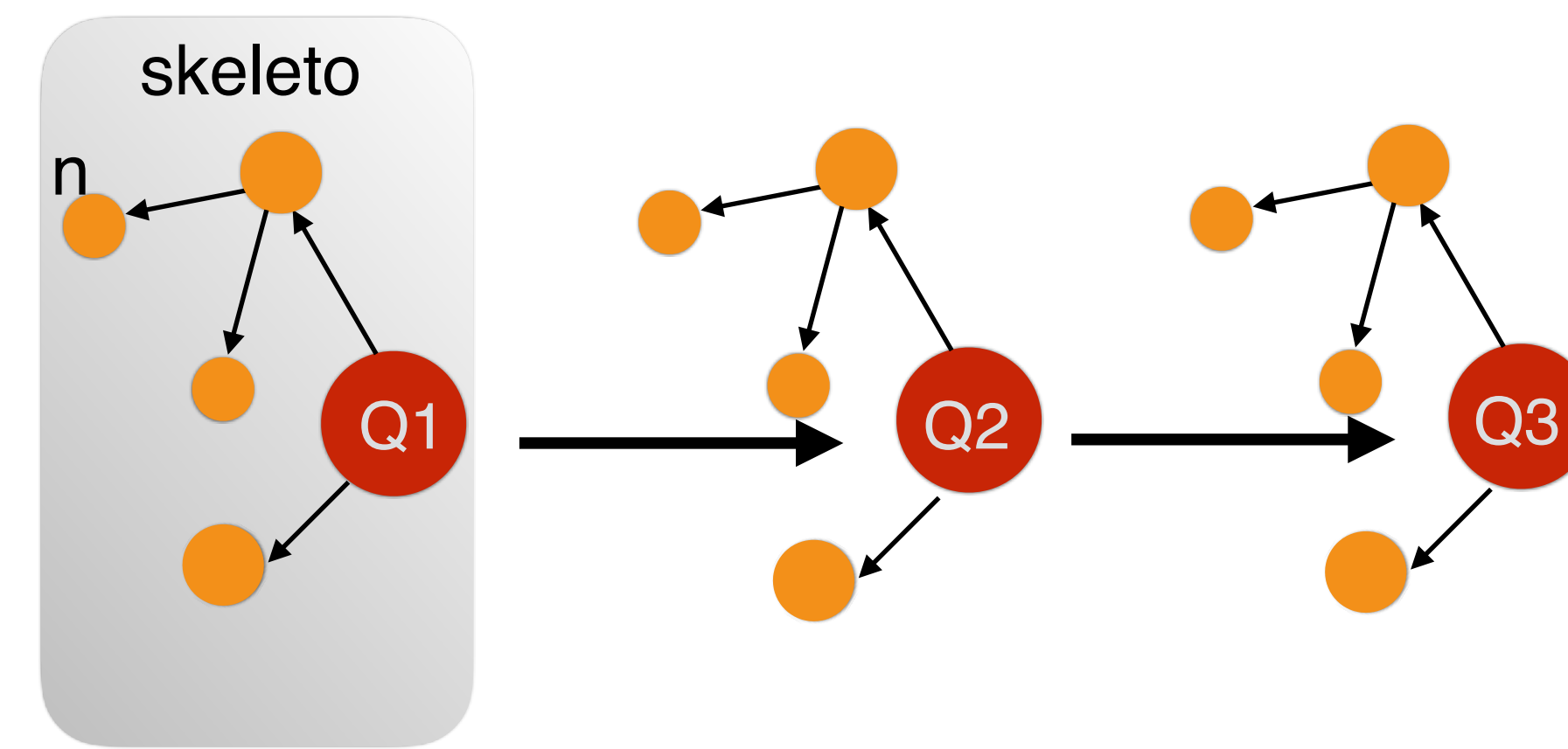
Stahl, A. E., & Feigenson, L. (2015). Observing the unexpected enhances infants' learning and exploration.



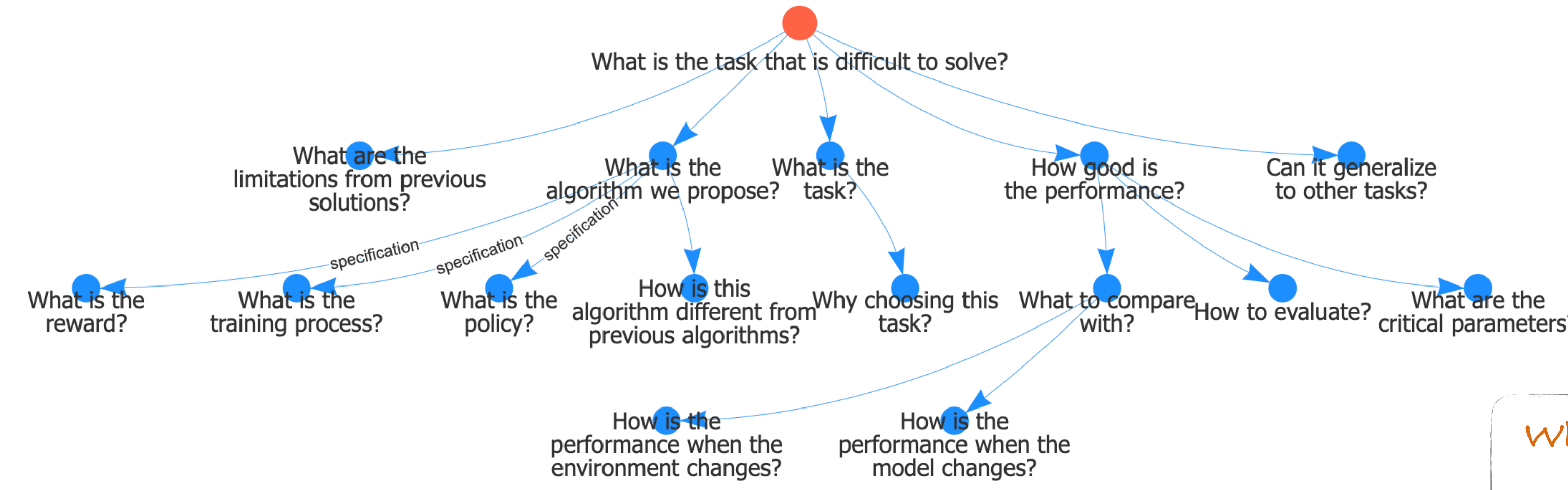
When we have big dataset to train on: automatic scientific research

Analysis 1: Question skeletons

Question skeleton: a series of questions repetitively appear in a research or in papers of the same field.



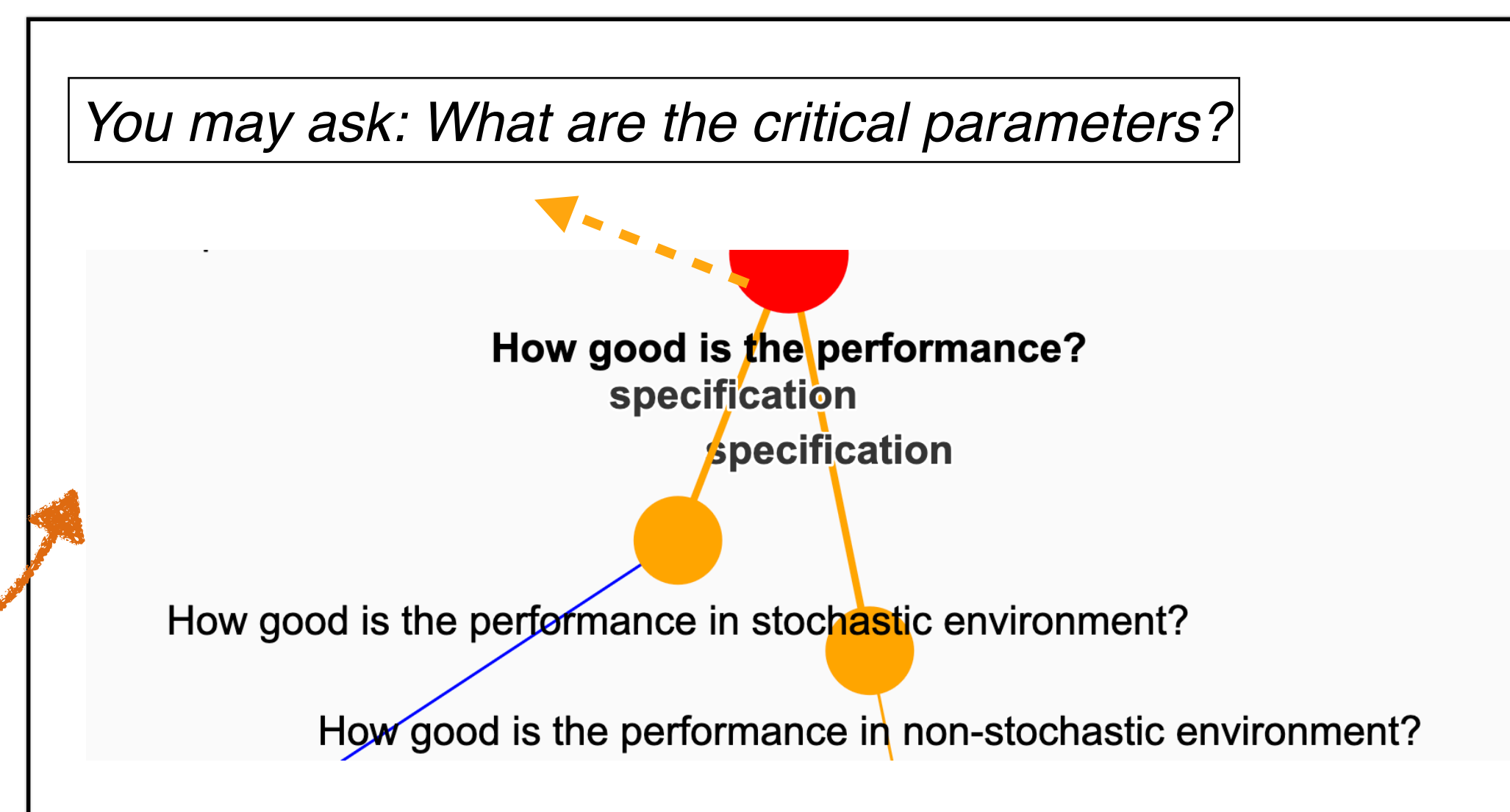
Field question skeleton: combining multiple papers in a field



Extracted from studies on curiosity-driven AI

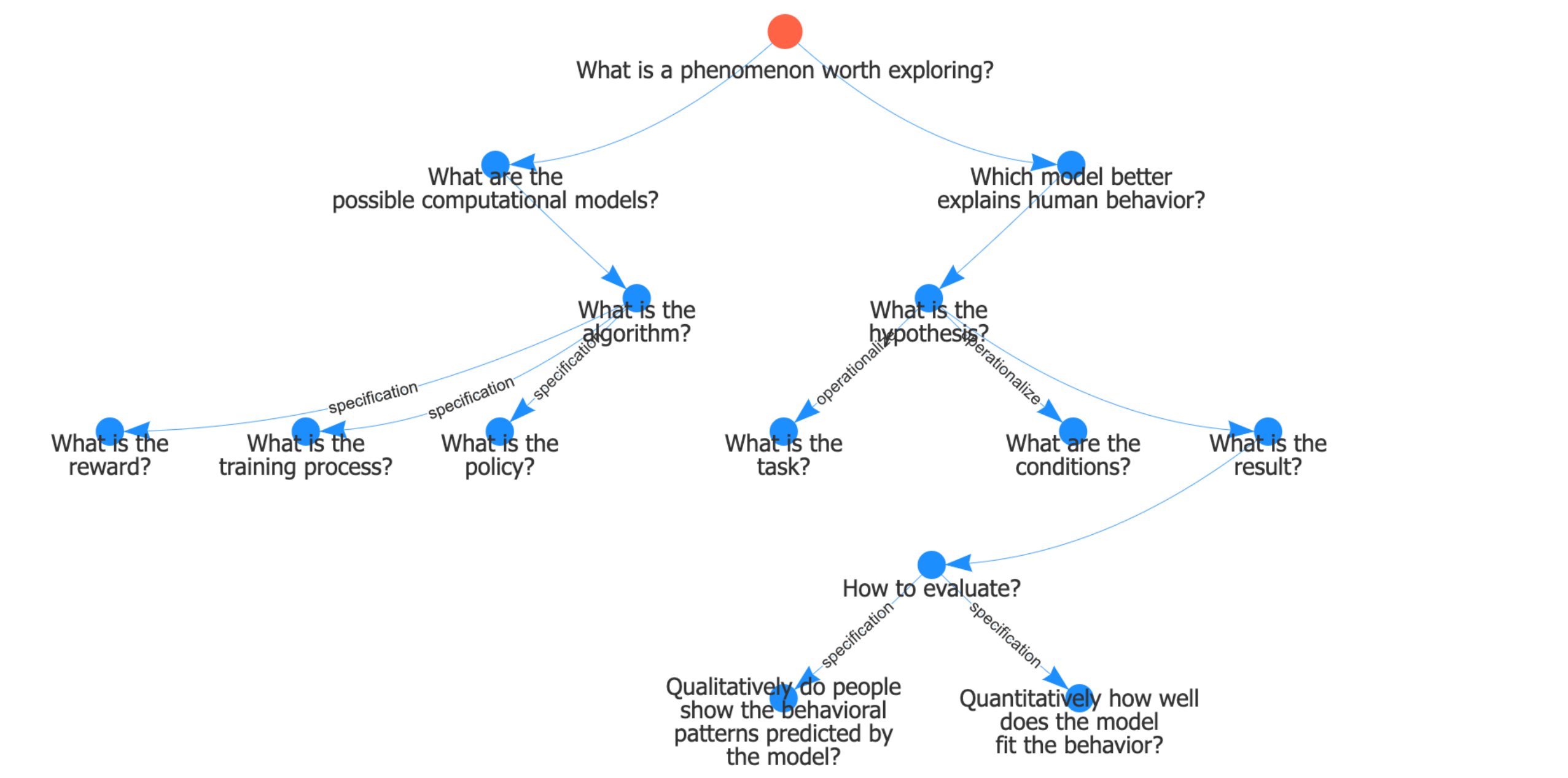
How to use it?

- Facilitates question network construction for other papers in the same field.
- Identify questions could potentially be asked for a given paper

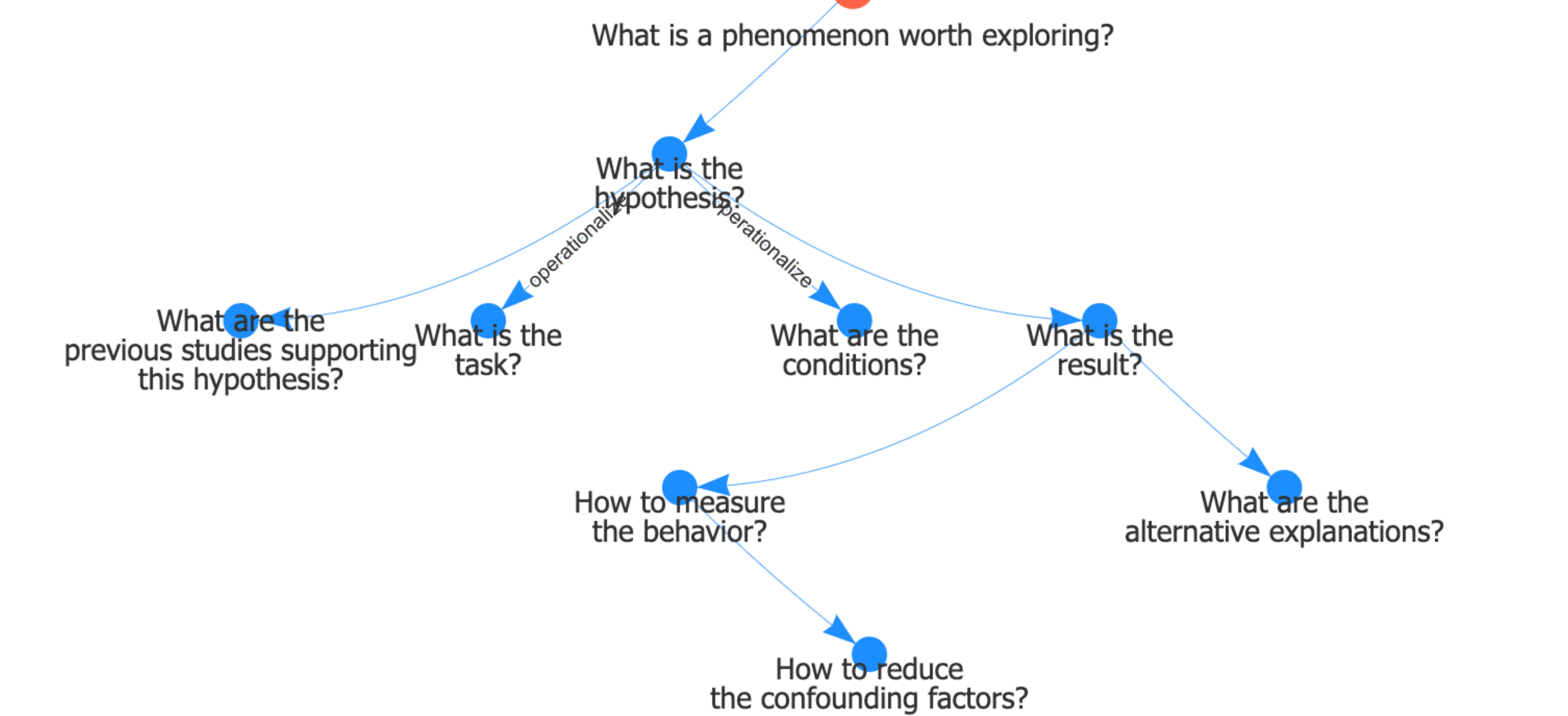


Features of question skeletons in different fields:

- Root question: What is the study driven by? Hypothesis, unsolvable task, or models showing certain behavior?
- Is there clear prediction of results?
- Is model necessary for making predictions?
- Is different task conditions essential in design?
- How many iterations of question skeleton appear in one paper?

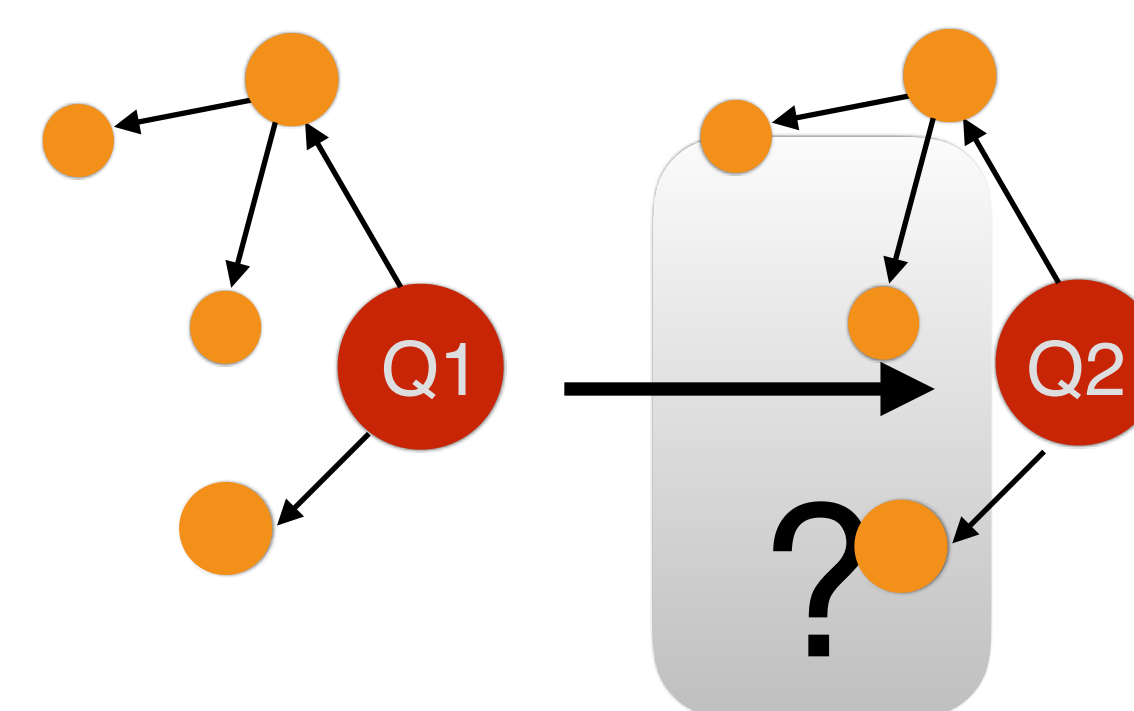


Example study about exploration in computational cognitive psychology



Example study about exploration in developmental psychology

Analysis 2: Question generation



When we have big dataset to train on: automatic scientific research

1. Come back to the original hypothesis

- Alternative ways to specify the hypothesis?
- Connect the hypothesis to more principled theory?

2. Examination of the results

- Alternative interpretation?
- Detailed specification of the process involved?
- Where is the boundary of the conclusion:
 - Can this result generalize to other tasks/environment?
 - Ways to intervene and reverse the behavior?
 - Ways to change pre-sumptions yet keep the behavior?

Future directions

- Towards a note-taking tool that facilitates deep thinking in a specific field: more easy-to-use "mindmap".
- Towards a new way of summarizing a field beyond review papers: question networks as a database (Question-pedia?).
- Towards automated question extraction and analysis: training data needed.