# Soft Presuppositions as Scalar Implicatures in Signalling Games

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# CONTENTS

1 Introduction

2 The Models

3 Applications

4 Summary and Future Work

# Introduction


Angelo *won* the contest.

→ Angelo *participated in* the contest.

Presupposition in **pragmatic** sense is to be taken for granted (Stalnaker 1972) ; or interlocutors purported to (Lewis 1979).

# Introduction

**Presupposition Projection**

**uniform**

Heim (1983)
Beaver (2001)

Angelo *won* the contest.
Angelo didn't *win* the contest.
If Angelo *won* the contest, he will celebrate.
Did Angelo *win* the contest?
It's possible that Angelo *won* the contest.
→ Angelo ***participated in*** the contest.

# Introduction

**Presupposition Projection**

**uniform**

Heim (1983)
Beaver (2001)

**problem?**

**Soft vs. Hard triggers**

**cancelable; uniform through quantification**

Abusch (2002, 2010)
Charlow (2009)

# Introduction

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**Soft vs. Hard triggers**

**cancelable; uniform through quantification**

Abusch (2002, 2010)
Charlow (2009)

(1) I don't know whether Linda participated in the contest or not.
But if she *won*, she will celebrate.

(2) I don't know whether anybody saw the cat.
#But if *it is* Angelo *who* saw it, he should let me know.

# Introduction

(1) a. All of the students smoke Marlboro *too*.
b. None of the students smoke Marlboro *too*.
c. Some of the students smoke Marlboro *too*.
d. → All of the students smoke ***something other than*** Marlboro.

**Soft vs. Hard triggers**

**cancelable; uniform through quantification**

Abusch (2002, 2010)
Charlow (2009)

(2) a. All of the students *stopped* smoking.
b. None of the students *stopped* smoking.
c. → All of the students *used to* smoke.
d. Some of the students *stopped* smoking.
e. ↛ All of the students ***used to*** smoke.

# Introduction

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Beaver (2001)

*problem?*

**Soft vs. Hard triggers**

**cancelable; uniform through quantification**

Abusch (2002, 2010)
Charlow (2009)

*an account*

**Presupposition vs. Scalar Implicature**

**alternatives, triggers=strong scalar**

Chelma (2009, 2010)
Romoli (2015)

# Introduction

**Game-Theoretic Pragmatics**

**Rationality**

Franke (2009)
Rothschild (2014)

a framework

**Presupposition Projection**

**uniform**

Heim (1983)
Beaver (2001)

problem?

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# Introduction

**Distinguish Types/Situations**

speaker expertise vs. non-expertise

**Goals**

# Introduction

Goals

**Distinguish Types/Situations**

speaker expertise vs. expertise

**Construct Models**

basic model and solution
extended models and solutions

# Introduction

**Goals**

### Distinguish Types/Situations

speaker expertise vs. non-expertise

### Construct Models

basic model and solution
extended models and solutions

### Apply Models

soft presupposition, scalar implicature
B: expertise (negation, conditional, existential quantification)
E: expertise (universal quantification), non-expertise

# Introduction

Goals

### Distinguish Types/Situations

speaker expertise vs. non-expertise

### Construct Models

basic model and solution
extended models and solutions

### Apply Models

soft presupposition, scalar implicature
B: expertise (negation, conditional, existential quantification)
E: expertise (universal quantification), non-expertise

### Predict Projection

cancelability; non-uniformity

# The Model-Basic Model and Solution

**Type/Situation**

Speaker Expertise

$t \in T^W$

**Speaker Strategy**

Intentionally consistent (IC)

$\sigma \in S = \left(\Delta(M)\right)^T, t = [\![m]\!]$

**Hearer Strategy**

IC

$\rho \in H = (\Delta(T)^M), t = [\![m]\!]$

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**Payoff Function**

$U_N\left(t_i, m, t_j\right), N \in \{S, H\}$

**Failure: 0**

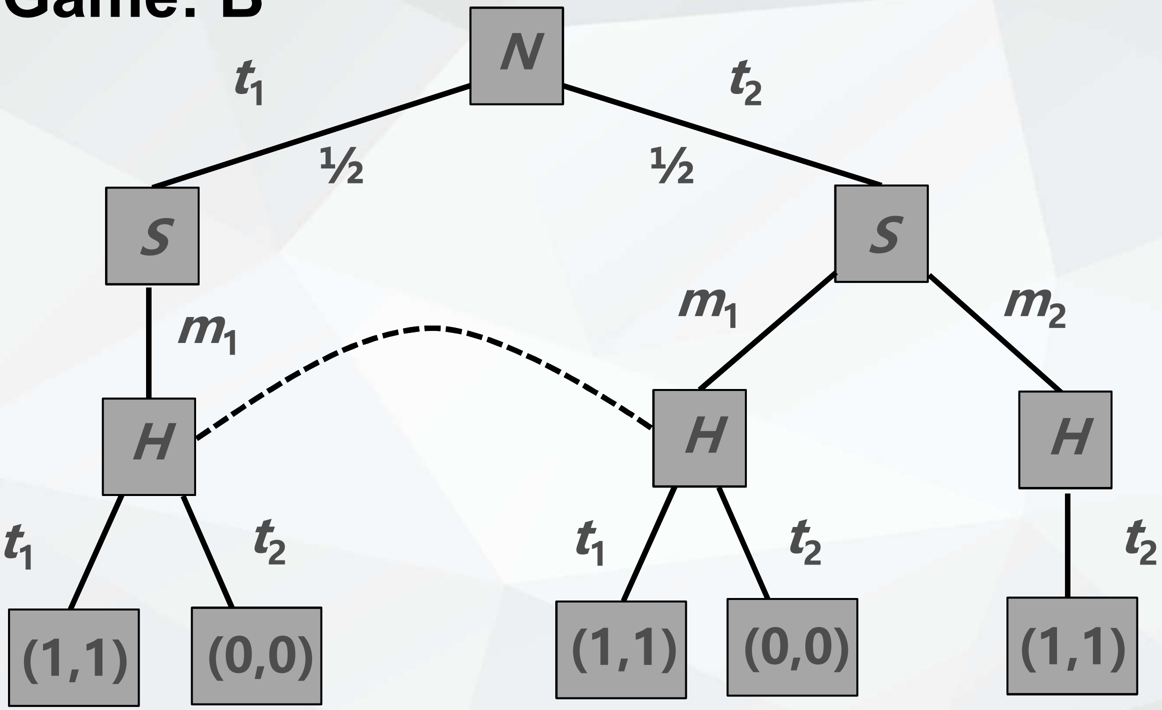
if $i \neq j$

**Success: 1**

if $i = j$

# The Model-Basic Model and Solution

**Signaling Game: B**

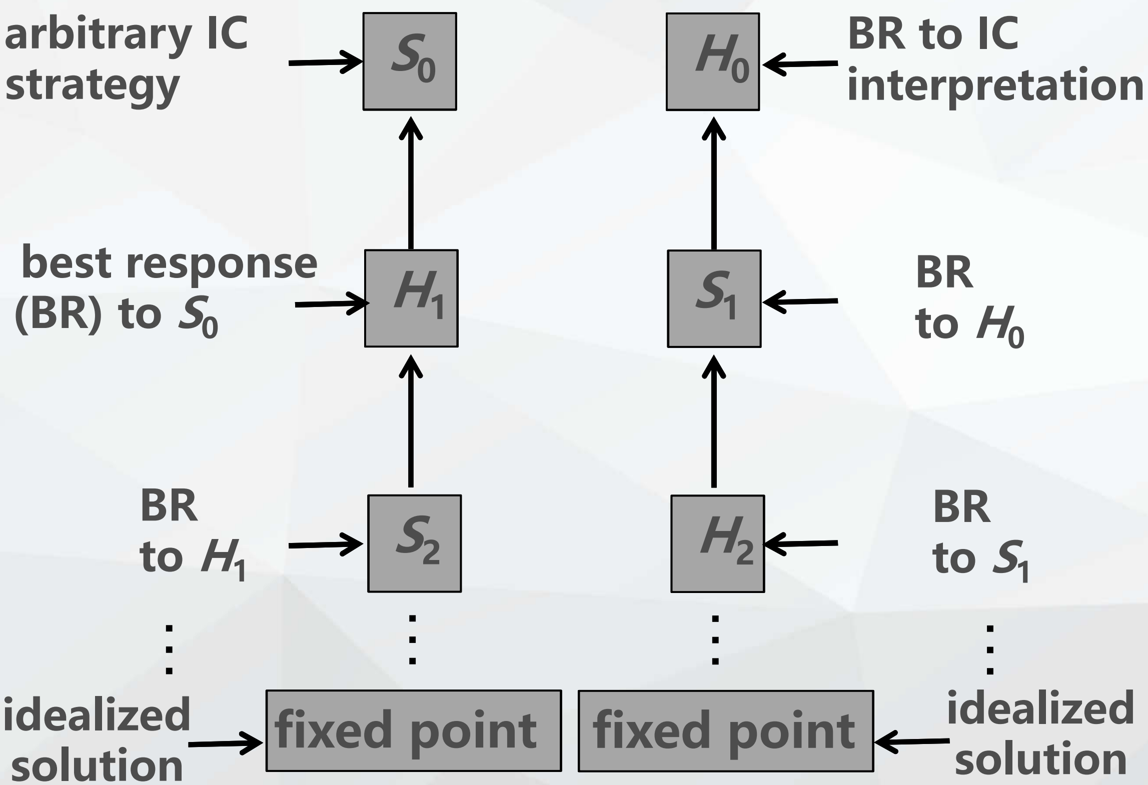



| Type | Knowledge |
|---|---|
| $t_1$ | $\{w_w\}$ |
| $t_2$ | $\{w_s\}$ |

- speaker intention: $t_1$, $t_2$.
- hearer prior belief: $p$=½ .
- messages: weak-$m_1$, strong-$m_2$.
- hearer interpretation: $t_1$, $t_2$.

# The Model-Basic Model and Solution

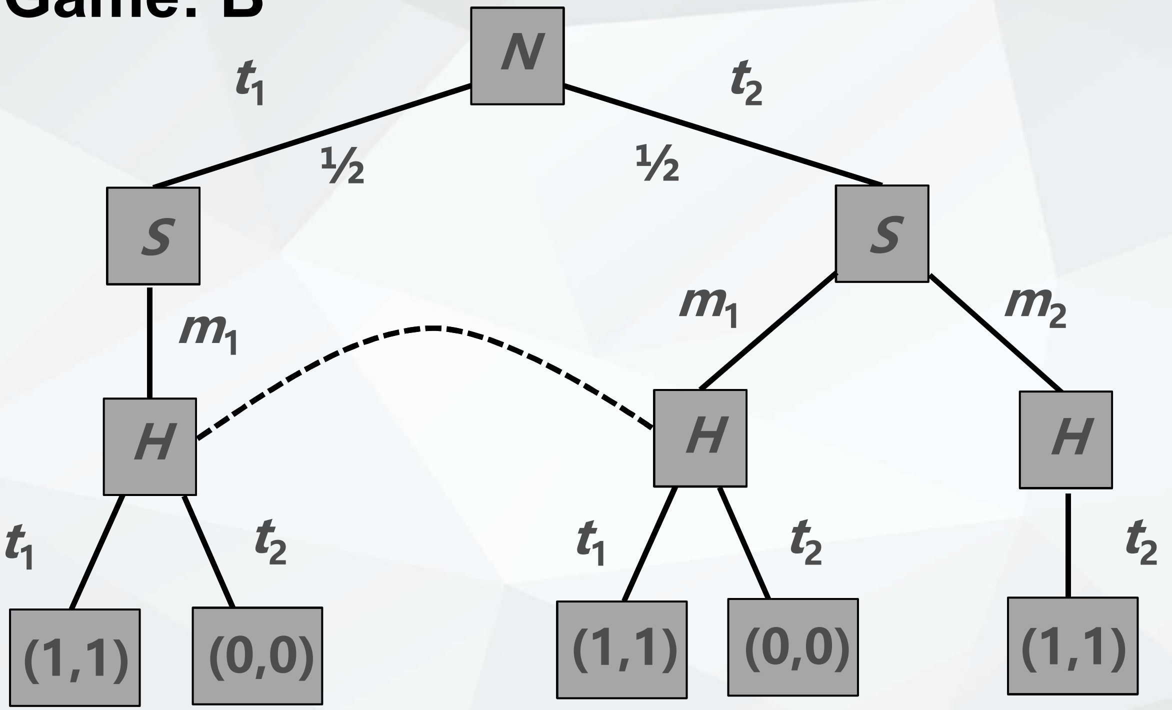
Solution: iterated best response (IBR) reasoning framework




- $s(t) \in \arg\max_{m \in M} \mathrm{EU}_S(m, t, \rho)$
- $\mathrm{EU}_S(m, t, \rho) =$
$$\sum_{t \in T} \rho(m, a) \times \mathrm{U}_S(t, m, a)$$
- $h(m) \in \arg\max_{t \in T} \mathrm{EU}_H(t, a, \mu)$
- $\mathrm{EU}_H(t, a, \mu) =$
$$\sum_{t \in T} \mu(t|m) \times \mathrm{U}_H(t, m, a)$$
- $\mu(t|m) = \frac{Pr(t) \times \sigma(m|t)}{\sum_{t' \in T} Pr(t') \times \sigma(m|t')}$

# The Model-Basic Model and Solution

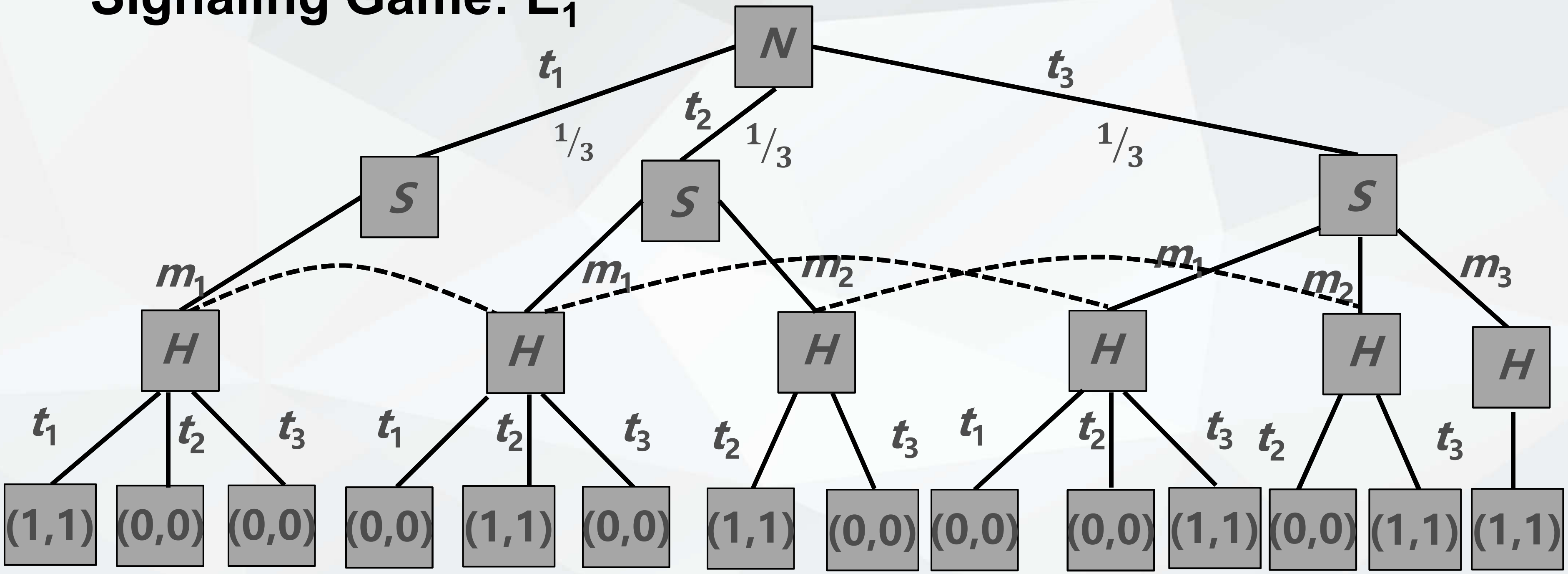
**Signaling Game: B**




$$S^* = \begin{cases} \sigma(t_1) = m_1 \\ \sigma(t_2) = m_2 \end{cases}, H^* = \begin{cases} \rho(m_1) = t_1 \\ \rho(m_2) = t_2 \end{cases}$$

# The Model-Extended Models and Solutions

**Signaling Game: $E_1$**

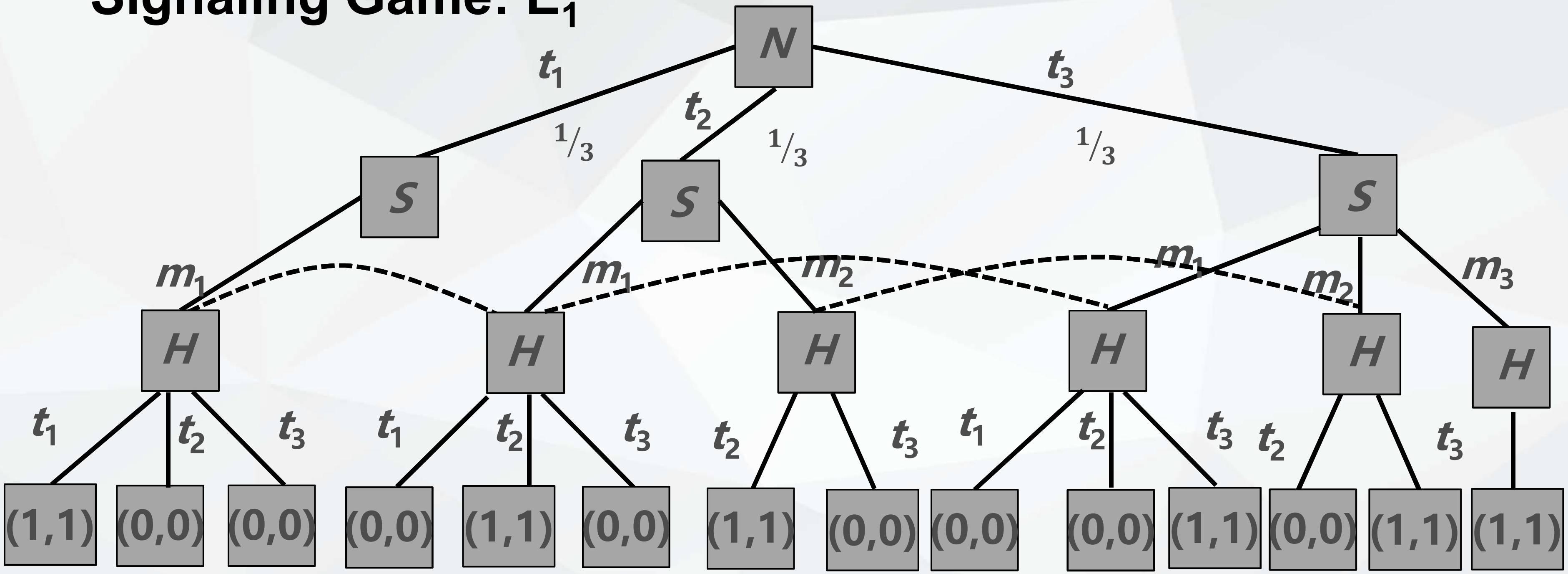



| Type | Knowledge |
|---|---|
| $t_1$ | $\{w_{\forall}\}$ |
| $t_2$ | $\{w_{\exists\neg\forall}\}$ |
| $t_3$ | $\{w_{\neg}\}$ |

- speaker intention: $t_1$, $t_2$ , $t_3$.
- hearer prior belief: $p$, $1\text{-}p$ .
- messages: $m_1$, $m_2$ , $m_3$.
- hearer interpretation: $t_1$, $t_2$ , $t_3$.

# The Model-Extended Models and Solutions

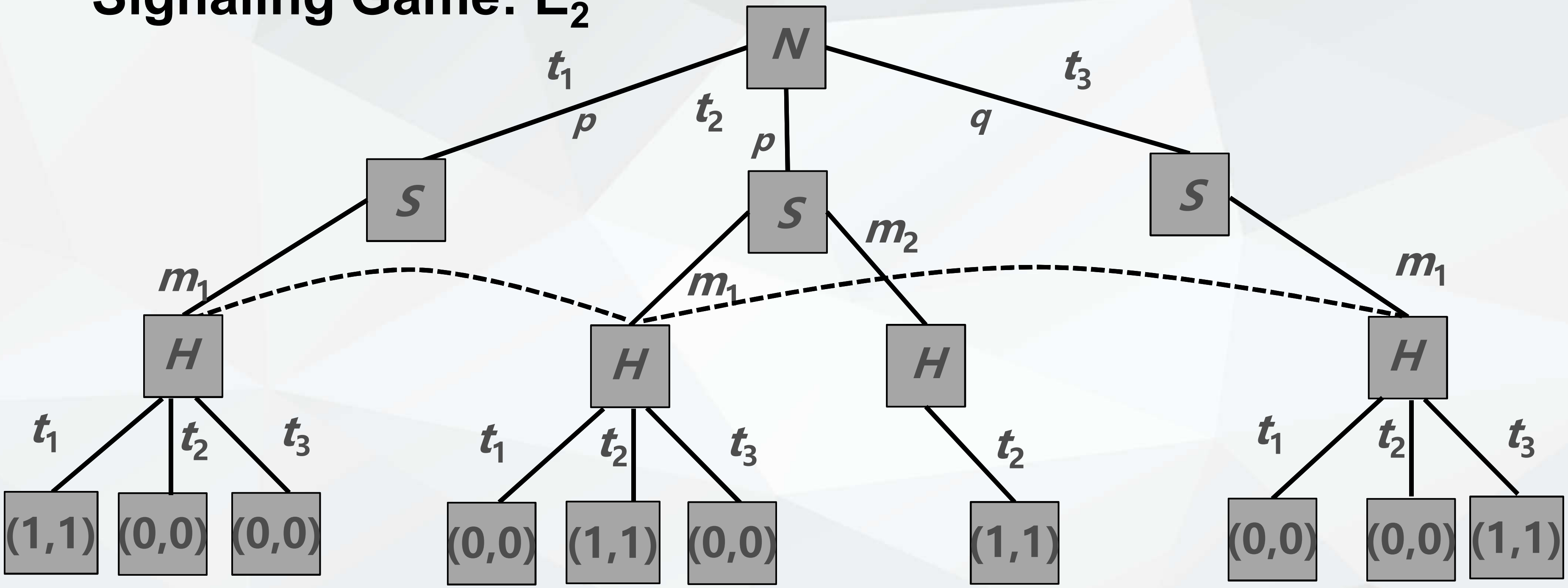
**Signaling Game: $E_1$**




$$S^* = \begin{cases} \sigma(t_1) = m_1 \\ \sigma(t_2) = m_2, \\ \sigma(t_3) = m_3 \end{cases} H^* = \begin{cases} \rho(m_1) = t_1 \\ \rho(m_2) = t_2 \\ \rho(m_3) = t_3 \end{cases}$$

# The Model-Extended Models and Solutions

## Signaling Game: $E_2$

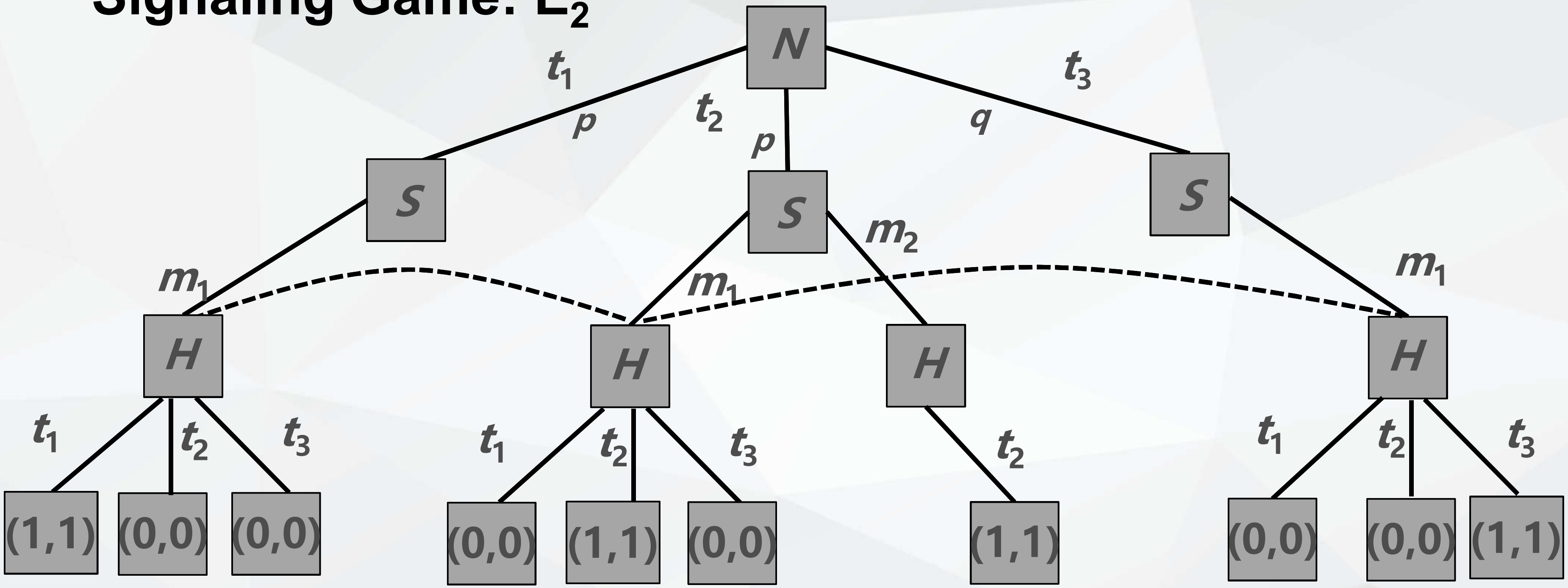



| Type | Knowledge |
|---|---|
| $t_1$ | $\{w_w\}$ |
| $t_2$ | $\{w_s\}$ |
| $t_3$ | $\{w_w, w_s\}$ |

- speaker intention: $t_1$, $t_2$ , $t_3$.
- hearer prior belief: $p = {}^{1-q}/_2$, $q$.
- messages: $m_1$, $m_2$.
- hearer interpretation: $t_1$, $t_2$ , $t_3$.

# The Model-Extended Models and Solutions

**Signaling Game: $E_2$**




$$S^* = \begin{cases} \sigma(t_1) = m_1 \\ \sigma(t_2) = m_2, \\ \sigma(t_3) = m_1 \end{cases} H^* = \begin{cases} \begin{cases} \rho(m_1) = t_1 \\ \rho(m_2) = t_2 \end{cases}, q < \frac{1}{3} \\ \begin{cases} \rho(m_1) = t_3 \\ \rho(m_2) = t_2 \end{cases}, q > \frac{1}{3} \end{cases}$$

# The Model-Model Comparison

**Chelma Model**

Projection: exhausitification principle vs. payoff.
**Signaling game.**

**Parikh Signaling Game**

Expertise: speaker type vs. knowledge
t: situation vs. intention;
solution: Pareto-dominating equilibrium vs. IBR.
**Expertise; Reasoning.**

**Rothschlid Game Model**

solution: weak dominance reasoning vs. IBR.
**Cancelability;**
**Reasoning.**

**Franke IBR Model**

Starting point: semantic vs. intentional consistent.
Prior belief: unbiased vs. biased.
**Cancelability.**

# Applications

**Example**

Neg: He didn't eat all. → He ate some.

He didn't win. → John participated.

Cond: If he didn't eat all,...→ He ate some.

If he won,... → He participated.

Exis Qut: Some of them ate all. → Some but not all ate some. $\nrightarrow$ All ate some.

Some of them won. → Some but not all participated. $\nrightarrow$ All participated.

**Correspondence with B**

Expertise: S knows about the presupposition/weak implicature.

Alternatives: <strong, weak>. eg. <none, some but not all>, <not participate, participate but not win>.

# Applications

## Example

Univ Qut: None of them ate all. → All ate some.
None of them won. → All participated.

## Correspondence with $E_1$

Expertise: S knows about the presupposition/weak implicature.
Alternatives: < ∀ , ∃¬∀, ¬ >. eg. <all participate, some but not all participate, none participate>.

# Applications

**Example**

Sus: I don’t know whether John ate any of the cake or not. But if he ate all, Linda will cry. $\nrightarrow$ He ate some.

I don’t know whether Linda participated in the contest or not. But if she won, she will celebrate. $\nrightarrow$ She participated.

**Correspondence with $E_2$**

Non-Expertise: S does not know about the presupposition/weak implicature. $q$=1

Alternatives: <strong, weak>. eg. <none, some but not all>, <not participate, participate but not win>.

# An Evolutionary View

**Prediction 1**

Cancelability

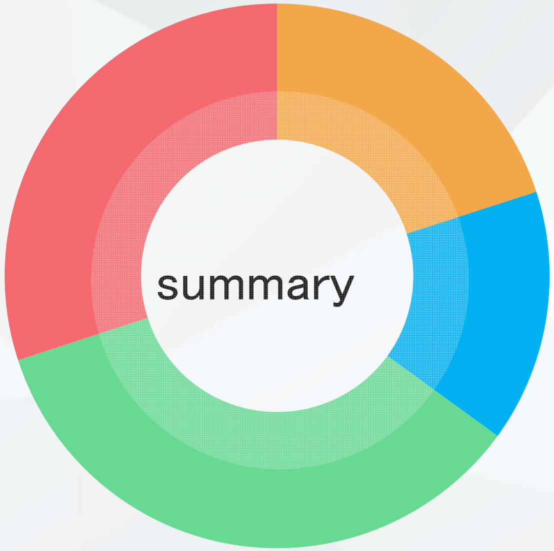
**Projection happens unless it is common knowledge that the speaker is ignorant about it, in which case the presupposition is cancelable.**

**Prediction 2**

Uniformity

**Projection depends on type of the quantifiers, which leads to non-uniform behaviors.**

# Summary and Future Work




### Model Construction

Game-theoretic models is built to analyze the rationale of soft presupposition.

### Application

Model is applied to analysis of projection through negation, conditional, quantificational sentences.

### Prediction

Two predictions on projection are given.

# Summary and Future Work

### Corpus Study

Compare our predictions with corpus study results.

### Neuroscience Test

Test our assumption of rationality in neuroscientific experiments

### AI Simulation

Simulate our reasoning framework with computer programming.

# THANK YOU FOR LISTENING