

# Learning High-Level Planning with Questions

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# Motivation

Build a solving agent more resilient to lack of a-priori information.

We are posing a new problem, how we acquire information in a planning process to guide it's learning.

The goal of this project is to build a System to facilitate research exploration around collaborative systems.

# Background

## Low-level Planning

Logical system that finds actions to achieve goals

## High-Level Planning

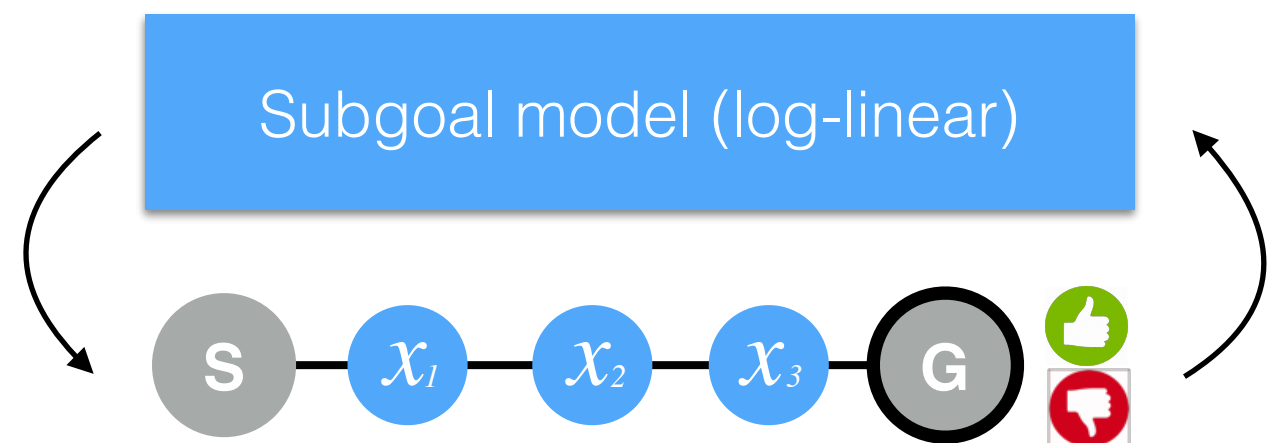
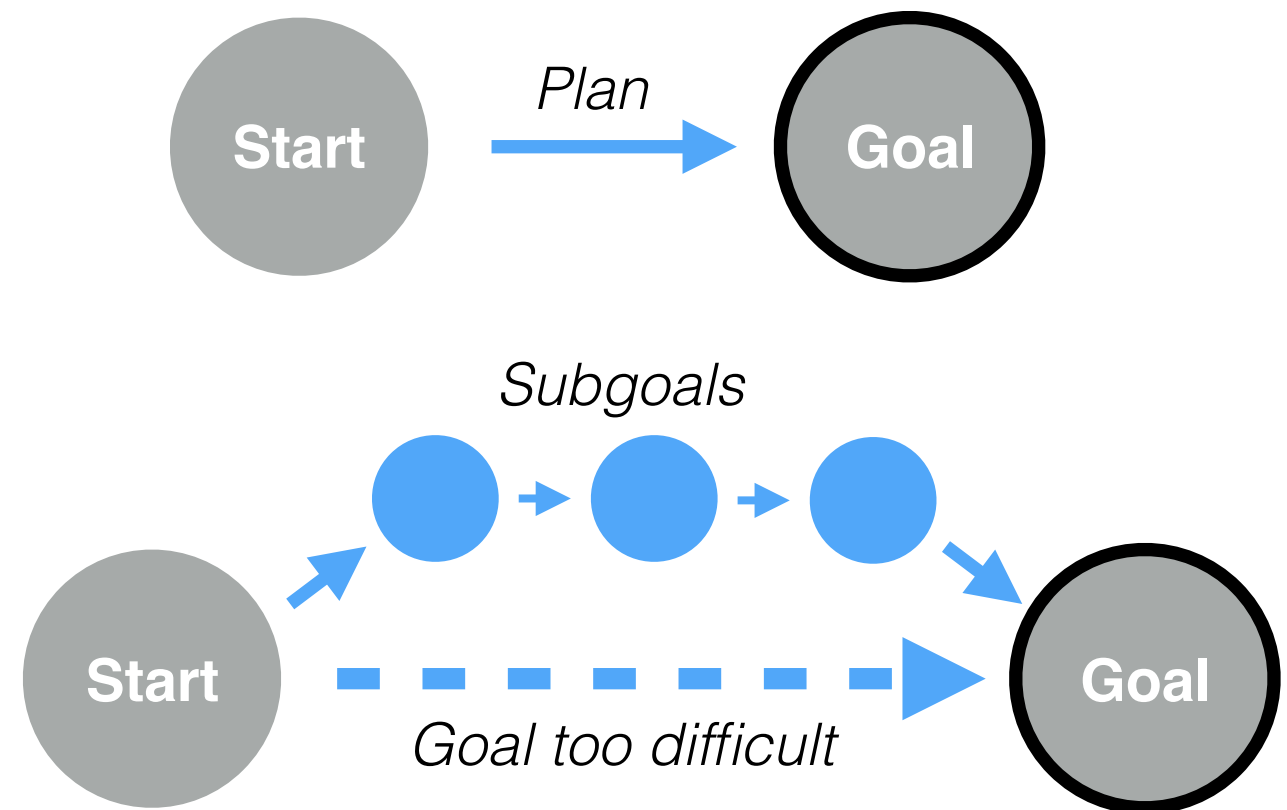
Break down the problem into smaller easier problems

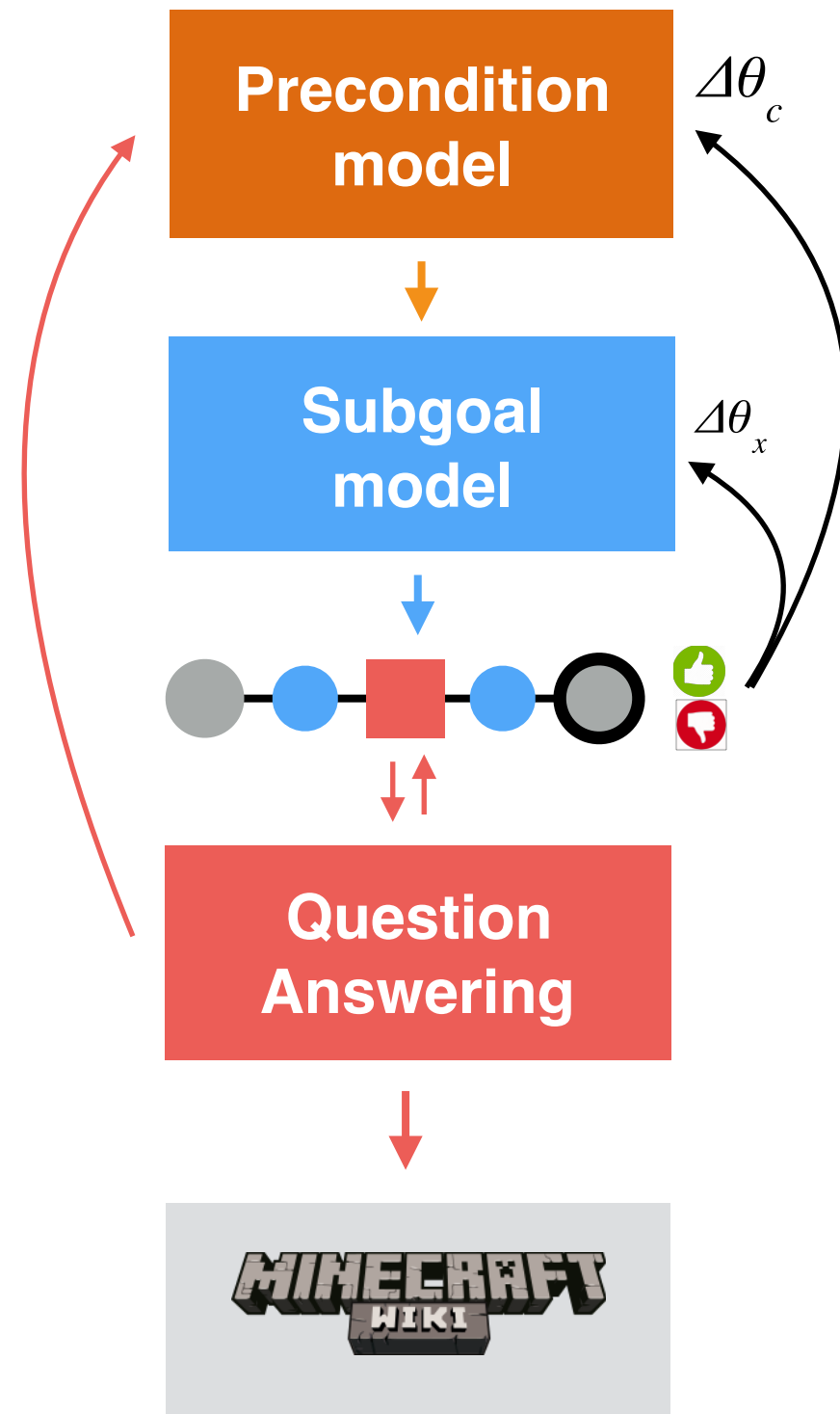
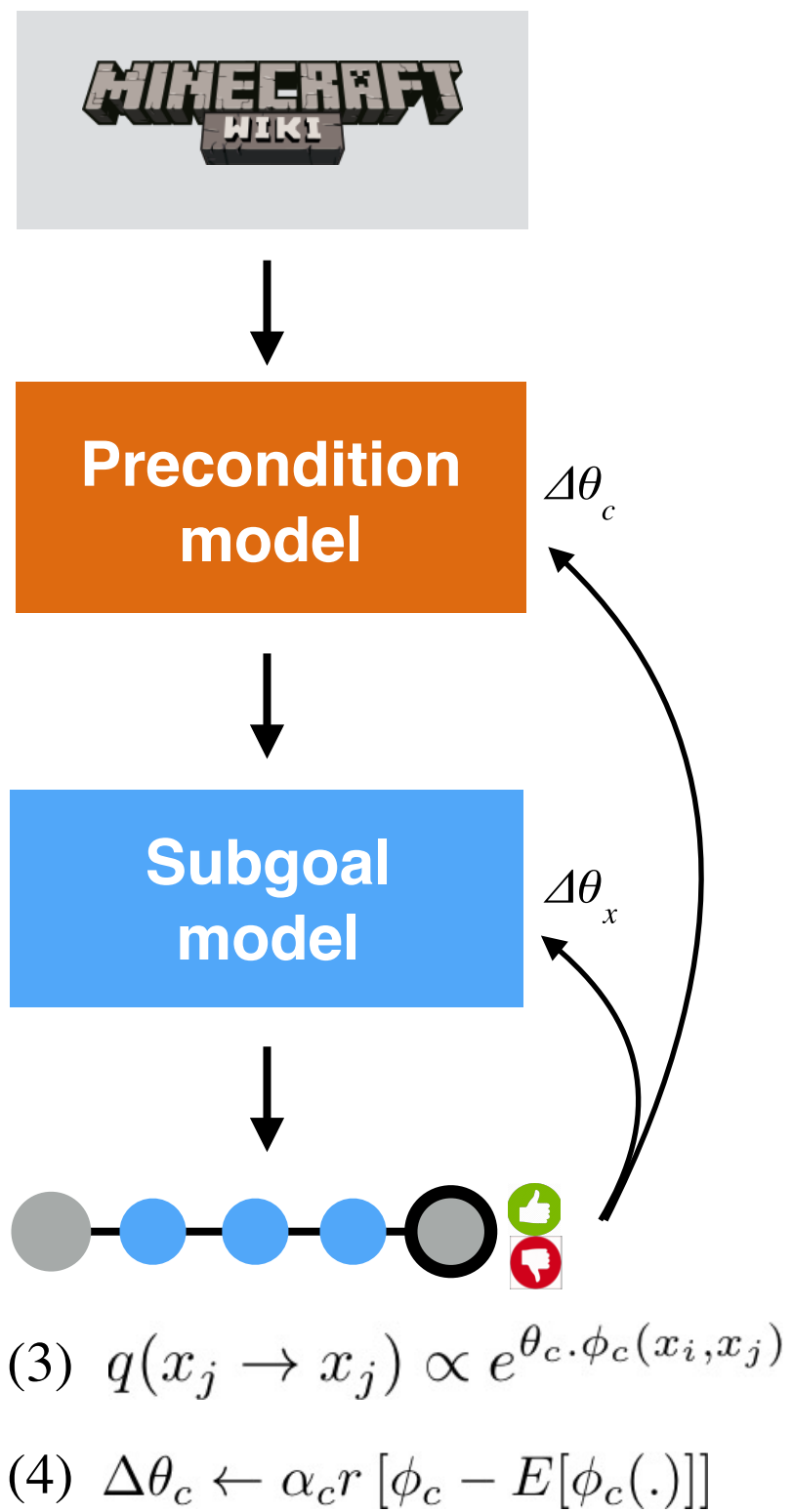
## Reinforcement learning

Learn from successes and failures

$$(1) \Delta\theta_x \leftarrow \alpha_x r \sum_t [\phi_x - E[\phi_x]]$$

$$(2) p(x_t|x_{t-1}) \propto e^{\theta_x \phi_x(x_t, x_{t-1})}$$



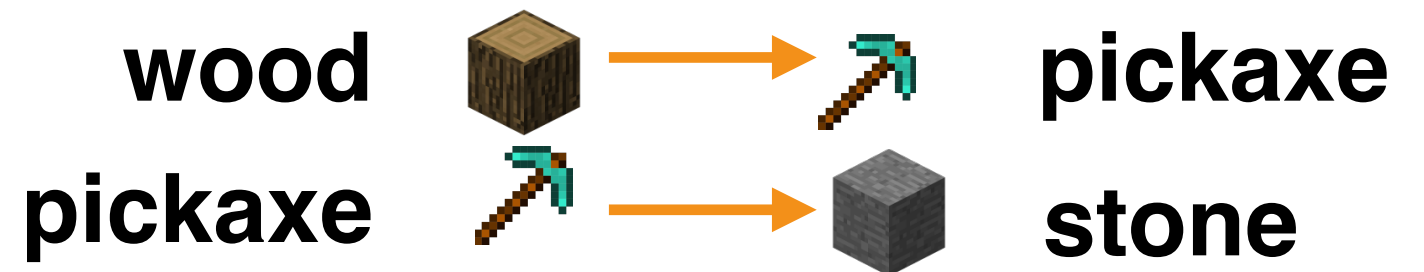


# Previous work

## Natural text

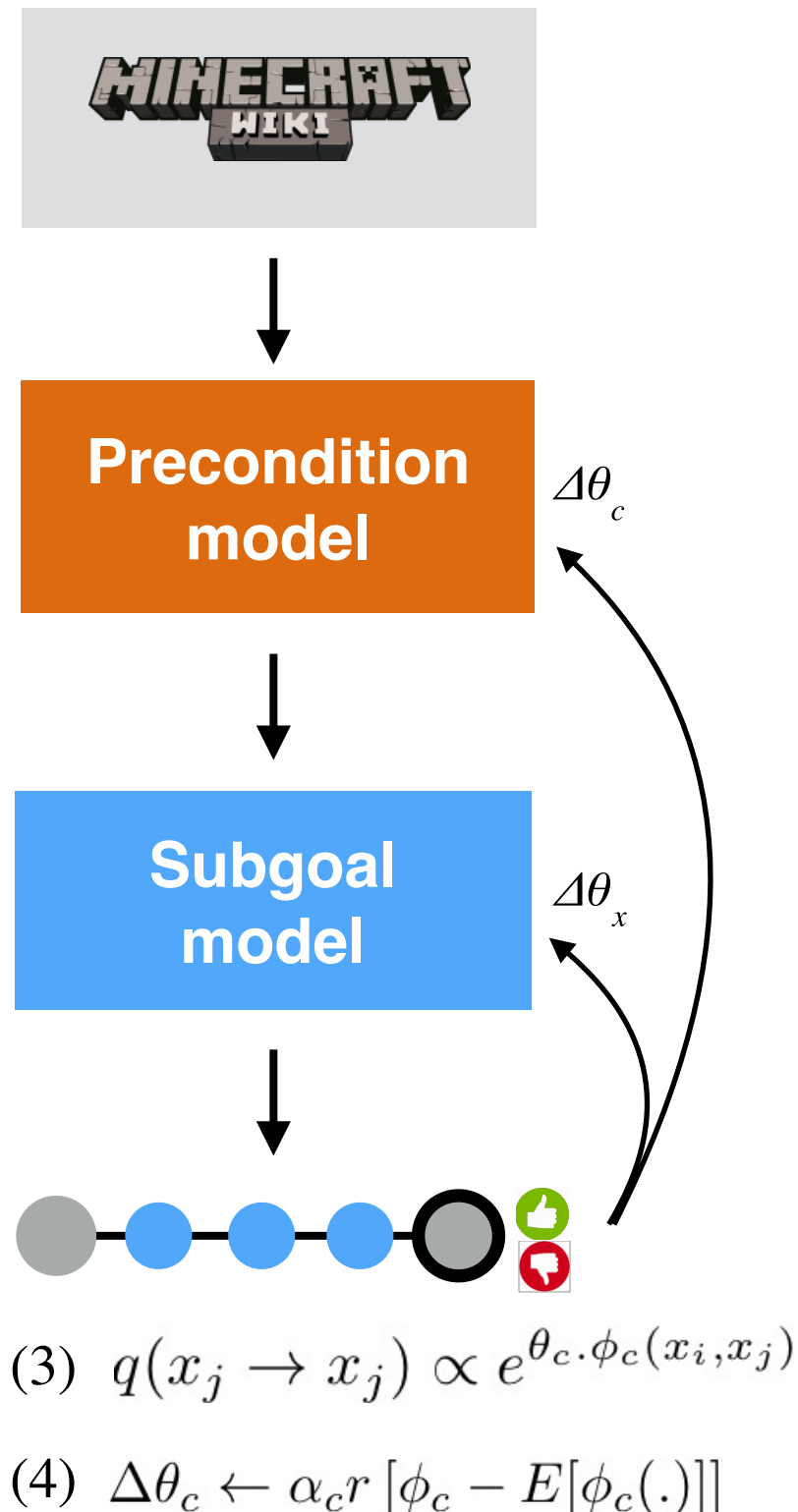
“A **pickaxe** , which is used to harvest **stone** , can be made from **wood** .

## Extracted pre-conditions



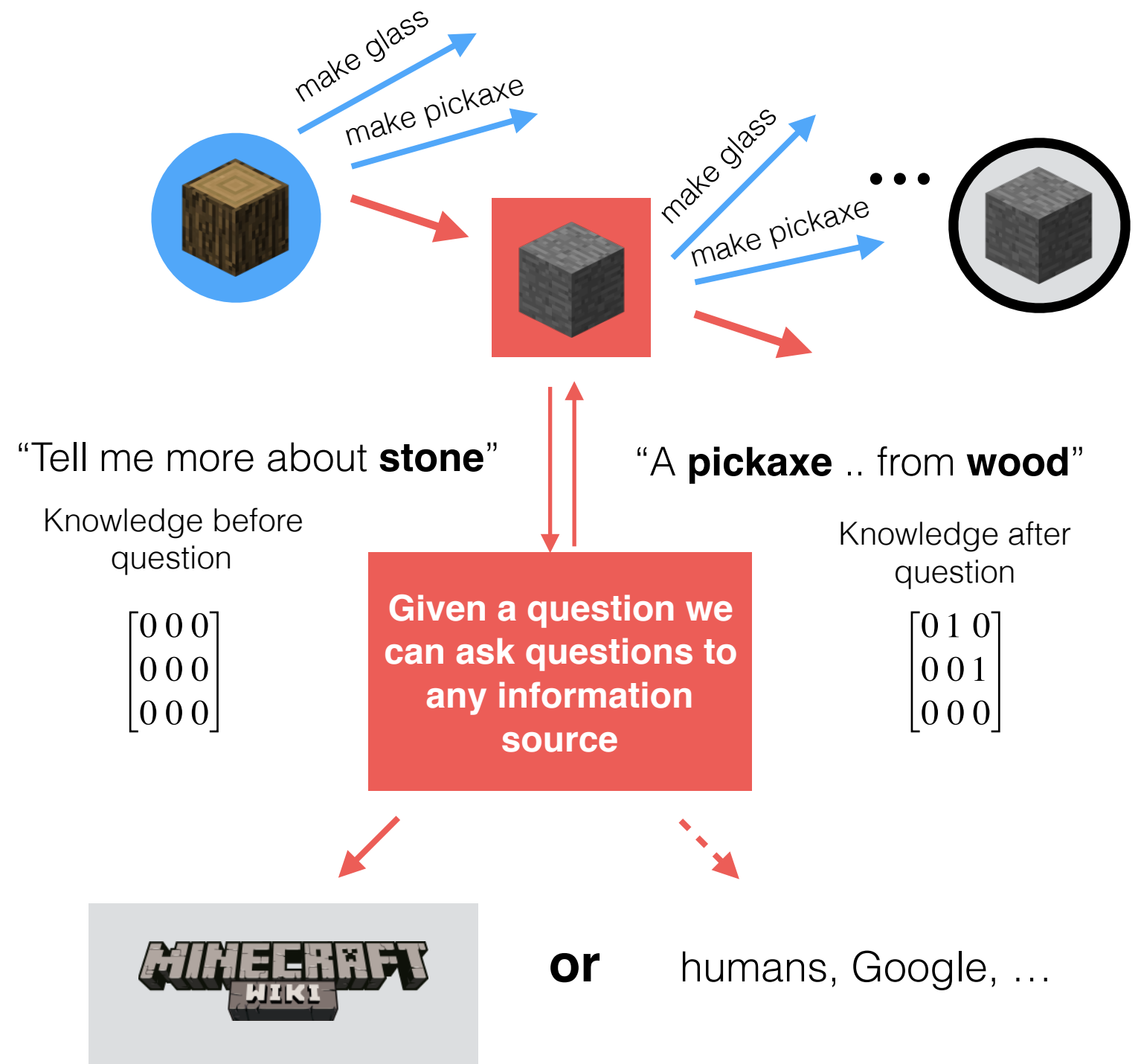
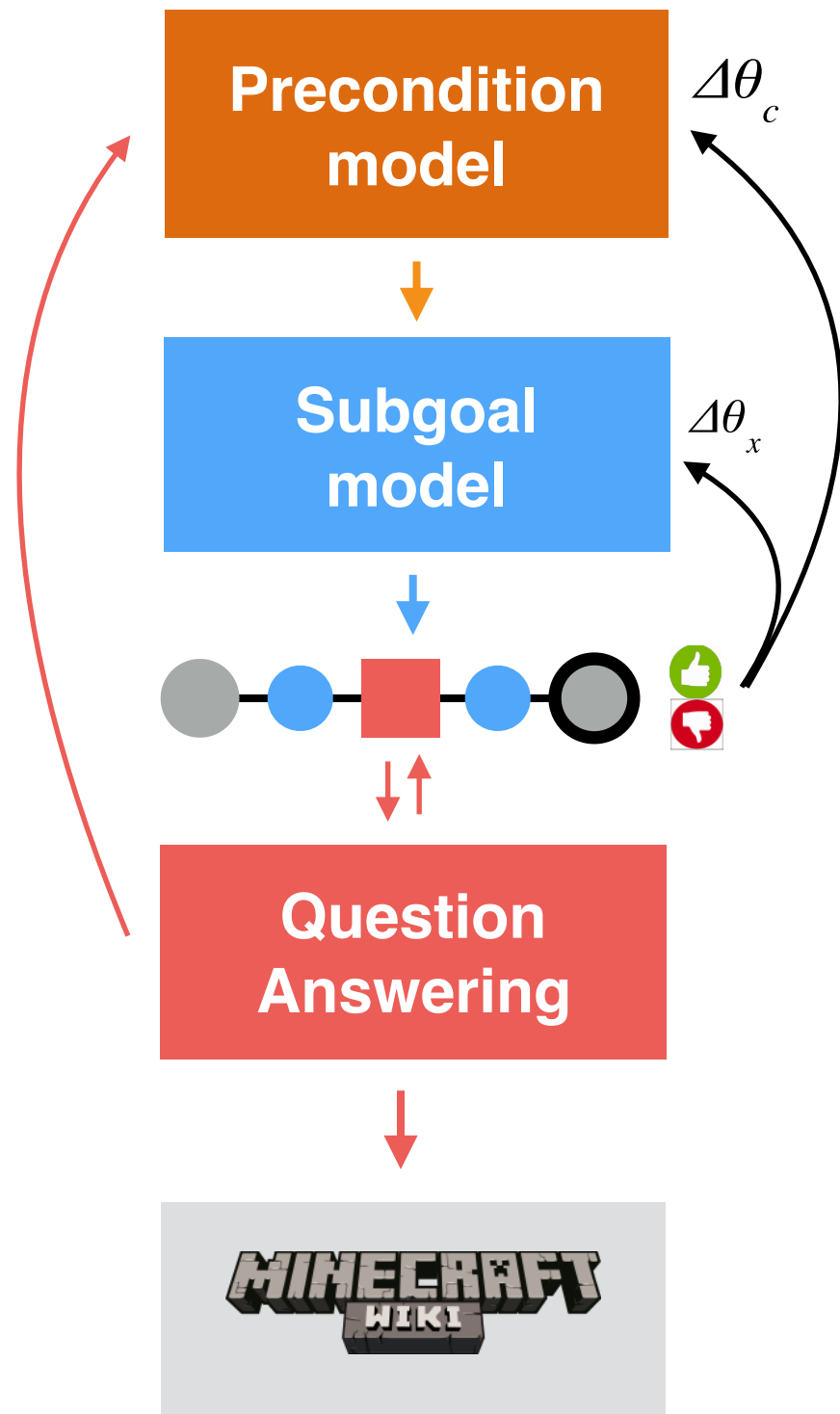
## Pre-condition matrix

$$C = \begin{matrix} & \begin{matrix} w & p & s \end{matrix} \\ \begin{matrix} w \\ p \\ s \end{matrix} & \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \end{matrix}$$



# Novel approach

## Asking questions to drive planning



# Baselines

| Method            | %Plans      |
|-------------------|-------------|
| FF                | 40.8        |
| No text           | 69.4        |
| All text          | 75.5        |
| <b>Full model</b> | <b>80.2</b> |
| Manual text       | 84.7        |
| Gold connection   | 87.1        |

[0] Branavan, S. R. K., et al. "Learning highlevel planning from text.", 2012.

# Results

First results :

- No answers = **62 %**
- Answers = **73 %**

Current framework

- With 200% larger action space
- Naive question asking system
- Same number of parameters

Next step : tuning hyper parameters

- Question types
  - Objects
  - Actions
  - Object + Actions
- Answer types
  - Information Source
  - Irrelevant answers
  - Some relevant answers
  - All relevant answers

# Future work

- Iterating on Question Asking Model
  - Separating Training model
  - Conditioning explicitly on unknowns
- Expanding information sources
  - Comparing to WSJ
  - Human info source for eval
- Exploring larger state spaces
  - Increasing grid size
  - Explore larger problem domains