Could you give me a hint? Generating inference graphs for defeasible reasoning

**Aman Madaan*[1], Dheeraj Rajagpoal*[1], Niket Tandon*[2]
Yiming Yang[1], Eduard Hovy[1]**

* Equal contribution, 1: Language Technologies Institute, Carnegie Mellon University, 2: Allen Institute for AI
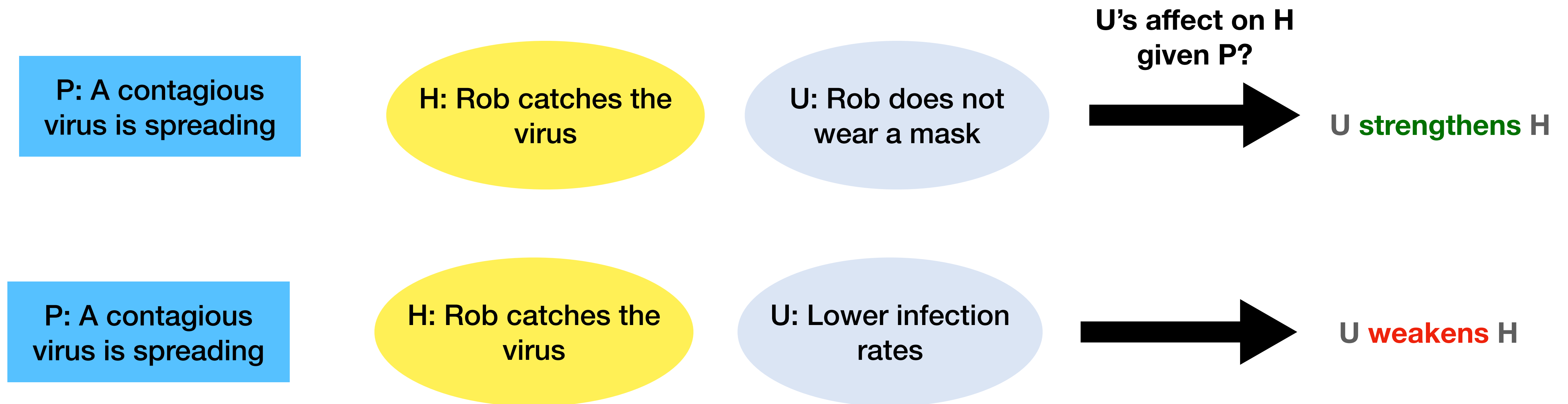
https://github.com/madaan/defeasible_graphs

Outline

Generating inference graphs for <u>defeasible reasoning</u>

I. Defeasible Reasoning

II. Generating graphs for defeasible reasoning queries

Defeasible Reasoning

- Given a premise **P**, a hypothesis **H** may be weakened or strengthened (revised) with new evidence (update) **U**

U's affect on H given P?

| P: A contagious virus is spreading | H: Rob catches the virus | U: Rob does not wear a mask | → | U **strengthens** H |

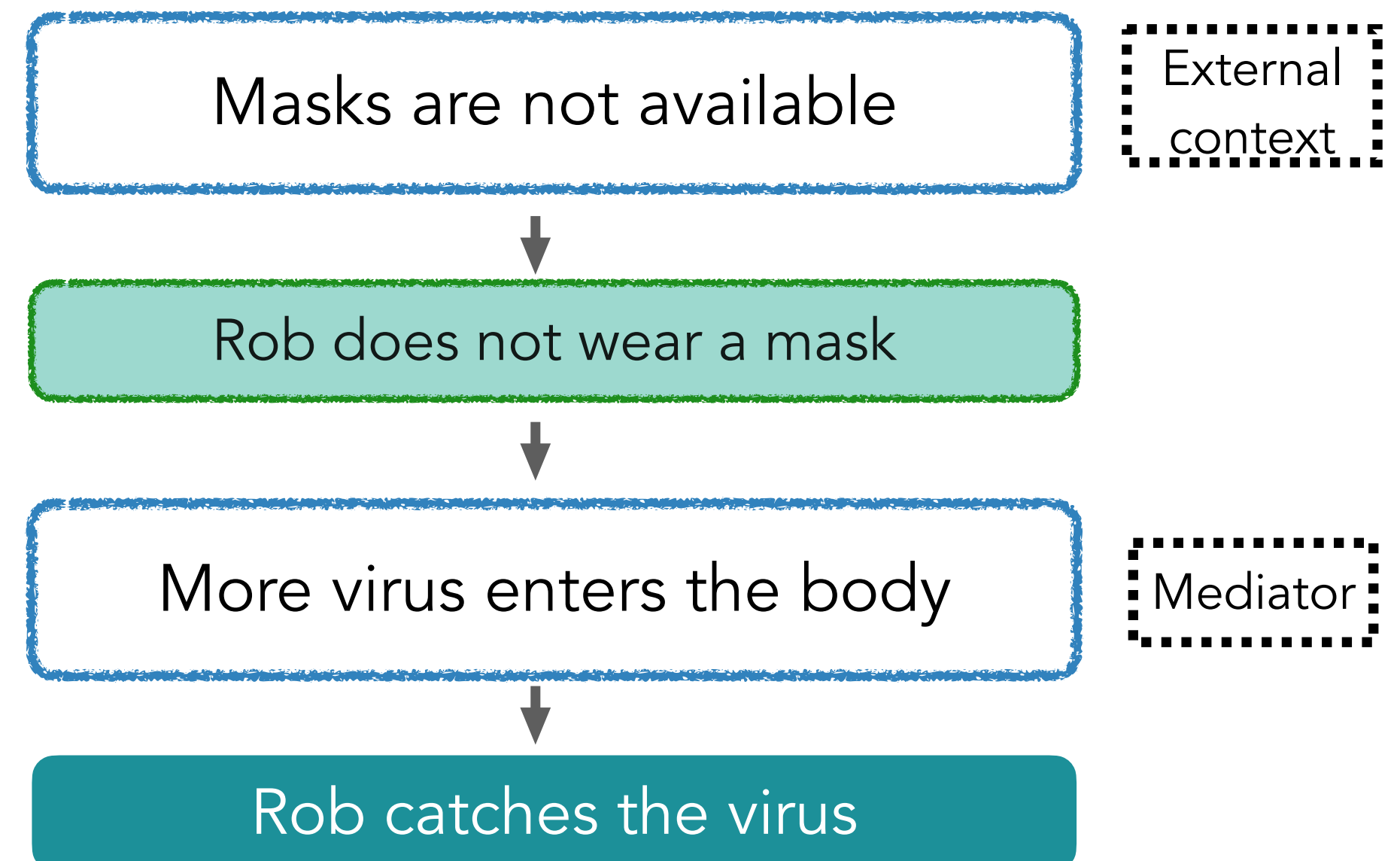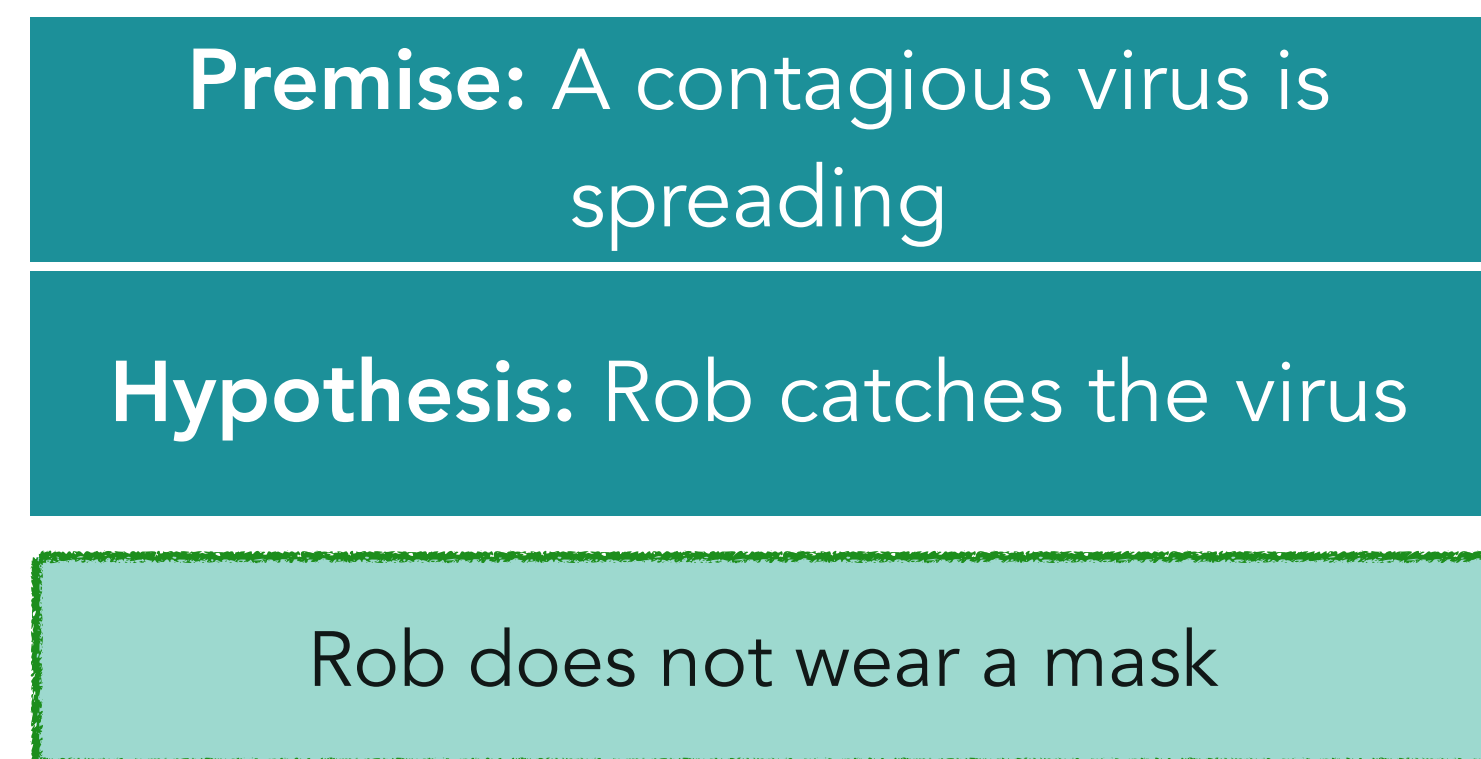| P: A contagious virus is spreading | H: Rob catches the virus | U: Lower infection rates | → | U **weakens** H |

J. Pollock. 1987. Defeasible reasoning. *Cogn. Sci.*, 11:481–518.

Improving Defeasible Reasoning with additional information

• Humans often have difficulty in this task [Rudinger et al, 2020]

• Idea: Adding information to defeasible query might be helpful

Key contributions and findings:

1. Method for automatic construction of inference graphs.

2. Human evaluation finds these graphs useful for defeasible reasoning.

Premise: A contagious virus is spreading

Hypothesis: Rob catches the virus

Rob does not wear a mask

Masks are not available — External context

Rob does not wear a mask

More virus enters the body — Mediator

Rob catches the virus

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I. Defeasible Reasoning

II. Generating graphs for defeasible reasoning queries

Generating inference graphs for defeasible reasoning
WIQA

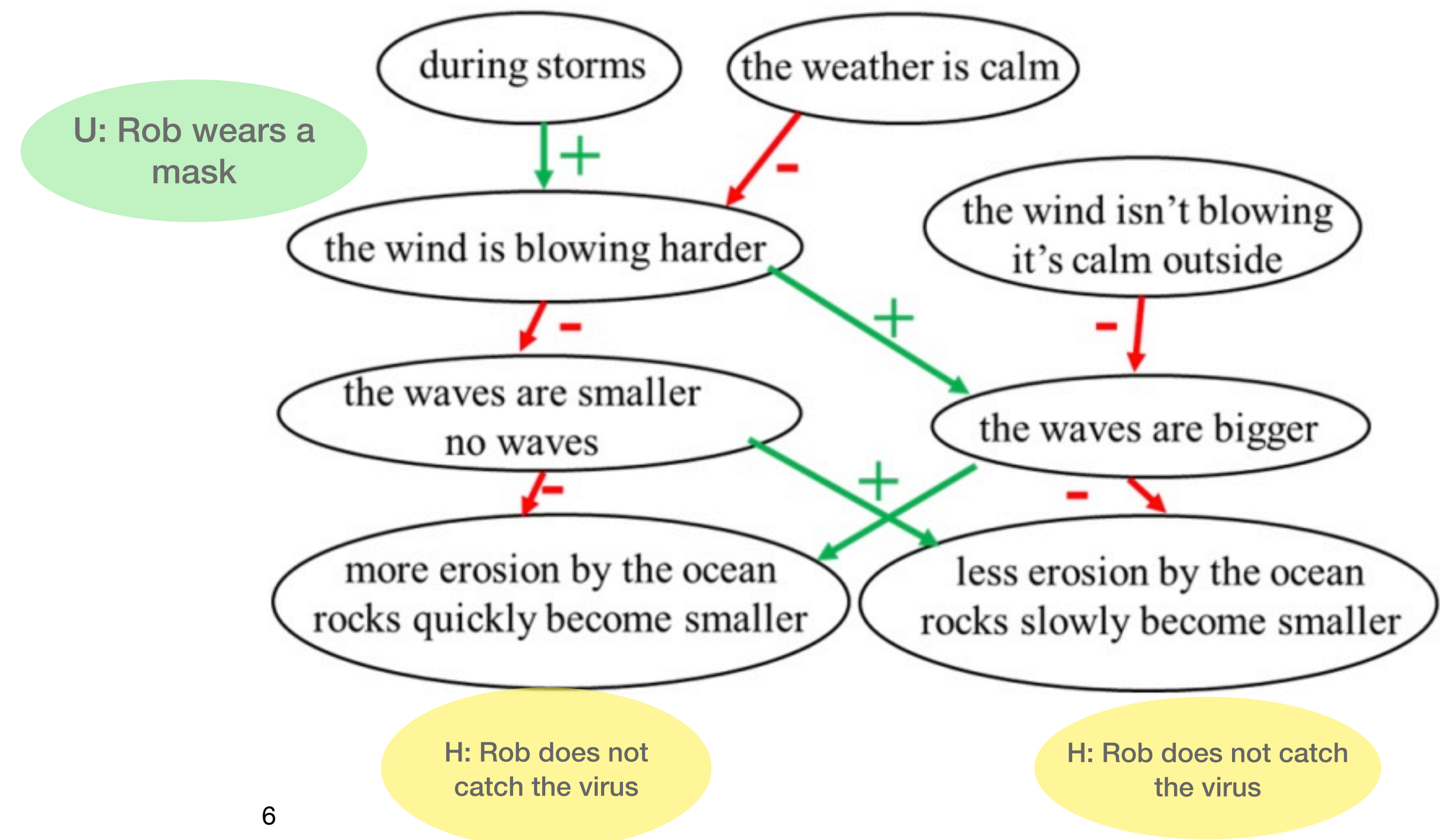- A corpus of 2100 (passage, graph) pairs

WIQA: A dataset for "What if..." reasoning over procedural text

Niket Tandon*, Bhavana Dalvi Mishra*, Keisuke Sakaguchi,
Antoine Bosselut, Peter Clark
Allen Institute for Artificial Intelligence, Seattle, WA
{nikett,bhavanad,keisukes,antoineb,peterc}@allenai.org

Generating inference graphs for defeasible reasoning

Training on WIQA

Erosion by the ocean:
1. Wind creates waves in the ocean.
2. The waves wash onto the beaches.
3. The waves hit rocks on the beach.
4. Tiny parts of the rock break off.
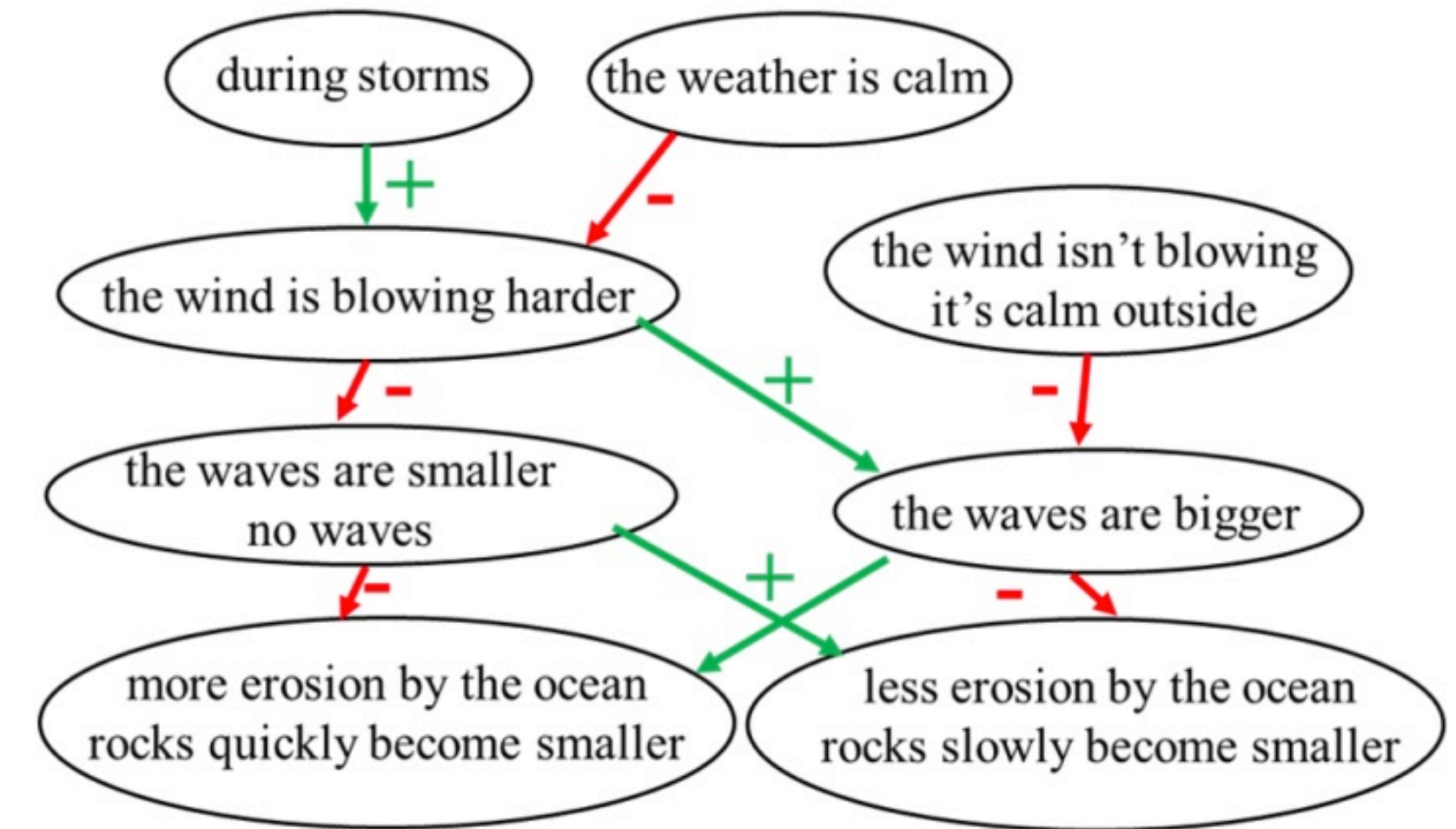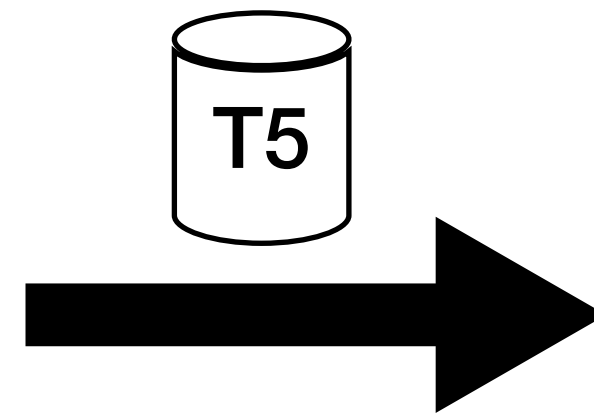5. The rocks become smaller.

Passage

+

Erosion by the ocean rocks quickly becomes smaller

Hypothesis
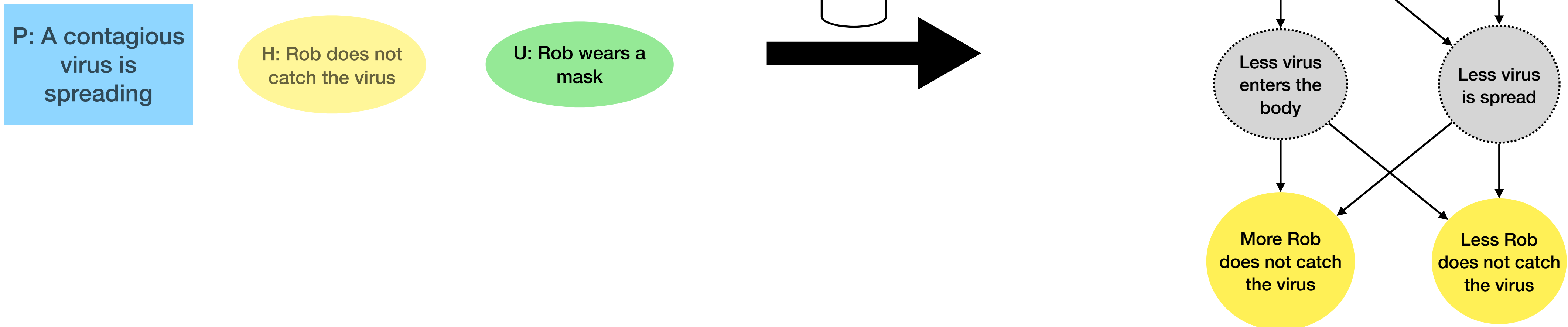
+

The wind is blowing harder

Situation

T5

during storms   the weather is calm

+   -

the wind is blowing harder   the wind isn't blowing it's calm outside

-    +   -

the waves are smaller no waves   the waves are bigger

-    +   -

more erosion by the ocean rocks quickly become smaller   less erosion by the ocean rocks slowly become smaller

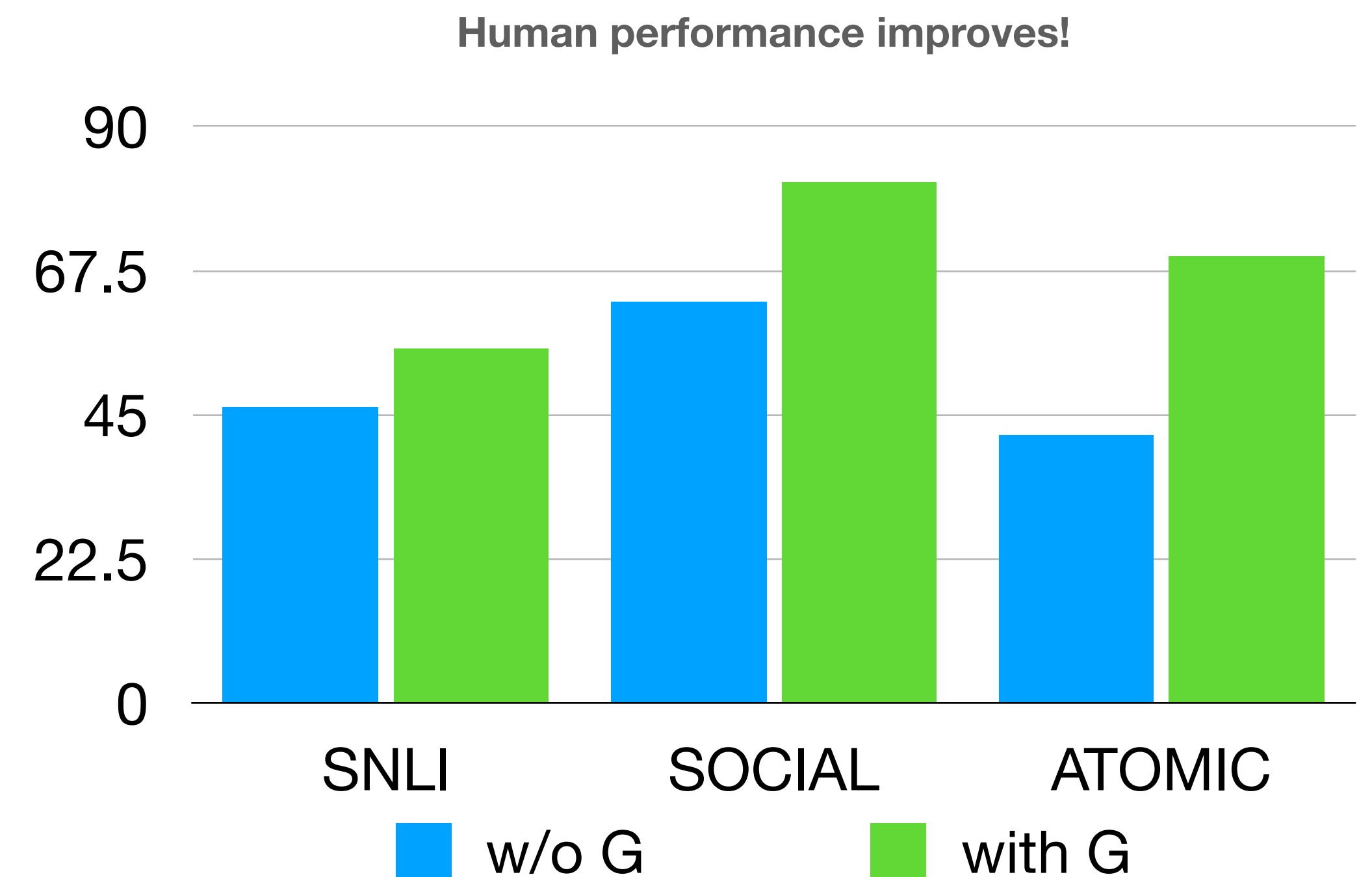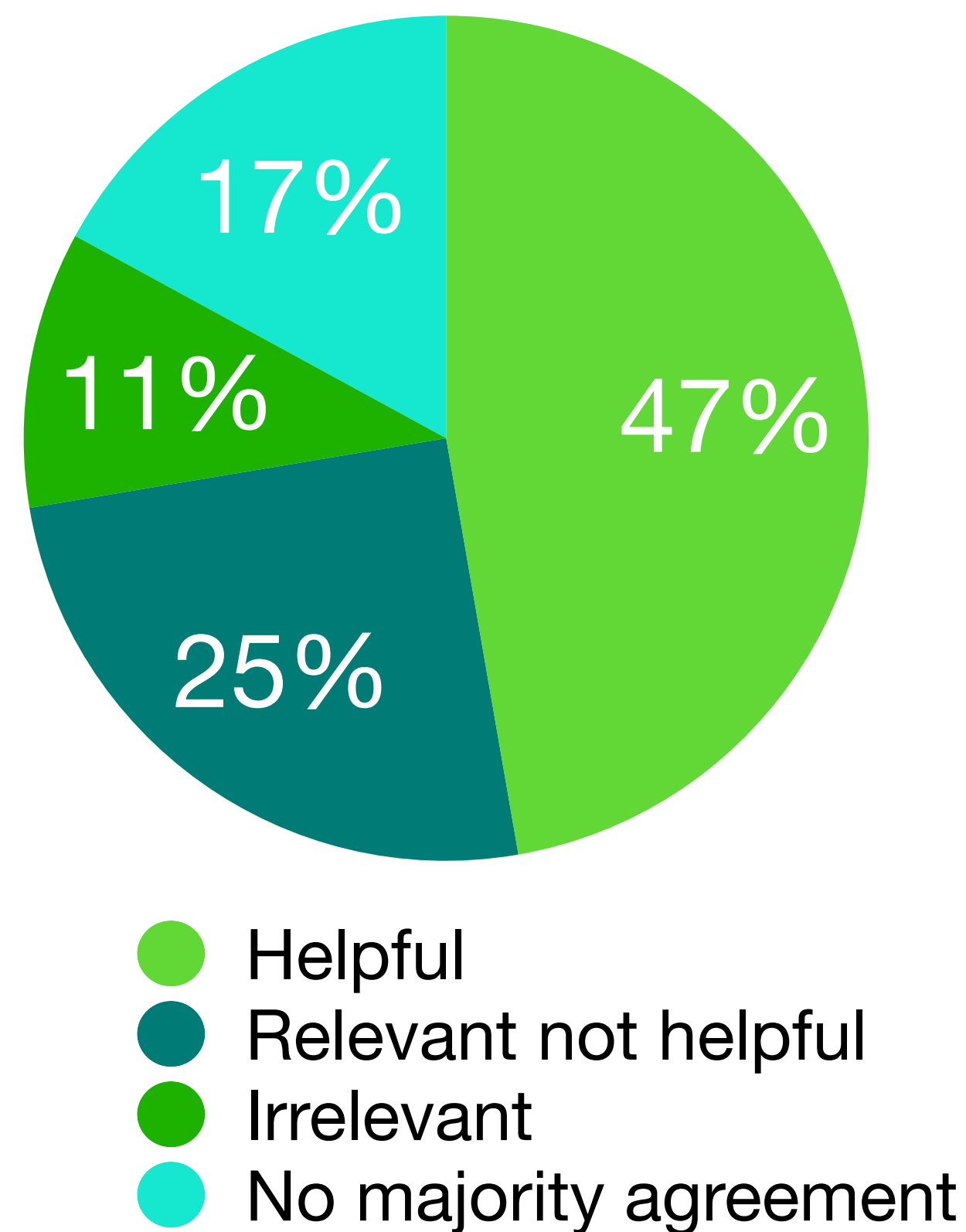# Generating inference graphs for defeasible reasoning

Inference on Defeasible

- Given a new query PHU, run inference on graph generator trained on WIQA to obtain an influence graph
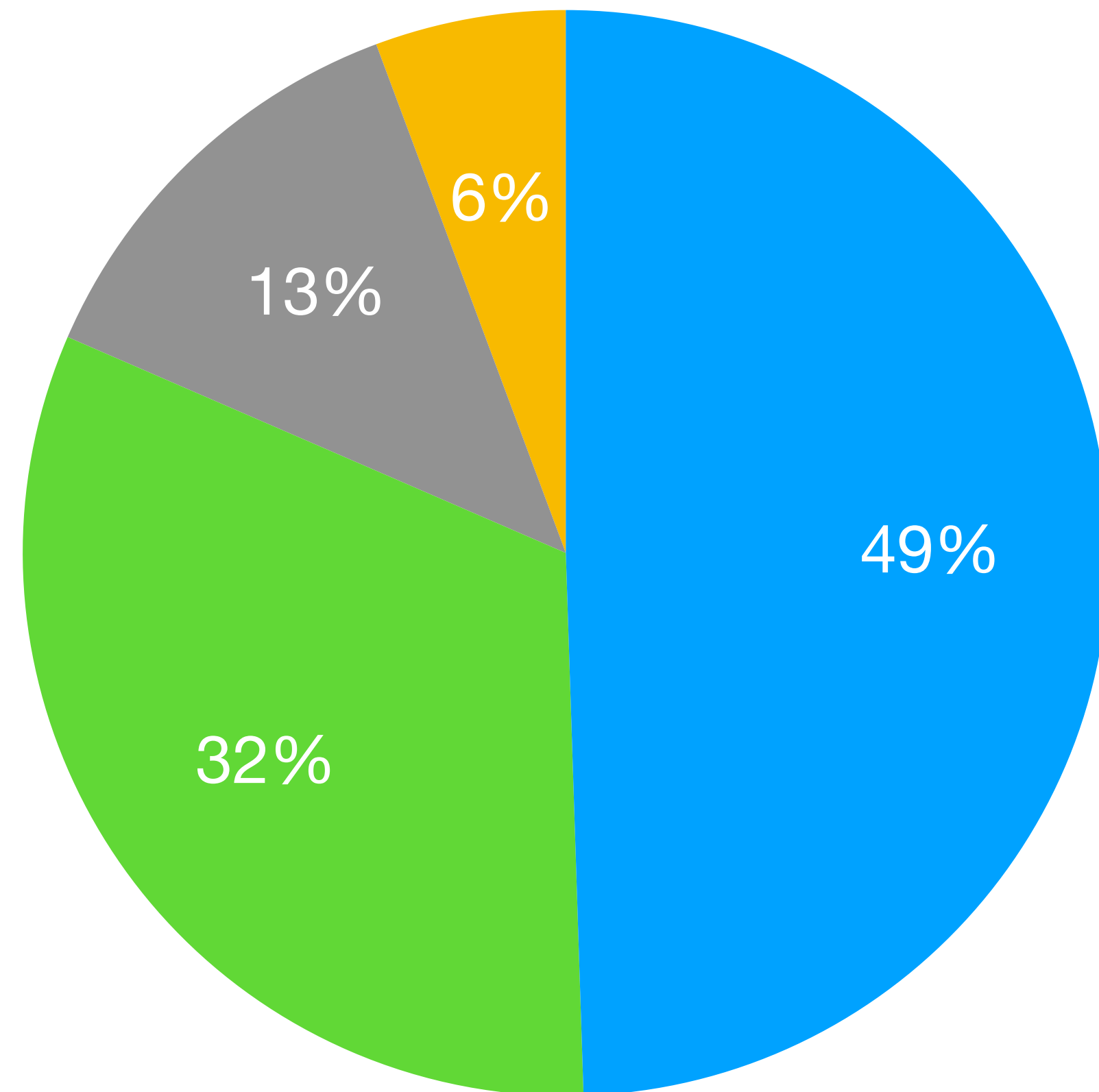
Do humans find these graphs useful for defeasible reasoning?

- For the same human pool from Rudinger et al, 2020, we show defeasible inference questions along with the generated inference graphs.

- Each question was answered by 3 annotators and majority was taken as the chosen answer

Helpful — 47%
Relevant not helpful — 25%
Irrelevant — 11%
No majority agreement — 17%

Human performance improves!

SNLI   SOCIAL   ATOMIC

■ w/o G   ■ with G

Do humans find these graphs useful for defeasible reasoning?

49% Mediator
32% Extraneous
13% Structure
6% None helpful

- Different parts of the graph were found to be useful to a different degree

Model-generated graphs help humans at Defeasible Reasoning!

Graphs available here: https://github.com/madaan/defeasible_graphs