

How do we know we both know?

# Human Communication



## 1. Models of dialogue

Message model, interactive alignment, grounding

## 2. Experimental semiotics

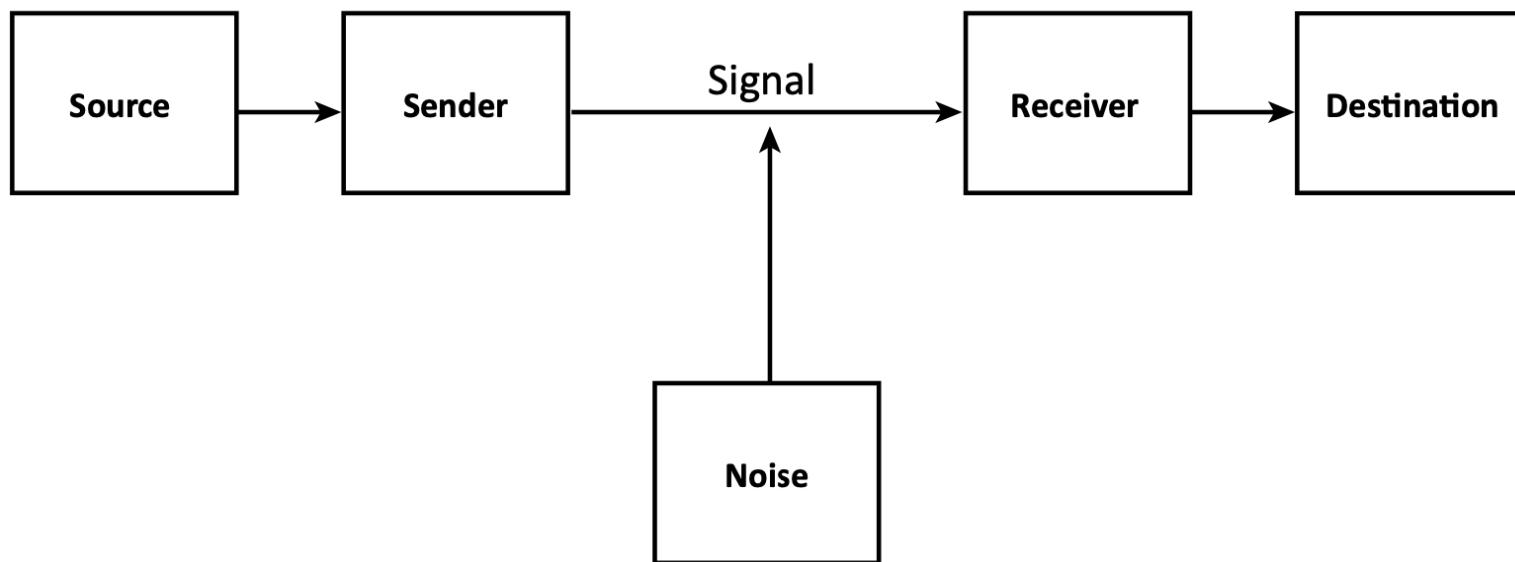
Sign language, talking heads, Pictionary

## 3. Tacit communication game

Measuring mutual understanding



## Message model



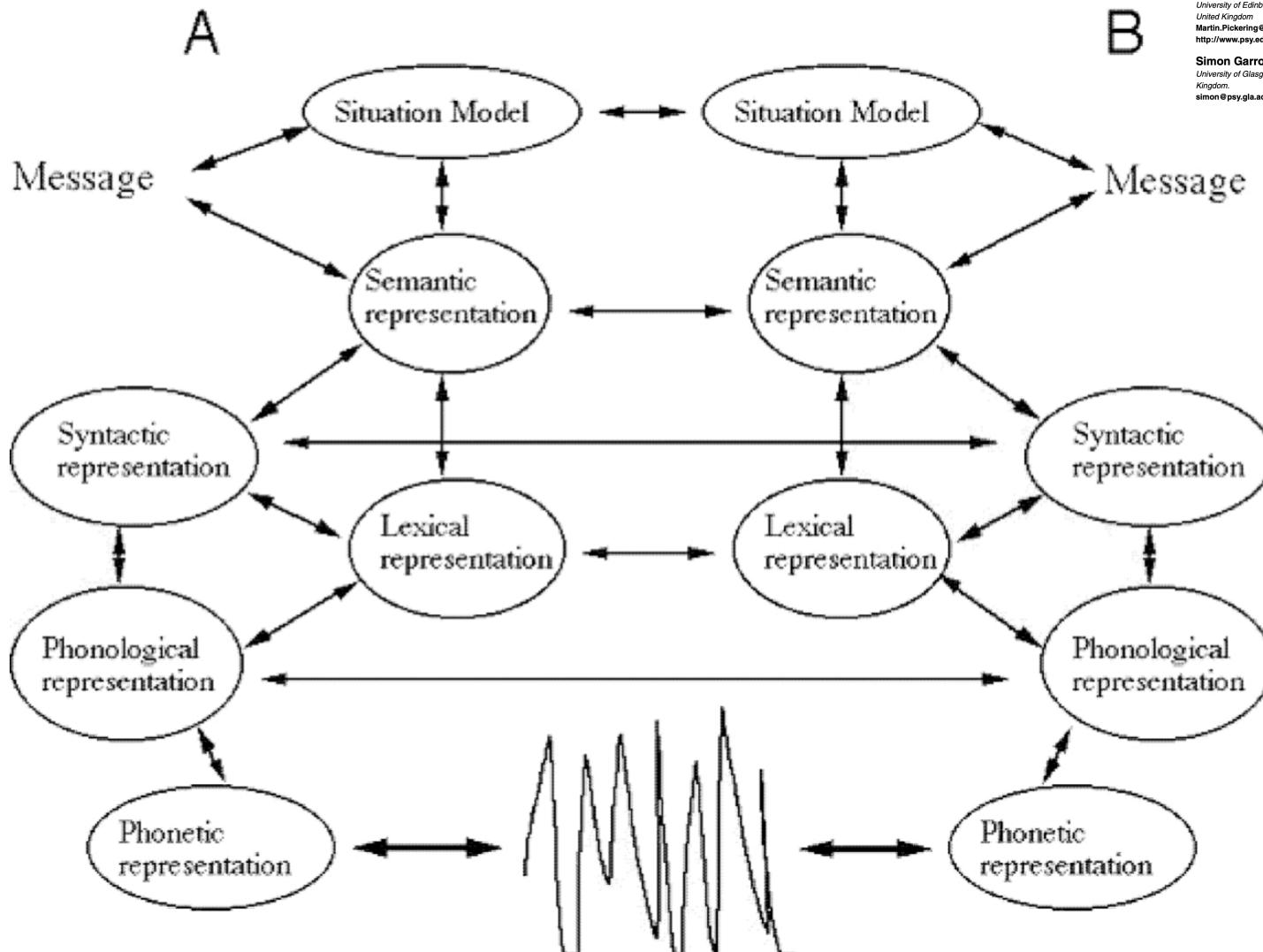
A Mathematical Theory of Communication

By C. E. SHANNON

Presupposes shared encoding/decoding rules for transferring information



## Interactive alignment model



Presupposes shared associations between signals and meanings



## Grounding model

...

Leah: um... then he gets punished or whatever?

Dale: what was that, a wreath or—

Leah: yeah it was some kind of browny—

Adam: yeah it was some kind of straw thing or something

Leah: mhm

Dale: around his neck

Leah: so that everybody knew what he did or something?

Adam: straw wreath

Dale: yeah

## Evidence used for grounding

- Can be explicit, such as a backchannel response (*uhuh*) or clarification question
- Can be implicit, such as displaying continuing attentiveness via eye contact or continuing with a next relevant utterance
- Paralinguistic cues provide information about the ongoing utterance itself, yet they have been largely neglected by traditional models

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- Respect collaborative and open-ended nature of human interaction (cf. a conversation)
- Experimental control over communicative environment (log interactive behaviors)
- Experimental control over communicative history (capture emergence of shared representations)

# Communication in context

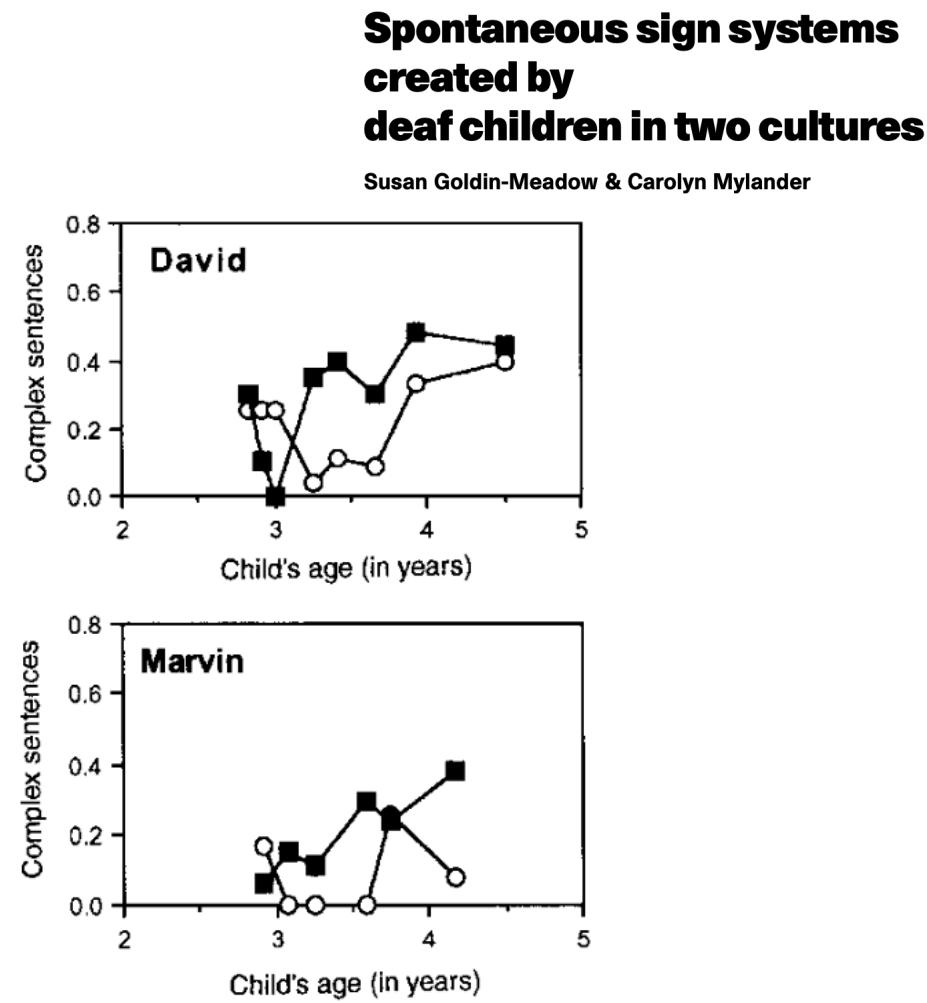
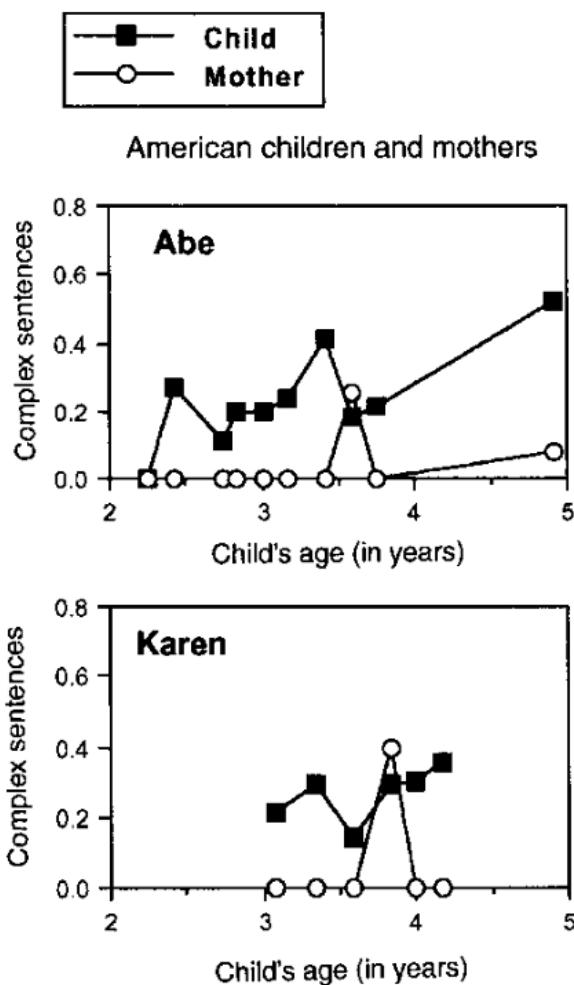
- **Psycholinguists:** Encoding and decoding of linguistic material by individual agents  
(isolated from the context of interaction)
- **Generative linguists:** Internal structural dependencies of language  
(focus on pre-defined rules instead of human agents)
- **Neuroscientists:** Passive observation or production of scripted behaviors  
(knowledge retrieval rather than creation of mutual understanding)
- **Exp. semioticians:** Language use as joint action  
(taking interactive contexts and generative elements seriously, interested in communication beyond purely linguistic means)

# Nicaraguan sign language

Nicaraguan Sign Language  
Emergence and Evolution

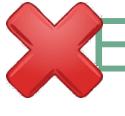


## Home sign language



Deaf children spontaneously introduce language-like structure into gestures

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-  Experimental control over communicative environment (log interactive behaviors)
-  Experimental control over communicative history (capture emergence of shared representations)



## Talking heads



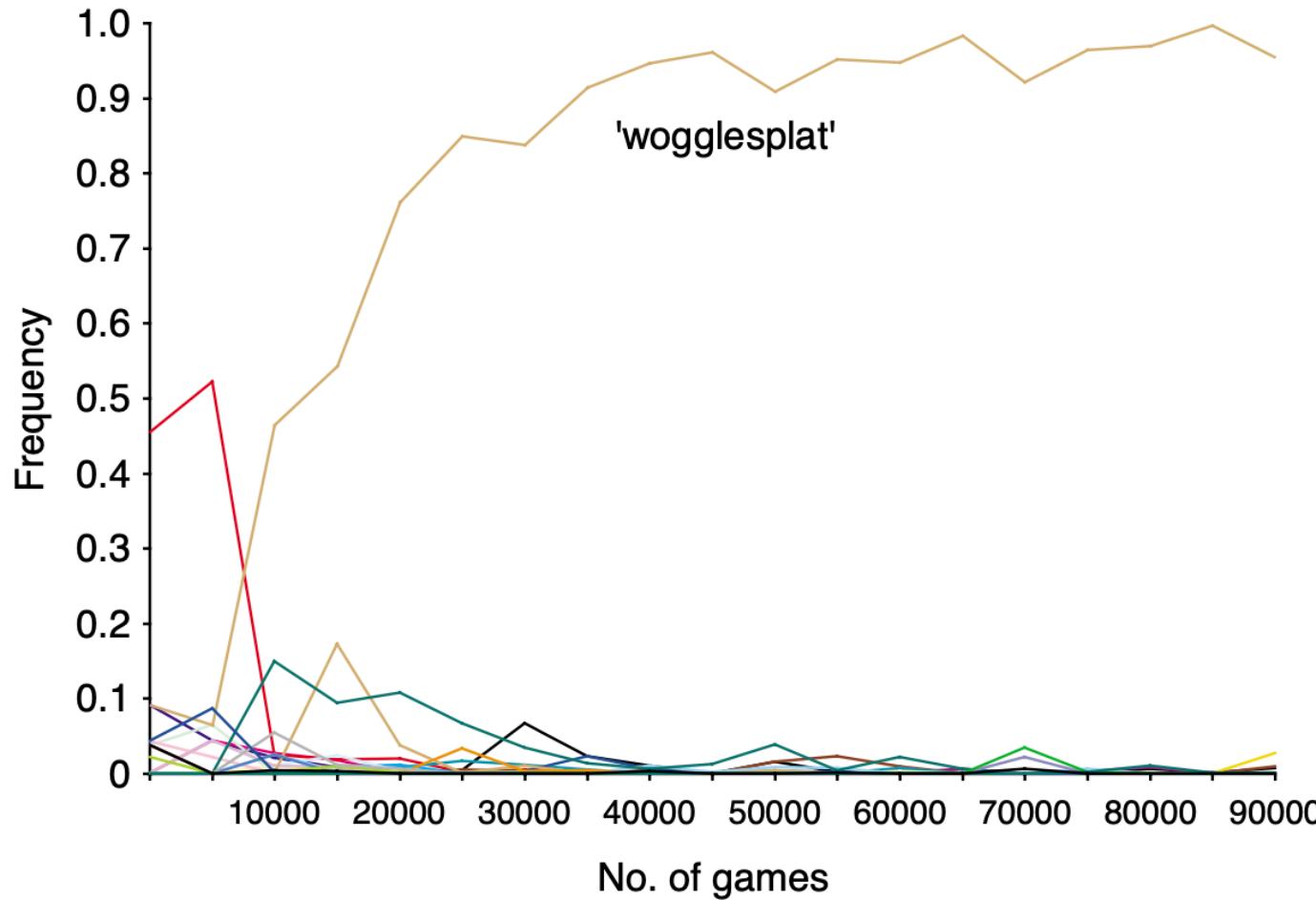
**Evolving grounded communication  
for robots**

Luc Steels

Computer simulations



## Talking heads



Establishing arbitrary mappings requires many thousands of interactions

## Research criteria

-  Respect collaborative and open-ended nature of human interaction (cf. a conversation)  
*Prespecified word and figure options*
-  Experimental control over communicative environment (log interactive behaviors)
-  Experimental control over communicative history (capture emergence of shared representations)  
*But not quite like how humans converge on a meaning*



## Pictionary task

<b>Block 1 (CF)</b>	<b>Block 2 (CF)</b>	<b>Block 3 (CF)</b>
<b>Block 4 (CF)</b>	<b>Block 5 (CF)</b>	<b>Block 6 (CF)</b>

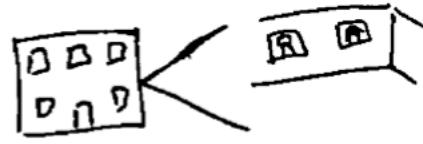
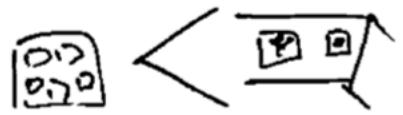
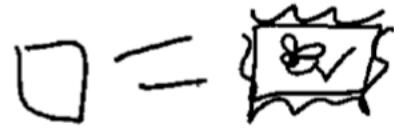
Foundations of Representation: Where Might Graphical  
Symbol Systems Come From?

Simon Garrod<sup>a</sup>, Nicolas Fay<sup>b,c</sup>, John Lee<sup>d</sup>, Jon Oberlander<sup>d</sup>, Tracy MacLeod<sup>a</sup>

Capturing the creation of conceptual pacts



## Pictionary task

		
<b>Block 1</b>	<b>Block 2</b>	<b>Block 3</b>
		
<b>Block 4</b>	<b>Block 5</b>	<b>Block 6</b>

Increasing simplicity without reduction in semantic complexity

## Research criteria

-  Respect collaborative and open-ended nature of human interaction (cf. a conversation)  
*Prespecified and limited set of referents*
-  Experimental control over communicative environment (log interactive behaviors)
-  Experimental control over communicative history (capture emergence of shared representations)  
*Depictions rely on conventions and iconicity at first*

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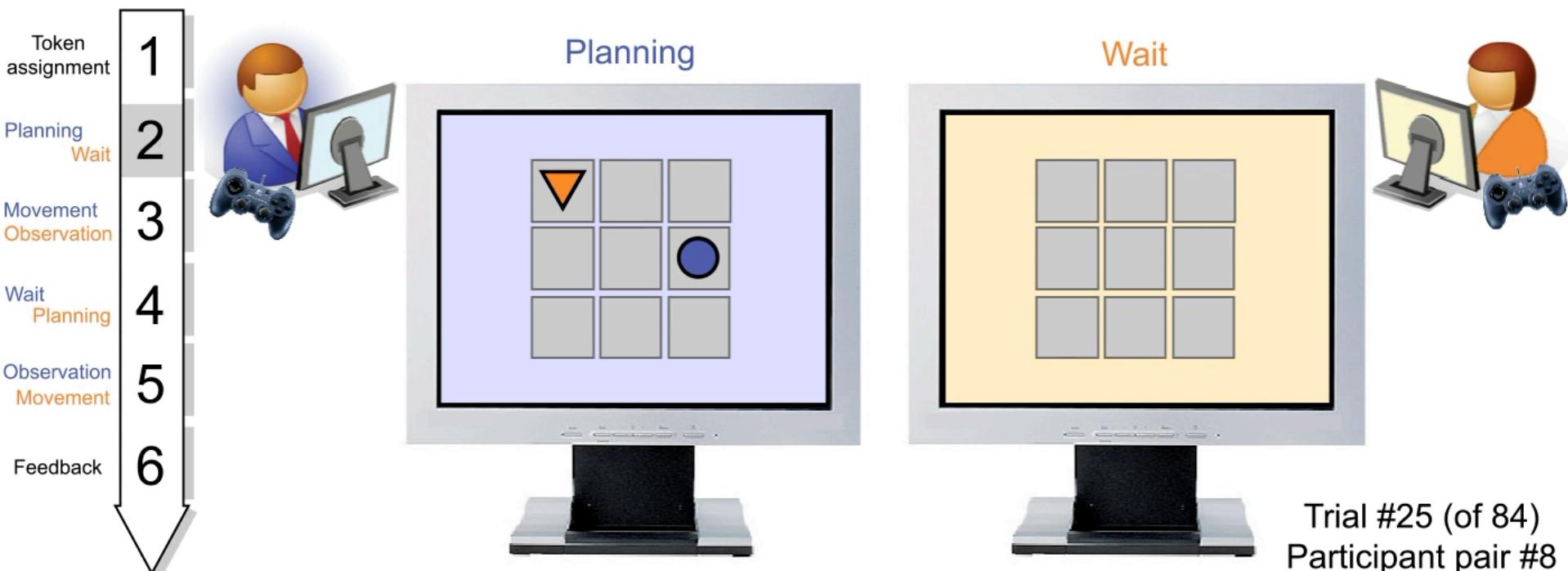
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Measuring mutual understanding

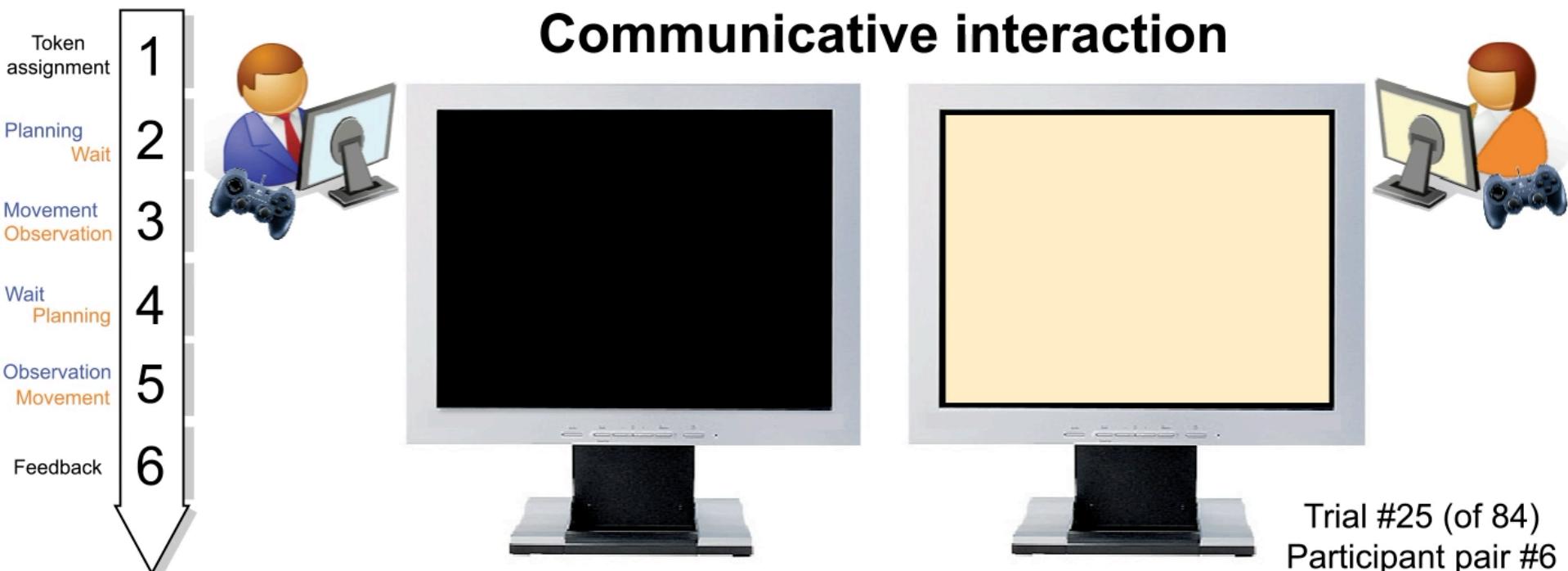


# Tacit communication game

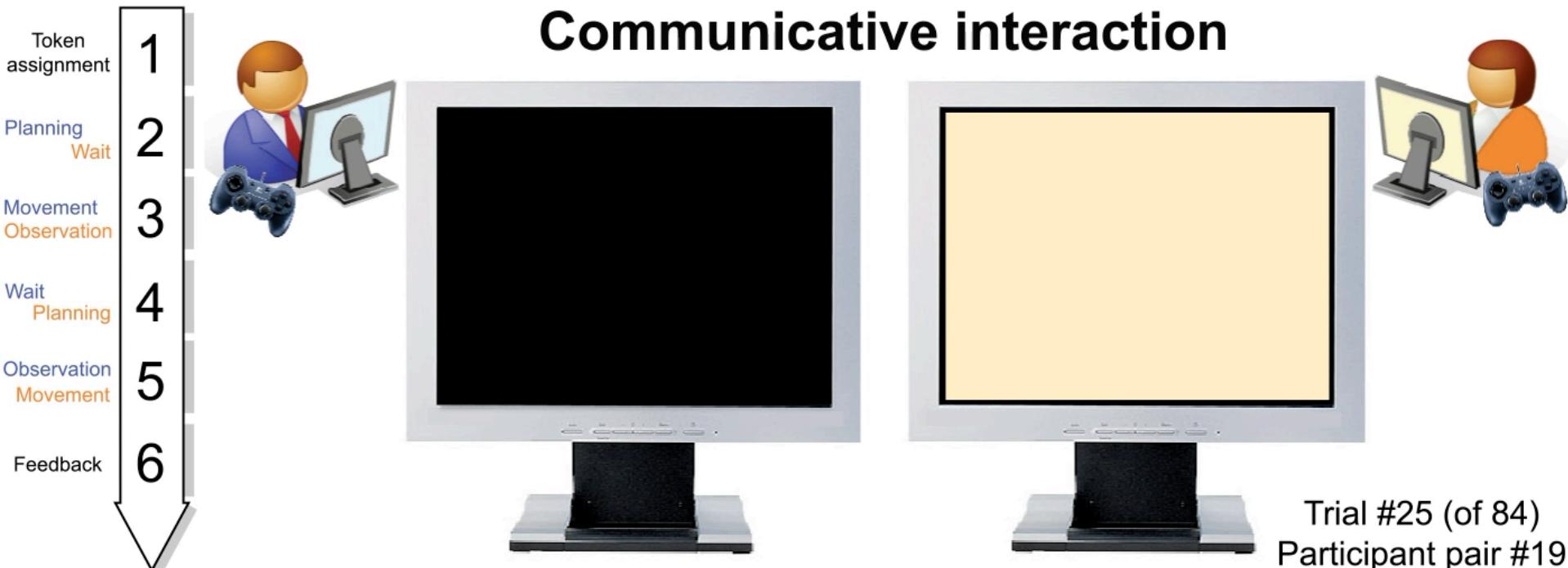
DARTMOUTH



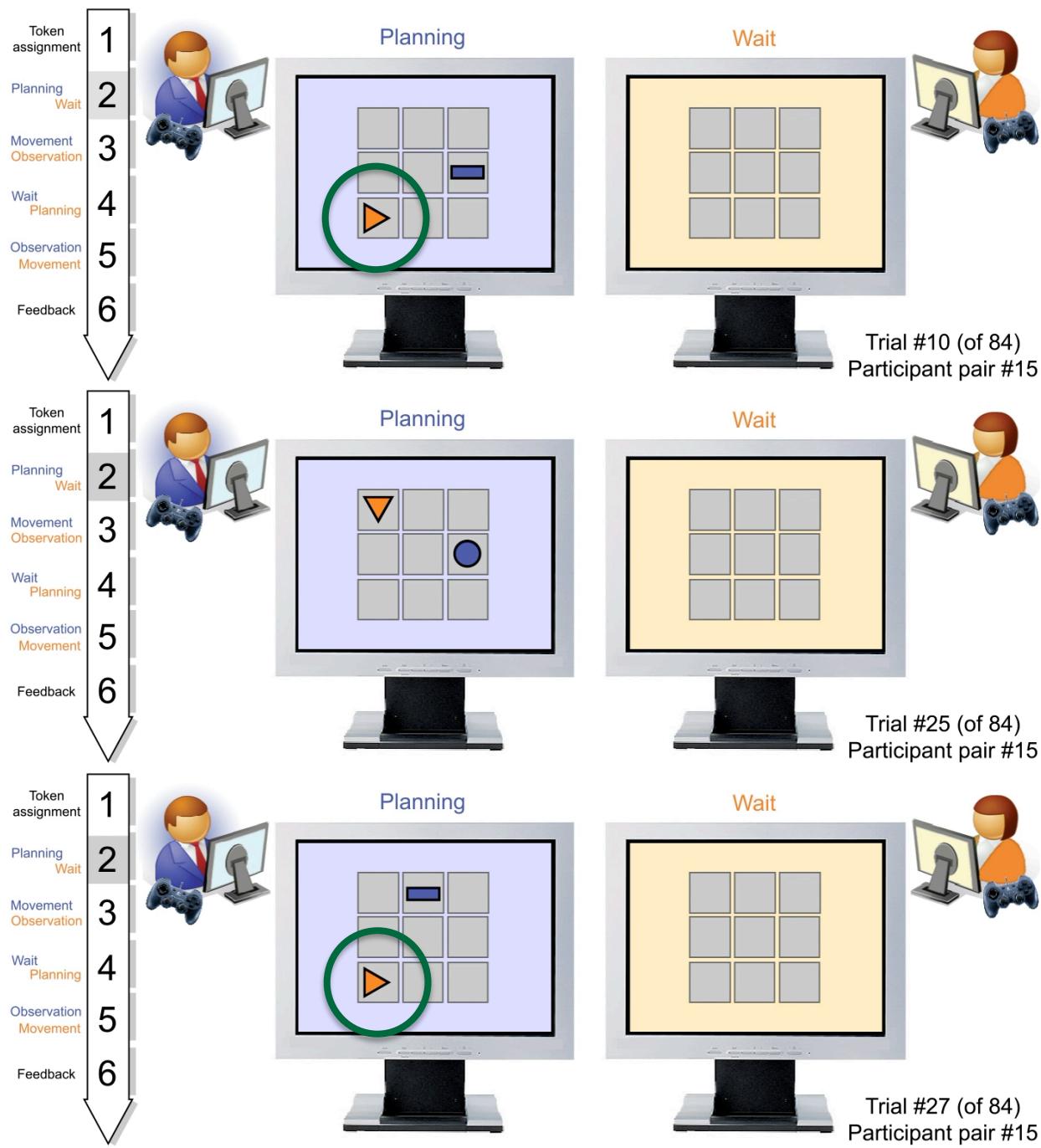
The Communicator (blue player) must use his own assigned shape to “tell” the Addressee (orange player) her shape’s target location and orientation



What is this Communicator “telling” you using his blue shape?



And what is this Communicator “telling” you?





## Research criteria

- ✓ Respect collaborative and open-ended nature of human interaction (cf. a conversation)
- ✓ Experimental control over communicative environment (log interactive behaviors)
- ✓ Experimental control over communicative history (capture emergence of shared representations)



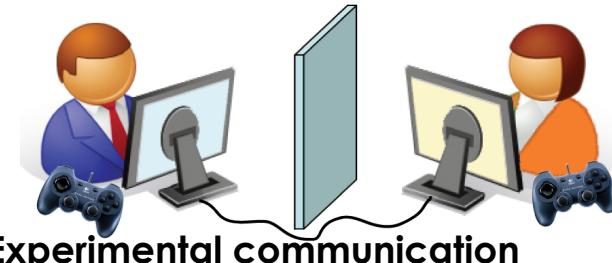
- People are endowed with a special interactional intelligence that allows them to communicate successfully even without any conventions
- Experimental semiotics strips everyday communication of conventions to gain reliable access to this core interactional intelligence

- Dual 5: Brain-To-Brain Coupling



# Bonus: Natural vs. experimental dialogue

DARTMOUTH



## *What's different?*

Multiple communication channels  
(vocalizations, bodily and facial postures/movements, eye contact)

Access to pre-existing conventions  
(a common language, body emblems, facial expressions)

Spontaneous turn-taking

Single communication channel  
(movements of a geometric shape:  
experimental control over communicative environment)

Novel communicative signals  
(lack of pre-existing shared representations:  
experimental control over shared cognitive history)

Experimentally-controlled roles  
(isolation of production and comprehension)

## *What's identical?*

Dynamic communicative context  
(jointly built, updated according to the fleeting idiosyncrasies of an ongoing interaction)