

# **A model is not the territory it represents**

**Causal models as relativized dynamic perspectives**

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**Converging On Causal Ontology Analyses (COCO)**

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# A model (map) is not the territory (world)



# Intentional actions in progress

# Nadathur & Bar-Asher Siegal 2022

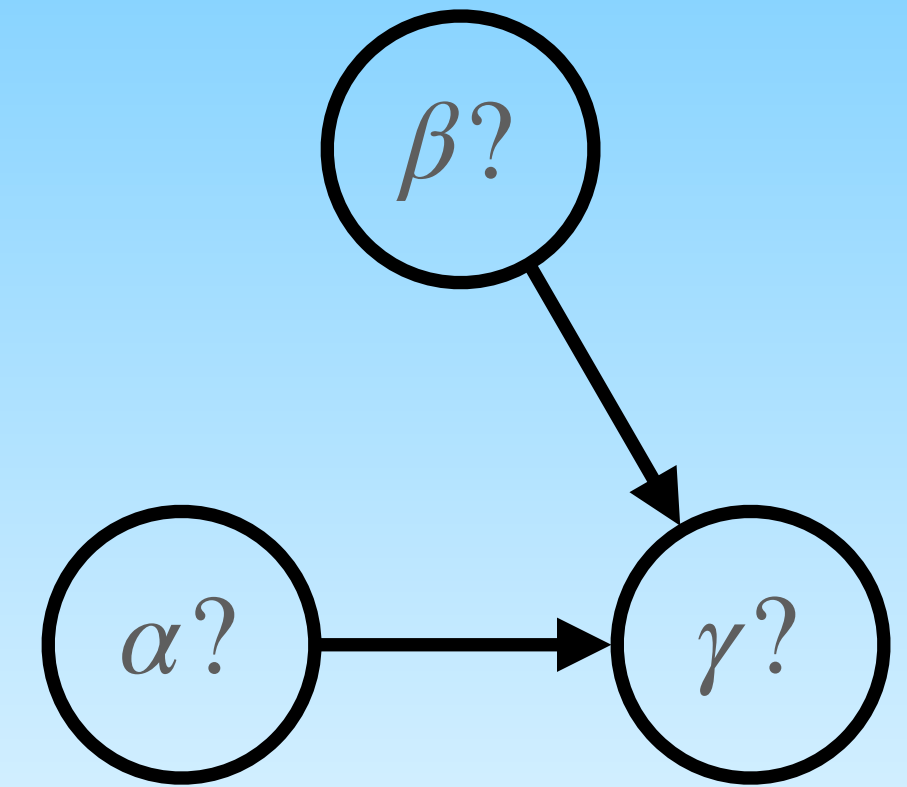
How do we know when an intentional action is in progress at a particular moment?

- (1) a. Emanuel is baking a cake.  
b. Mary is going to London.  
c. Maya is digging to China.

N&B-AS's answer: “[T]elic progressives do not depend for their truth on a (reference time) projection or expectation of culmination, but instead on a truth-conditional assessment of the match between reference time facts and the facts that *would need to hold* in order for a *P*-eventuality to be in progress.”

# Reminder: causal models

- Causal models represent the structure that causation gives to our conception of the world.
- Each node is a variable that can have different values.
- An arrow from e.g. A to B represents that the value of B is dependent on, or “listens to” the value of A and that this dependency is causal. Crucially, absence of an arrow means the two variables are causally independent of each other.
- The dependencies are represented by functions.
- A gentle introduction: First few chapters of Pearl & Mackenzie 2018



$\alpha?$  = whether the match is struck  
 $\beta?$  = whether there is oxygen  
 $\gamma?$  = whether the match lights

$\alpha$	$\beta$	$\gamma$
1	1	1
1	0	0
0	1	0
0	0	0

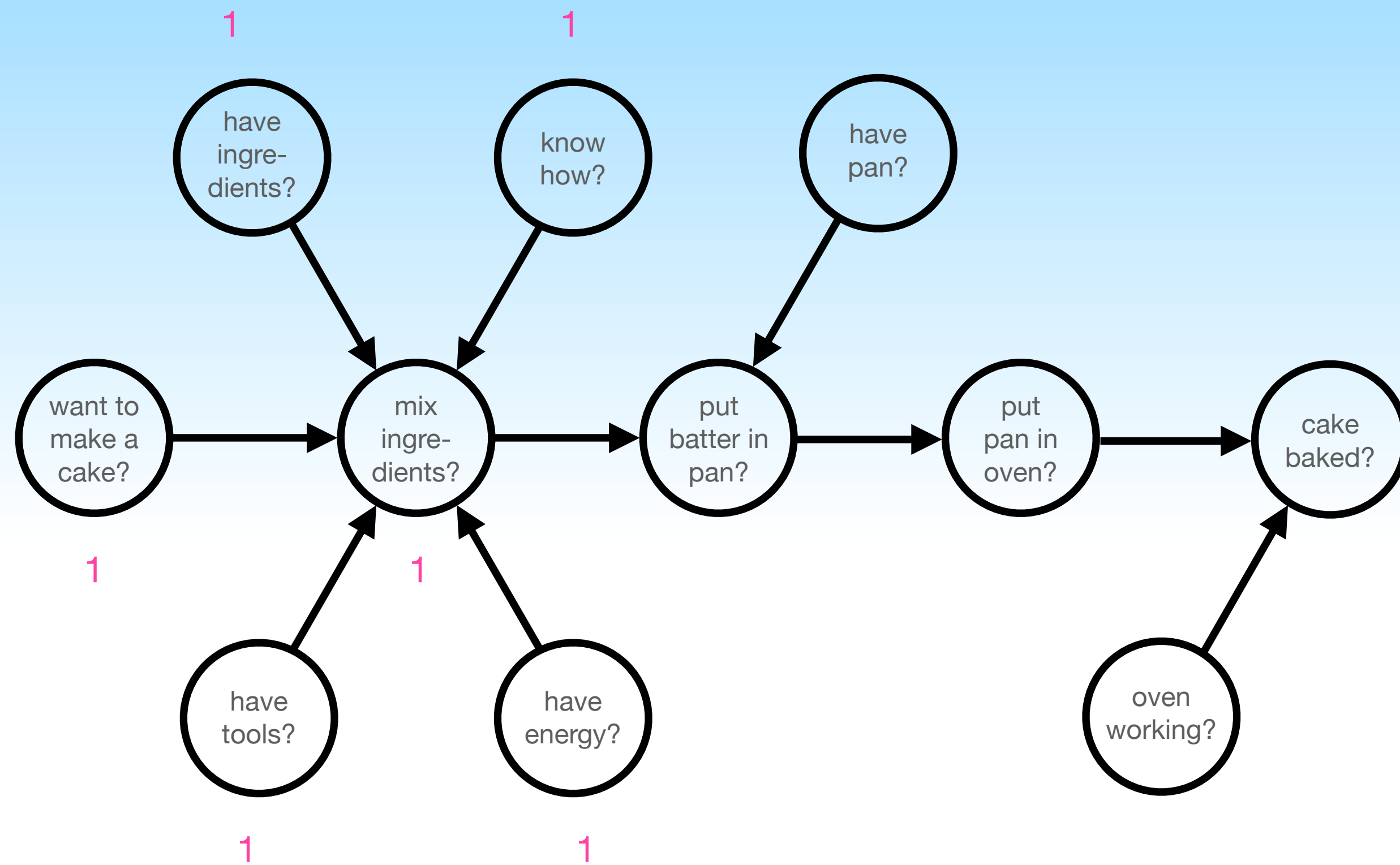
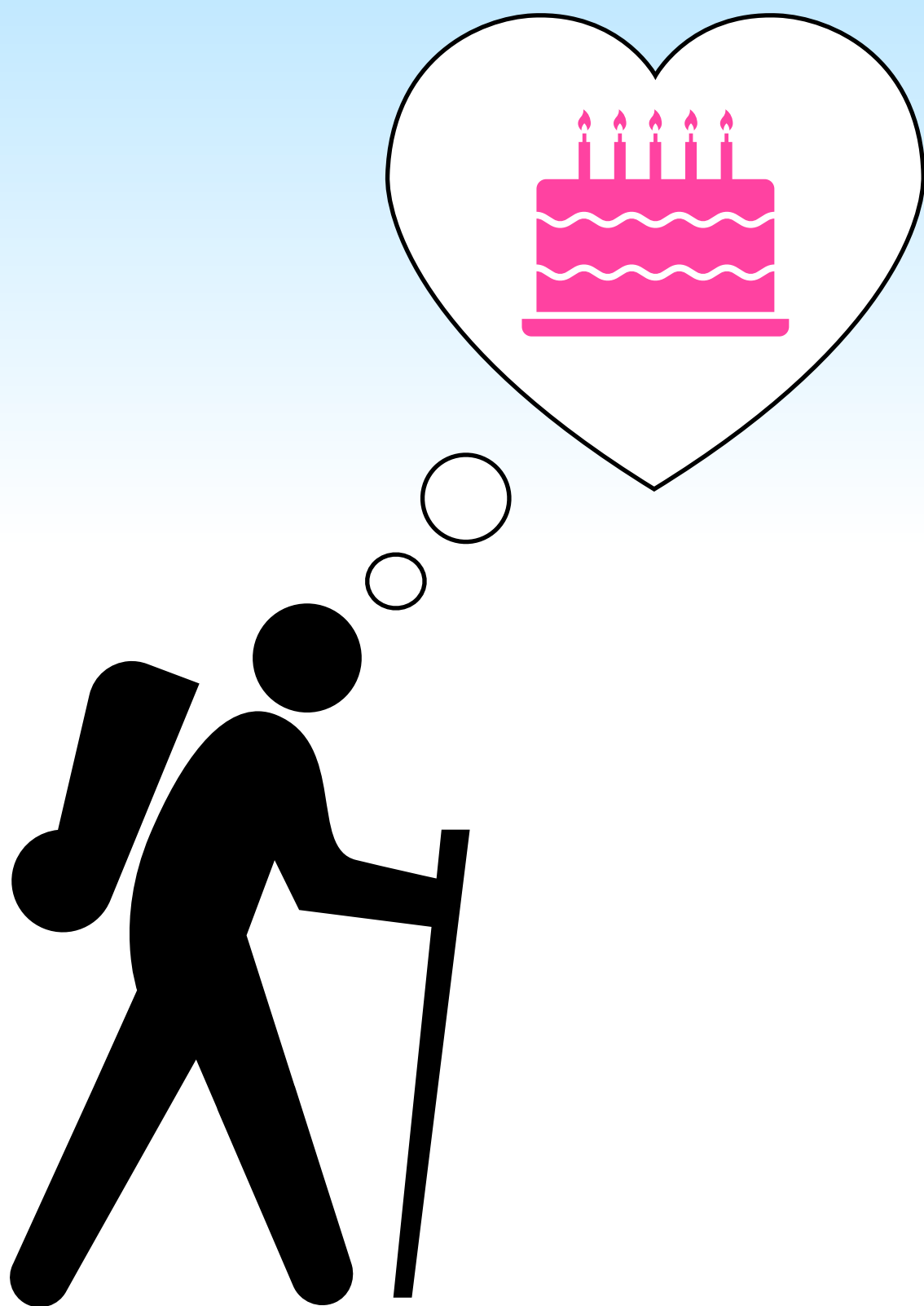
# Nadathur & Bar-Asher Siegal 2022

(2) Truth conditions for telic progressives with culmination condition  $C_p$  in model  $\mathcal{M}_p$ :

- a. An appropriate process for culmination condition  $C_p$  within model  $\mathcal{M}_p$  must have been initiated at reference time (i.e., at least one of a sufficient set of conditions for  $C_p$  within  $\mathcal{M}_p$  has been realized)
- b. No process for  $C_p$  should yet have been completed in  $\mathcal{M}_p$  at reference time (i.e., not all of any sufficient set of conditions for  $C_p$  within  $\mathcal{M}_p$  has been realized)
- c. It should be possible for progress towards the realization of  $C_p$  to continue (i.e., no sufficient set within  $\mathcal{M}_p$  for the negation of  $C_p$  should yet be realized)

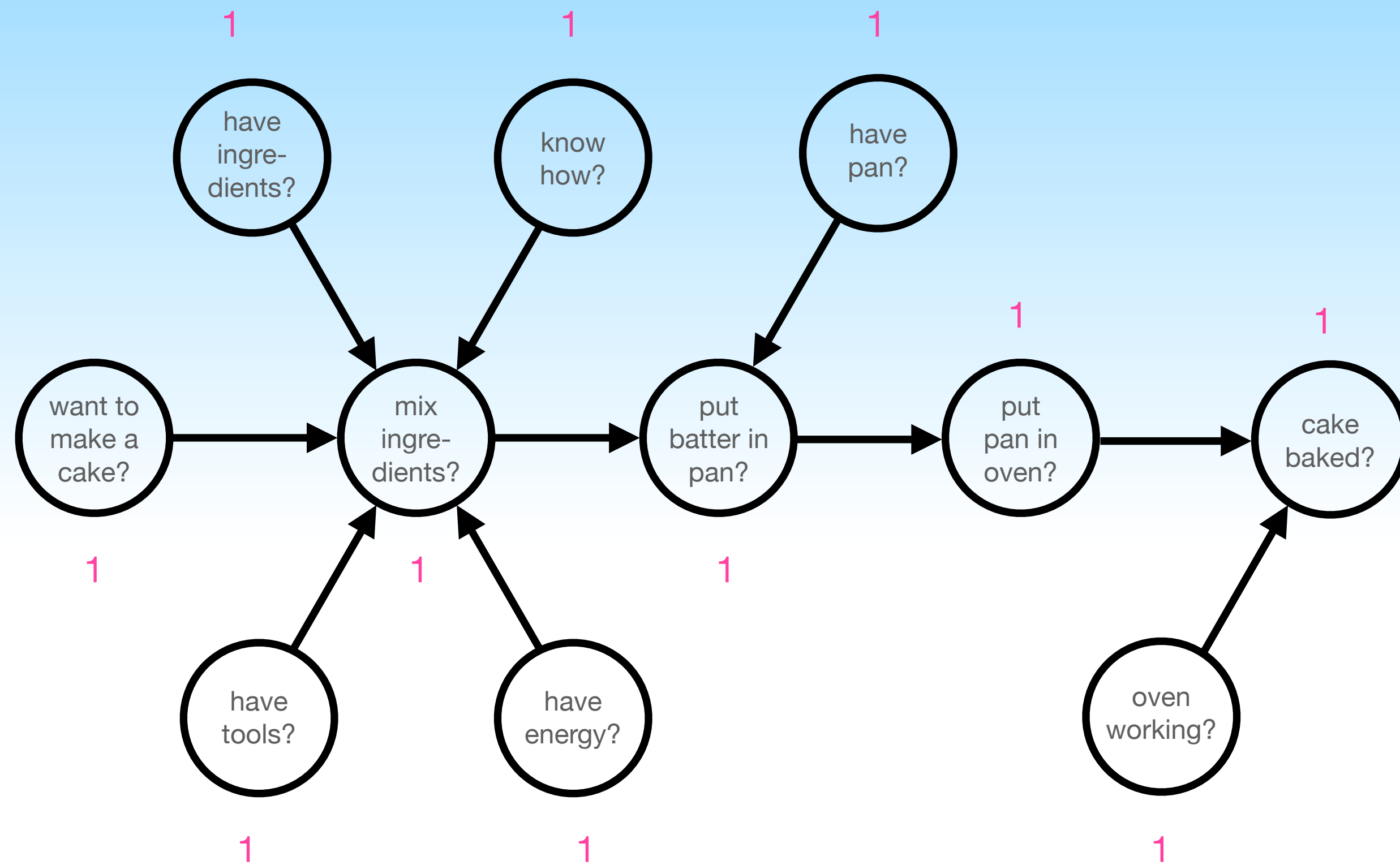
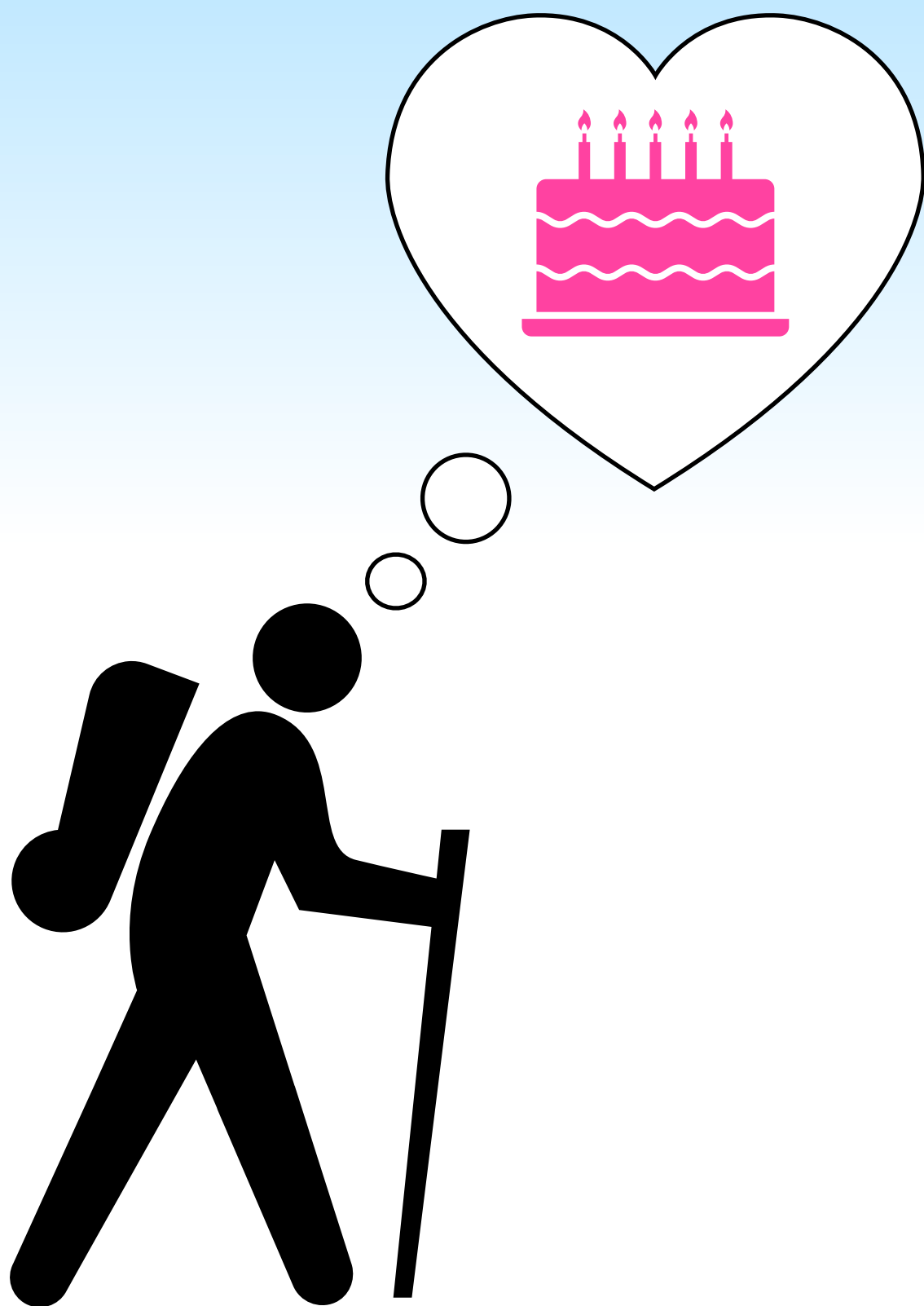
# Nadathur & Bar-Asher Siegal 2022

Example: baking a cake in progress



# Nadathur & Bar-Asher Siegal 2022

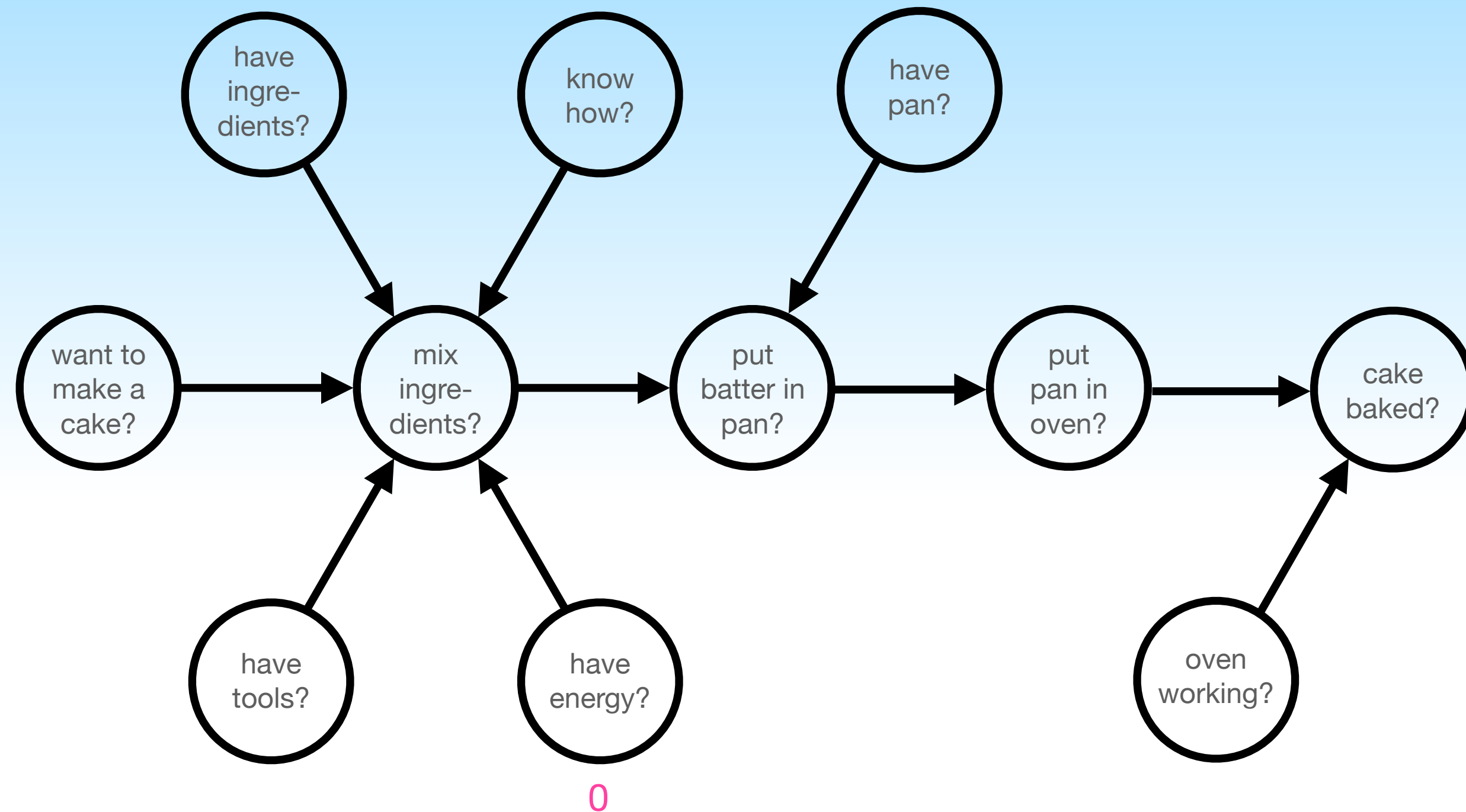
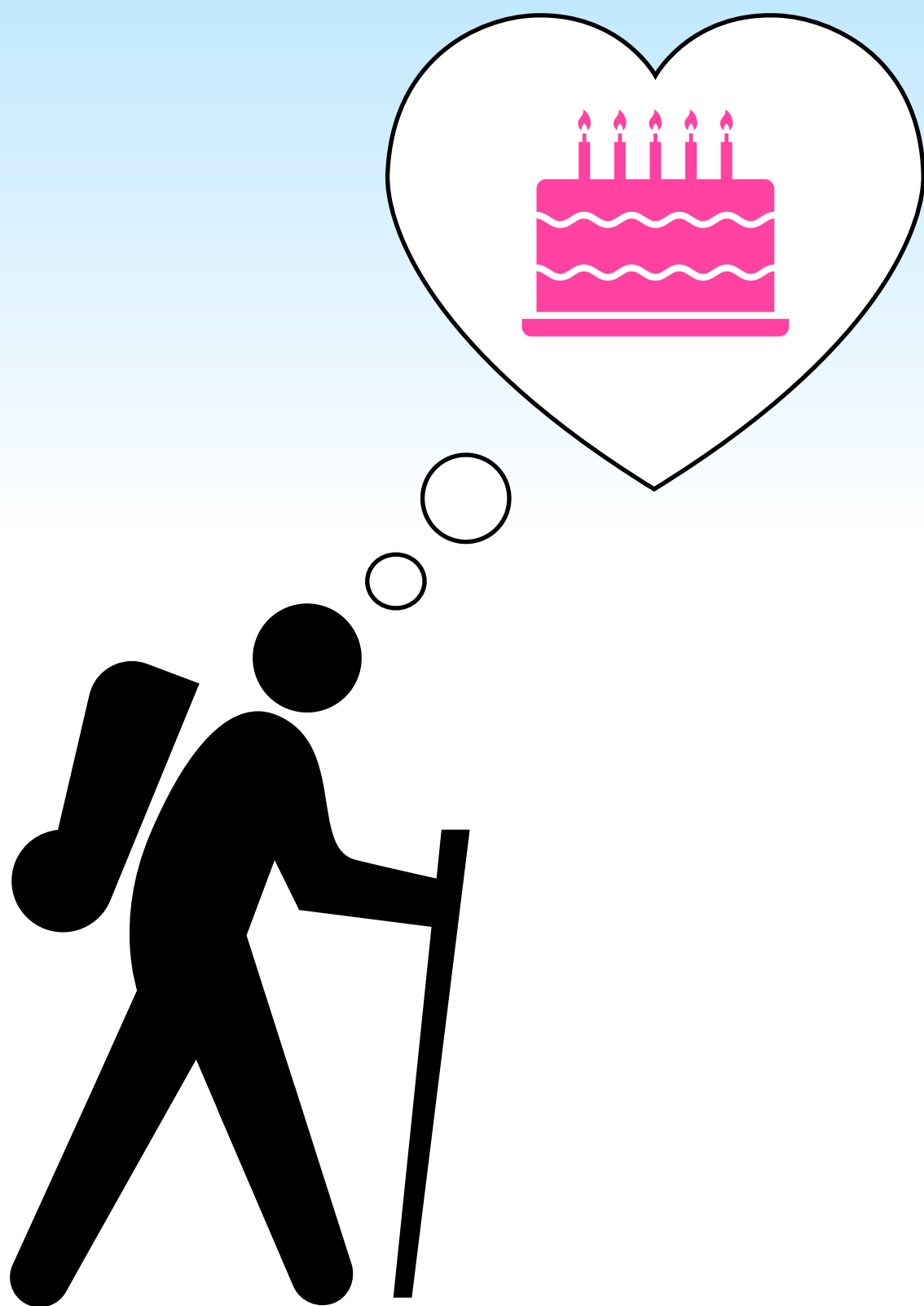
Example: baking a cake completed; not in progress





# Nadathur & Bar-Asher Siegal 2022

Example: baking a cake foreclosed; not in progress



# The problem of compositionality

- Nadathur and Bar-Asher Siegal's truth conditions crucially *evaluate* the sentence on a causal model that is a *network*.
- The causal structure *in the at-issue meaning* in decompositional theories of verb phrases is a causal *chain* (e.g. Ramchand 2008). And it's a *short chain*!
- Can we find a bridge between these theories?

What is the causal model's role in truth/acceptability conditions?

How do we associate a large causal network with a short causal chain?

**From a large causal network to a short causal chain**

# From a large network to a short chain

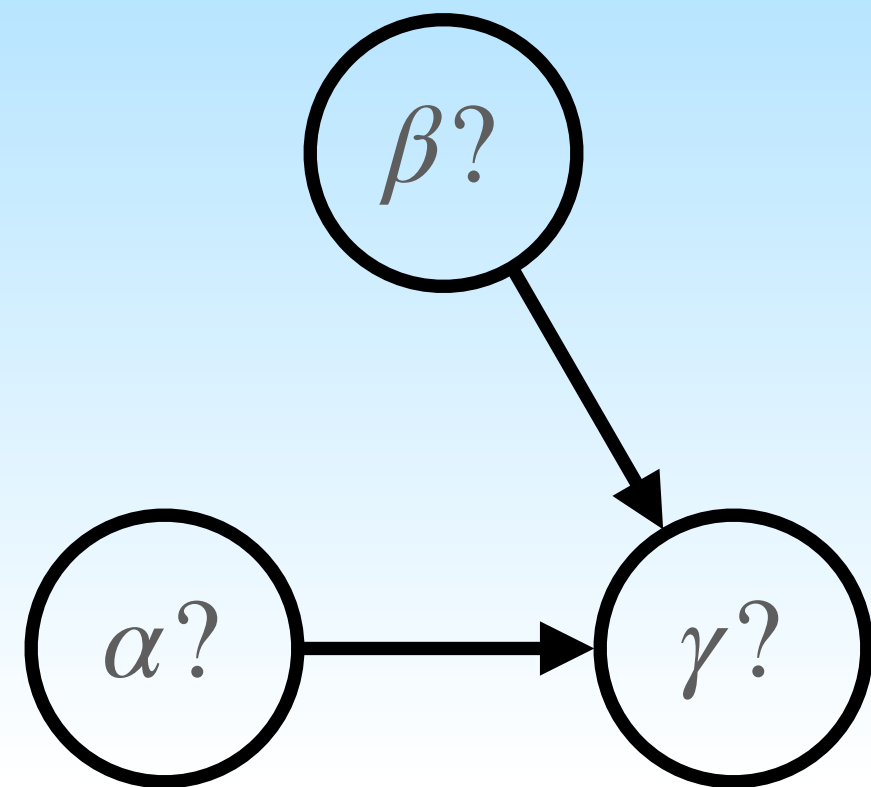
## Closing the model (backgrounding variables)

- We decide, and use language that says, what matters and what doesn't
- We don't have to represent every subevent or causal condition - a model is not the territory it represents
- Models are introduced by sentences and added to a Common Ground Alert: sweeping a lot under the pragmatics rug!
- The model introduced by sentences is crucially “**closed**”: the variables represented in the model matter, the variables not represented in the model don't
- Another way to think of this is that we are “backgrounding” certain real-world variables
- Cf. also error terms in structural equation models

# From a large network to a short chain

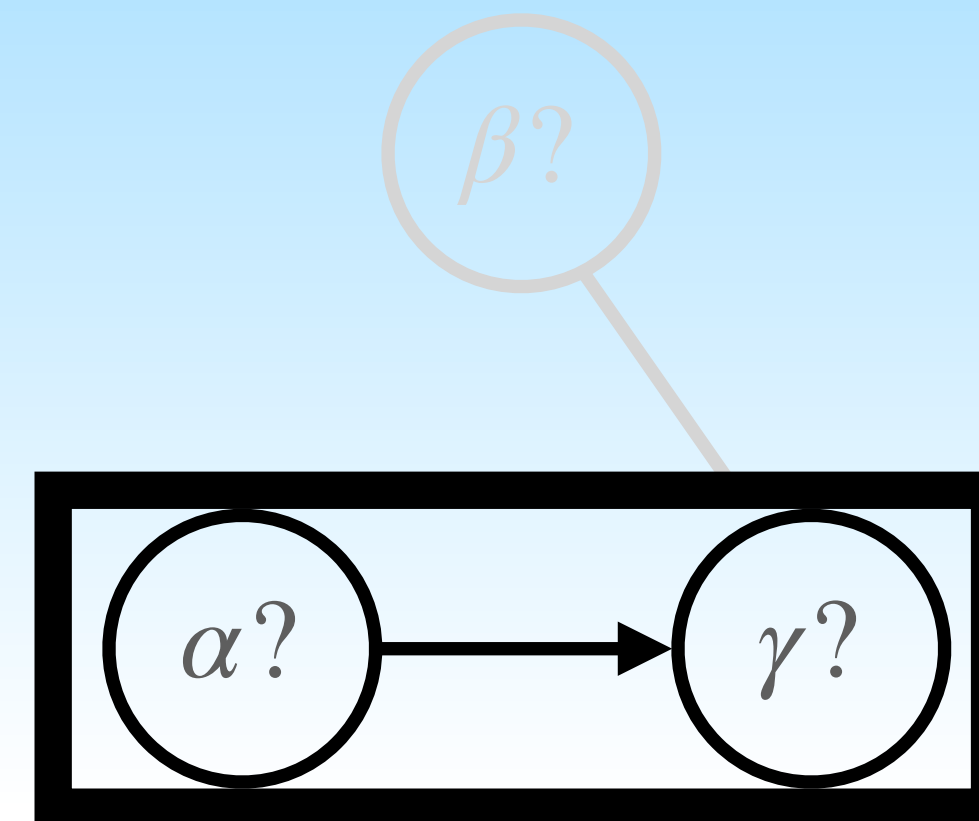
## Closing the model (backgrounding variables)

$\alpha$	$\beta$	$\gamma$
1	1	1
1	0	0
0	1	0
0	0	0



$\alpha?$  = whether the match is struck  
 $\beta?$  = whether there is oxygen  
 $\gamma?$  = whether the match lights

Striking the match caused the match to light.



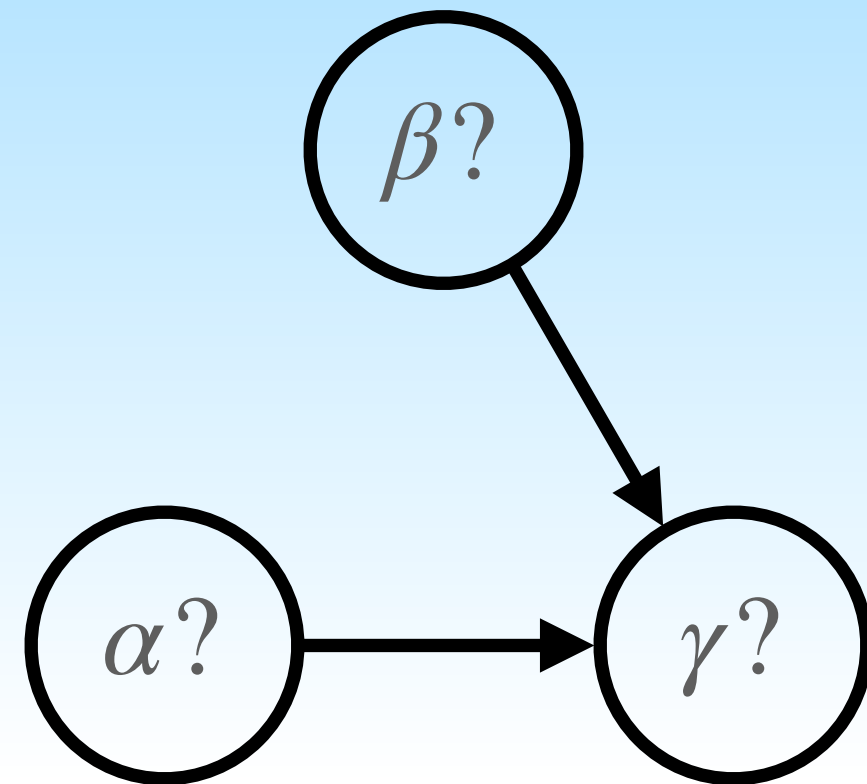
# From a large network to a short chain

## Closing the model (backgrounding variables)

$f_1$

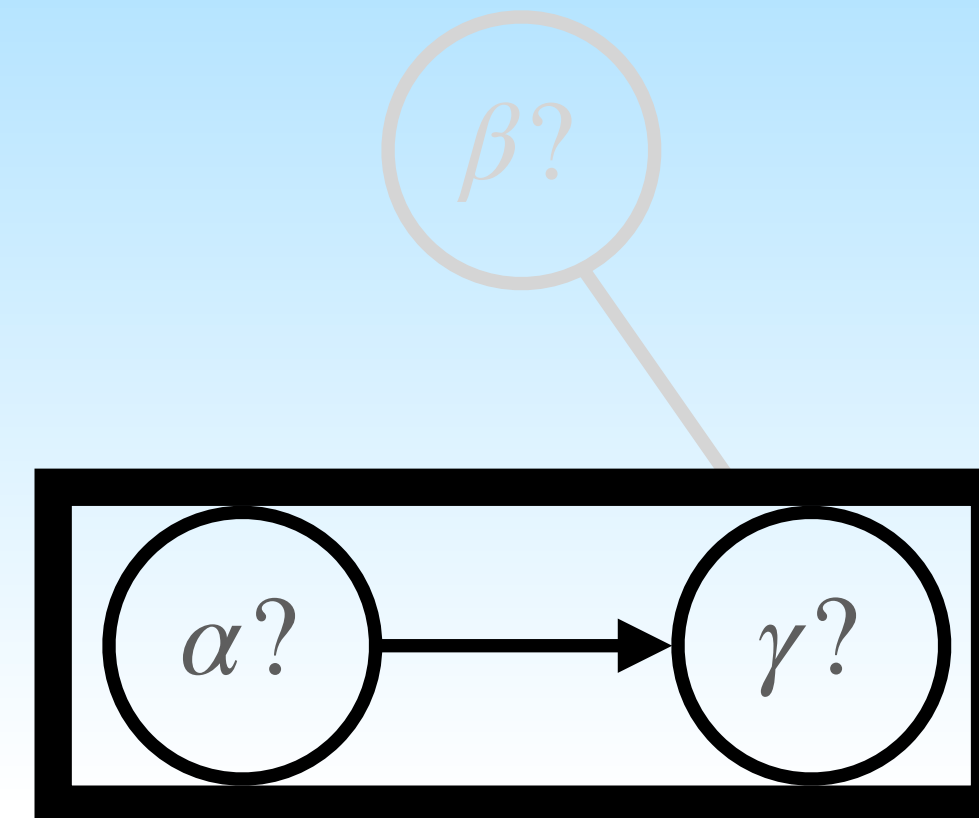
$\alpha$	$\beta$	$\gamma$
1	1	1
1	0	0
0	1	0
0	0	0

$\mathcal{M}_1$



$\alpha?$  = whether the match is struck  
 $\beta?$  = whether there is oxygen  
 $\gamma?$  = whether the match lights

$\mathcal{M}_2$



$\alpha?$  = whether the match is struck  
 $\gamma?$  = whether the match lights

$f_2$

$\alpha$	$\gamma$
1	1
0	0

Backgrounding of  $\beta$  (i.e., replacing  $\mathcal{M}_1$  with closed  $\mathcal{M}_2$ ) is licensed iff

$$f_2(\alpha) = f_1(\alpha, \beta) \text{ for normal/expected value of } \beta$$

(and  $\beta$  is as yet unvalued)

# From a large network to a short chain

## Telescoping



Telescoping of  $\beta$  (i.e., replacing  $\mathcal{M}_1$  with closed  $\mathcal{M}_2$ )  
 is always licensed, since  $f_2(\alpha) = f_1(\alpha, \beta)$  always

Possible functions for  $f_1$ :

$\alpha$	$\beta$	$\gamma$
1	1	1
0	0	0

$\alpha$	$\beta$	$\gamma$
1	0	1
0	1	0

$\alpha$	$\beta$	$\gamma$
1	0	0
0	1	1

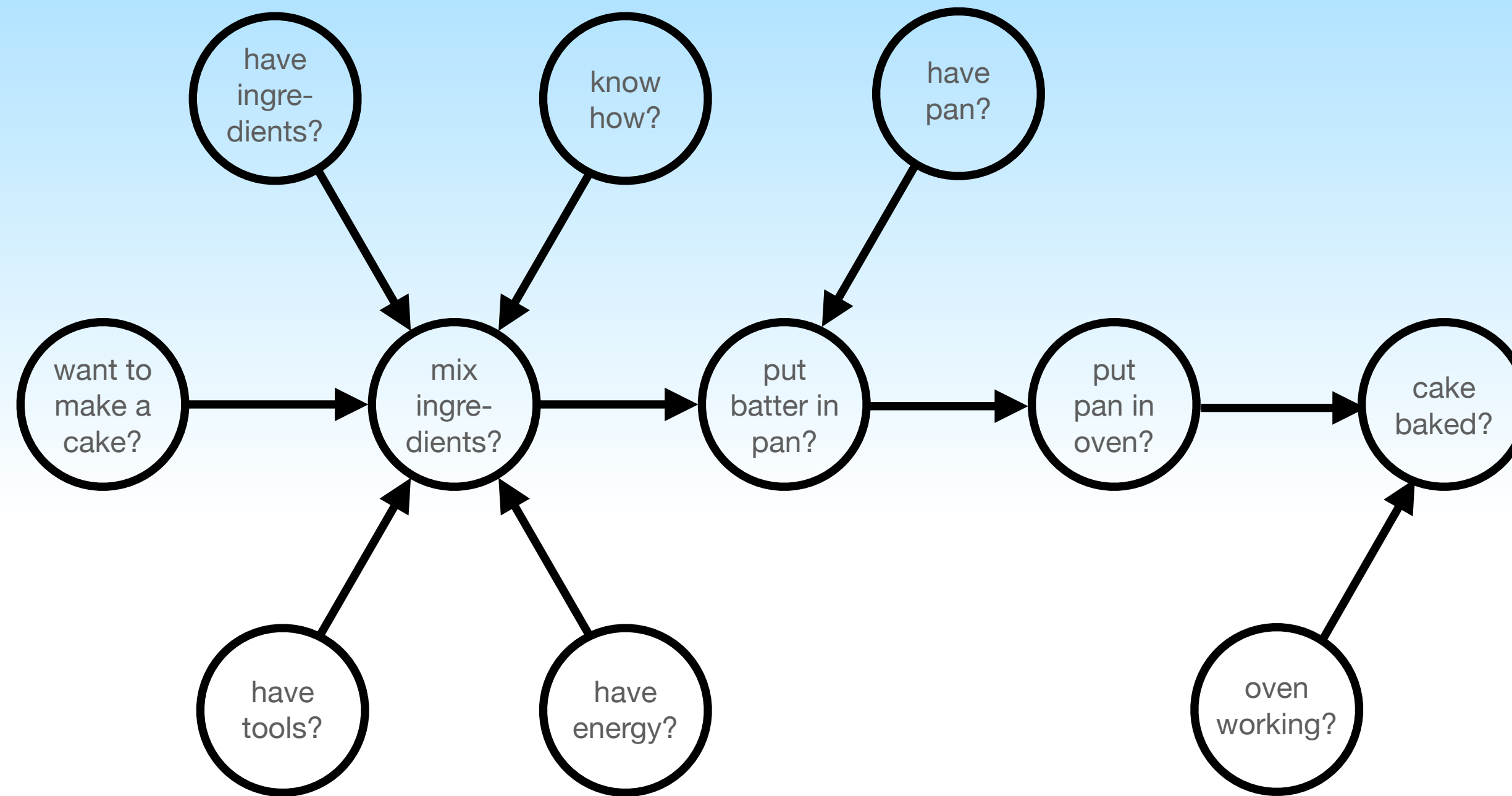
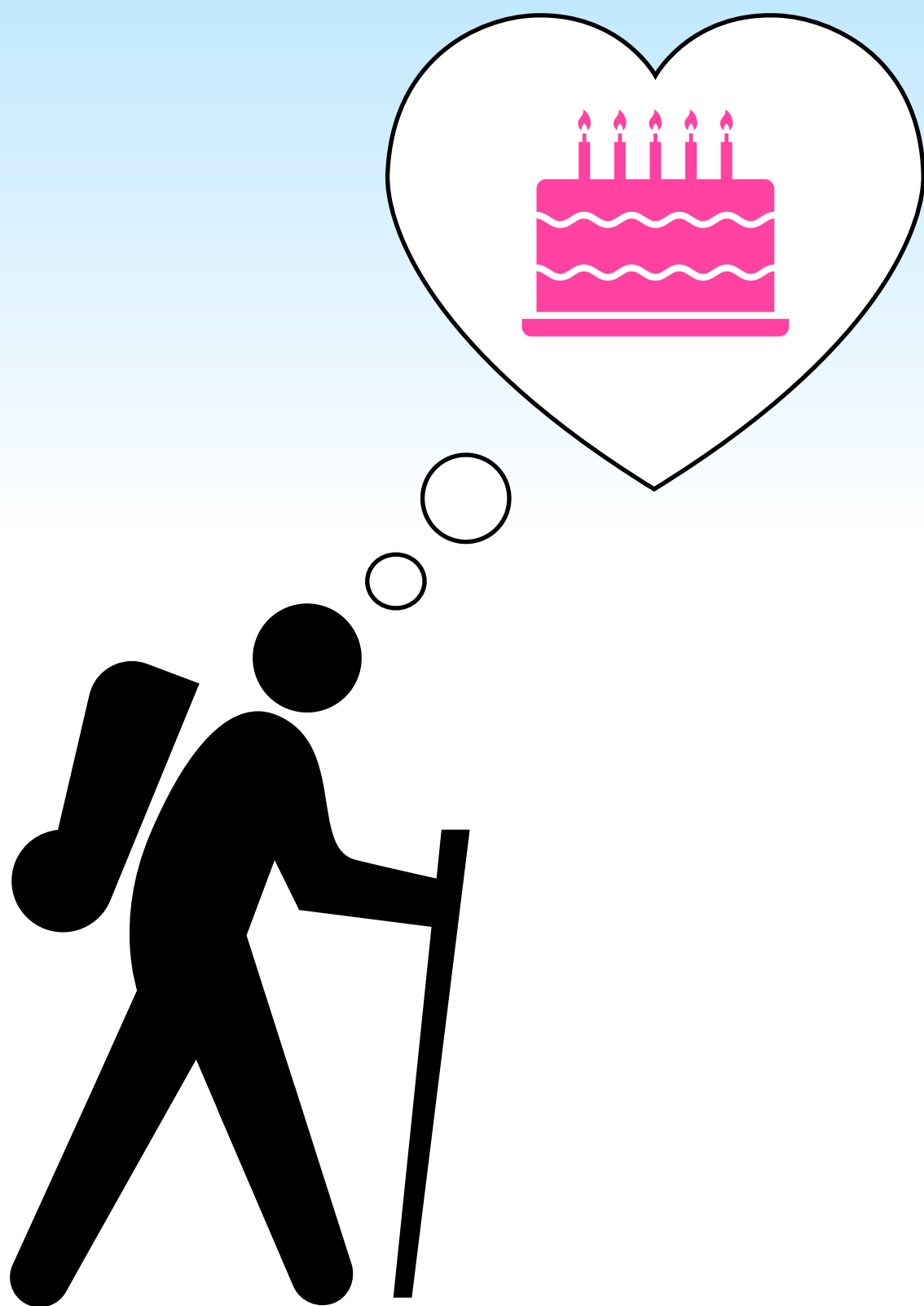
$\alpha$	$\beta$	$\gamma$
1	1	0
0	0	1

# Putting it together



# Putting it together

Closure (backgrounding) + telescoping



# Putting it together

## Are intentions enough?

- Nadathur & Bar-Asher Siegal: Intentions are *globally necessary conditions* - a lack of intention on its own is sufficient to scutter progress toward culmination
- Futurates (Copley 2008, 2018 and refs therein): Dowty's (1979) observation that one can, e.g. be baking a cake if one only has an intention  $\Rightarrow$  "plan" = causing intention
- But! The "intention problem" (Engelberg 2001): *Although she really intended not to do it she was making him a millionaire by placing all his money on the skinniest nag at the races.*
- Solved by assuming verbs in English can have, instead of an intentional causing node, a non-intentional causing node reflecting *cause-relevant properties*

# Putting it together

## What about ability?

- To have confidence that an agent can culminate an intentional action, the agent needs a sort of situational ability
- Copley 2008 on futurates: commitment (intention) + ability
- I propose that situational ability = whether the culmination occurs depends *only* on whether the agent has the intention
- If this isn't the case, the agent doesn't have the situational ability, and we can't be sure the event will culminate (or, we might be sure it won't)
- This is modeled both in N&B-AS's large network (explicitly, by considering what factors might intervene) and in the closed short chains (implicitly, through closure of the model)

# Putting it together

## What's the status of the causal model in the truth conditions?

- Decompositional approaches to the verb phrase *assert* the causal structure: e.g.  $e_1$  CAUSE  $e_2$
  - For N&B-AS, the sentence is evaluated on the model, and the causal structure seems to be not-at-issue.
  - Who's right?
  - N&B-AS are right. With causal models we can express exactly what is at-issue (values at reference time) and what is not at issue (the causal structure)
- (3) a. Emanuel isn't baking a cake.  
b. Is Emanuel baking a cake?

# Putting it together

## Towards compositionality

(4)

- a. Where  $\alpha = \textit{Mary cross the street}$ , the causal model contributed by  $\llbracket \alpha \rrbracket$ , to be written  $\mathcal{M}_{\llbracket \alpha \rrbracket}$ , is  $\boxed{\textcircled{\text{I}} \rightarrow \textcircled{\text{R}}}$ , where  $\textcircled{\text{I}} = \lambda i \lambda s . \textit{Mary intends during } i \textit{ in } s \textit{ to cross the street}$  and  $\textcircled{\text{R}} = \lambda s . \exists j, i \textit{ begins before } j : \textit{Mary crosses the street (completely) during } j \textit{ in } s$
- b. Reminder from def of causal models: For any  $i, s'$ ,  $\textcircled{\text{I}} \rightarrow \textcircled{\text{R}}$  is read “whether  $[\lambda s . \textit{Mary intends during } i \textit{ in } s \textit{ to cross the street}](s') = 1$  influences whether  $[\lambda s . \exists j, i \textit{ begins before } j : \textit{Mary crosses the street (completely) during } j \textit{ in } s](s') = 1$ ”
- c.  $\llbracket \textit{Mary cross the street} \rrbracket^{\mathcal{M}_{\llbracket \alpha \rrbracket}} = \llbracket \textit{Mary cross the street} \rrbracket^{\boxed{\textcircled{\text{I}} \rightarrow \textcircled{\text{R}}}} = \lambda i \lambda s . 1 \textit{ iff } [\textit{first}(\mathcal{M}_{\llbracket \alpha \rrbracket})](i)(s) = 1$

(5)

$$\llbracket \text{PROG} \rrbracket = \lambda p_{ist} \lambda i \lambda s . \exists i' \leq i : p(i')$$

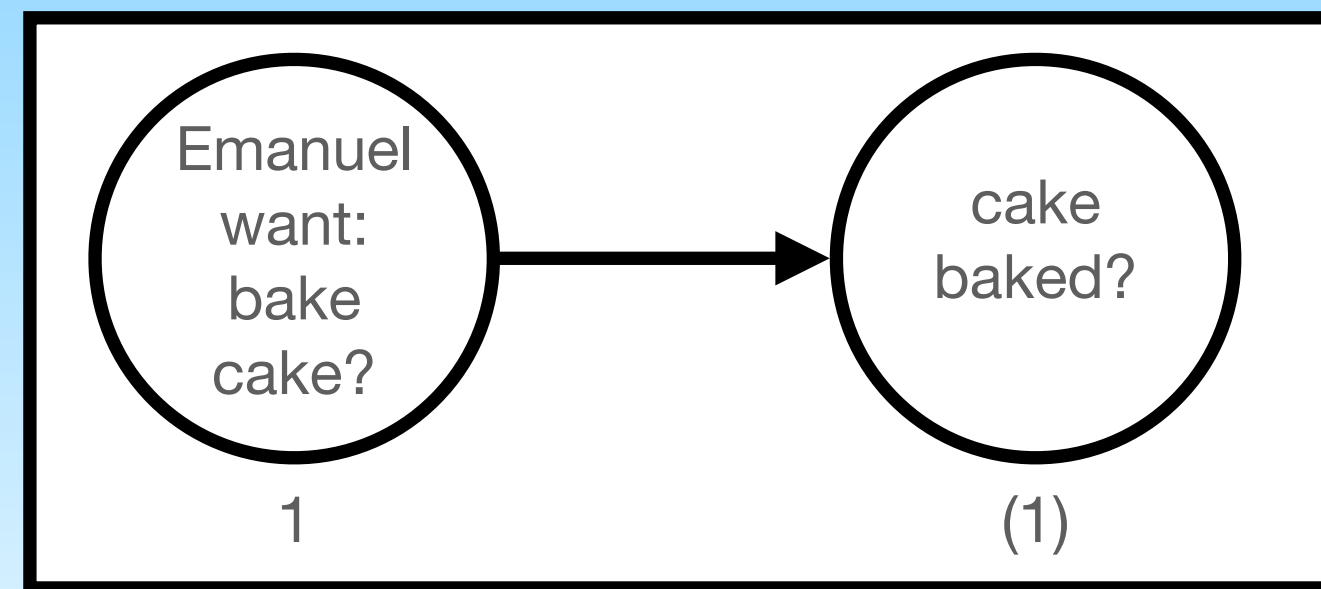
# Putting it together

## Evaluating the sentence

- But how can we evaluate a progressive intentional action sentence if we can't always directly observe intention, and can never directly observe ability?
- We need to observe what we *can* observe in the real world to reason about intention and ability
- That is, we need to look at the values of the variables we have backgrounded and telescoped
- Nadathur's and Bar-Asher Siegal's proposal is exactly this process: we assure ourselves that nothing will intervene to scutter the process

**A model is a perspective**

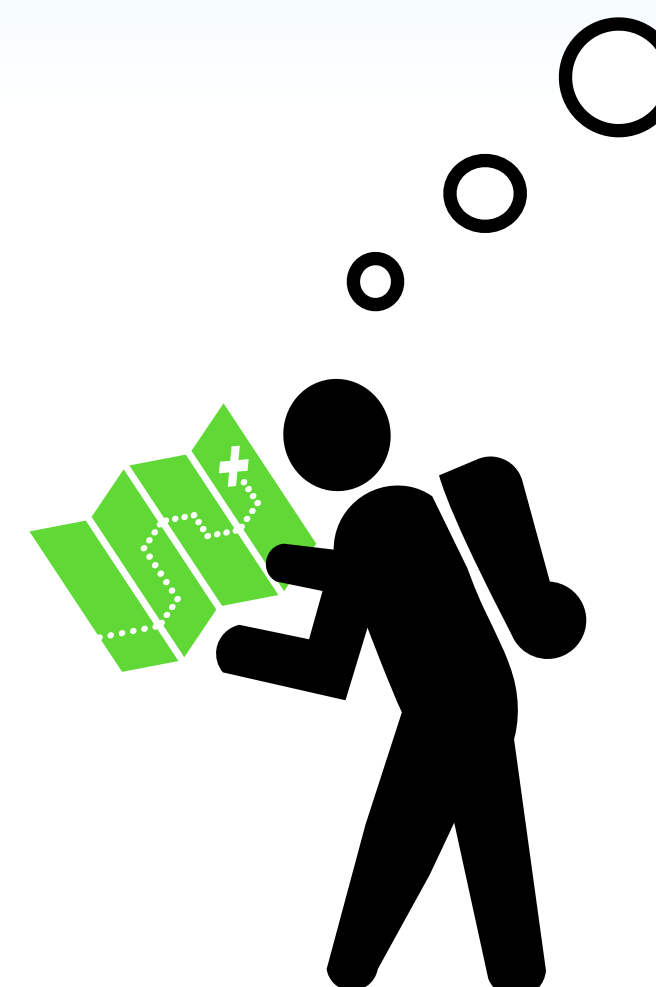
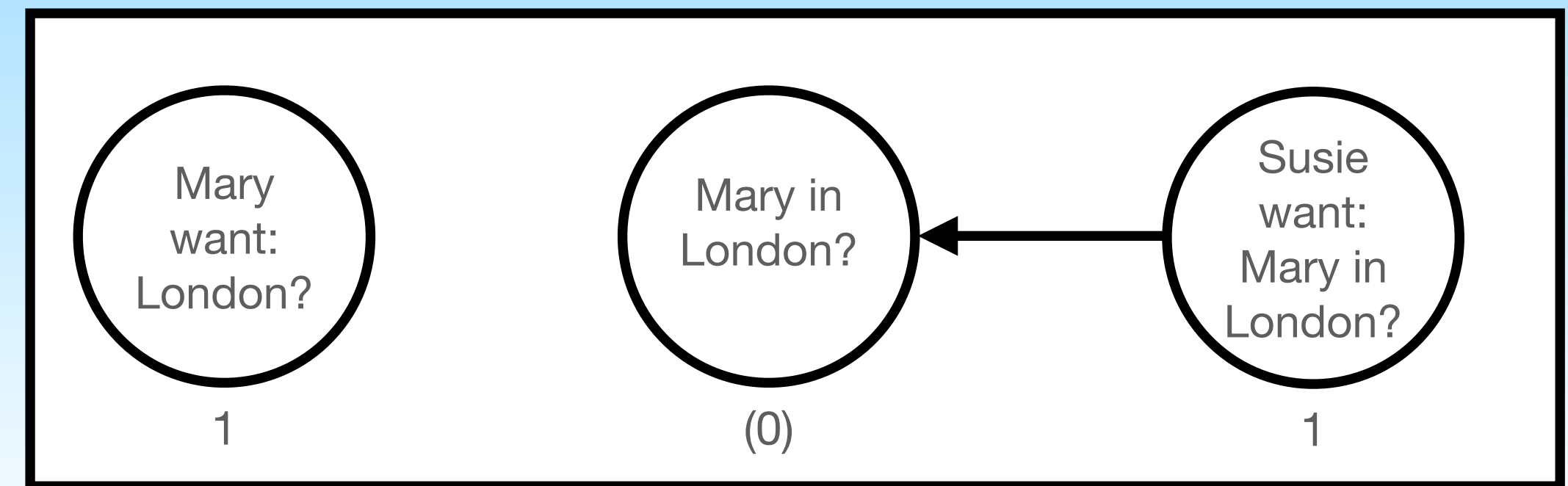
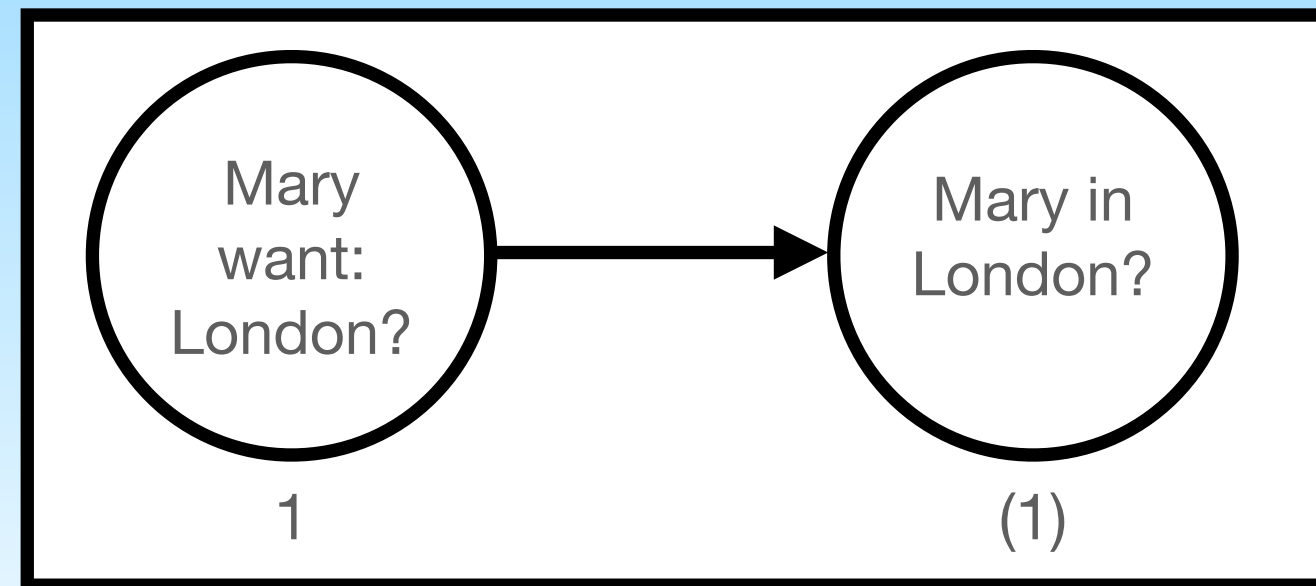
# “Fake” truth values are normal/expected but unratified against reality



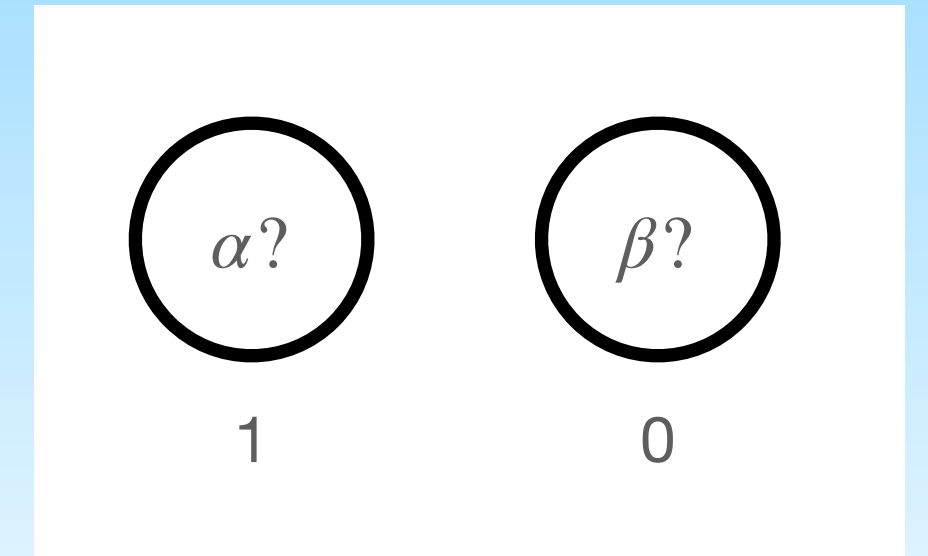
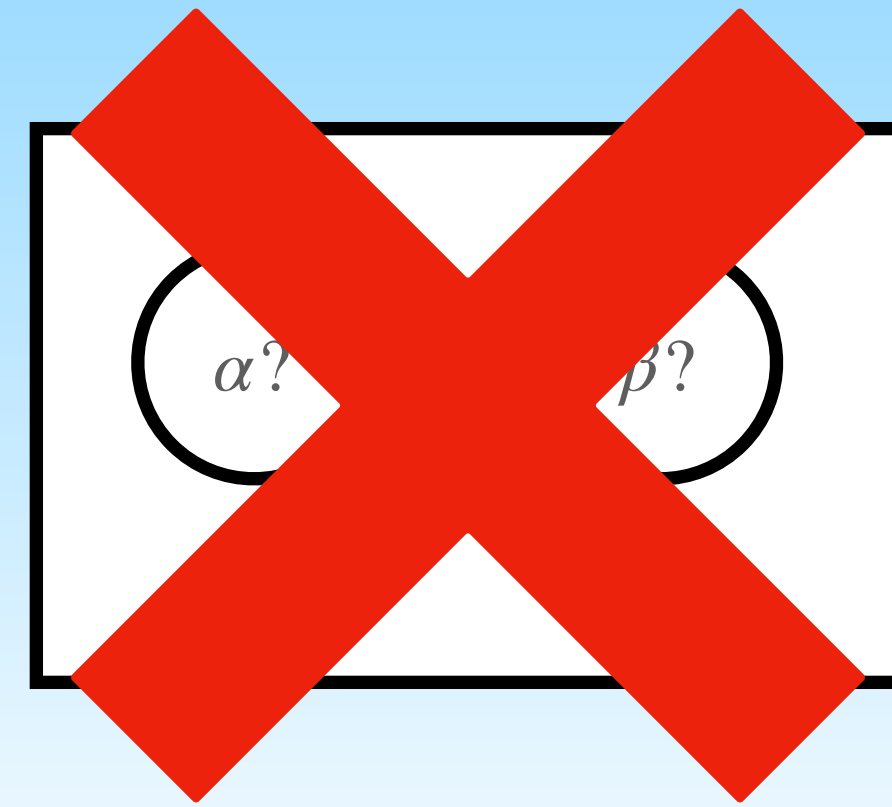
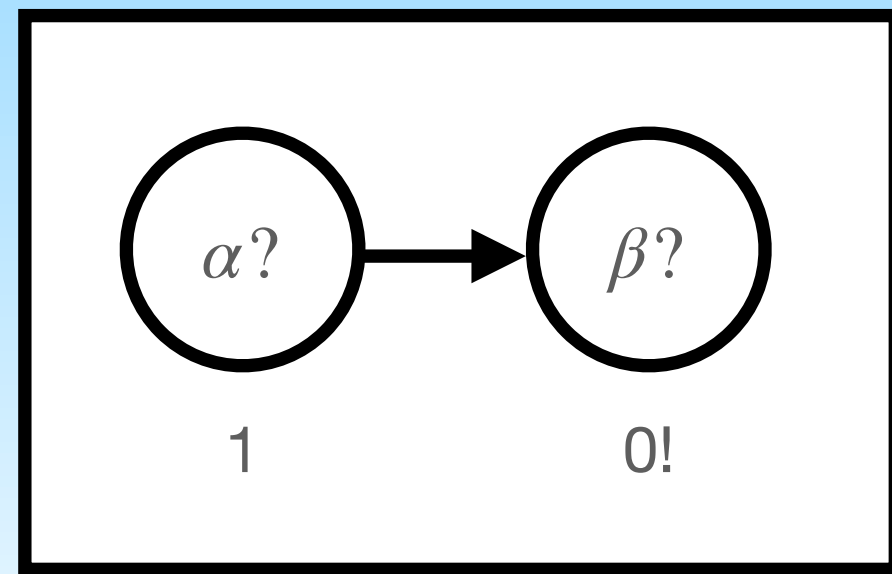
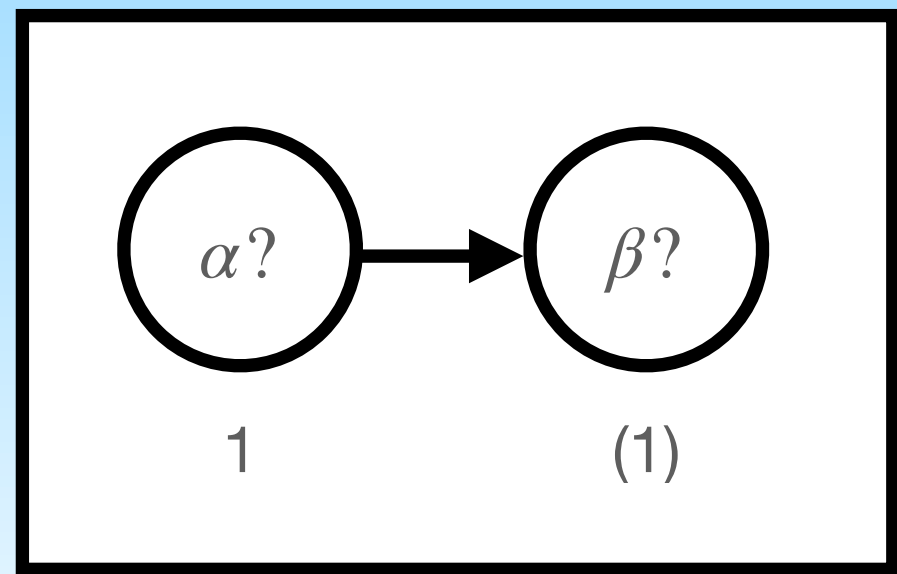


# A model is a perspective

- (6) a. Mary is going to London.  
b. Mary is not going to London.



# A truth value that conflicts with reality “breaks” a model

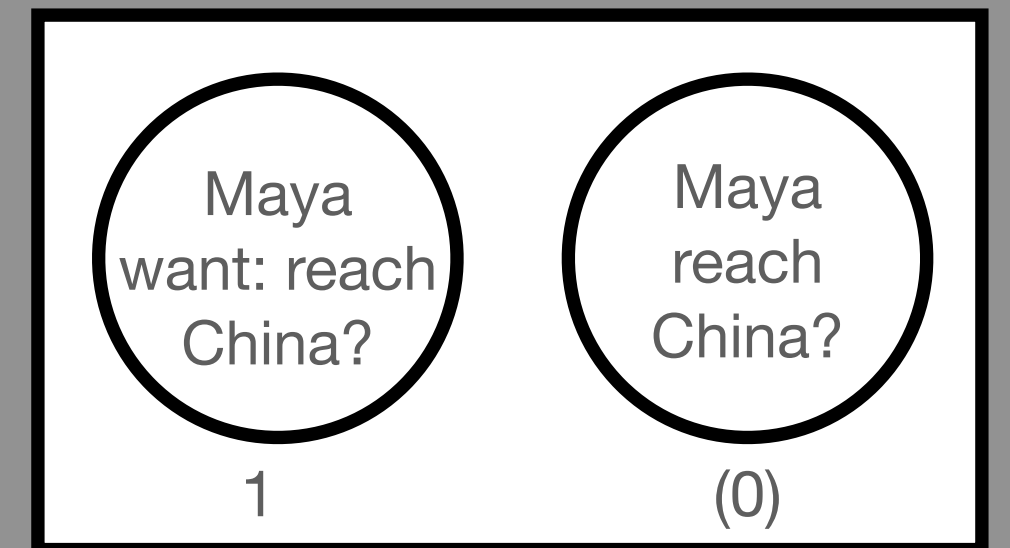
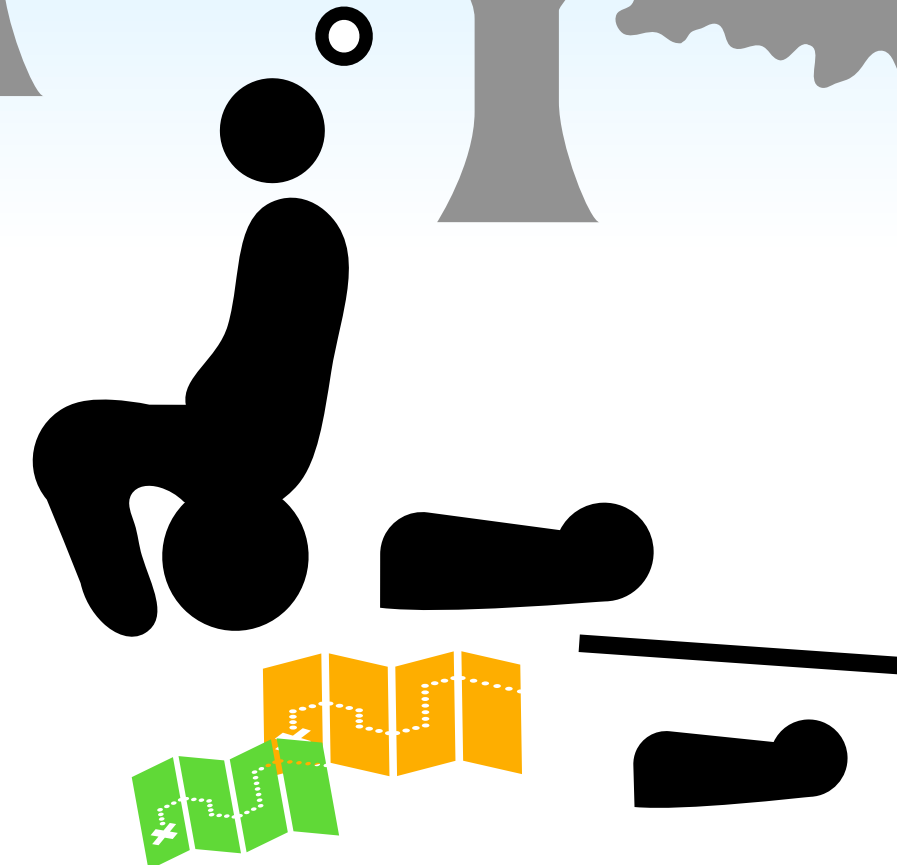
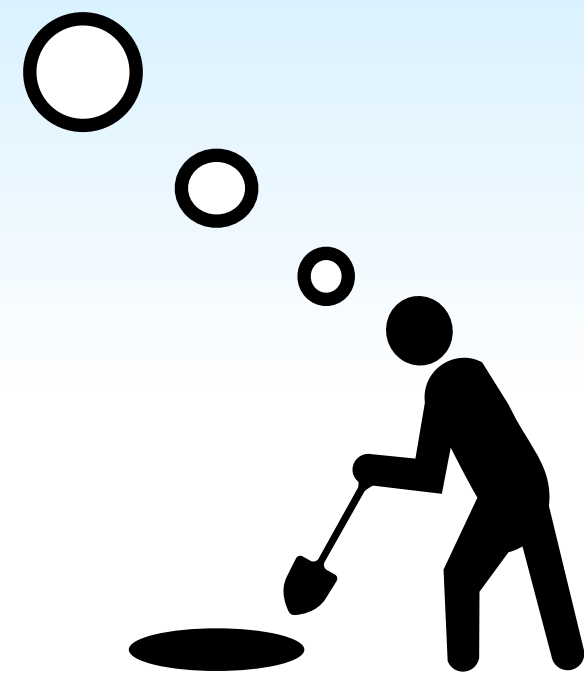
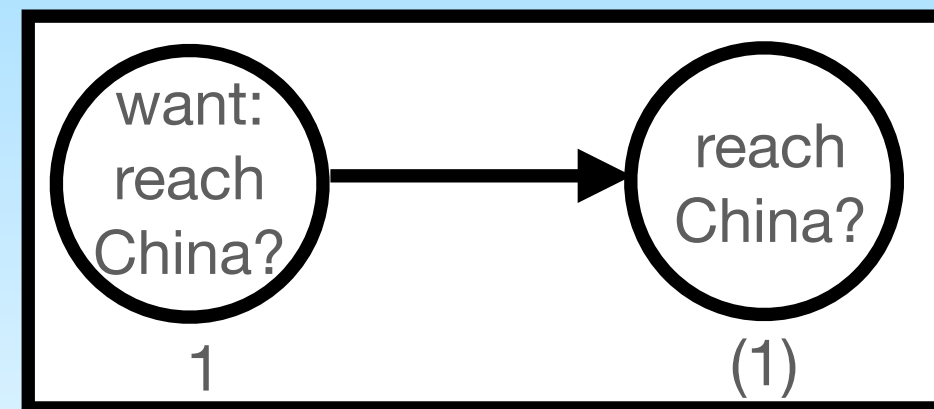


!



# Impossible outcomes

(7) Maya is digging to China.



# Thanks

