

How do we know we both know?

Human Communication



1. Models of dialogue

Message model, interactive alignment, grounding

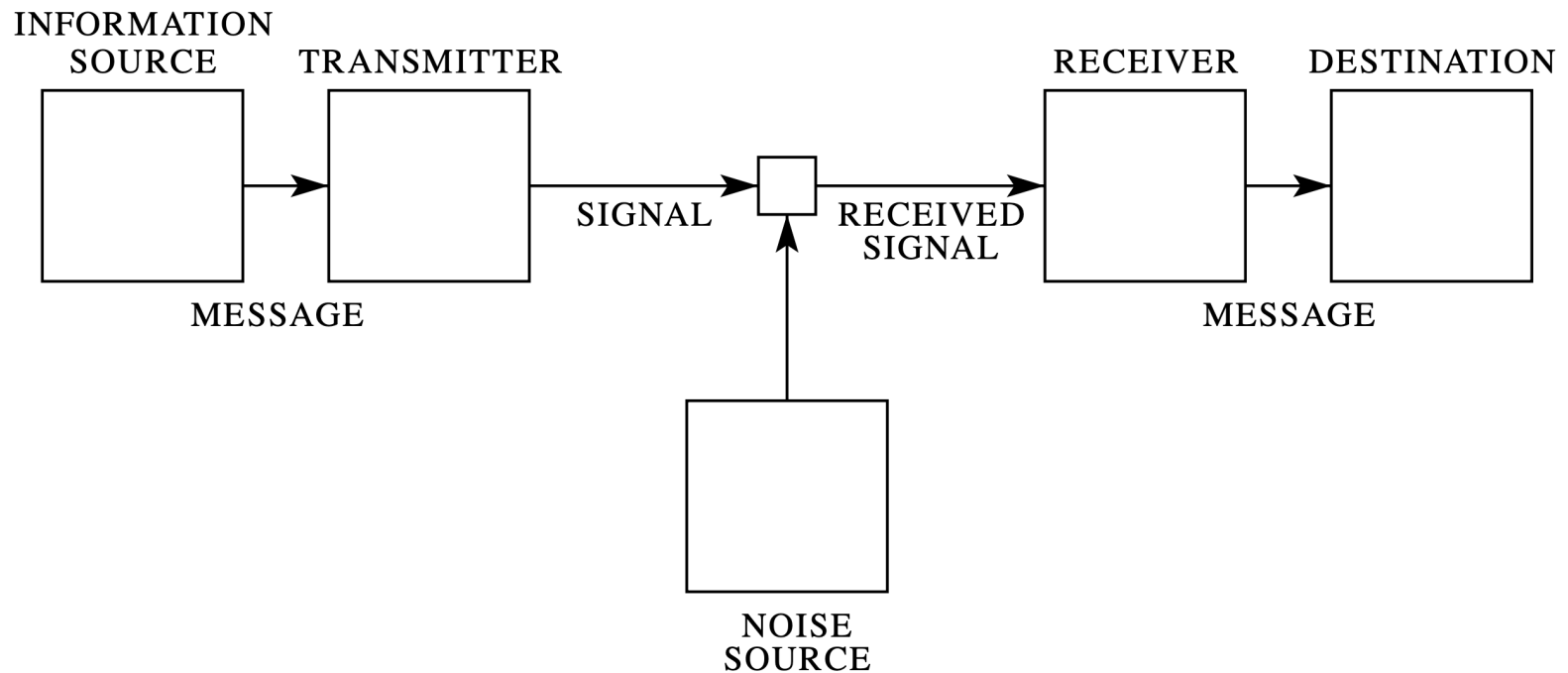
2. Experimental semiotics

Sign language, talking heads, Pictionary

3. Tacit communication game

Measuring mutual understanding

Message model



A Mathematical Theory of Communication

By C. E. SHANNON

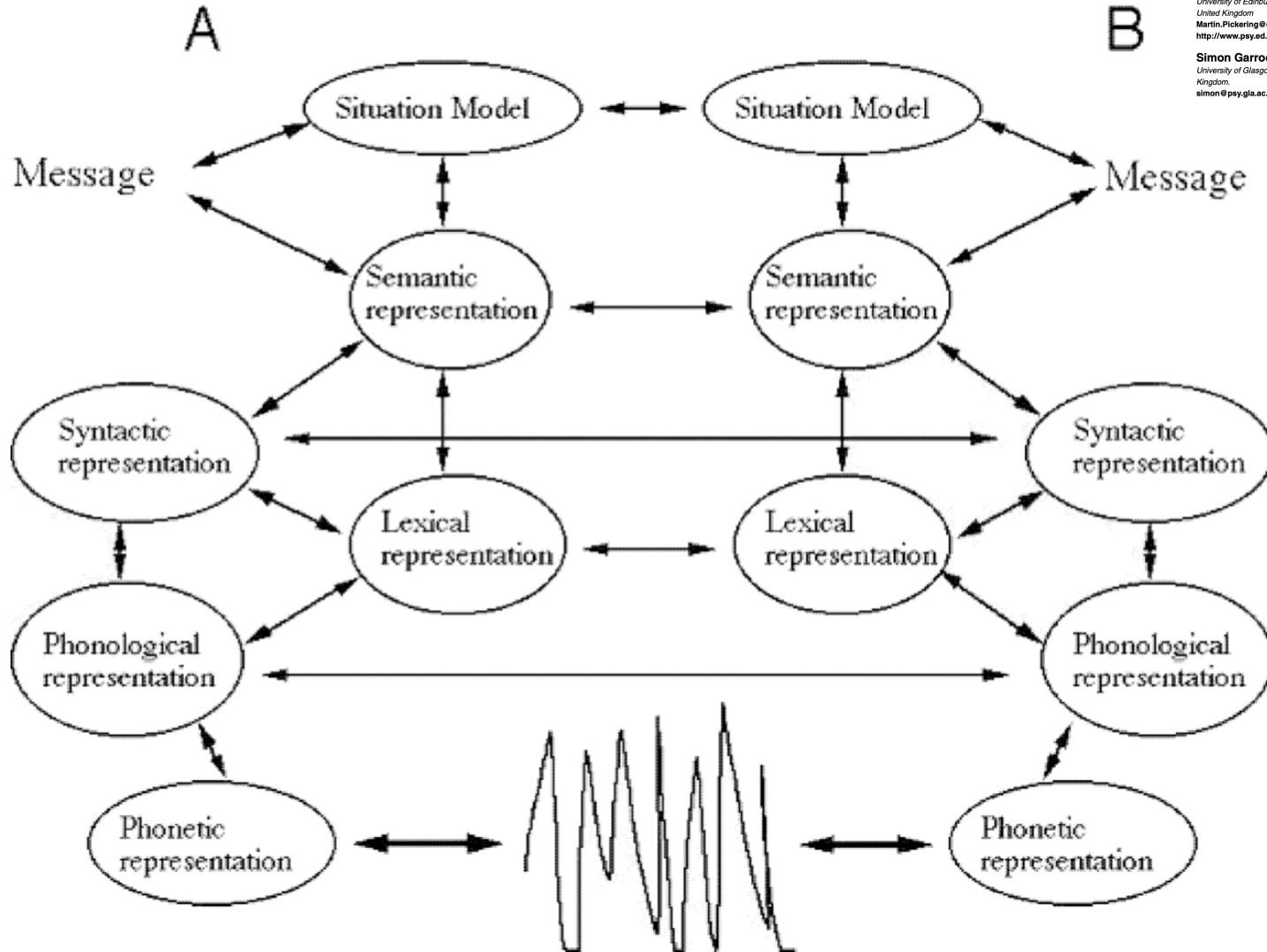
Presupposes shared encoding/decoding rules for transferring information

Interactive alignment model

Toward a mechanistic psychology of dialogue

Martin J. Pickering
University of Edinburgh, Department of Psychology, Edinburgh EH8 8JZ, United Kingdom
Martin.Pickering@ed.ac.uk
<http://www.psy.ed.ac.uk/Staff/academics.html#PickeringMartin>

Simon Garrod
University of Glasgow, Department of Psychology, Glasgow G12 8OT, United Kingdom
simon@psy.gla.ac.uk <http://staff.psy.gla.ac.uk/~simon/>



Presupposes shared associations across levels and individuals

Grounding model

...

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

Dale: what was that, a wreath or—

Leah: yeah it was some kind of brownny—

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

**TWO MINDS, ONE DIALOG: COORDINATING
SPEAKING AND UNDERSTANDING**

Susan E. Brennan, Alexia Galati, and Anna K. Kuhlen

People in dialogue seek and provide evidence for mutual understanding

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

People in dialogue seek and provide evidence for mutual understanding

1. Models of dialogue

Message model, interactive alignment, grounding

2. Experimental semiotics

Sign language, talking heads, Pictionary

3. Tacit communication game

Measuring mutual understanding

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)

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

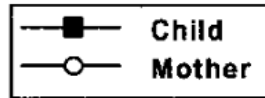
Nicaraguan Sign Language
Emergence and Evolution

Natural experiments

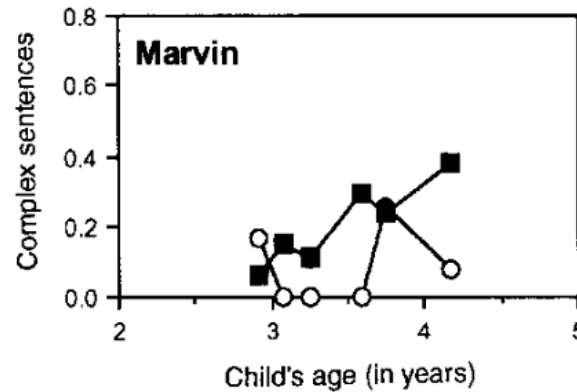
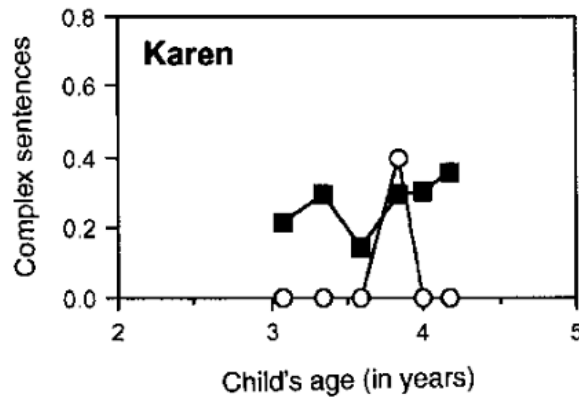
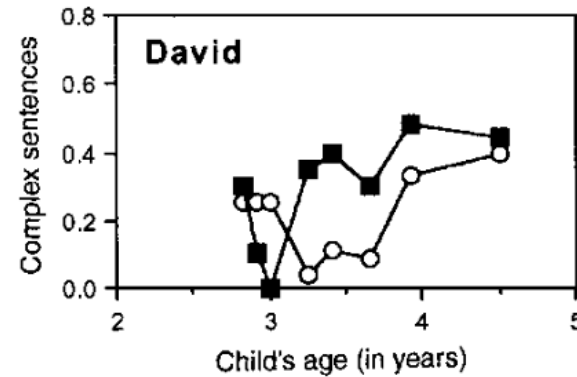
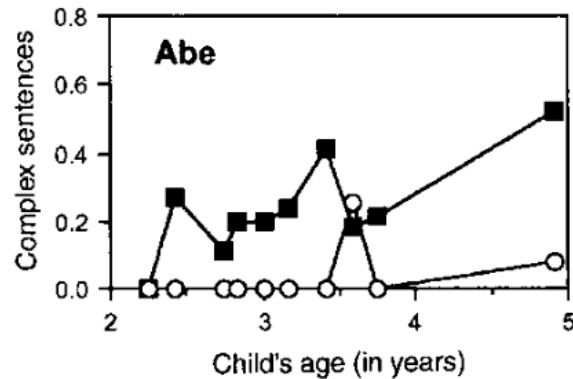
Home sign language

Spontaneous sign systems created by deaf children in two cultures

Susan Goldin-Meadow & Carolyn Mylander



American children and mothers



Deaf children spontaneously introduce language-like structure into gestures

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)

Talking heads

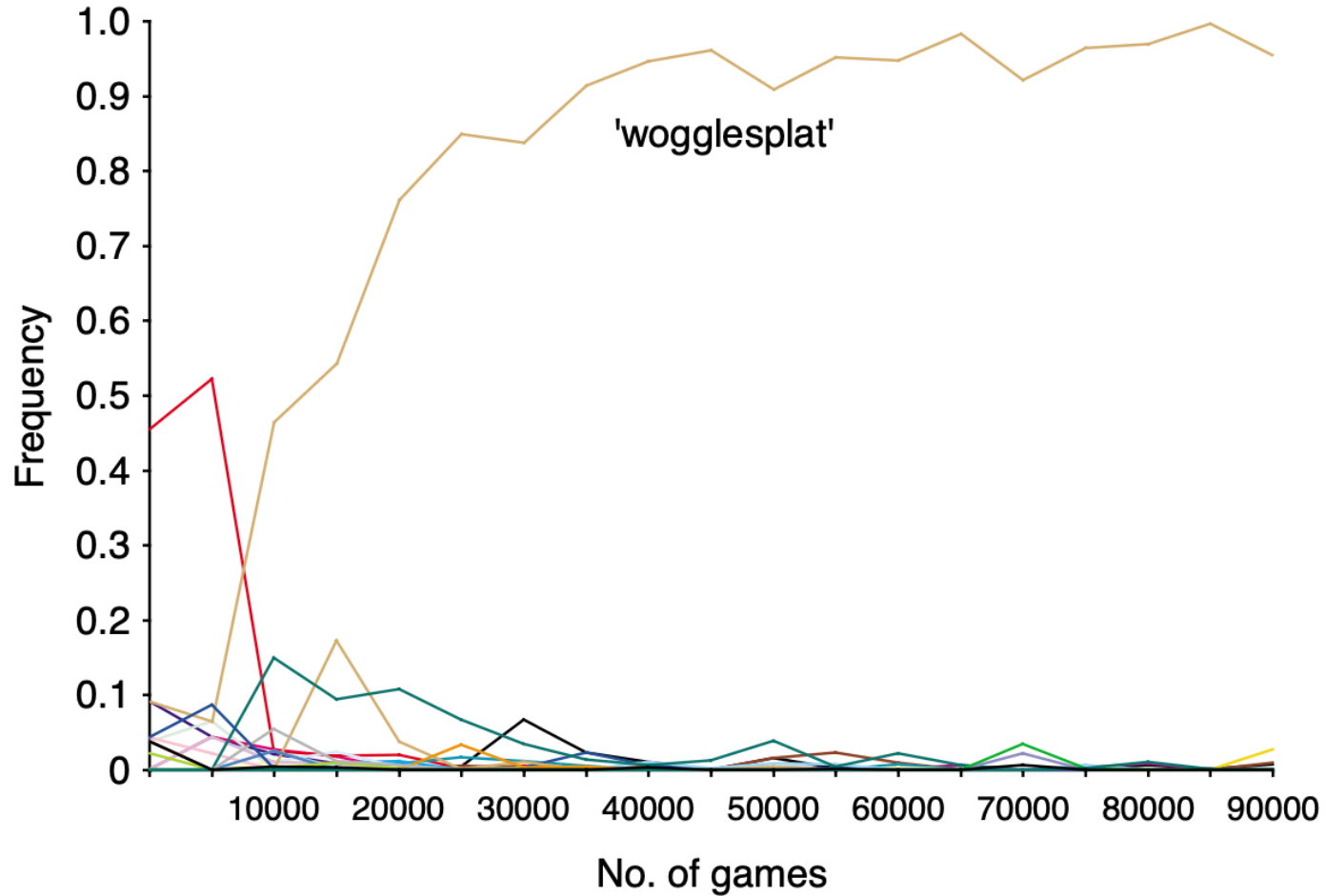


**Evolving grounded communication
for robots**

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




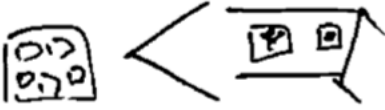
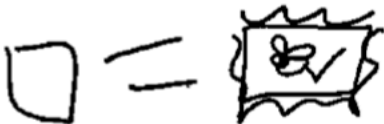
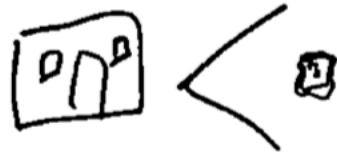
		
<p>Block 1 (CF)</p>	<p>Block 2 (CF)</p>	<p>Block 3 (CF)</p>
		
<p>Block 4 (CF)</p>	<p>Block 5 (CF)</p>	<p>Block 6 (CF)</p>

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

Simon Garrod^a, Nicolas Fay^{b,c}, John Lee^d, Jon Oberlander^d, Tracy MacLeod^a




Capturing the creation of conceptual pacts

Pictionary task

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

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

1. Models of dialogue

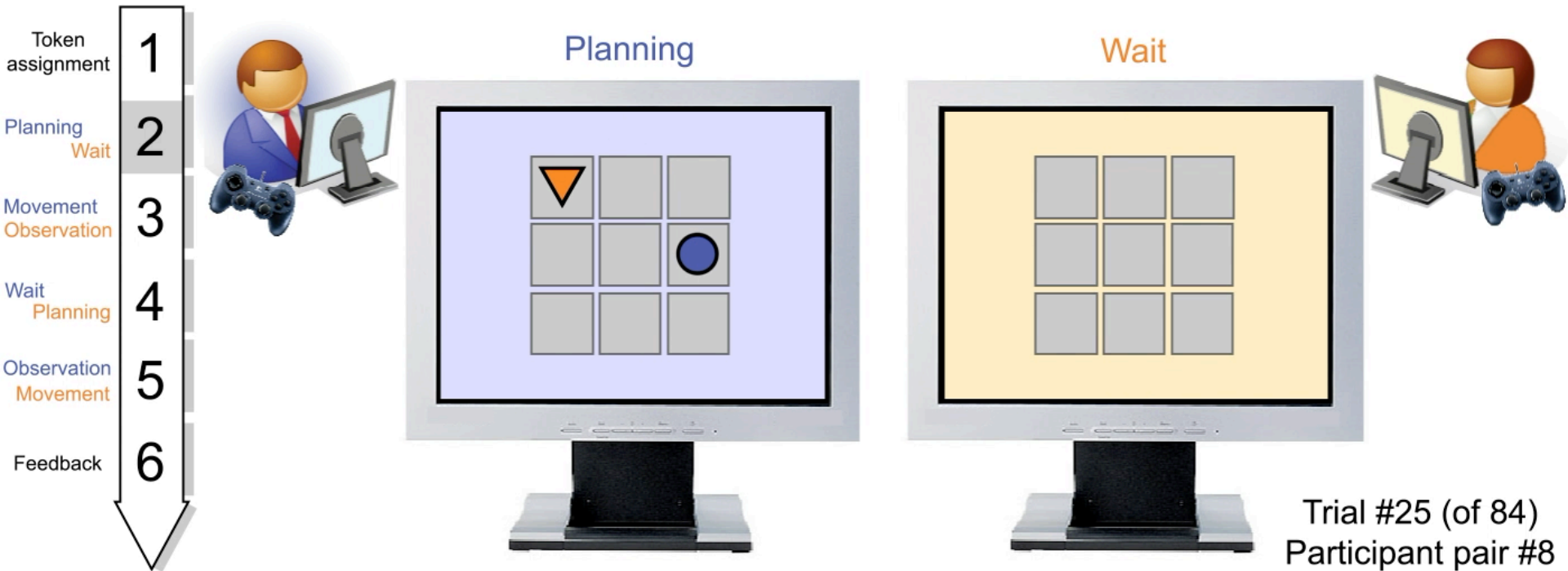
Message model, interactive alignment, grounding

2. Experimental semiotics

Sign language, talking heads, Pictionary

3. Tacit communication game

Measuring mutual understanding



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

- 1 Token assignment
- 2 Planning
Wait
- 3 Movement
Observation
- 4 Wait
Planning
- 5 Observation
Movement
- 6 Feedback

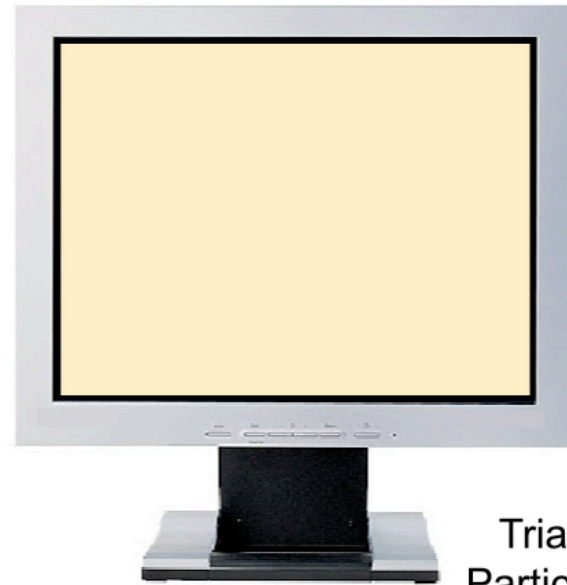
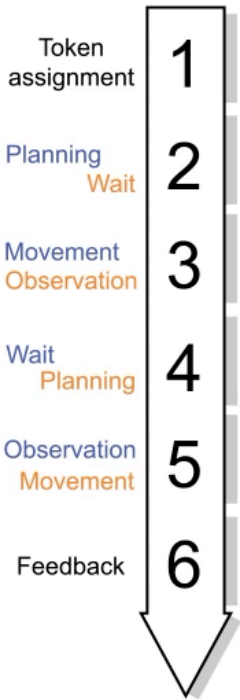
Communicative interaction



Trial #25 (of 84)
Participant pair #6

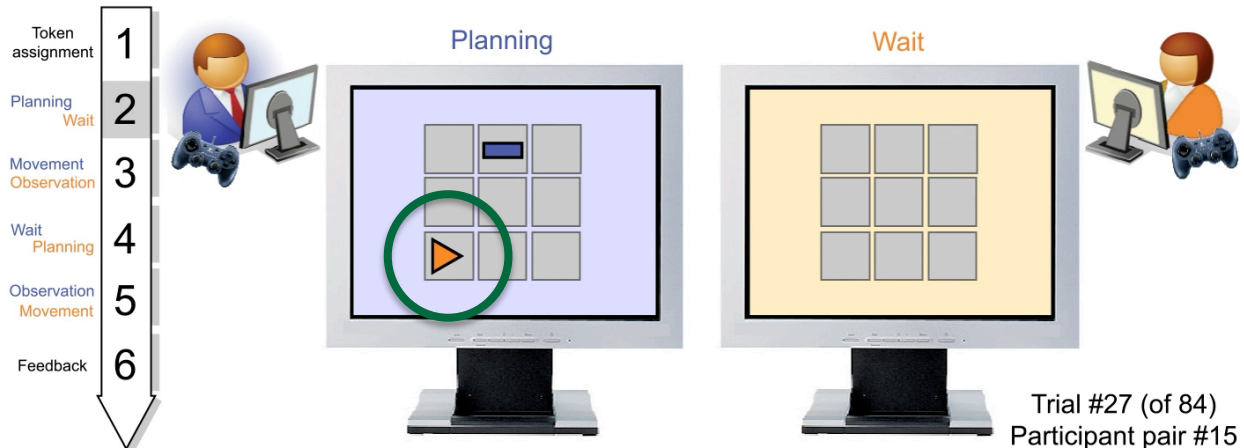
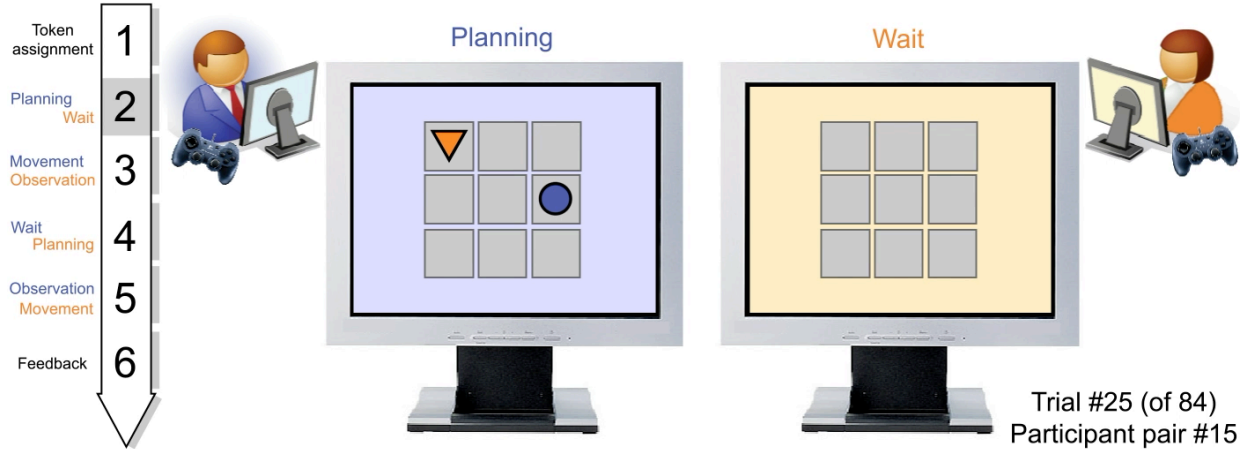
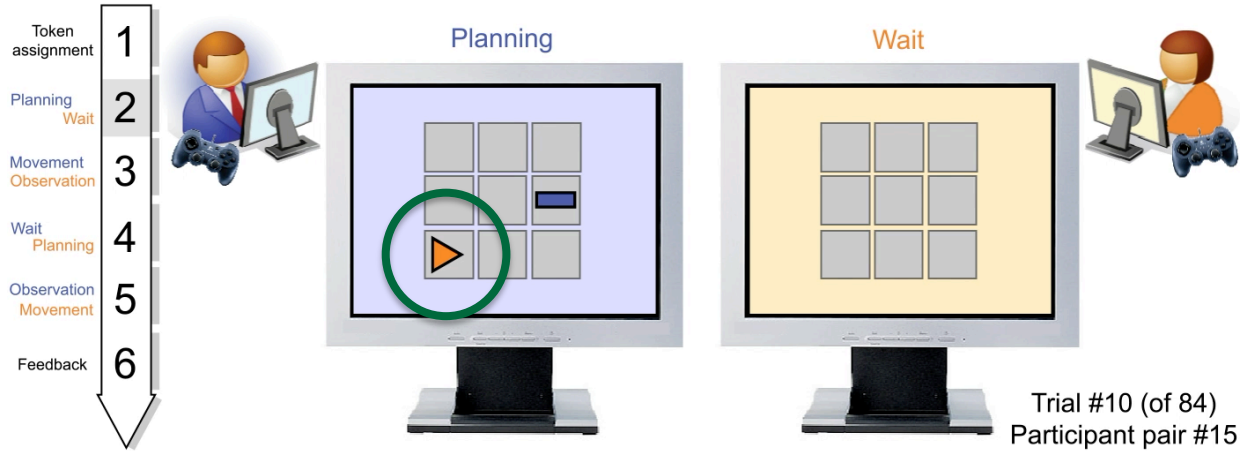
What is this Communicator “telling” you using his blue shape?

Communicative interaction



Trial #25 (of 84)
Participant pair #19

And what is this Communicator “telling” you?

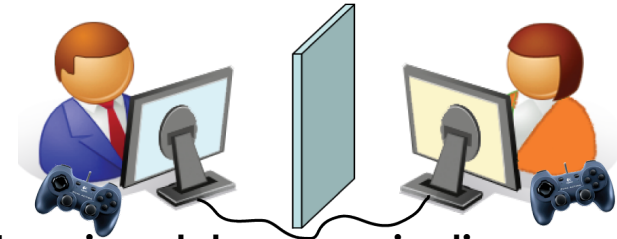


Research criteria

- ✓ 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



Experimental communication

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)