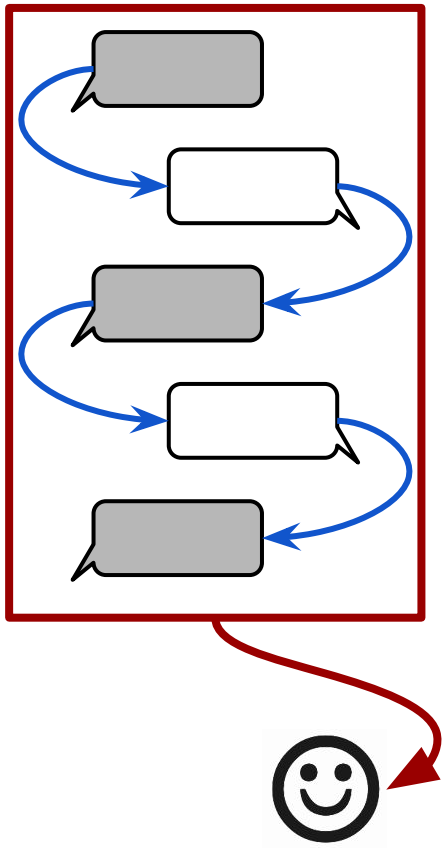
Wishful thinking: Making causal claims about conversational behavior

Cristian Danescu-Niculescu-Mizil
Cornell University

Includes slides prepared by Justine Zhang

conversational behavior

What conversational behavior **leads** to better outcomes?



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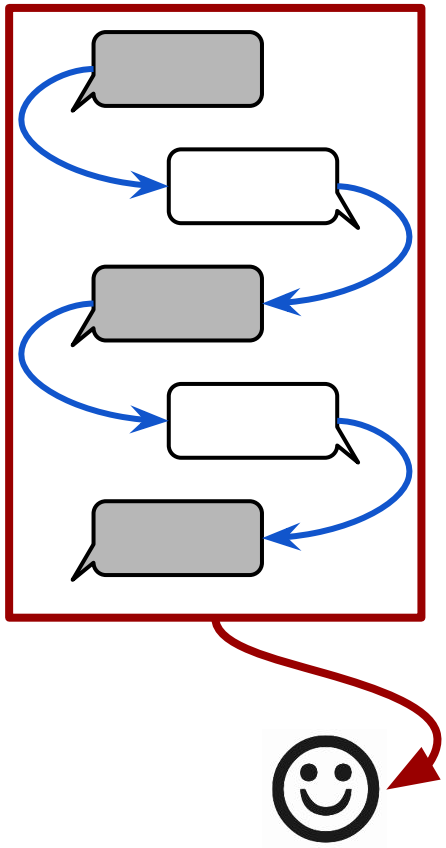
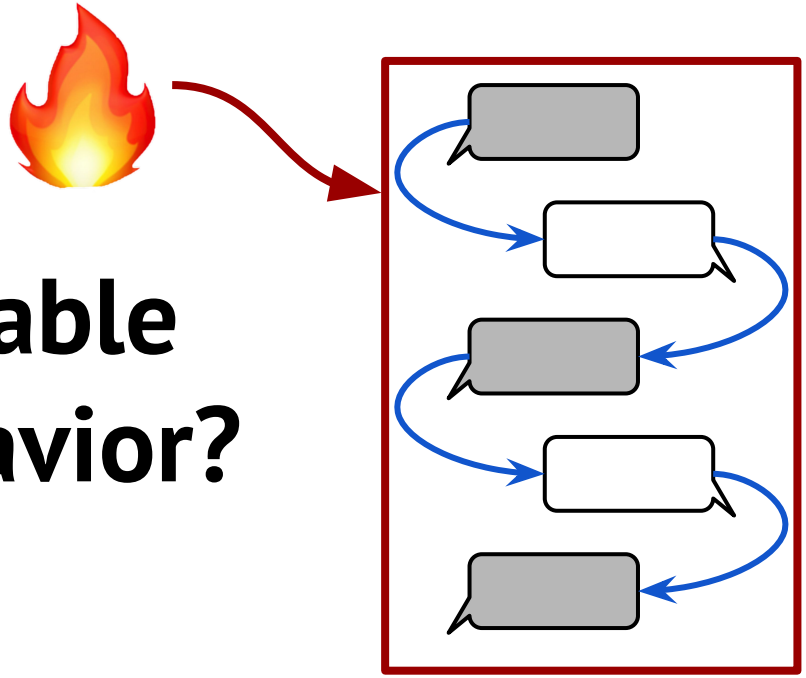


Potential applications:

- **training**
- **assignment**
- **assistance**

  […]

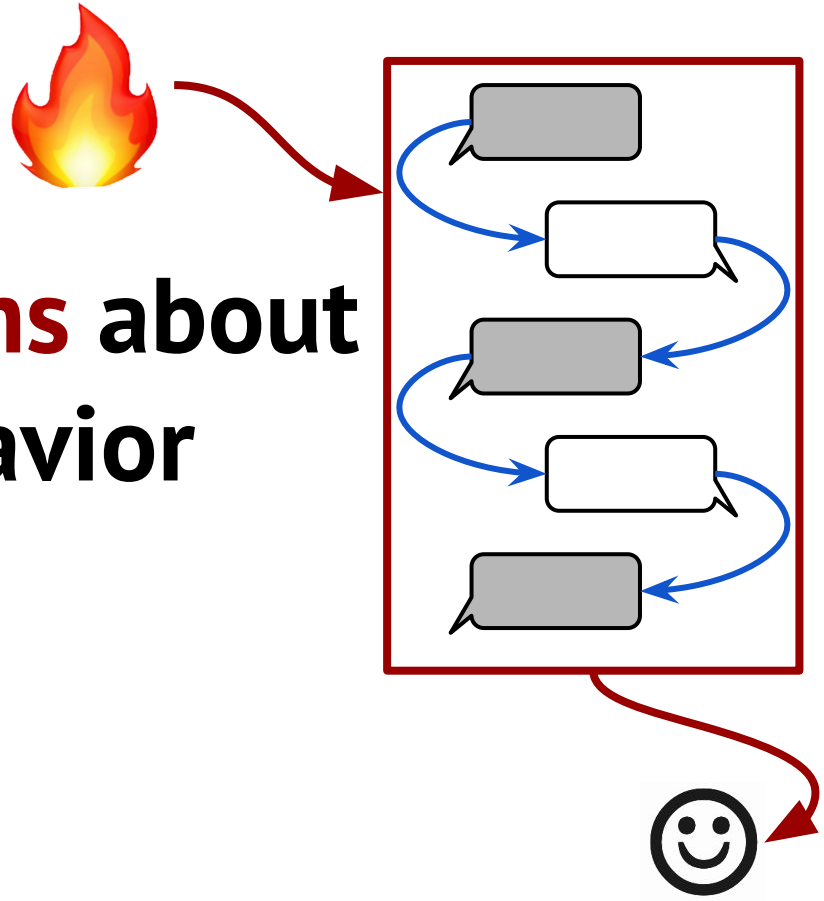


What leads to desirable conversational behavior?

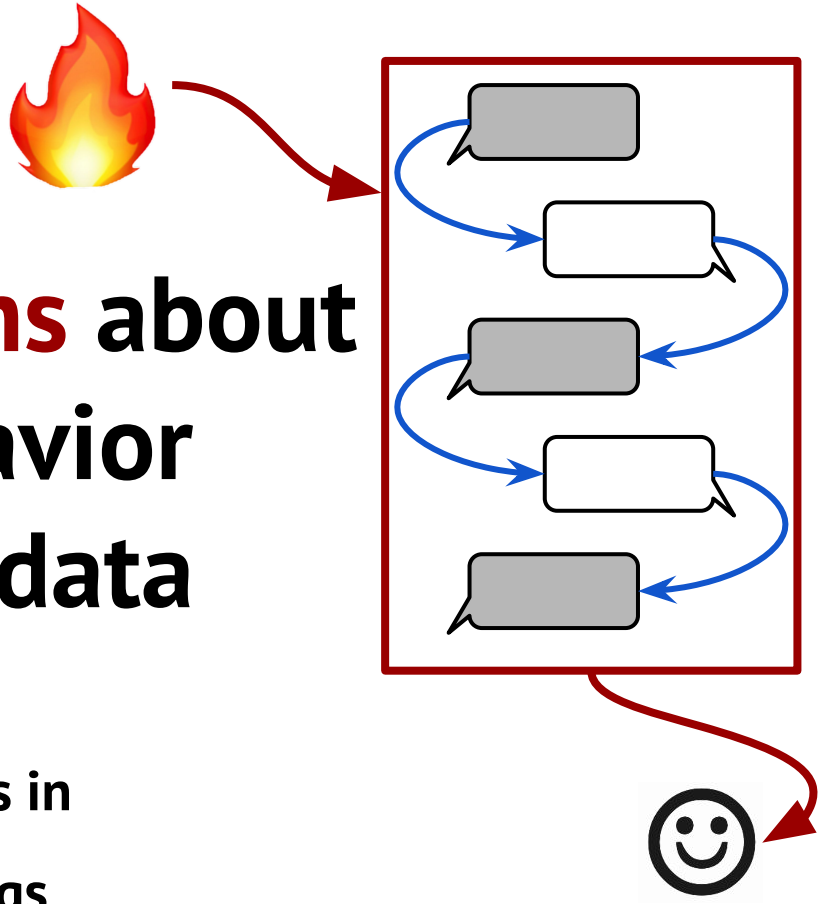
Potential applications:

- **platform design**
- **moderation**

Making causal claims about conversational behavior



Making causal claims about conversational behavior from observational data



This talk: three inference challenges in two conversational settings

Making causal claims about
[anything]
from observational data

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correlations

“truly causal” relations (e.g., RCT-grade)

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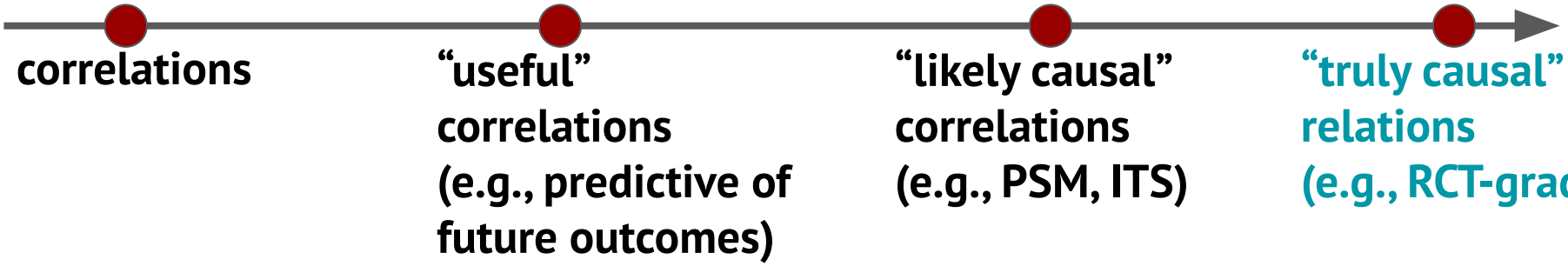

Wishful thinking:

Making causal claims about

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Wishful thinking:

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“truly causal” relations (e.g., RCT-grade)

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Imagine ideal setting needed for establishing "truly causal" relations

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Formally describe what is missing in our non-ideal observational setting

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Imagine ideal setting needed for establishing "truly causal" relations

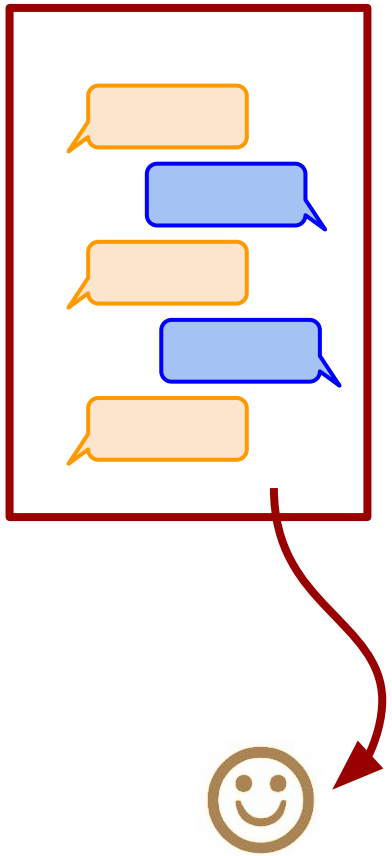
Formally describe what is missing in our non-ideal observational setting

Can we find an alternative that is just as good (or "good enough")?

correlations

"truly causal" relations (e.g., RCT-grade)

What conversational behavior **leads** to better outcomes?



Quantifying the Causal Effects of Conversational Tendencies
Justine Zhang, Sendhil Mullainathan, and
Cristian Danescu-Niculescu-Mizil
Proceedings of CSCW, 2020

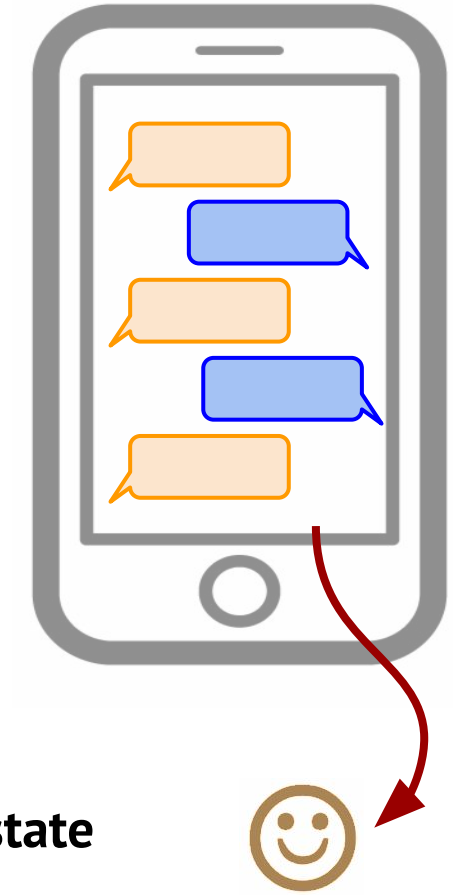
Empirical setting:
Crisis counseling conversations

CRISIS TEXT LINE |

Individuals in mental health crisis
(anxiety, suicidal ideation, …)

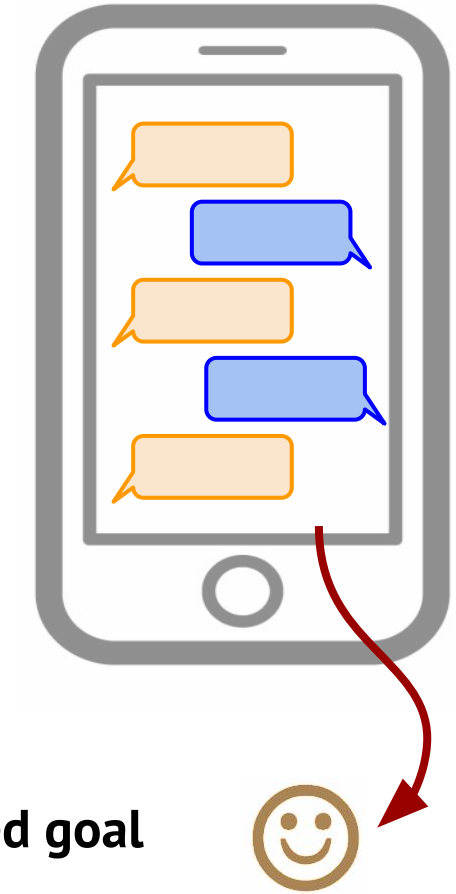
trained counselors

1.5 million conversations



Goal: calmer state

General setting:
goal-oriented conversation platforms

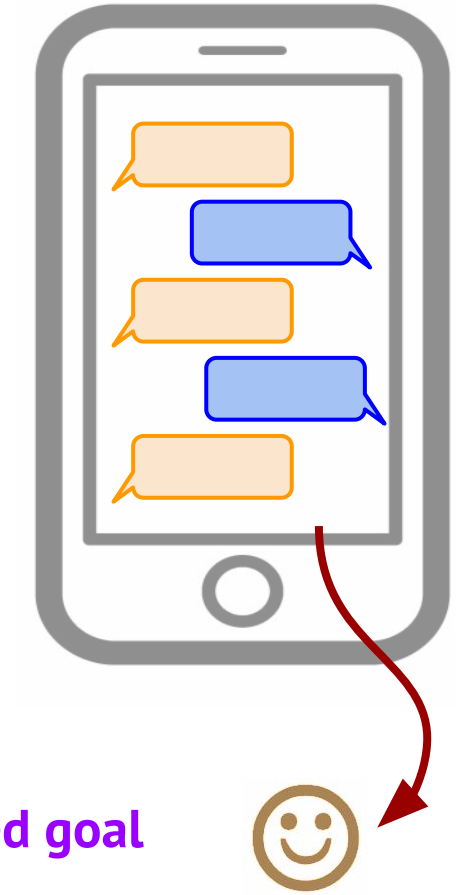


consequential, conversational settings:
crisis counseling, medicine, teaching, therapy, advising, customer service, contact tracing...

General setting:
goal-oriented conversation platforms

What **(agent) conversational behaviour** leads to a **better (client) outcome**?

- - -► training or assignment policies



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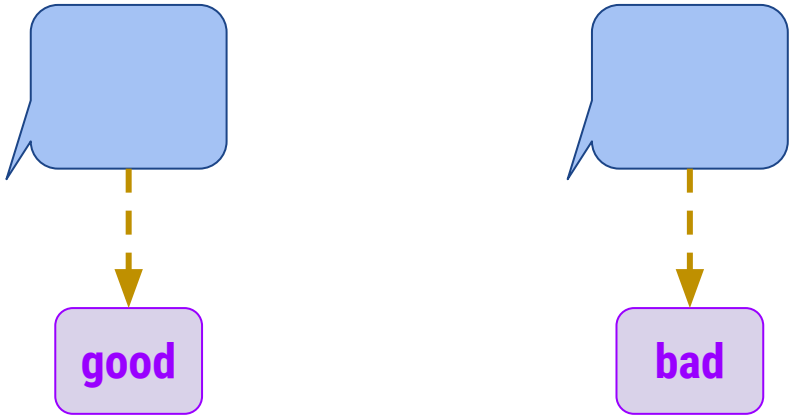
Preliminary idea: compare behaviours in good versus bad conversations



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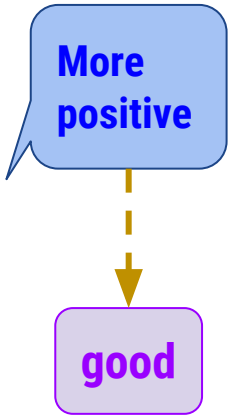

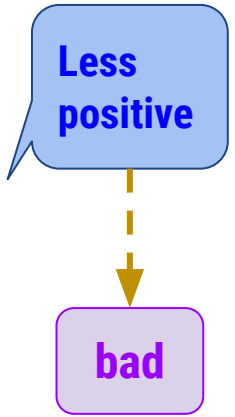

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- - -► Assign more positive agents?

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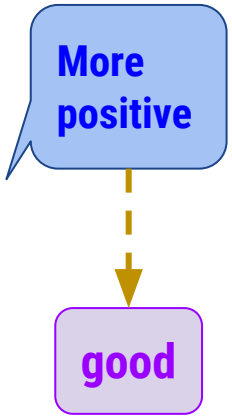

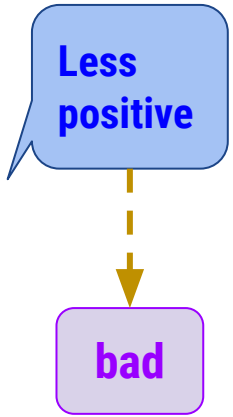

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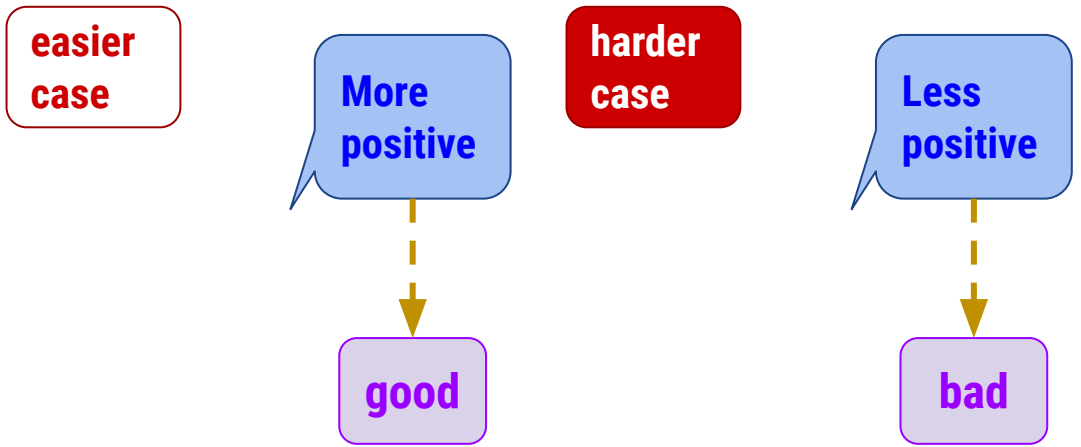

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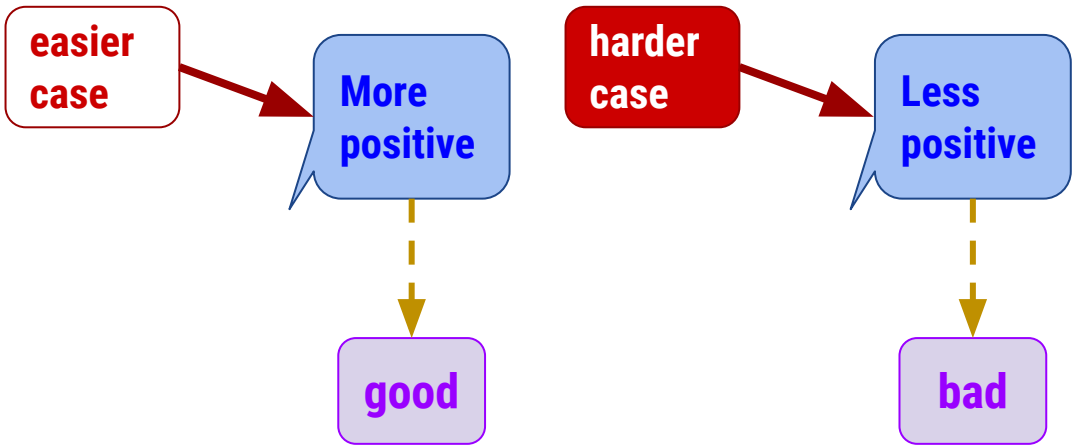

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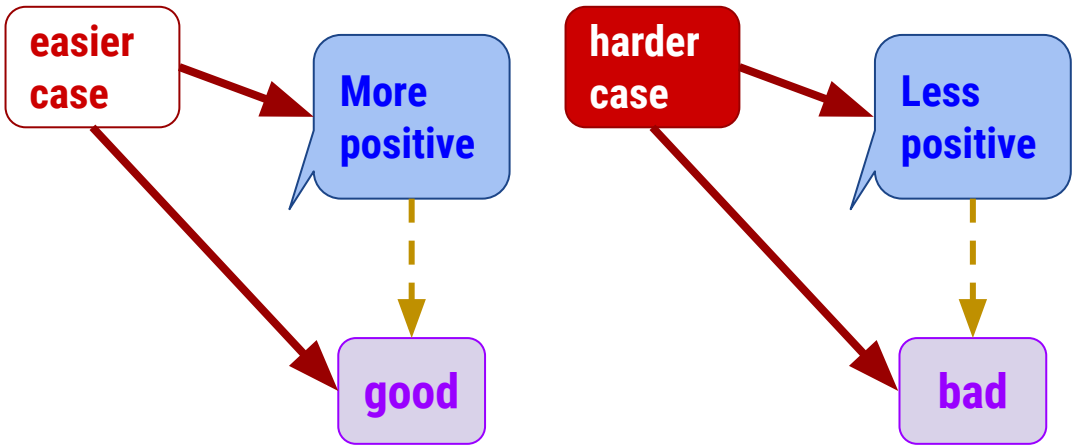

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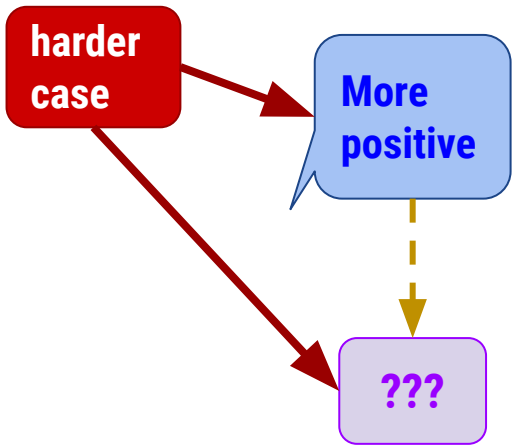
We cannot address this **counterfactual**:



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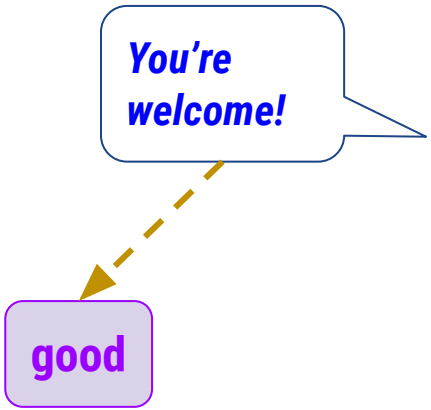

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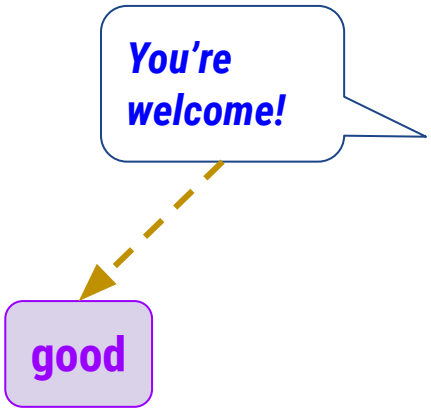
- - -► Teach agents to say “you’re welcome” more?



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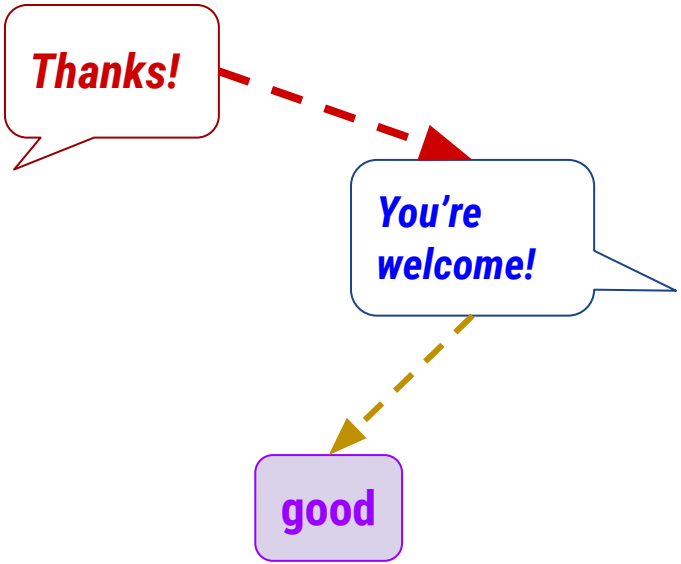

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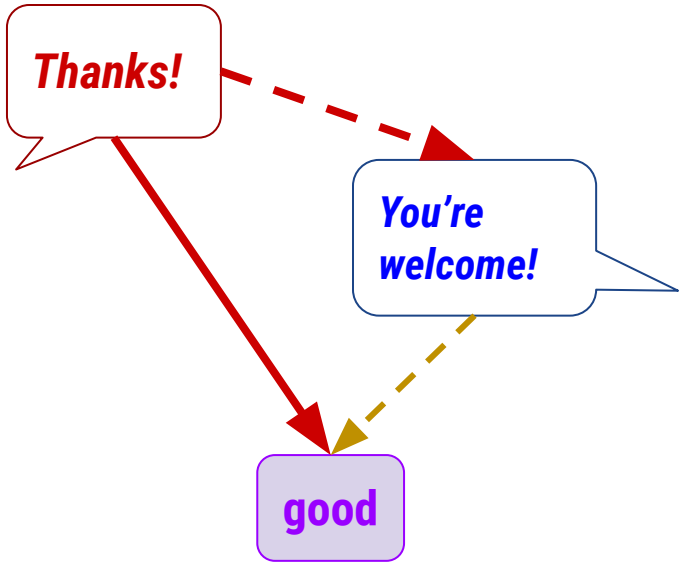
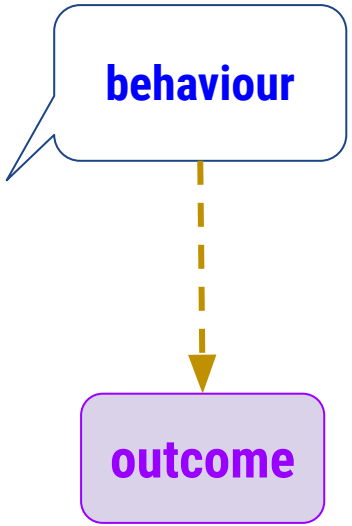
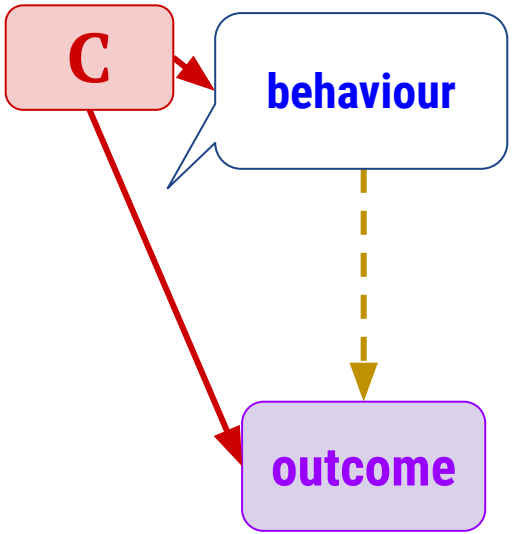


Problem:



Problem: **circumstances** of the conversation



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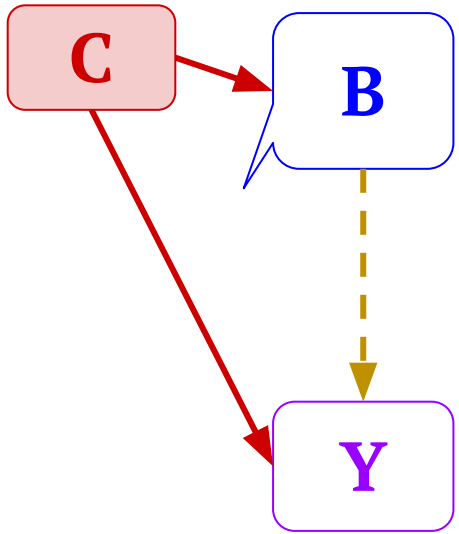

Problem: **circumstances** of the conversation

Drawing on the
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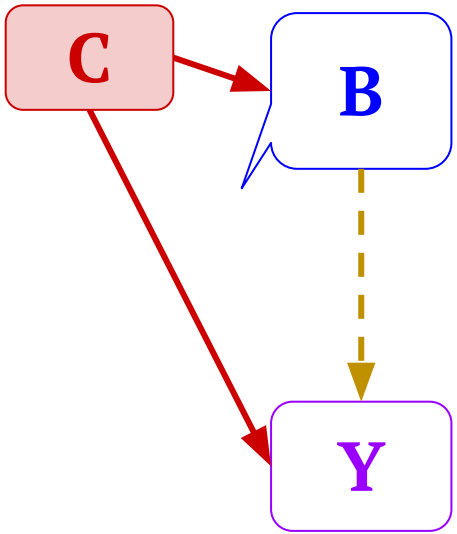
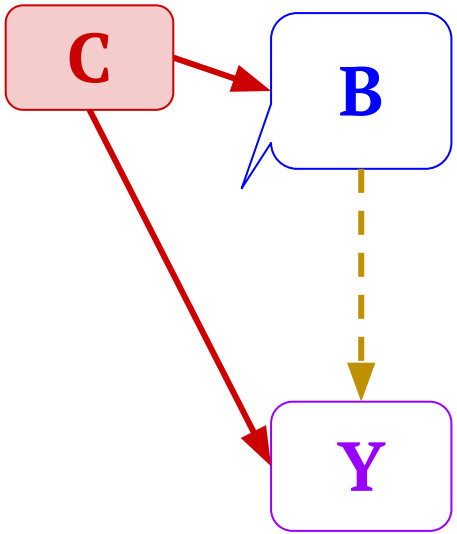


Problem: **circumstances** of the conversation

Drawing on the causal inference literature, we formally describe the problem of drawing **causal relationships** between **behaviour** and **outcome**



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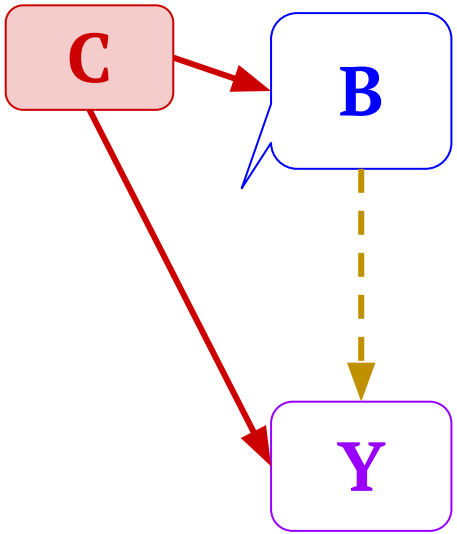

Problem: **circumstances** of the conversation

In this talk: **graphical models** of dependencies between **circumstance**, **behaviour** and **outcome**

Pearl, 1995

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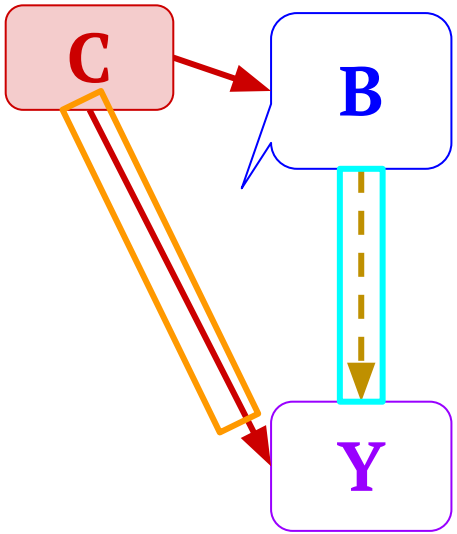

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In this talk: **graphical models** of dependencies between **circumstance**, **behaviour** and **outcome**

Pearl, 1995

Also in paper: potential outcomes framework

Rosenbaum, 2010

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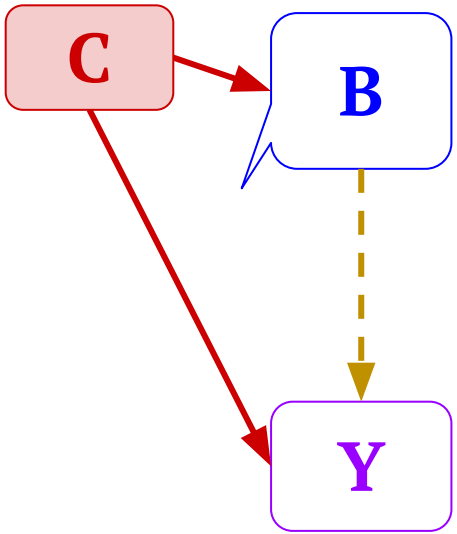
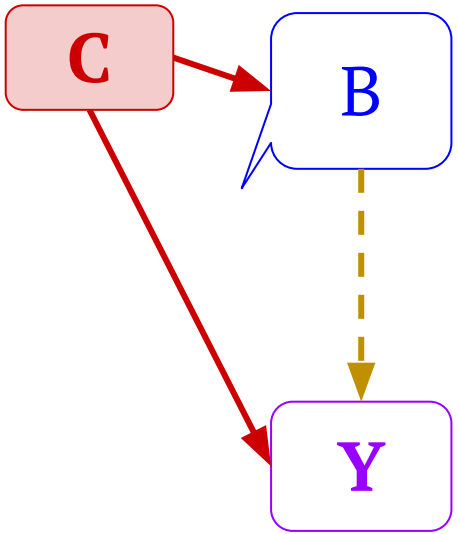
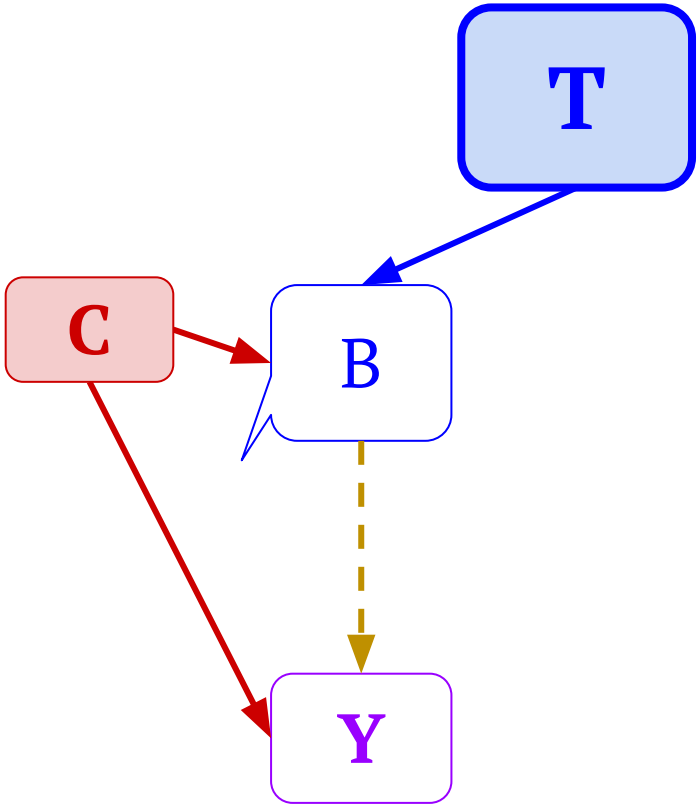


Our motivating task:



Our motivating task:

Assigning agents based on their **behavioural tendency**



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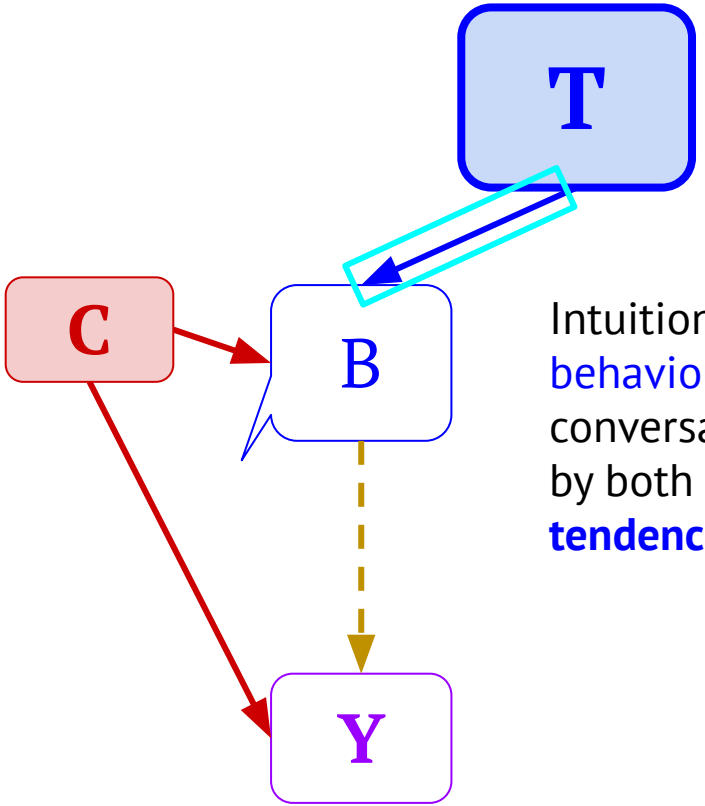

Intuition: an agent's behaviour in a conversation is shaped by both their **tendencies**

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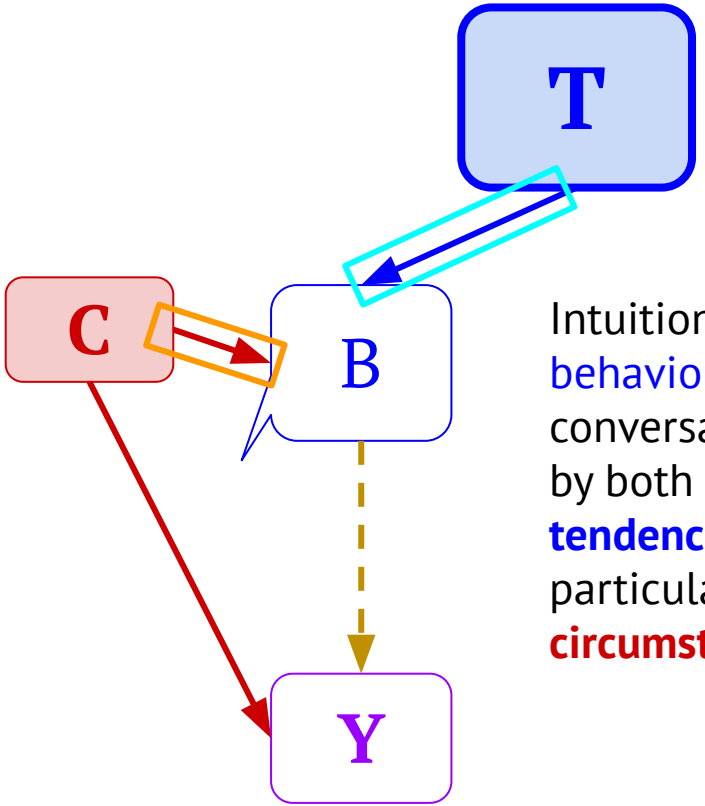
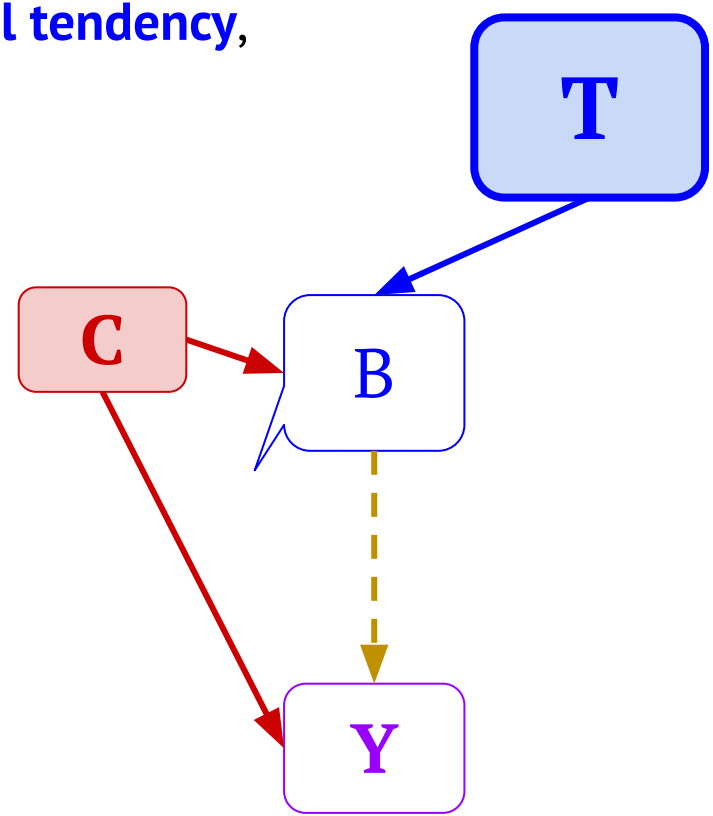


Intuition: an agent's behaviour in a conversation is shaped by both their **tendencies** and the particular **circumstances**

Our motivating task: **tendency-based assignment**

Causal inference problem: estimate **effect of assigning** an agent based on their **behavioural tendency**, as inferred from past conversations



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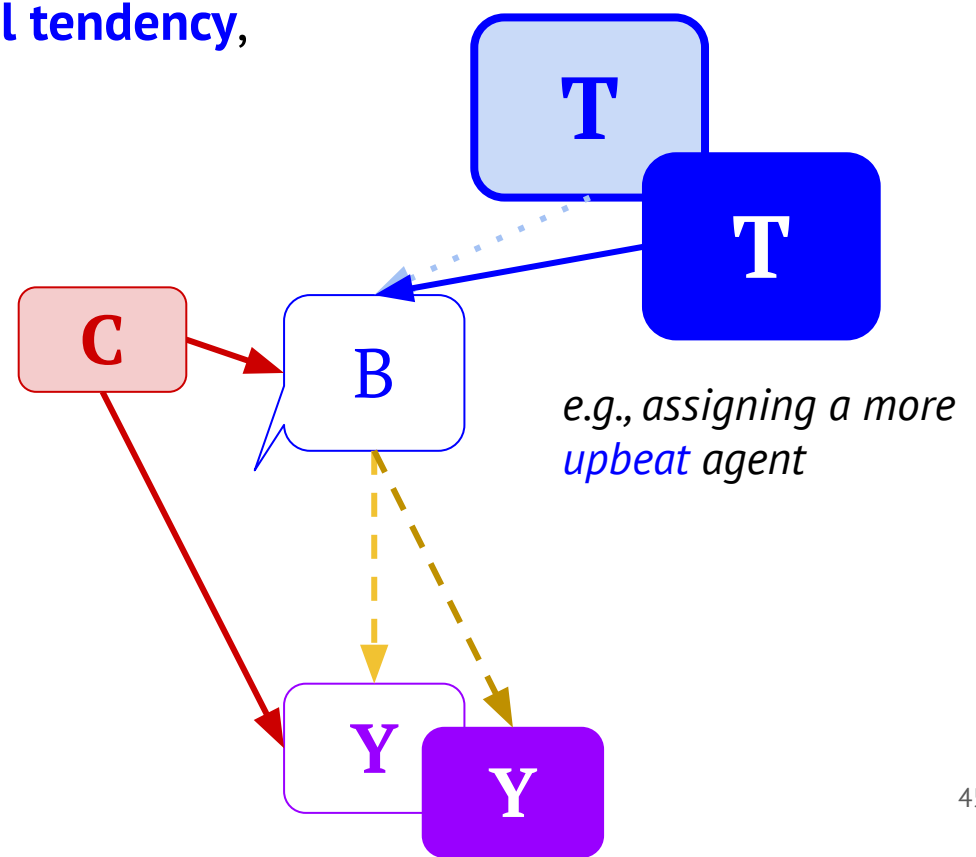

e.g., assigning a more upbeat agent

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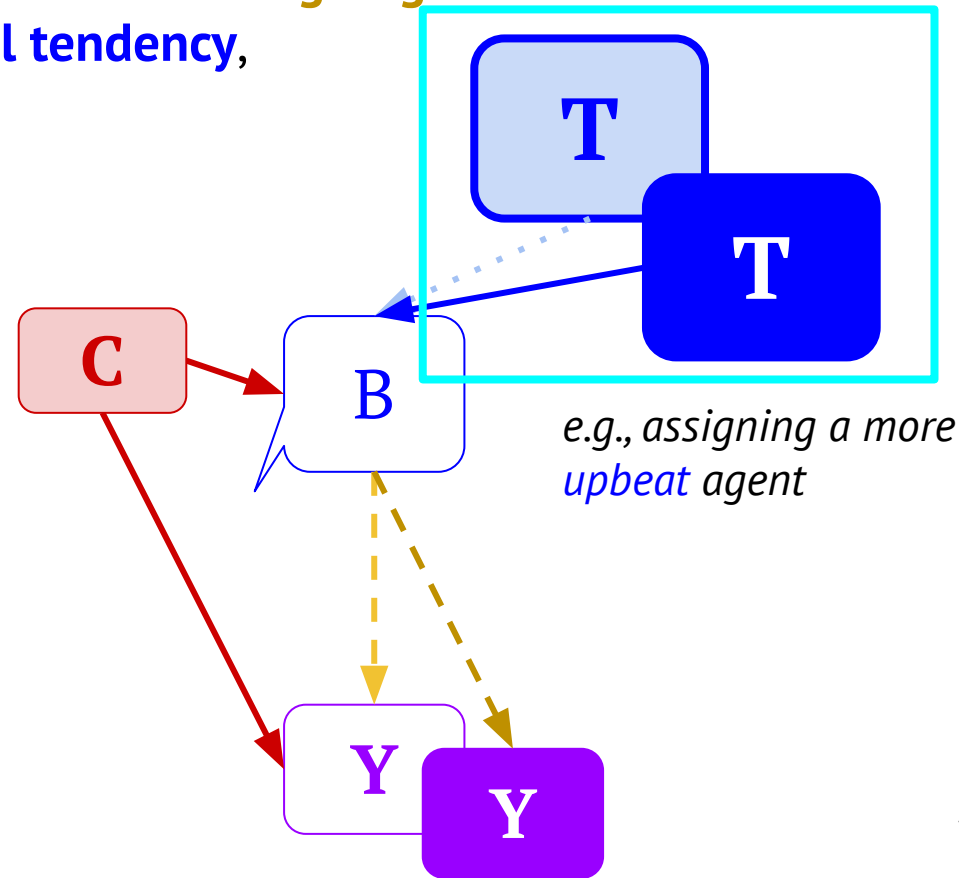
We want to say that two agents get different **outcomes** because their **tendencies** are different



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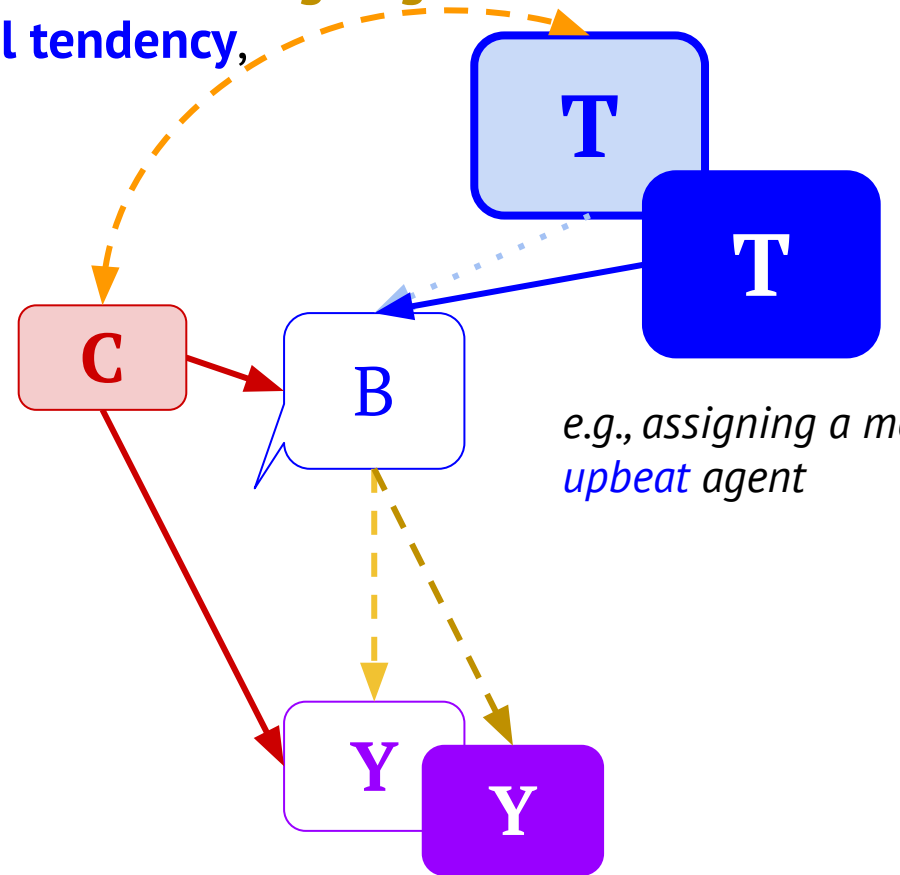
Our motivating task: **tendency-based assignment**

Causal inference problem: estimate **effect of assigning** an agent based on their **behavioural tendency**, as inferred from past conversations

We want to say that two agents get different **outcomes** because their **tendencies** are different,

not because the **circumstances** of their conversations were different



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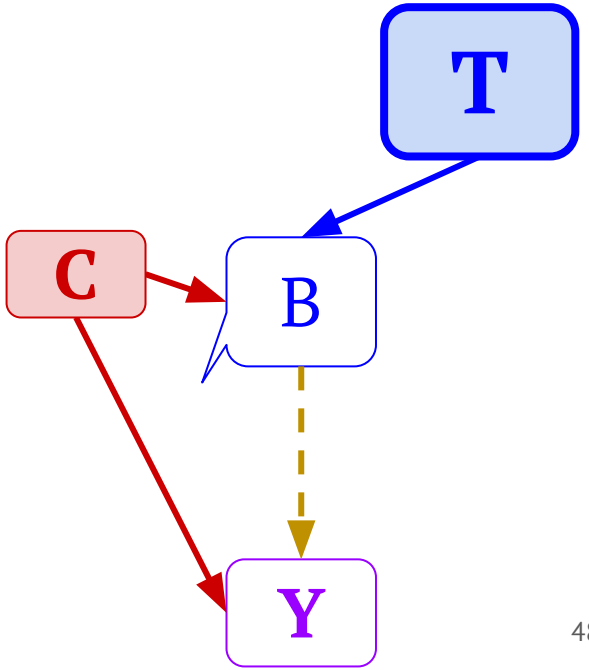

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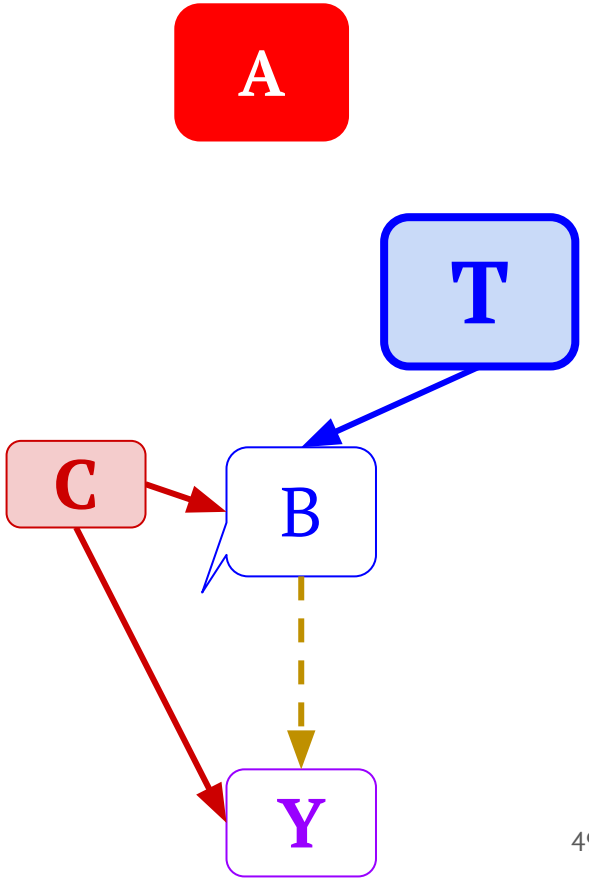

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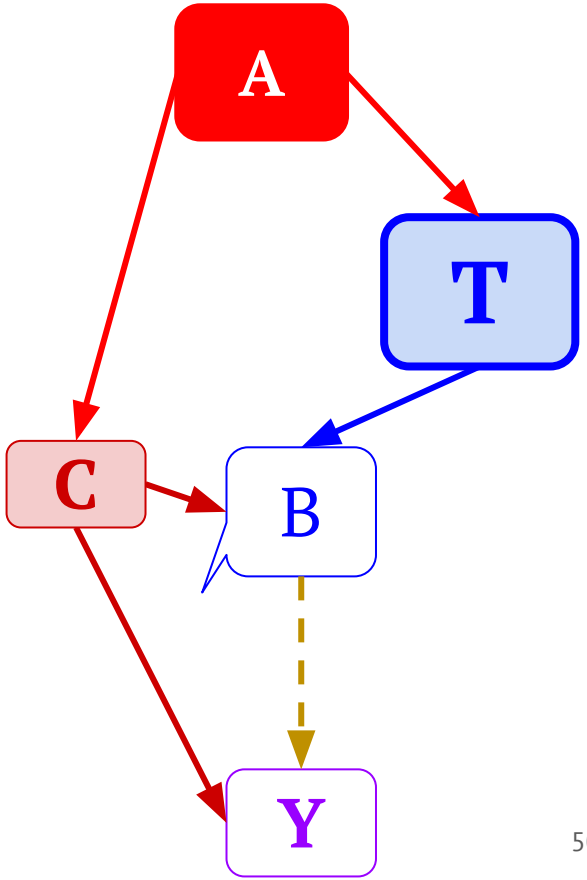

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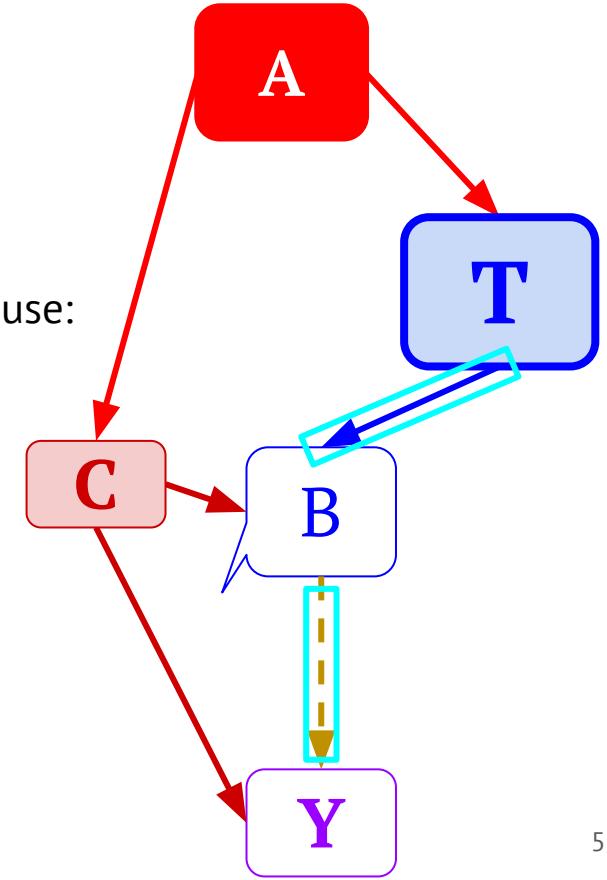
We could observe that two **agents** get different outcomes because:

their **tendencies** are different



Challenge 1: **observed assignment**

Intuition: we can only observe outcomes in conversations that an agent is *assigned* to

We could observe that two **agents** get different outcomes because:

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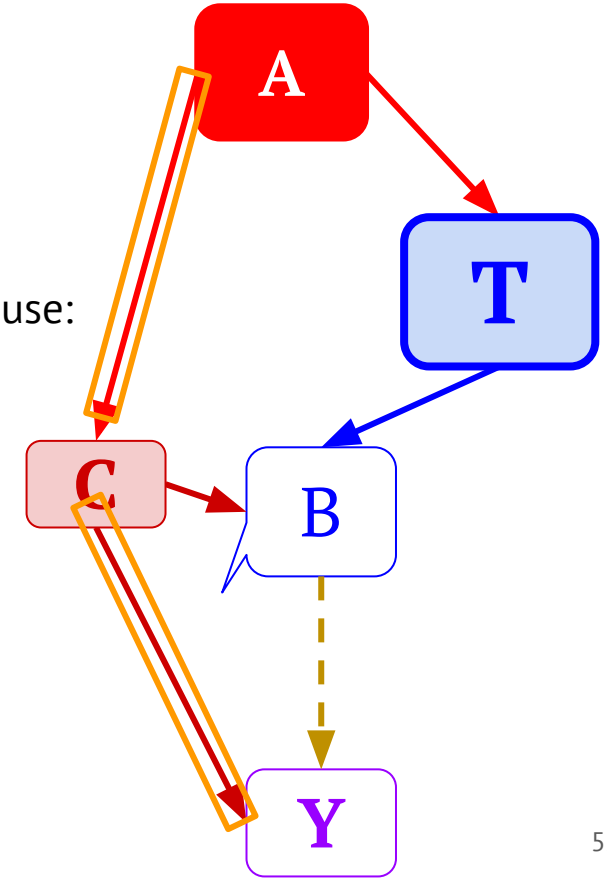

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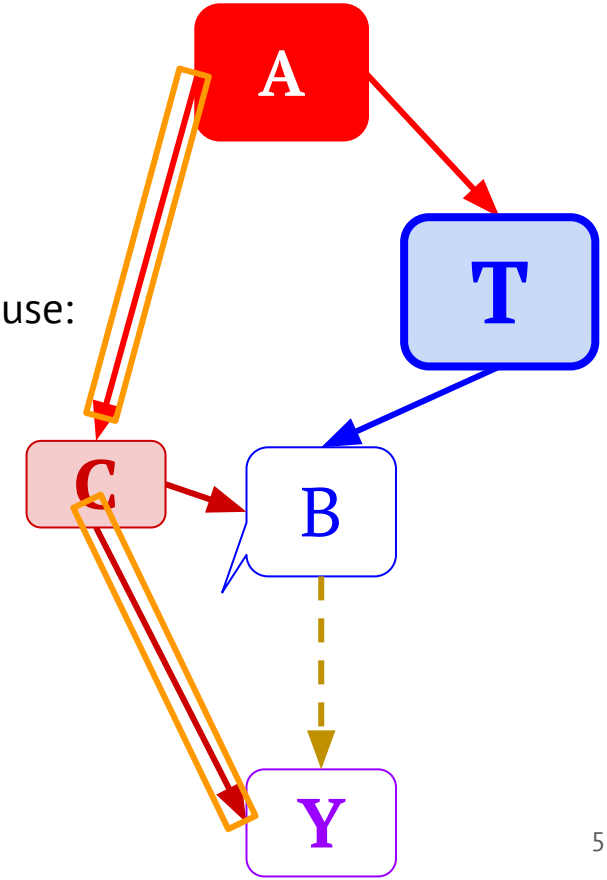

Goal: "break" this causal path

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i.e., only compare agents that take conversations
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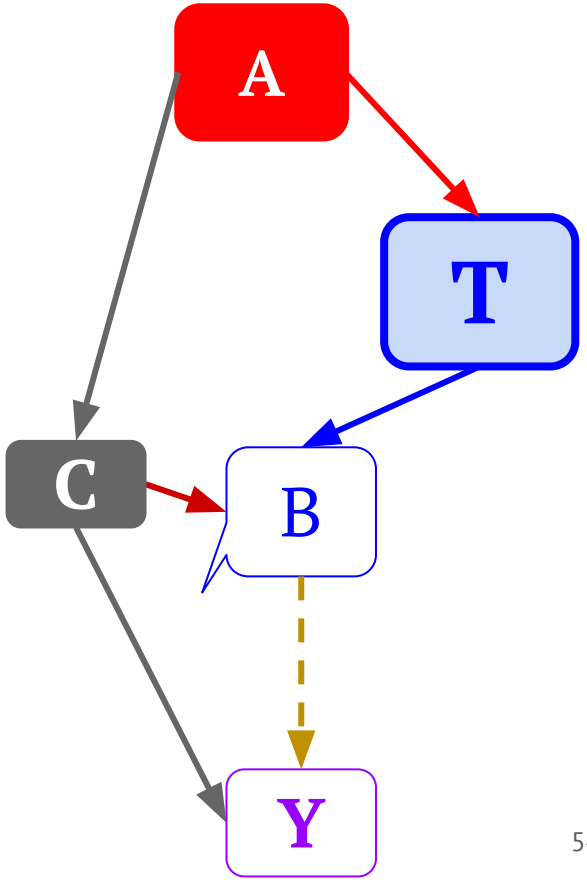

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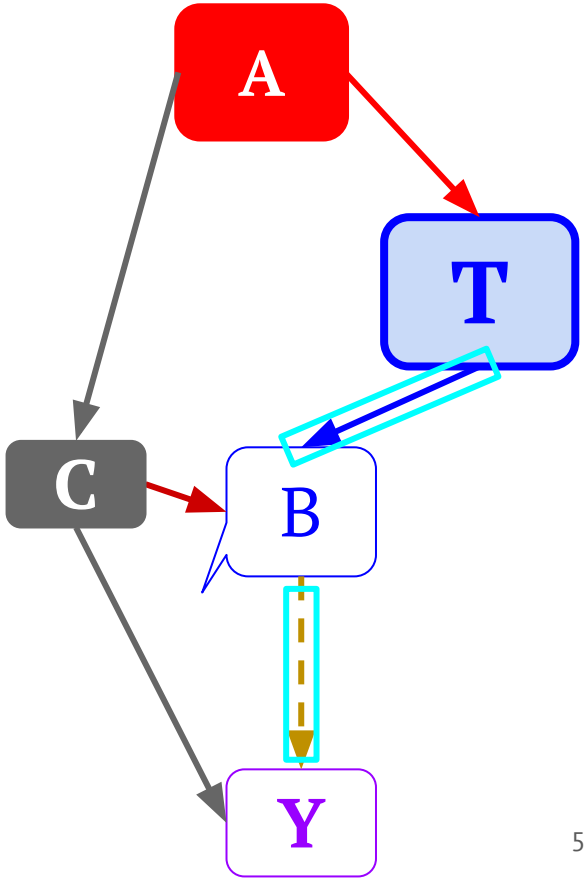

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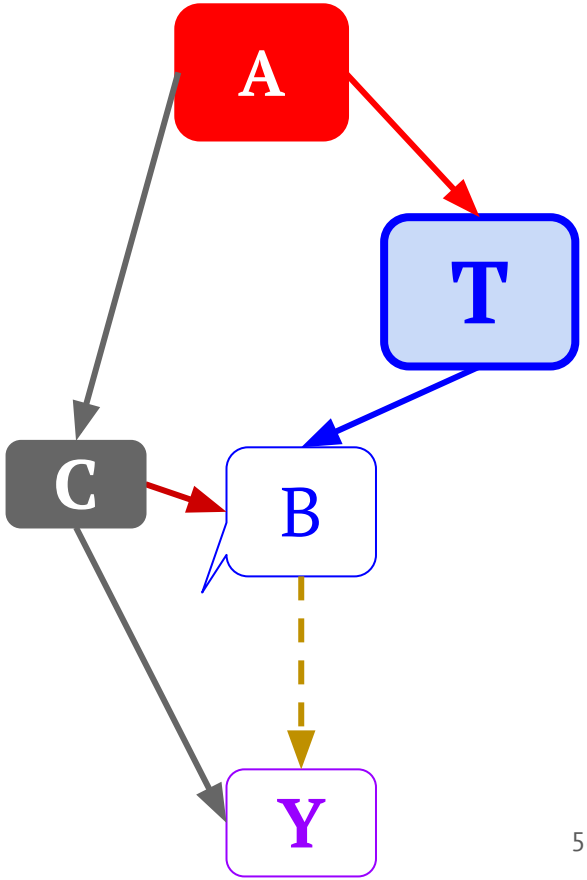

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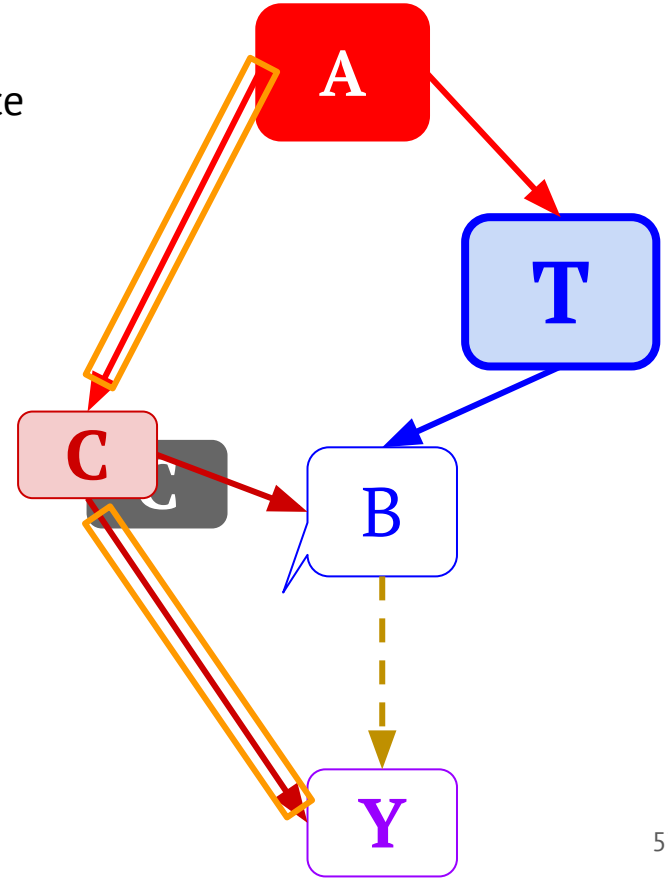

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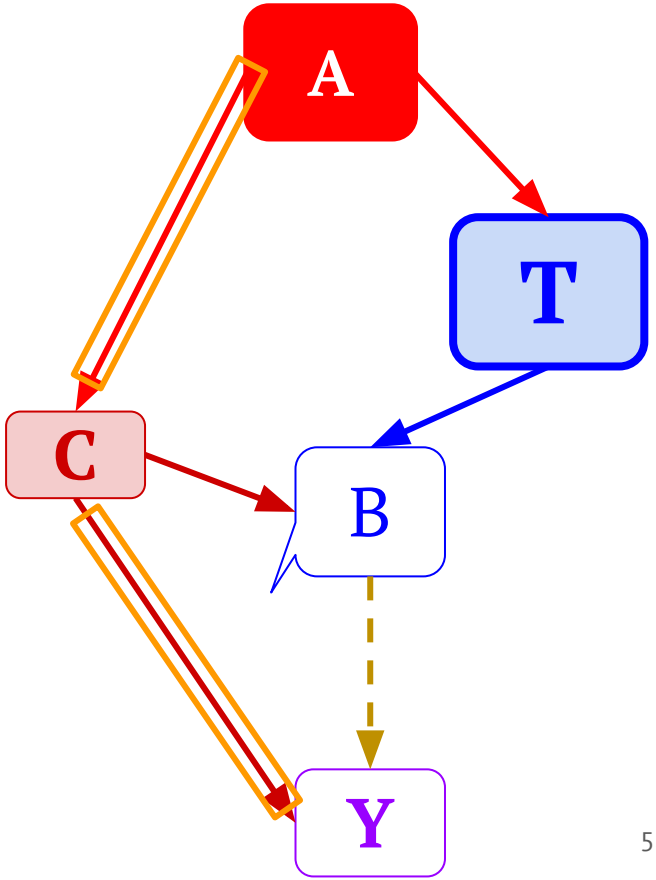

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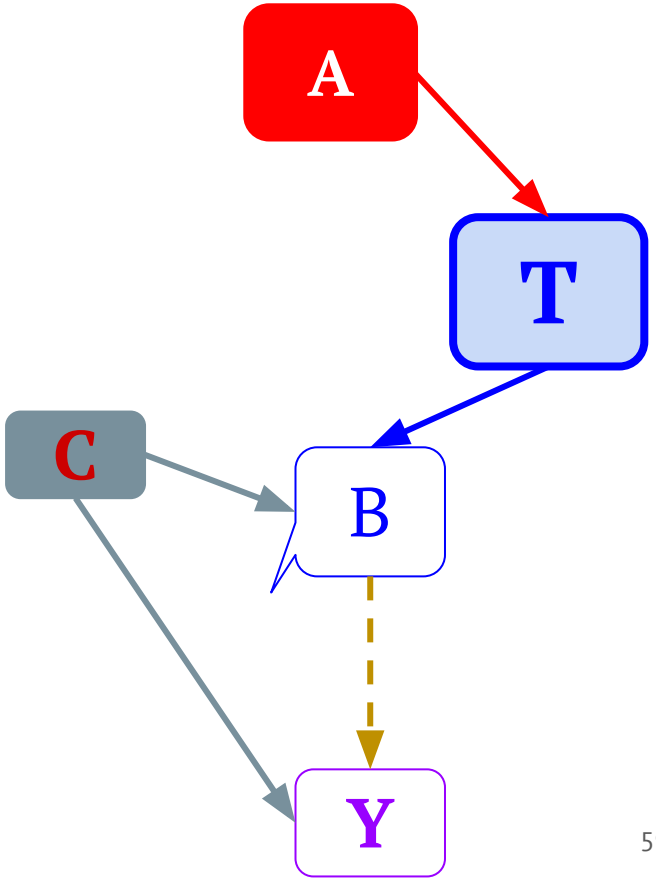

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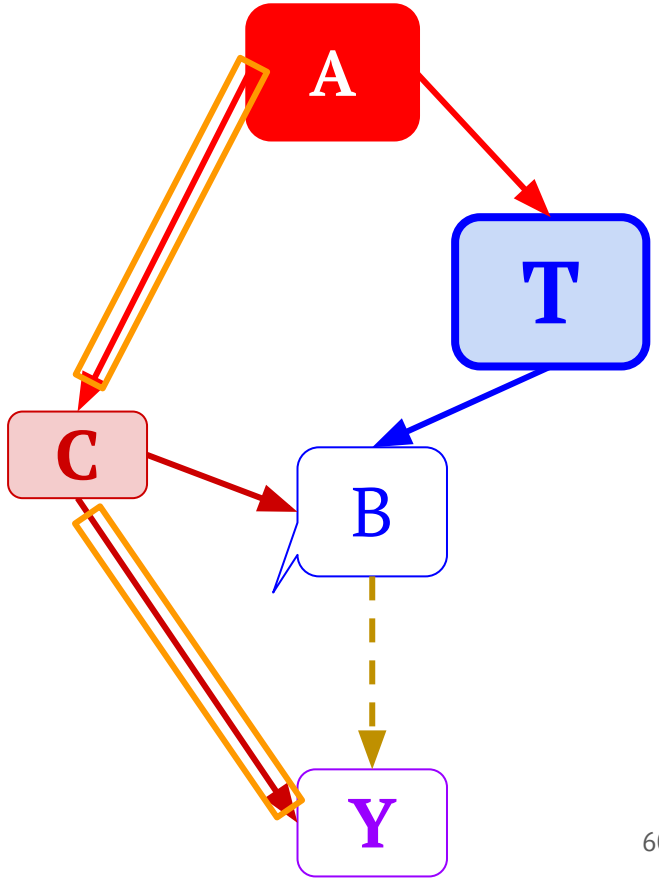

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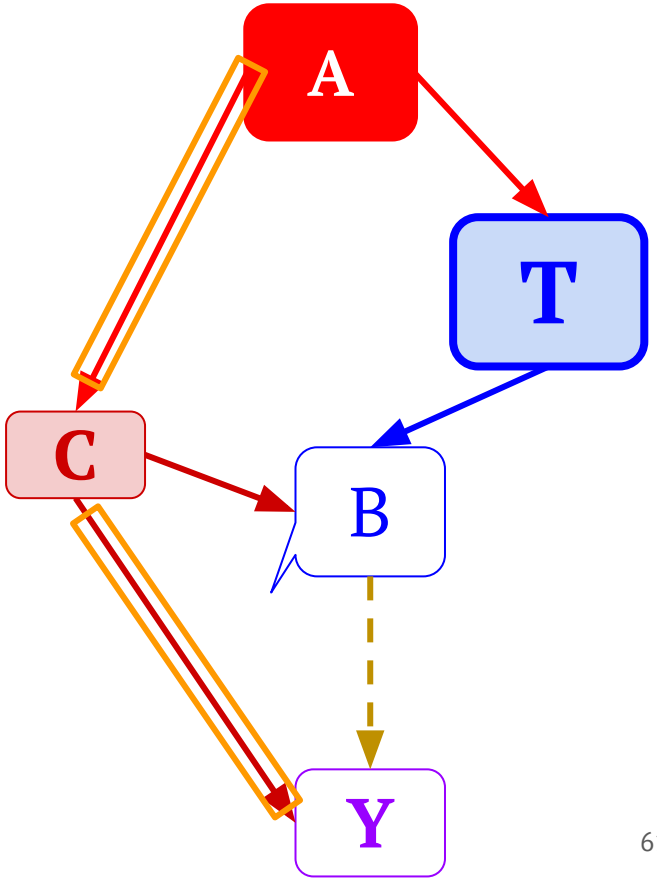
We could still exploit the assignment mechanism



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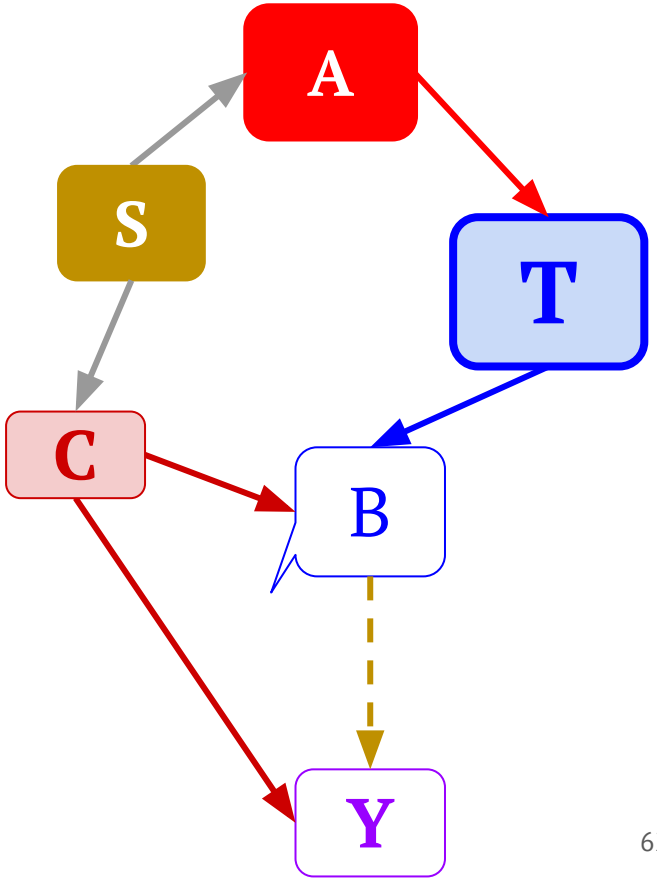
When assignment is governed by an accessible **selector variable S** (e.g., shift, location, department)…

e.g., crisis counselors are **randomly assigned within each shift**



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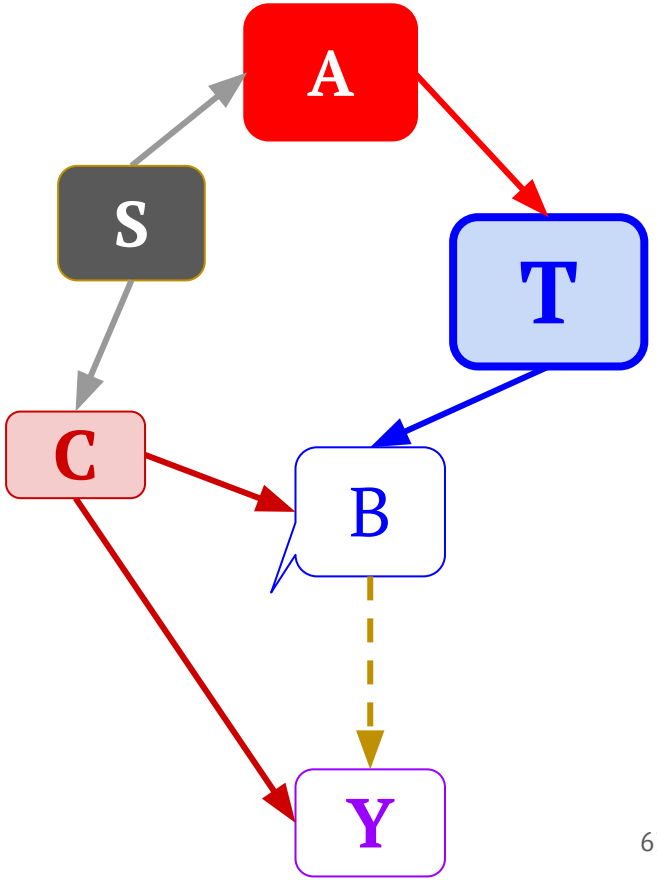

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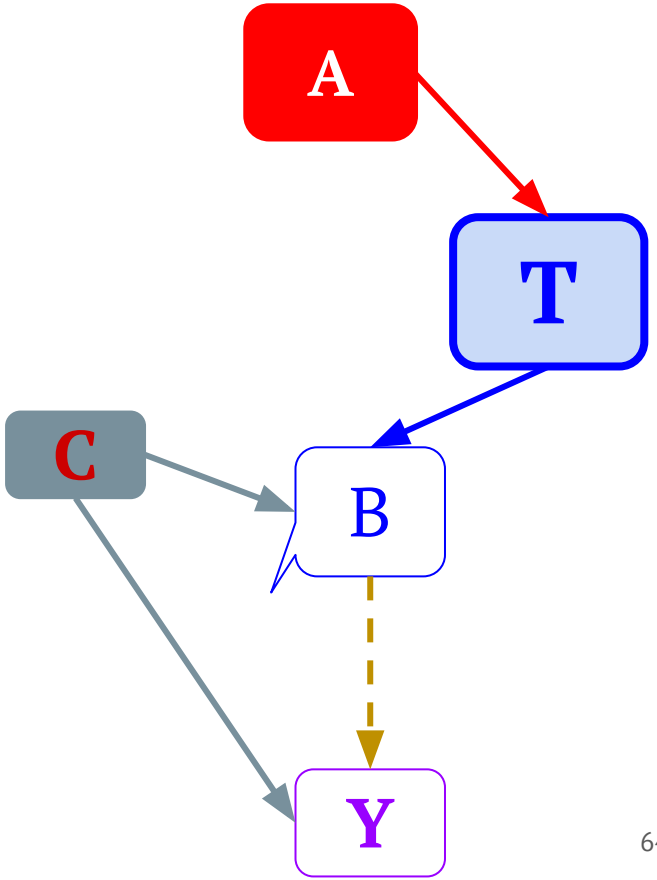
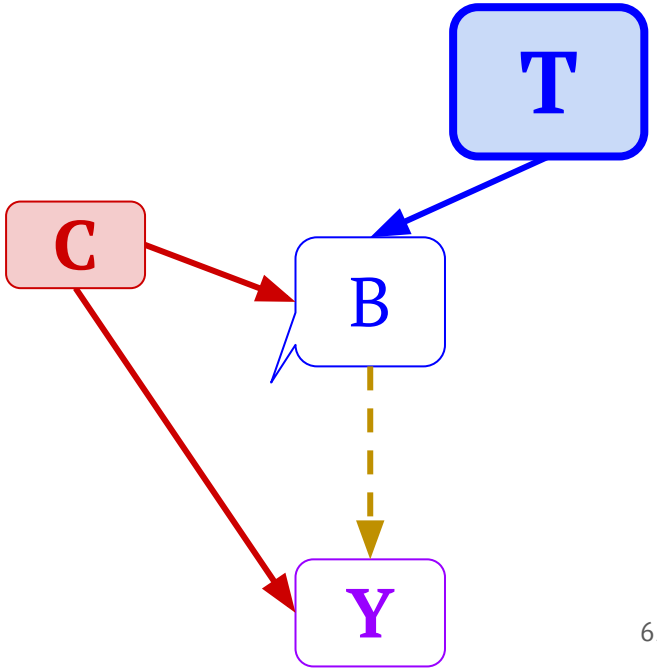


Challenge 2: **interactional effects**



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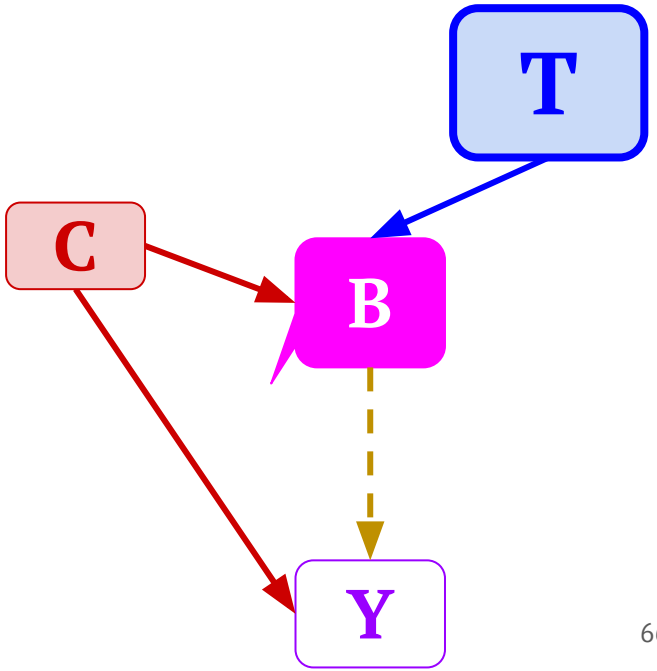

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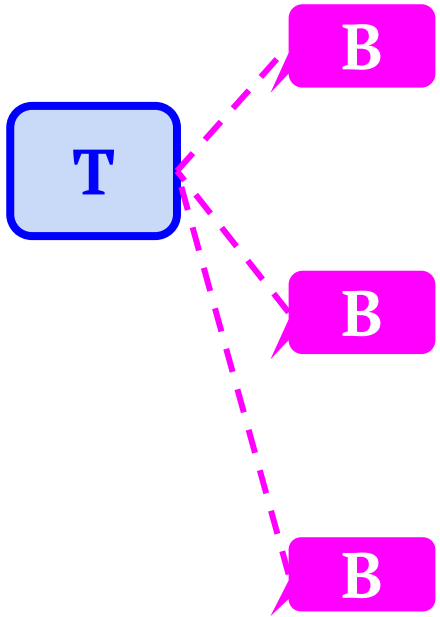

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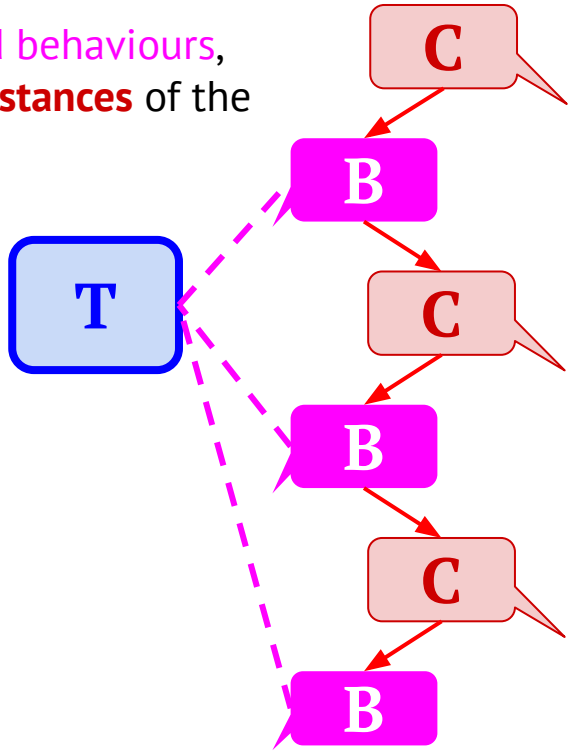

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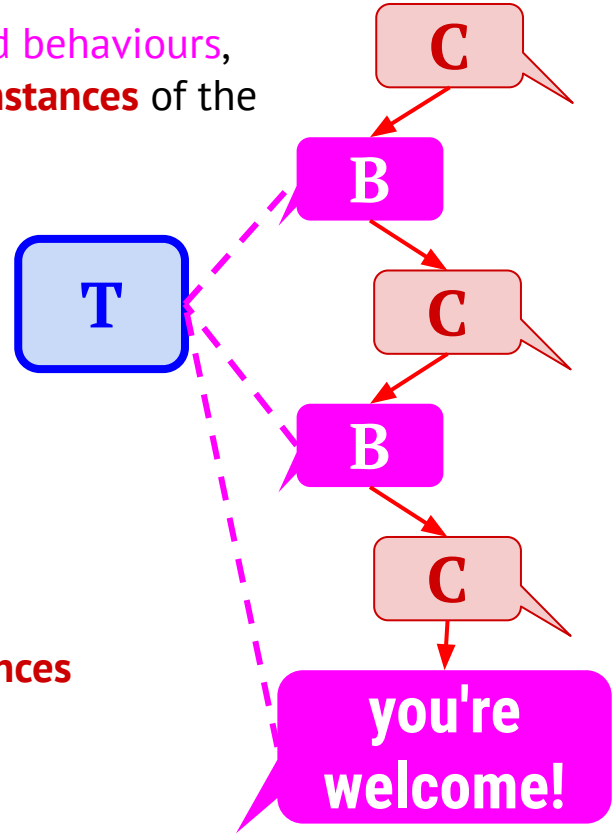

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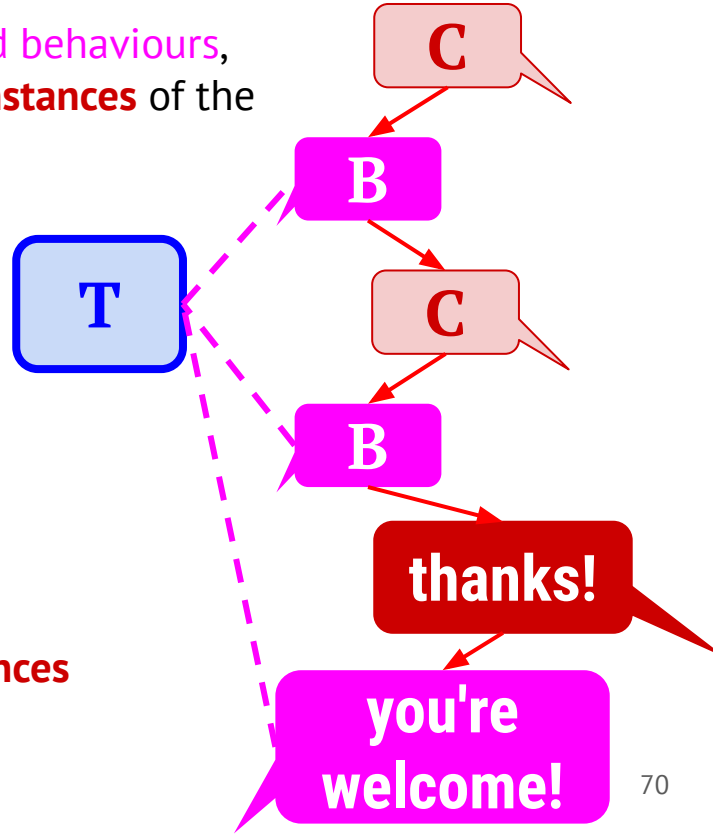

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Challenge 2: **interactional effects**

Wishful thinking: Don’t infer the tendencies based on observed behaviors

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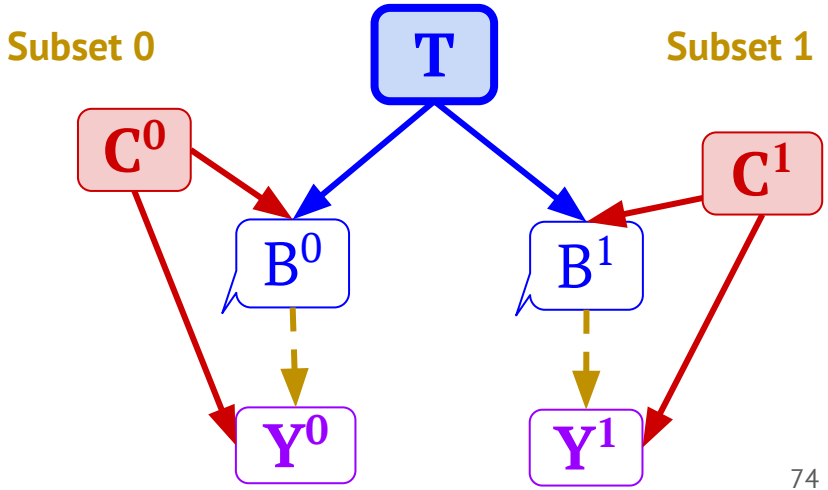
We split their conversations into **two subsets**



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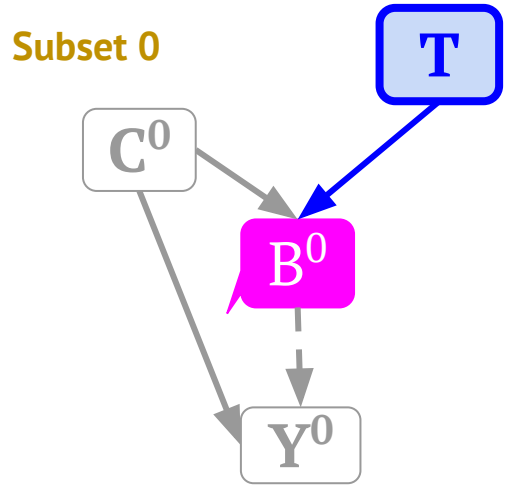

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We measure their **tendencies** on **one subset**
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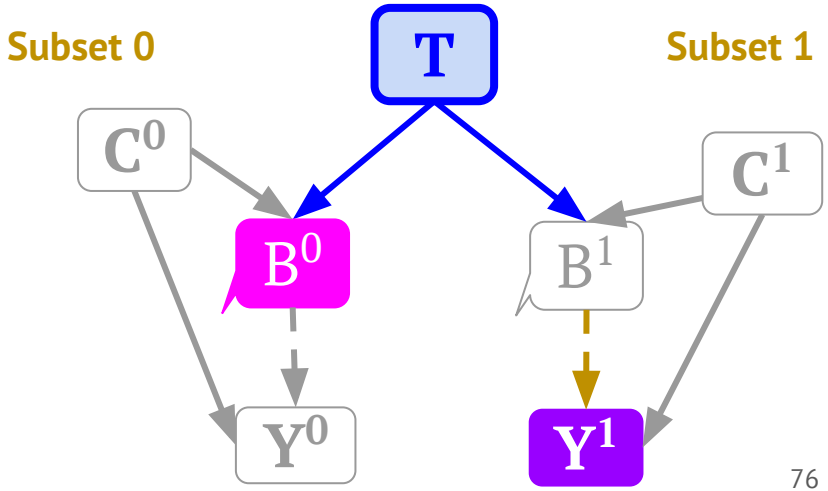

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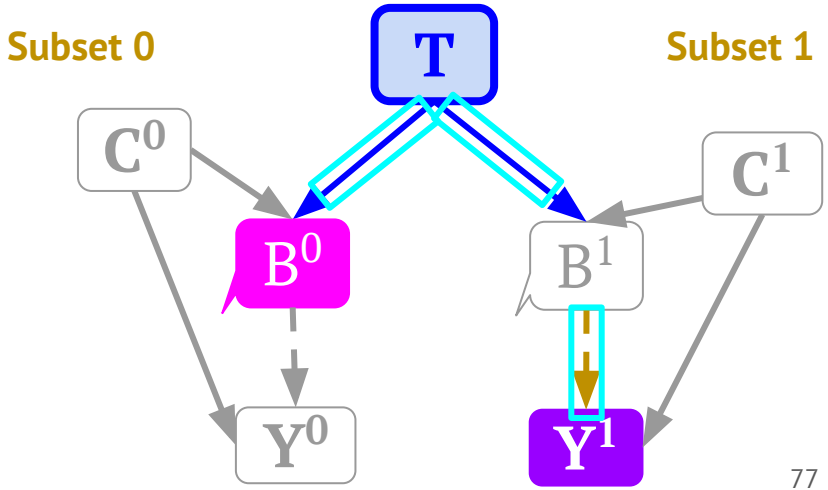

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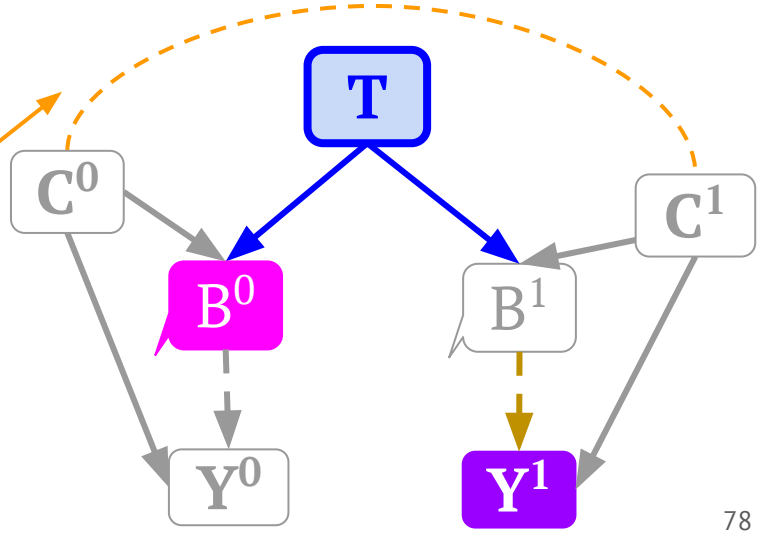
Just as good as having pre-established tendencies
provided circumstances of conversations
aren't related to each other



What do we gain from our concrete description?

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More **precise** inferences about the **relation** between **tendencies** and outcome, i.e., **helpfulness rating**:

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positive sentiment

longer messages

longer conversations

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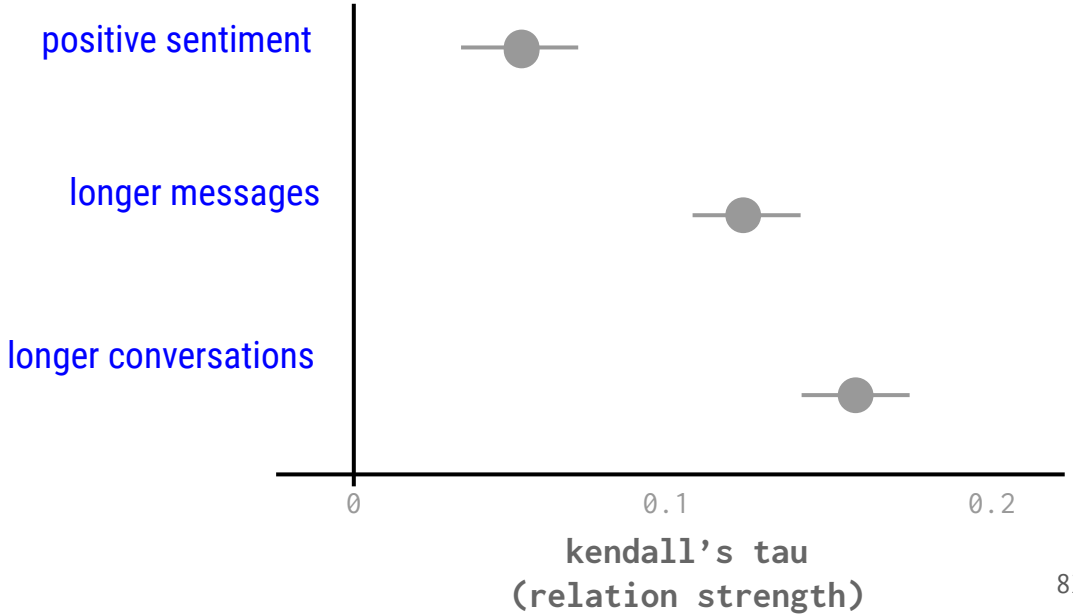

Simple counselor-level correlations

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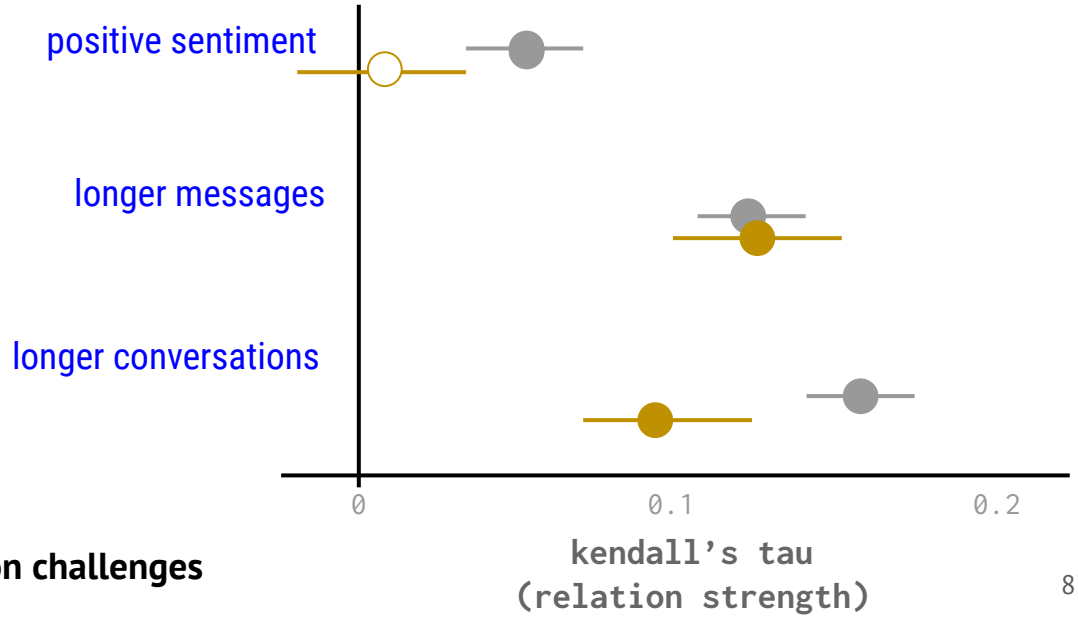

- Simple counselor-level correlations
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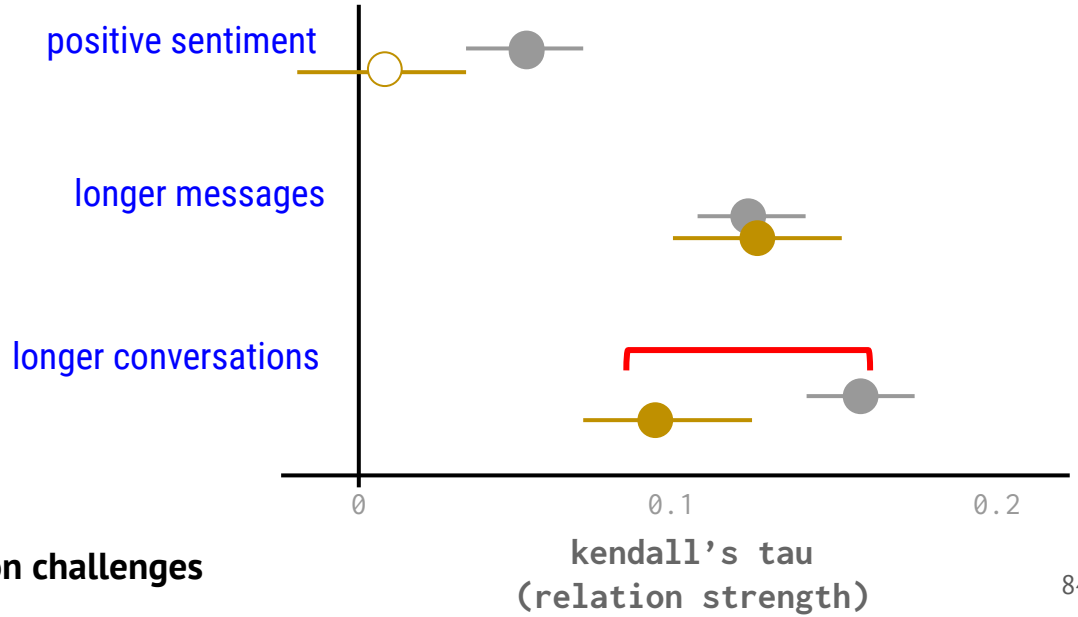

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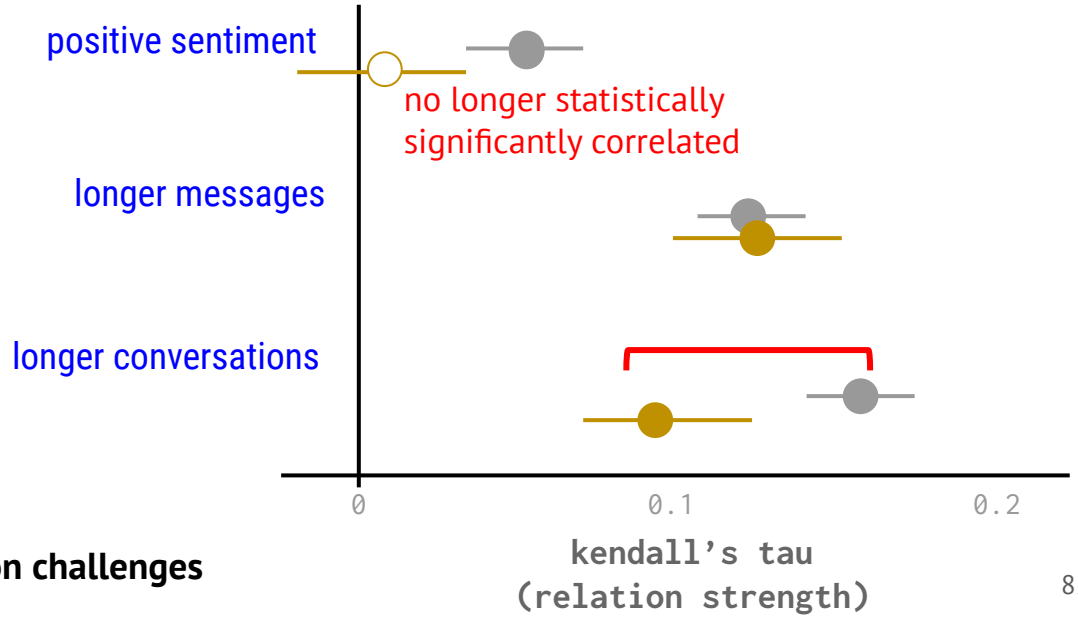

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current % of positively rated conversations: **88%**

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Back-of-the-envelope estimate of the potential impact of a tendency-based assignment policy:

current % of positively rated conversations: **88%**

estimated % under tendency-based assignment policy: **92%****

****Wilcoxon p<0.01; improved (counterfactual) outcome in 74% of shifts**

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Back-of-the-envelope estimate of the potential impact of a tendency-based assignment policy:

current % of positively rated conversations: **88%**

estimated % under tendency-based assignment policy: **92%****

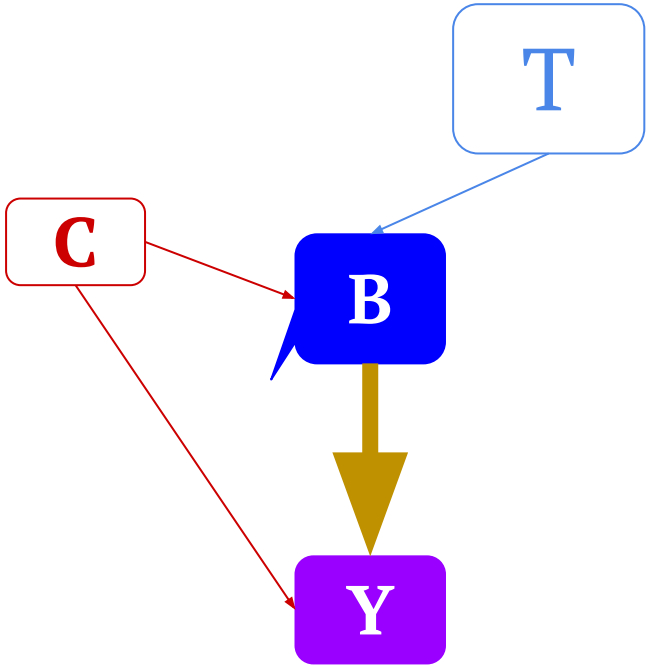
estimated % under historical efficiency assignment policy: **90%**

****Wilcoxon p<0.01; improved (counterfactual) outcome in 74% of shifts**

What we did **not** gain from our concrete description?

Causal effects of individual **actions in a conversation**

needed for training policies or assistance



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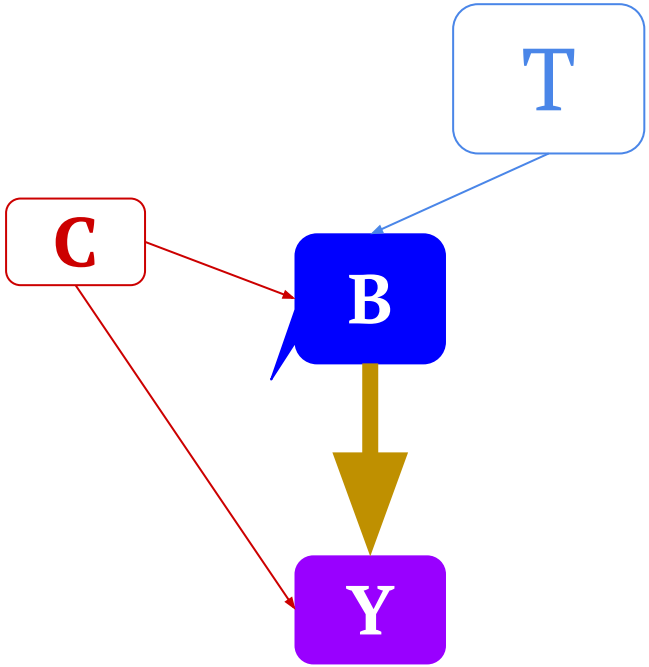
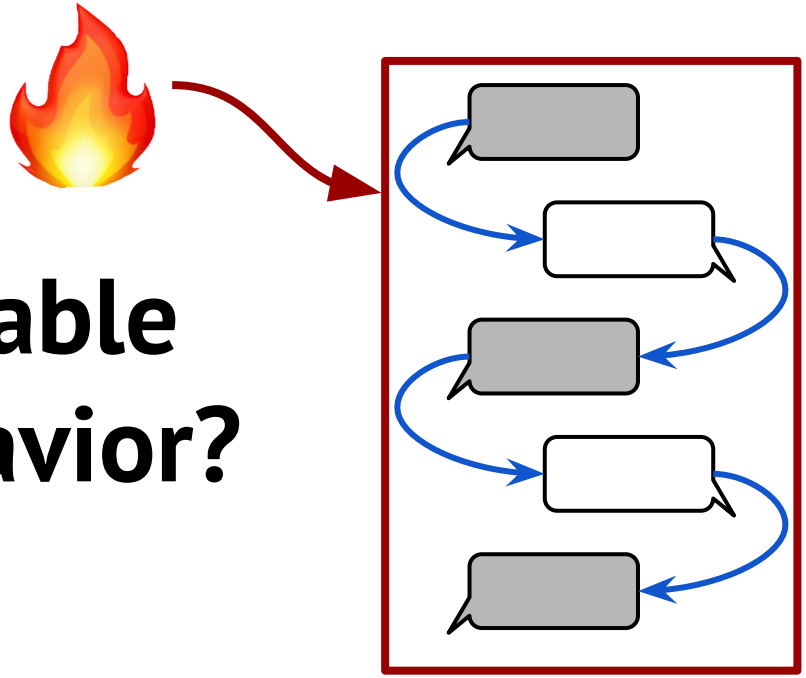


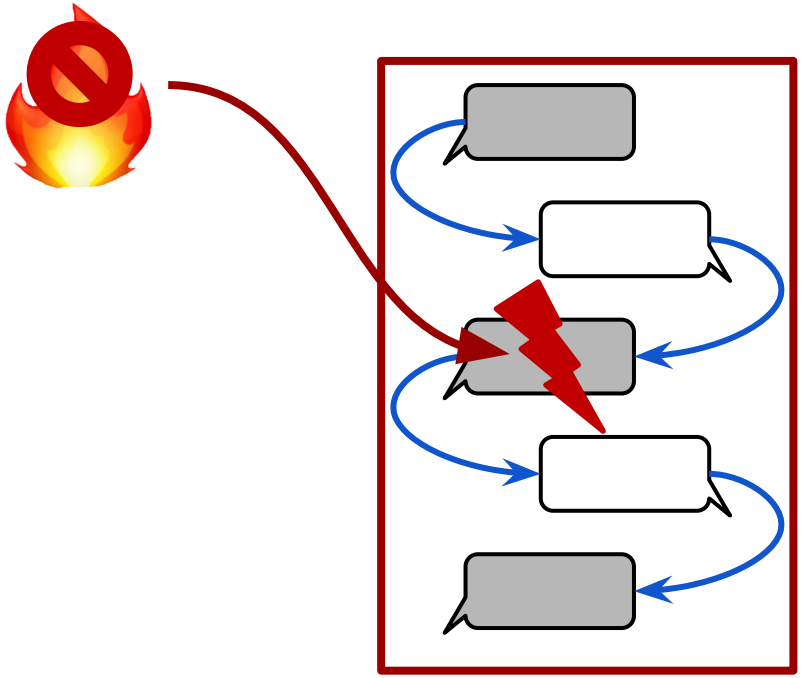


What leads to desirable conversational behavior?

Content removal as a moderation strategy
Kumar Bhargav Srinivasan,Cristian Danescu-Niculescu-Mizil,
Lillian Lee, Chenhao Tan
Proceedings of CSCW, 2019

Empirical setting:
Moderation of online discussions

r/ChangeMyView moderators
manually removed ***23k***
comments over 3 years

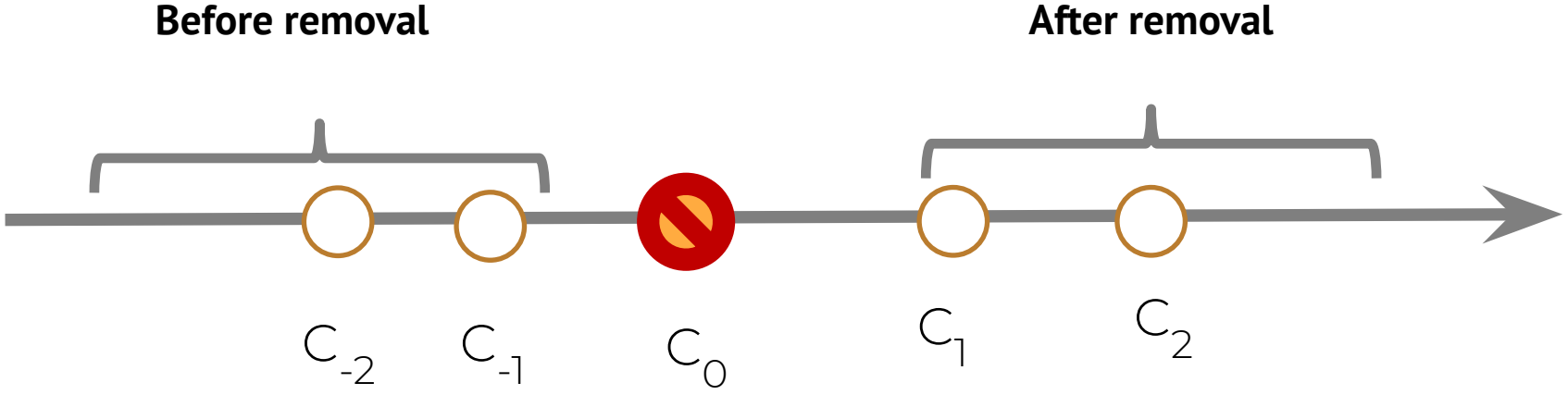


Does the removal of a problematic comment (by a moderator)
lead to a compliant* behavior (by the author of the removed comment)?

*: compliant ≠ better (moderation can be both good and bad)

Does removal of a noncompliant message (by a moderator) lead to compliant behavior (by the author of the removed comment)?

Standard attempt: compare behavior before removal with behavior after removal, i.e., interrupted time-series approach



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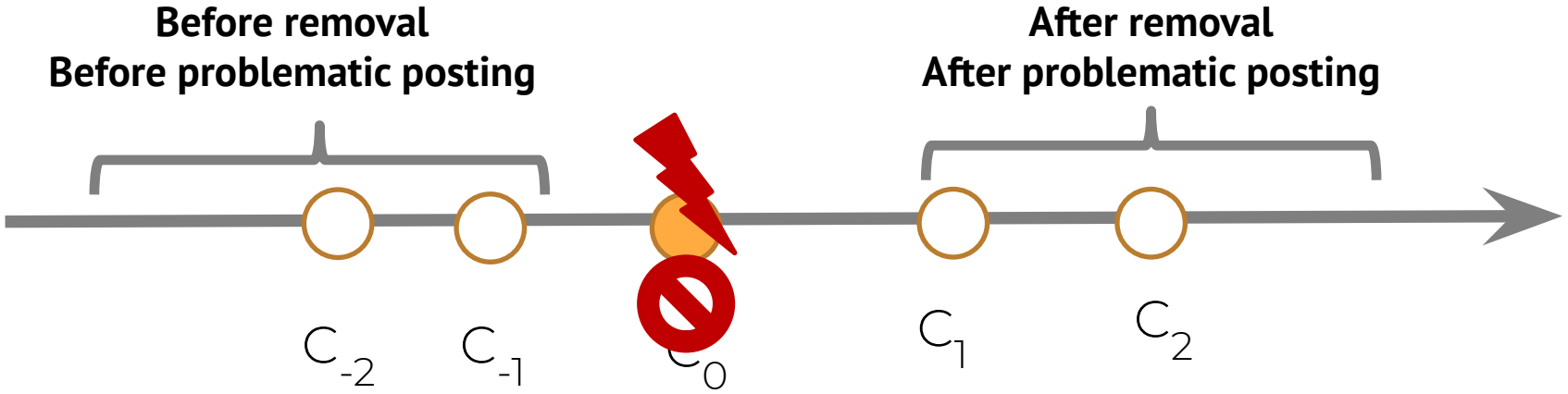

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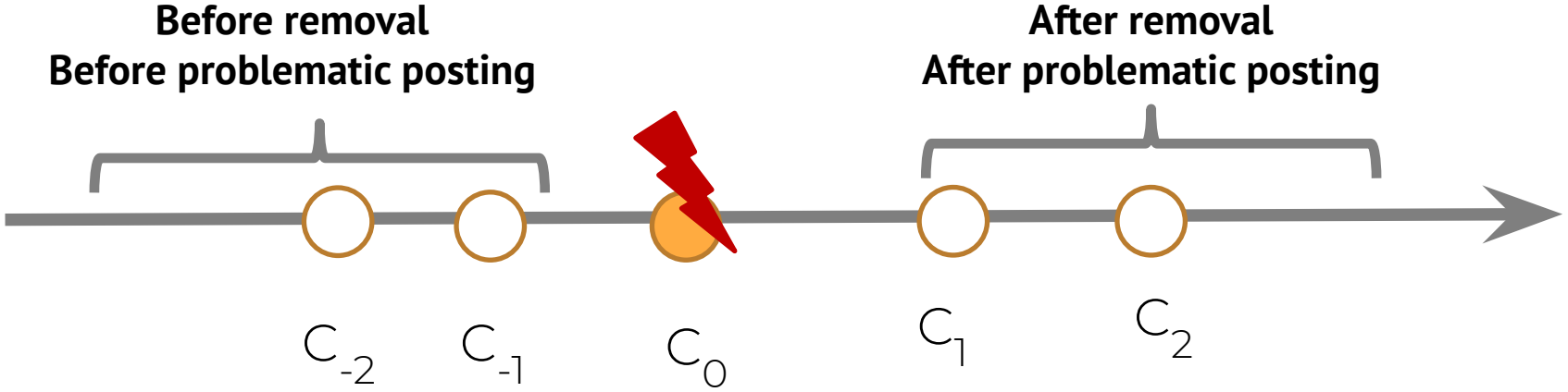


But: the removal and the circumstances comment are confounded
Missing counterfactual: problematic comments that are **not** removed

Challenge 3: missing counterfactual

Wishful thinking: find situations in which the problematic comment is **not** removed

Challenge 3: missing counterfactual

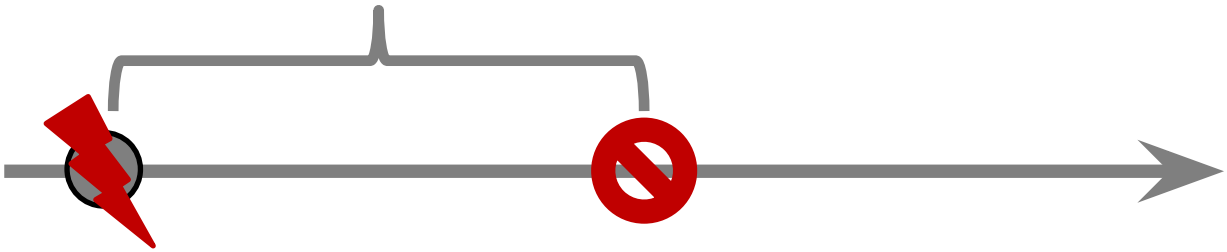
Wishful thinking: find situations in which the **same** problematic comment is **not** removed

Challenge 3: missing counterfactual

Wishful thinking: find situations in which the **same** problematic comment is **not** removed

Observation: removals don't happen immediately

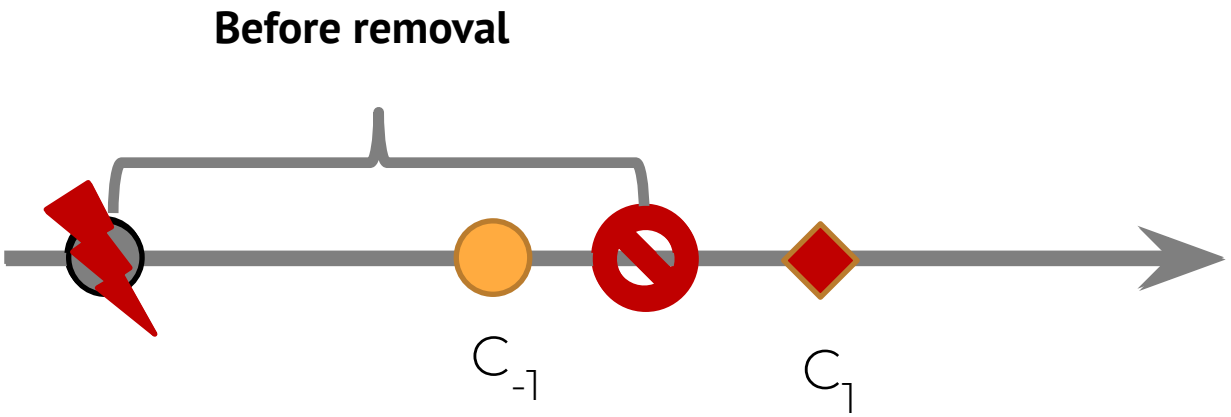
Delay between posting and removal
>2 hours in 40% of cases



Challenge 3: missing counterfactual

Wishful thinking: find situations in which the **same** problematic comment is **not** removed

Observation: removals don't happen immediately



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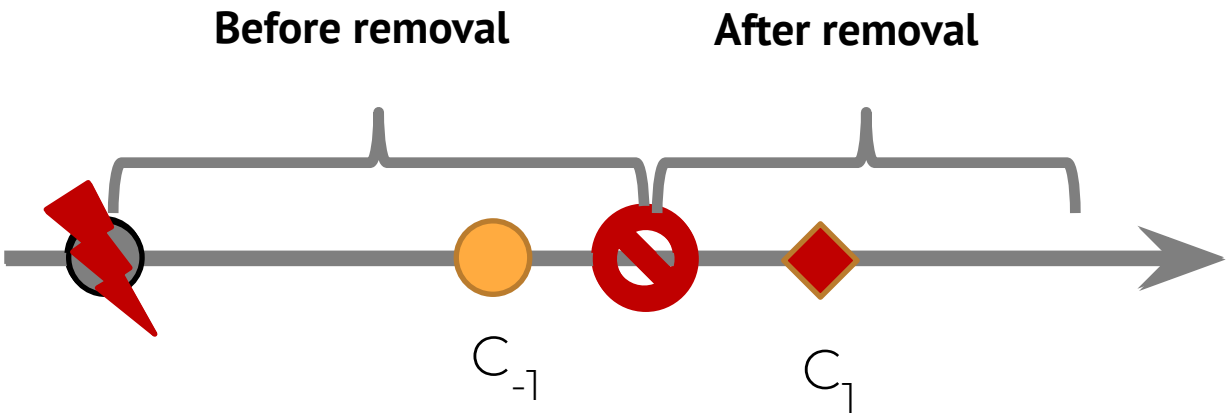

Challenge 3: missing counterfactual

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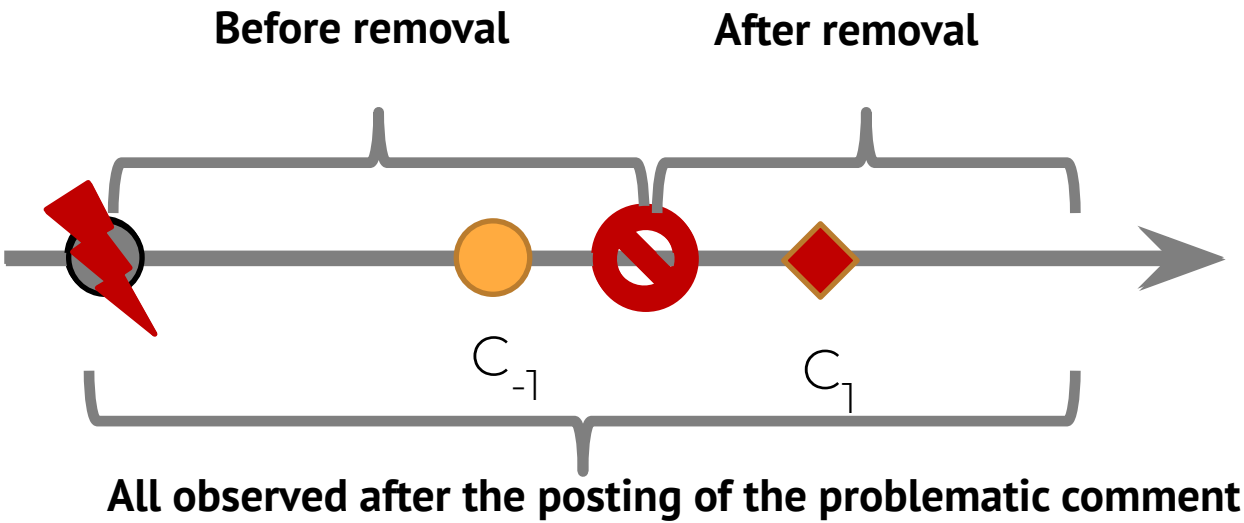
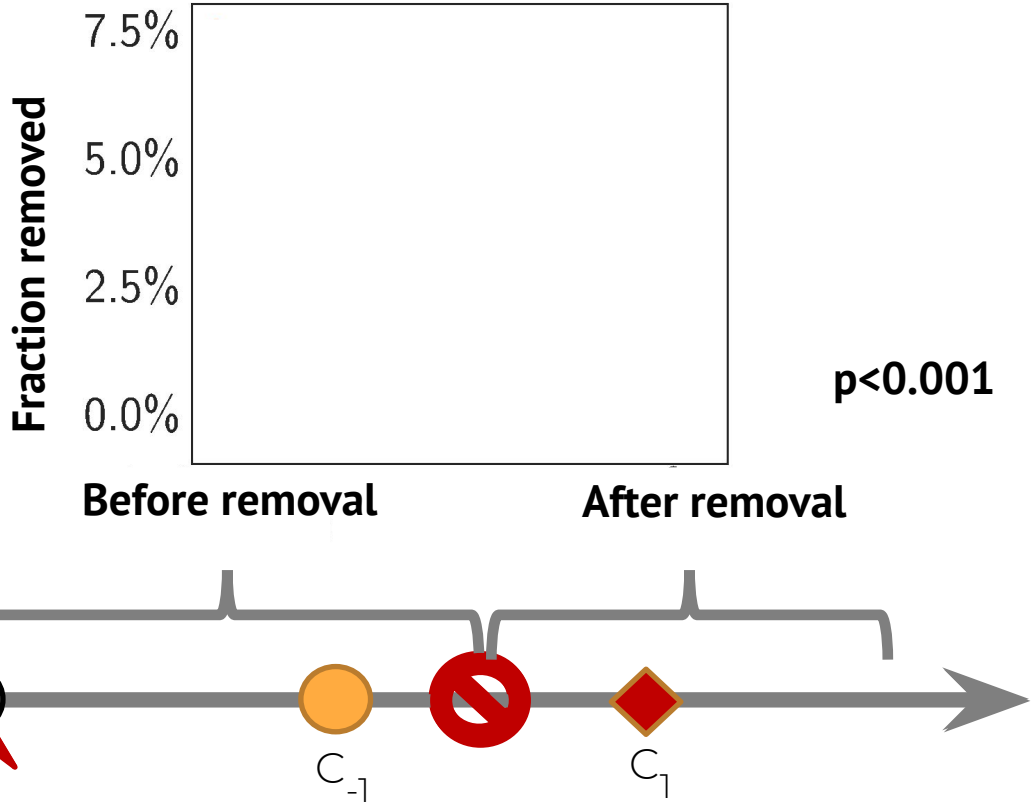
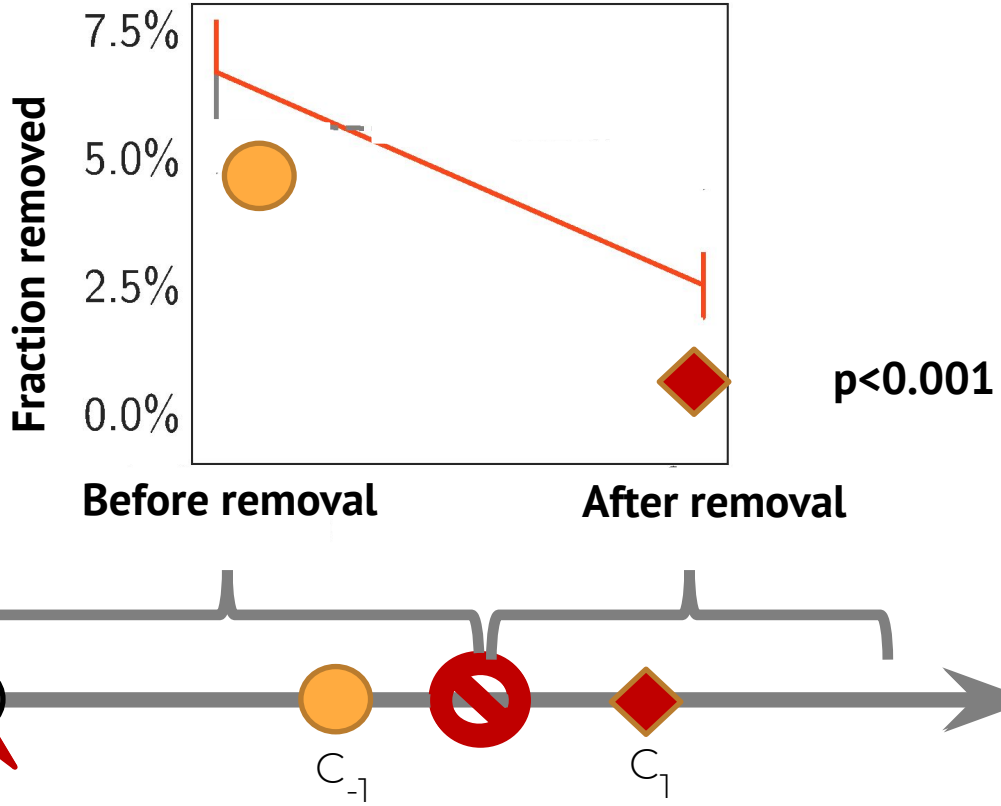


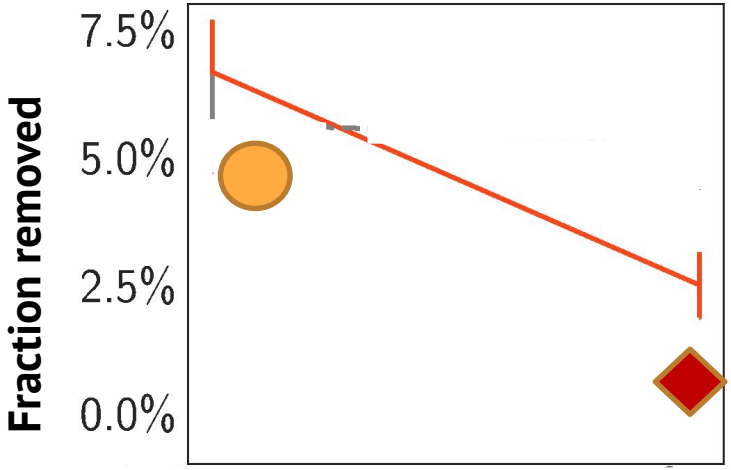


Does removal of a noncompliant message lead to compliant behavior?

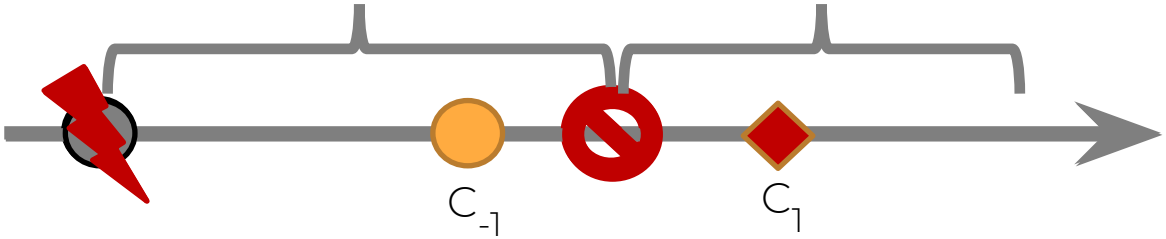


Does removal of a noncompliant message lead to compliant behavior?

Looks like it.

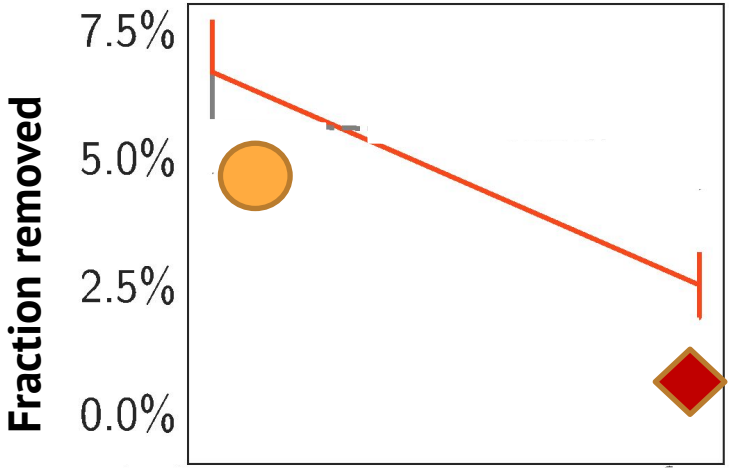


p<0.001



Does removal of a noncompliant message lead to compliant behavior?

Looks like it. Or are these just temporal effects?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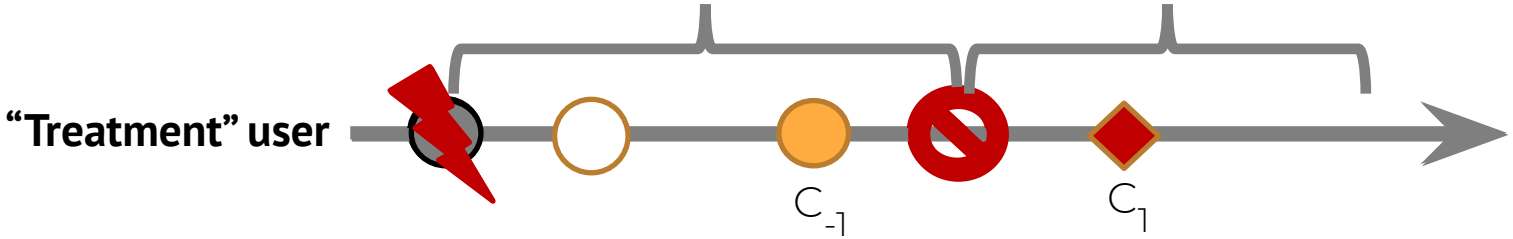
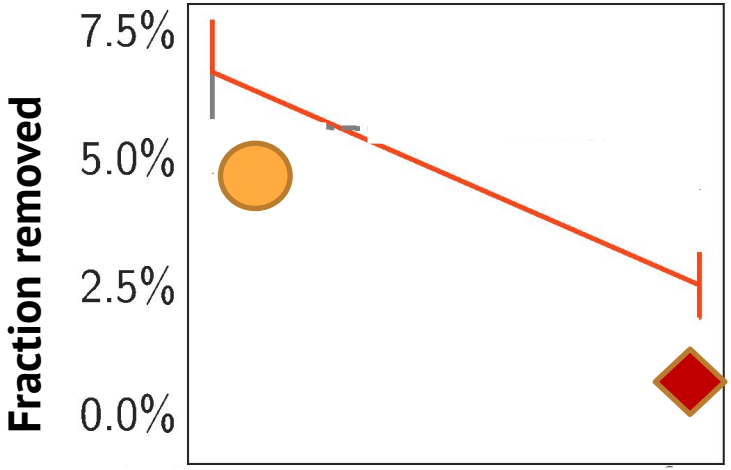

"Treatment" user
C-1
C1


"Control" user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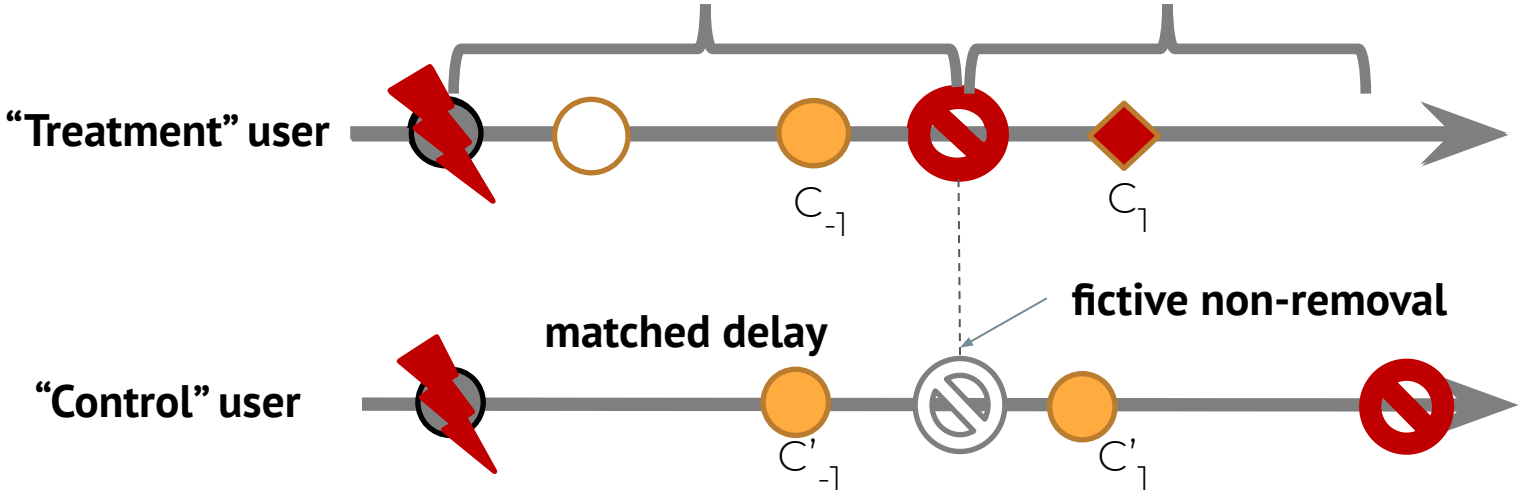
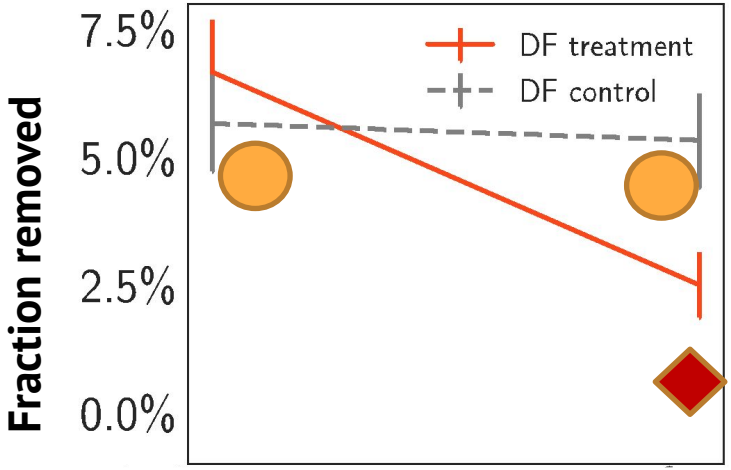

"Treatment" user
C -1
C 1
fictive non-removal
matched delay
"Control" user
C' -1
C' 1


Fraction removed
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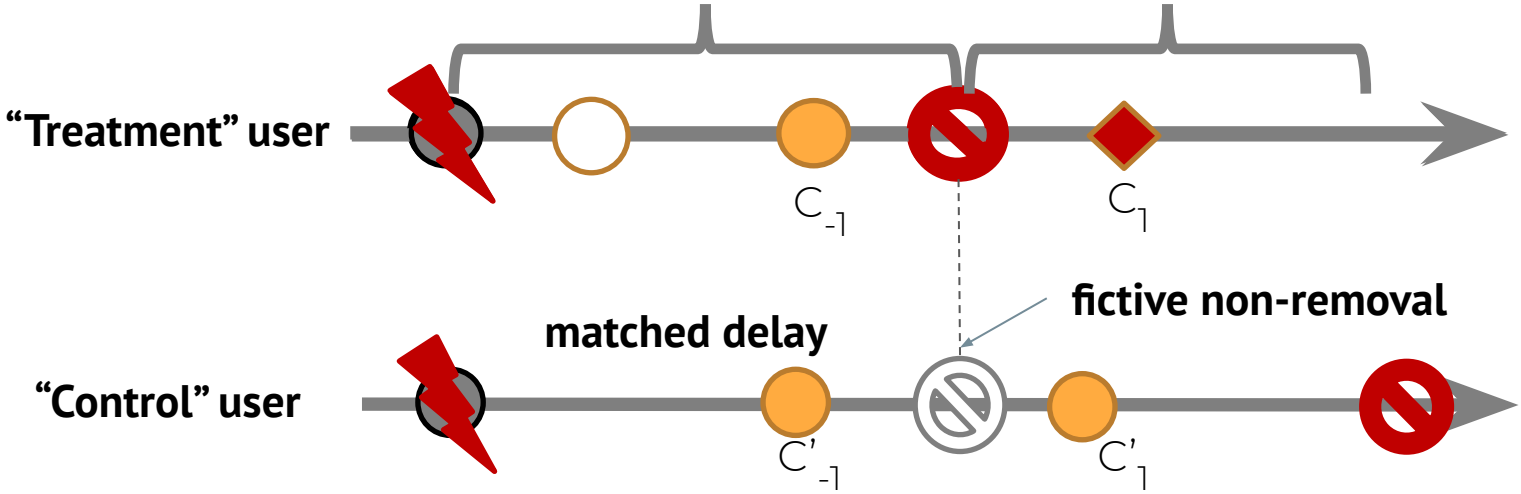
DF treatment
DF control


"Treatment" user
C -1
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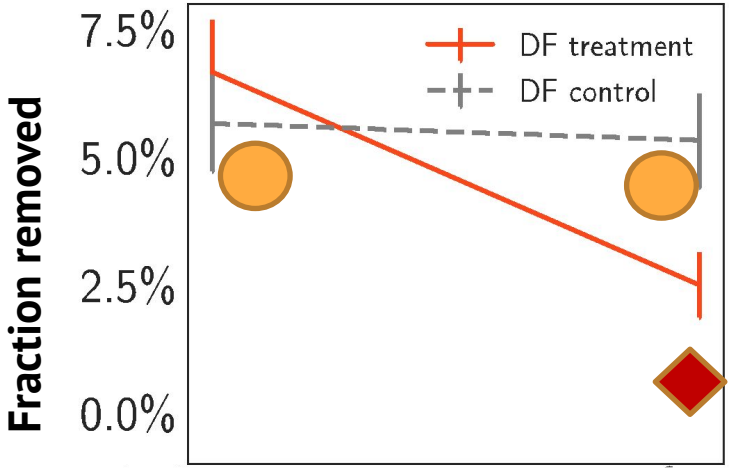
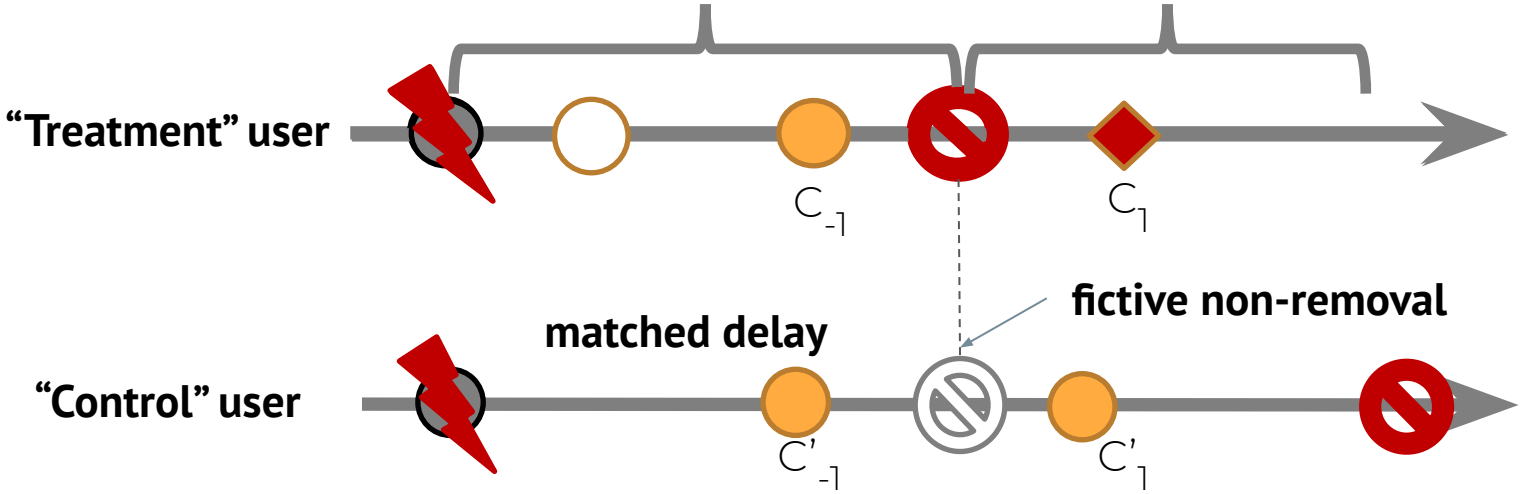


No temporal difference without removal



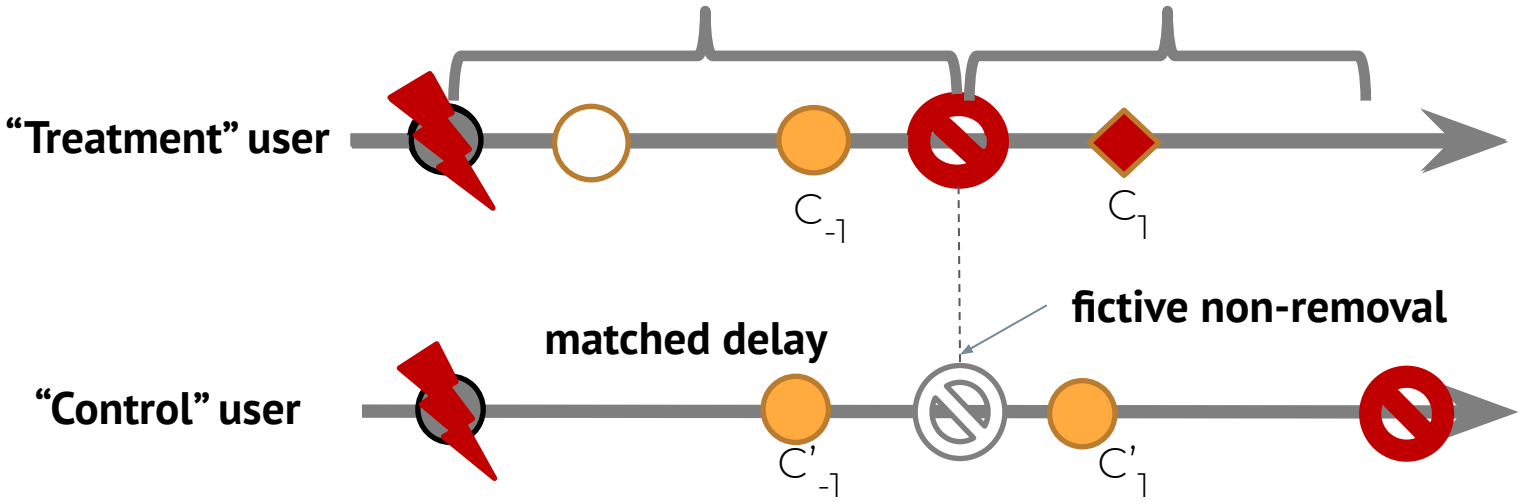
“Delayed feedback” paradigm

Provides a way to find the missing counterfactual in observational data

Limitation: we can only claim causality about active users,
who comment twice between posting and removal
(other caveats in the paper)

Good enough if we only care about active users

Again, we narrowed the scope of our claim to render it tractable



Takeaways

Making causal claims about conversations is hard, but don't give up

Formally describing why that is hard pays off

Wishful thinking as a conceptual mechanism

- Imagine ideal setting needed for establishing "truly causal" relations
  - e.g., random assignment, access to counterfactual situations
- Formally describe what is missing in our non-ideal observational setting
- Find an alternative that is just as good (or good enough)
  - Potentially by narrowing the scope of the claim to make it tractable

Thank you!