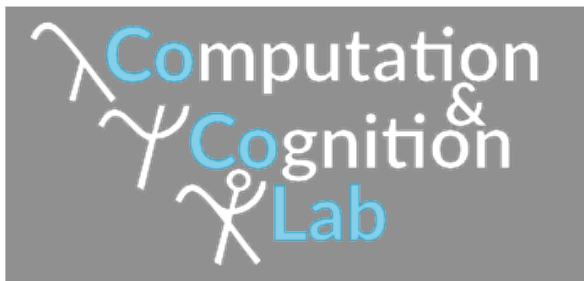


Communicating Generalizations in Web-Based Dyadic Games



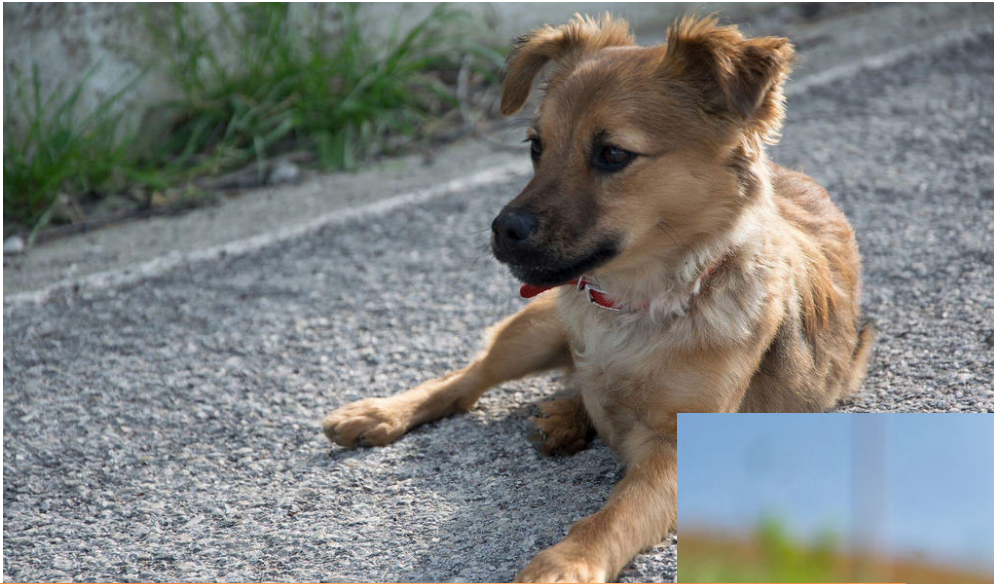
Lauren Oey, Andrea Shulman, MH Tessler
CSLI Summer Internship Program
August 18, 2017, 3:25pm

How do we learn about the world?

Through examples...







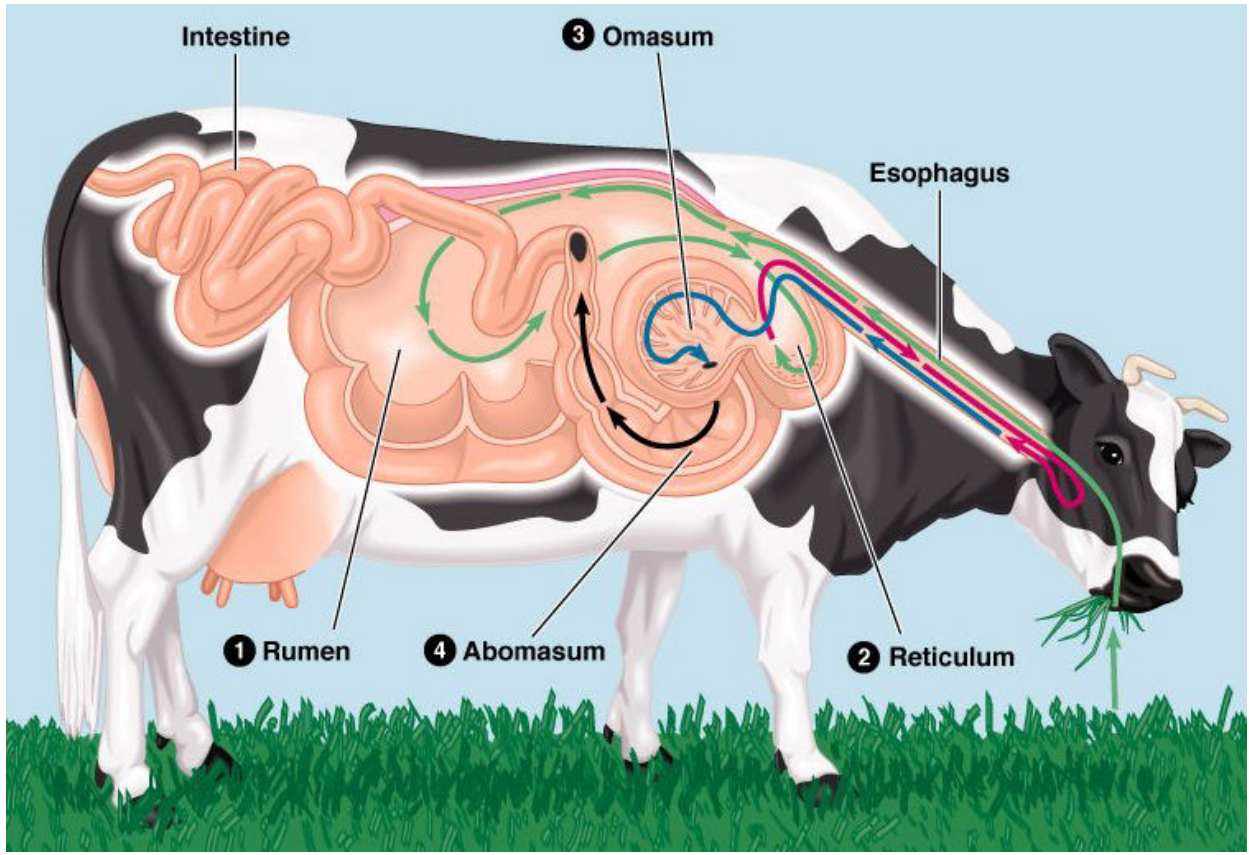
And making predictions about new instances

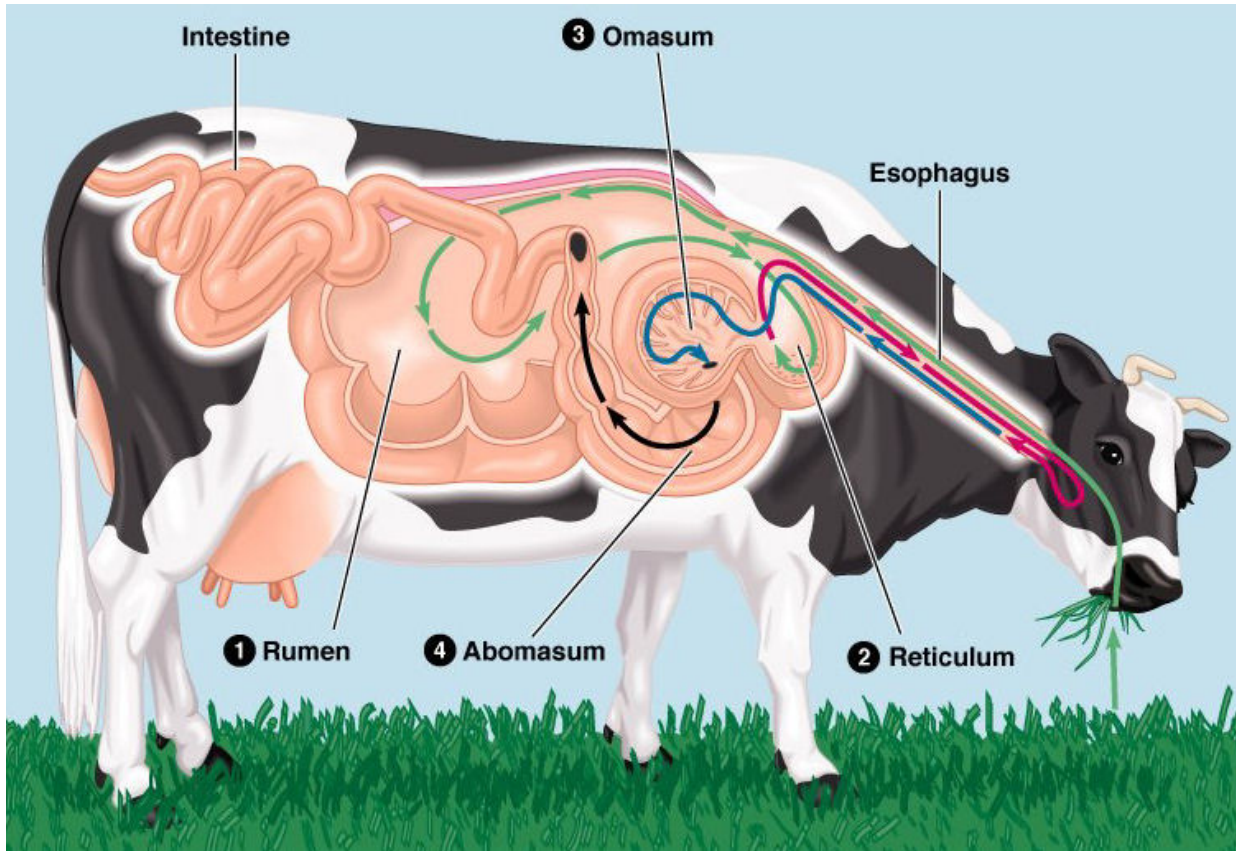


Generalization:

Inducing knowledge of a broader concept or category from observed instances

But is this the only way we learn?





Unobservable features





Infrequency





Costly



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Cognitive science

From Wikipedia, the free encyclopedia

For the journal, see [Cognitive Science \(journal\)](#).

"Brain science" redirects here. For other aspects of brain science, see [neuroscience](#), [neurology](#), and [neuropsychology](#).

Cognitive science is the interdisciplinary, [scientific](#) study of the [mind](#) and its processes.^[2] It examines the nature, the tasks, and the functions of [cognition](#). Cognitive scientists study intelligence and behavior, with a focus on how nervous systems represent, process, and transform [information](#). Mental faculties of concern to cognitive scientists include [language](#), [perception](#), [memory](#), [attention](#), [reasoning](#), and [emotion](#); to understand these faculties, cognitive scientists borrow from fields such as [linguistics](#), [psychology](#), [artificial intelligence](#), [philosophy](#), [neuroscience](#), and [anthropology](#).^[3] The typical analysis of cognitive science spans many levels of organization, from learning and decision to logic and planning; from [neural](#) circuitry to modular brain organization. The fundamental concept of cognitive science is that "thinking can best be understood in terms of representational structures in the mind and computational procedures that operate on those structures."^[3]

The cognitive sciences began as an intellectual movement in the 1950s often referred to as the [cognitive revolution](#).

Contents [hide]

1 Principles

- 1.1 [Levels of analysis](#)
- 1.2 [Interdisciplinary nature](#)
- 1.3 [Cognitive science: the term](#)

2 Scope

- 2.1 [Artificial intelligence](#)
- 2.2 [Attention](#)
- 2.3 [Knowledge and processing of language](#)
- 2.4 [Learning and development](#)

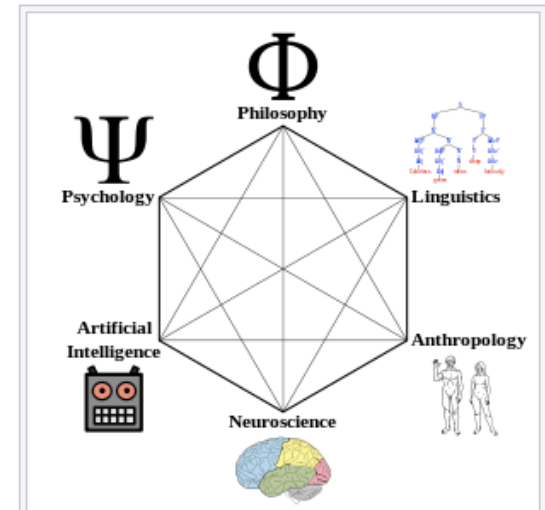
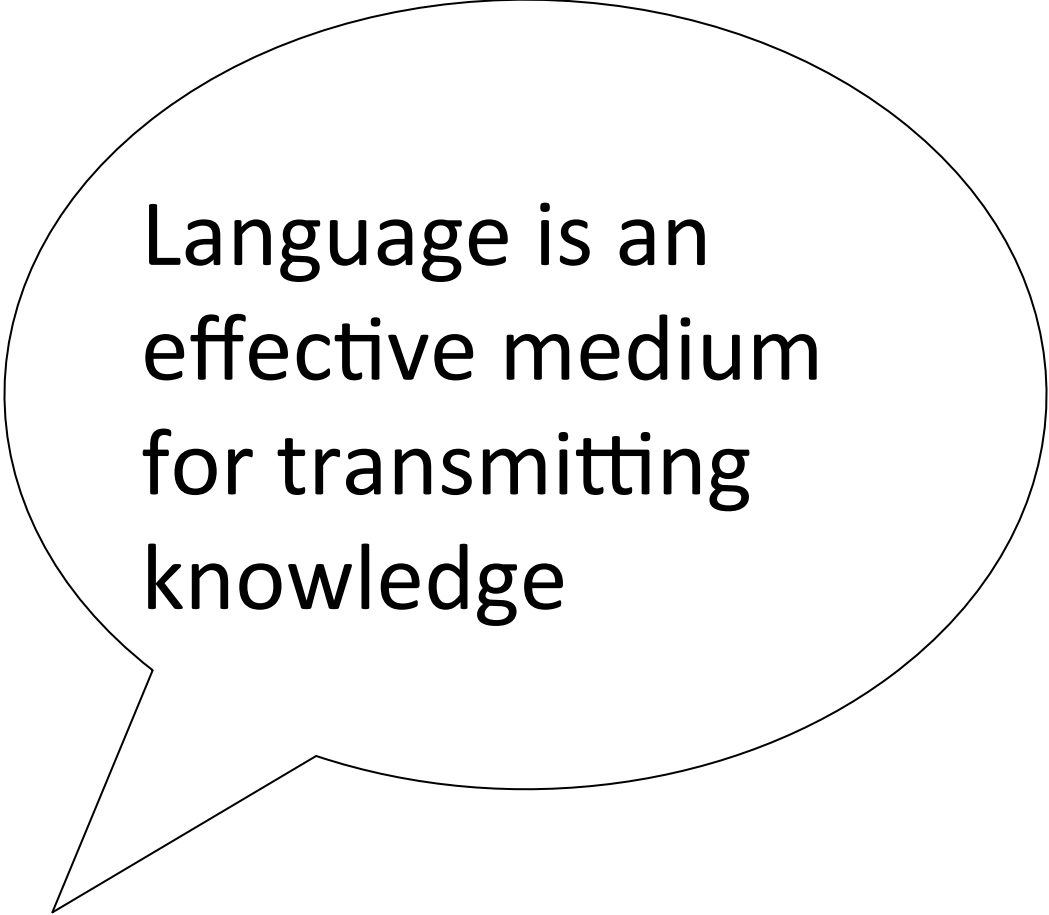


Figure illustrating the fields that contributed to the birth of cognitive science, including [linguistics](#), [neuroscience](#), [artificial intelligence](#), [philosophy](#), [anthropology](#), and [psychology](#).^[1]

[Trash](#)

Social Learning



A black-outlined speech bubble with a tail pointing towards the bottom-left. Inside the bubble, the text "Language is an effective medium for transmitting knowledge" is written in a black, sans-serif font, centered and arranged in four lines.

Language is an
effective medium
for transmitting
knowledge

A large, empty speech bubble with a black outline and a tail pointing towards the bottom-left. Inside the bubble, the word "Generics" is written in a bold, black, sans-serif font. Below it, the text "e.g. 'Birds lay eggs'" is written in a smaller, black, sans-serif font.

Generics

e.g. "Birds lay eggs"

(Gelman, 2009; Tessler & Goodman, 2016, in prep)

A black silhouette of an adult holding a child up in the air. The adult is on the left, and the child is on the right, being held up by the adult's hands. The child's arms are outstretched, and they appear to be reaching towards the text in the speech bubble.

Hypothesis:

Generics support
concept learning

(Gelman, 2003)

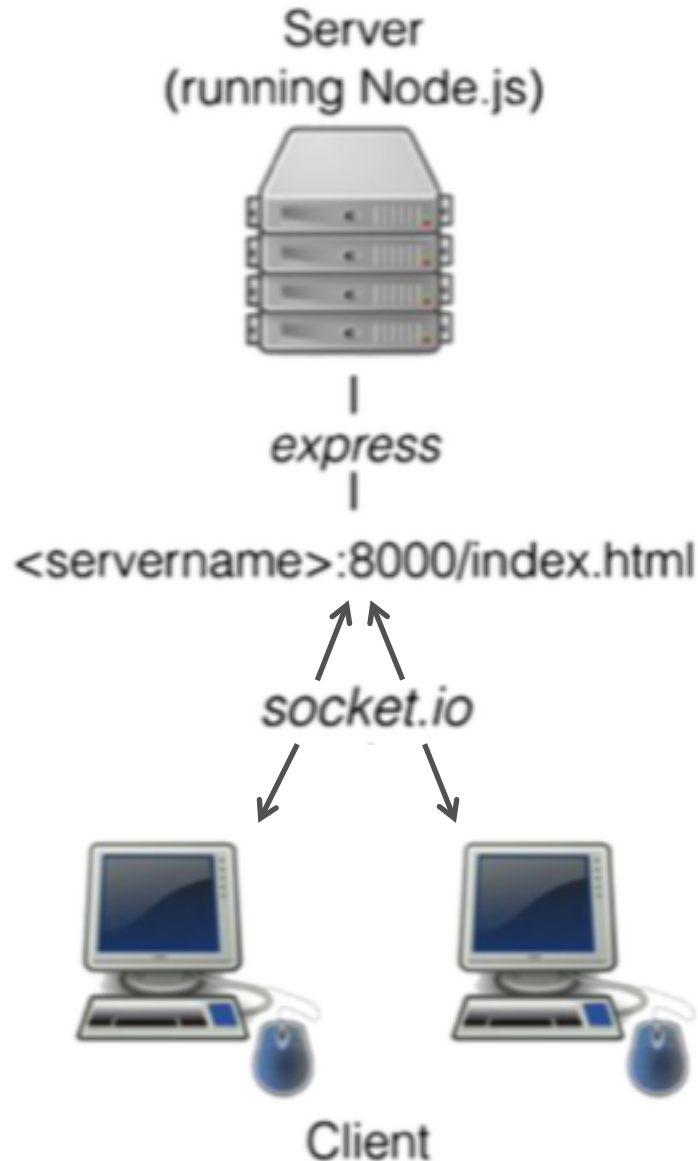
Research Question:

1. Is language effective for teaching simple concepts?

Research Question:

2. ***What*** in language is effective for teaching simple concepts?

Real-Time, Web-Based, Dyadic Experiment



(Modified from Hawkins, 2014)

Welcome to Critter Island

Click on each one to discover whether it lays eggs.



crullet 



fram 



fram



taifel



crullet 



taifel



taifel



taifel



fram



crullet



crullet



fram

Click on the birds that lay eggs.



fram



crullet



fram



taifel



crullet



taifel



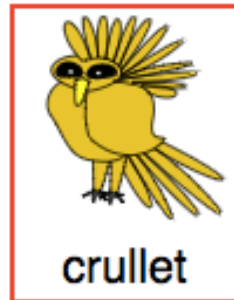
fram



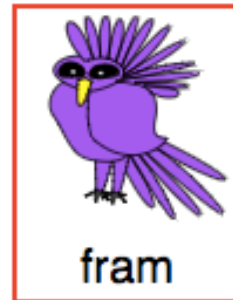
taifel



crullet



crullet



fram



taifel

Continue

Score Report

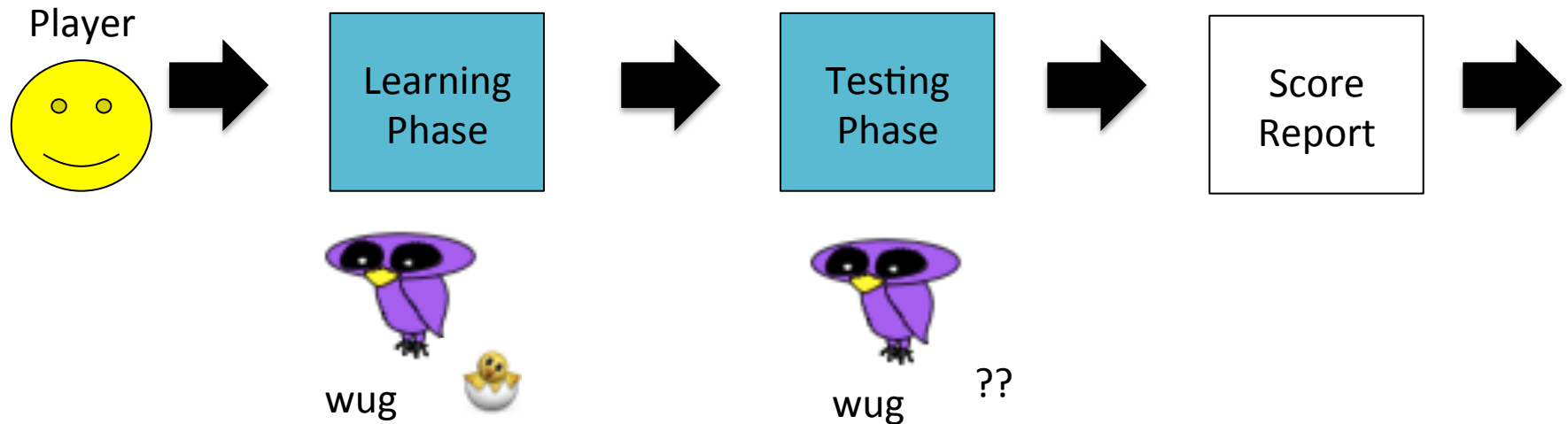
Here are the scores from this past section.

Your Score

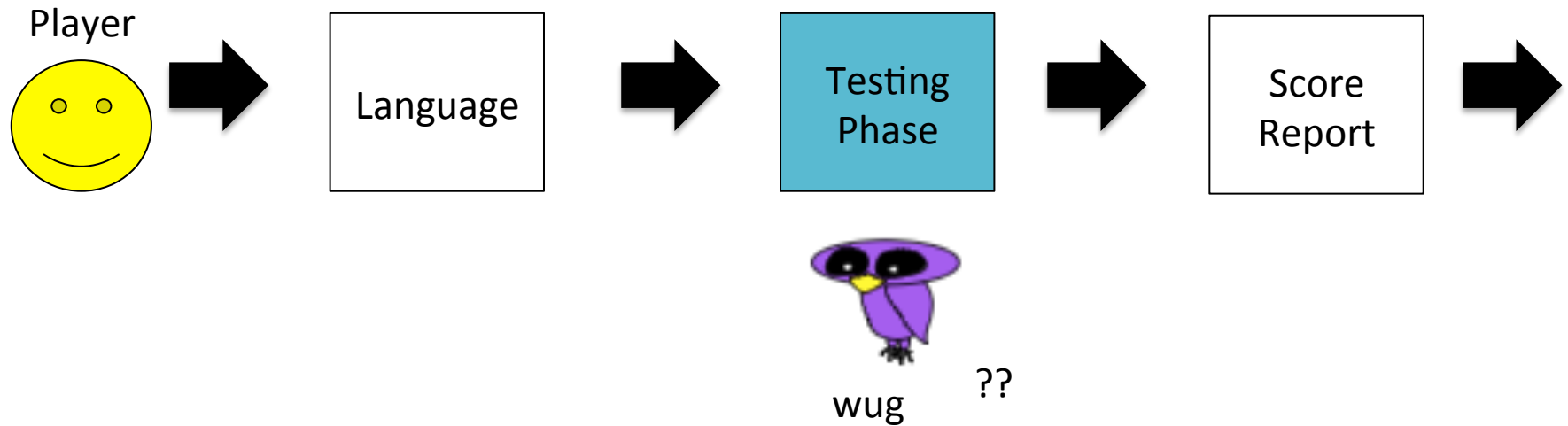
12

Continue

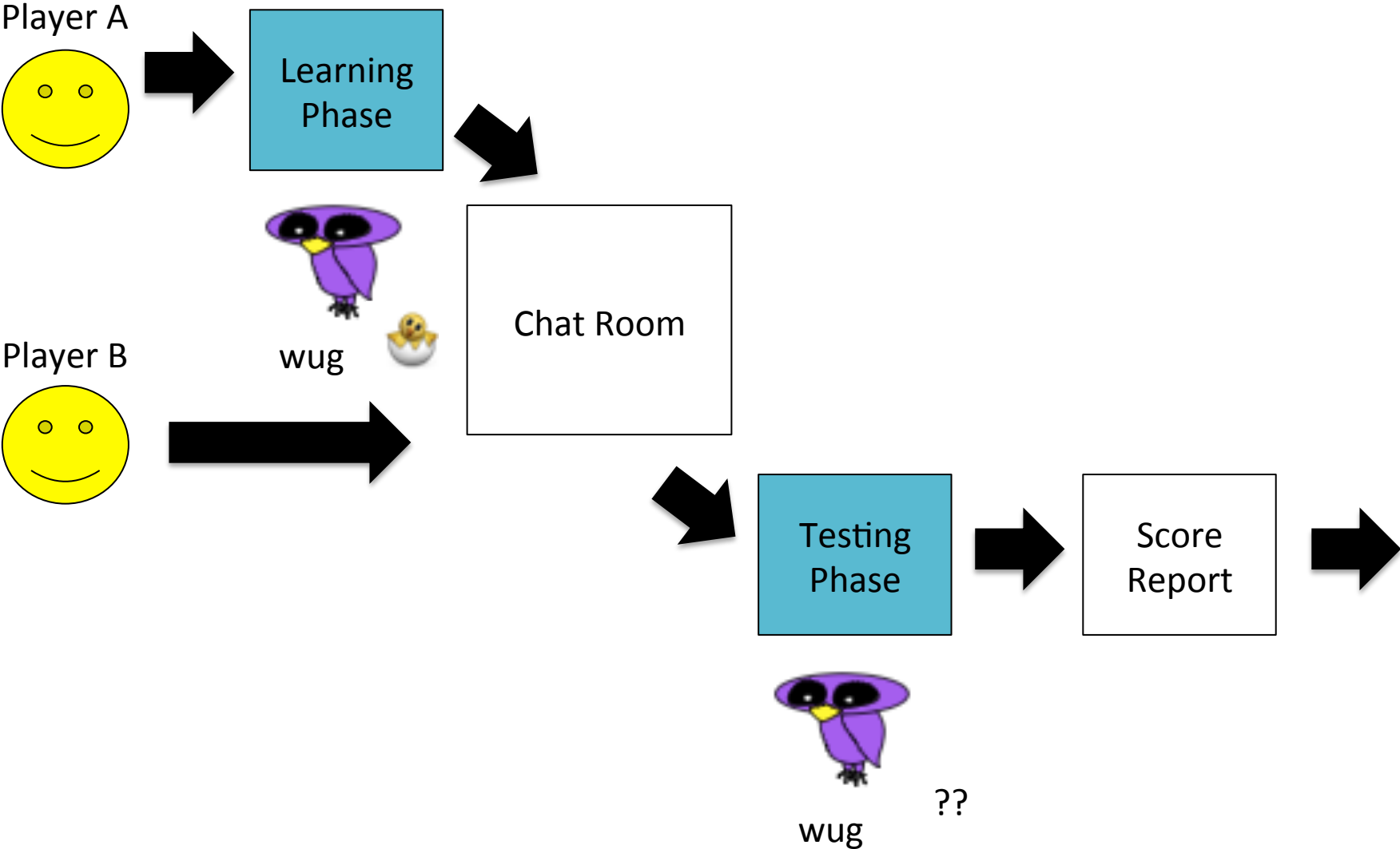
Experiment Block Design



Experiment Block Design



Experiment Block Design



Click on each one to discover whether it lays eggs.



crullet 



fram 



fram



taifel



crullet 



taifel



taifel



taifel



fram



crullet



crullet



fram

Discuss with your partner what each of you learned.

Send

Click on the birds that lay eggs.



fram



crullet



fram



taifel



crullet



taifel



fram



taifel



crullet



crullet



fram



taifel

Continue

Score Report

Here are the scores from this past section.

Your Score

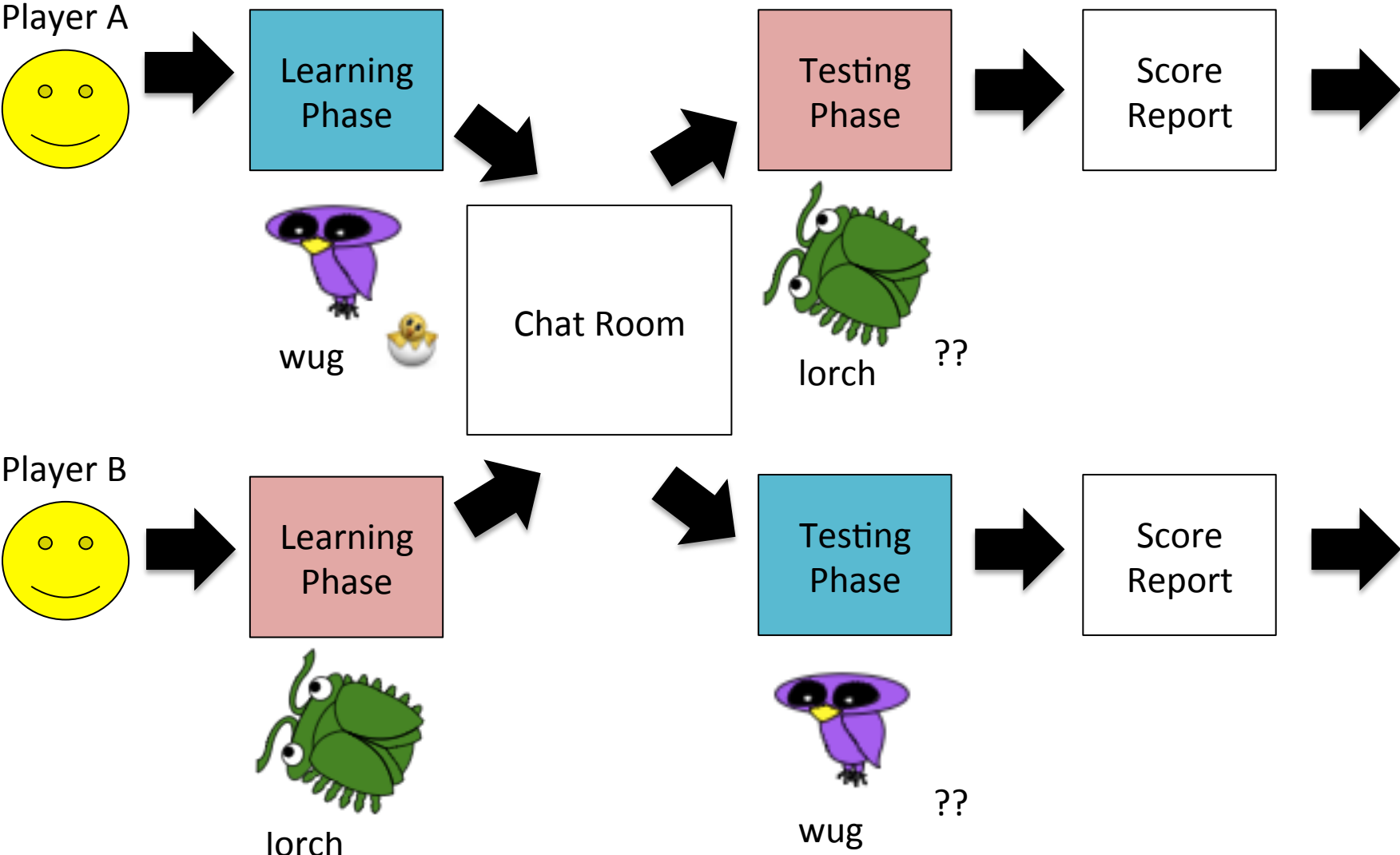
12

Your Partner's Score

10

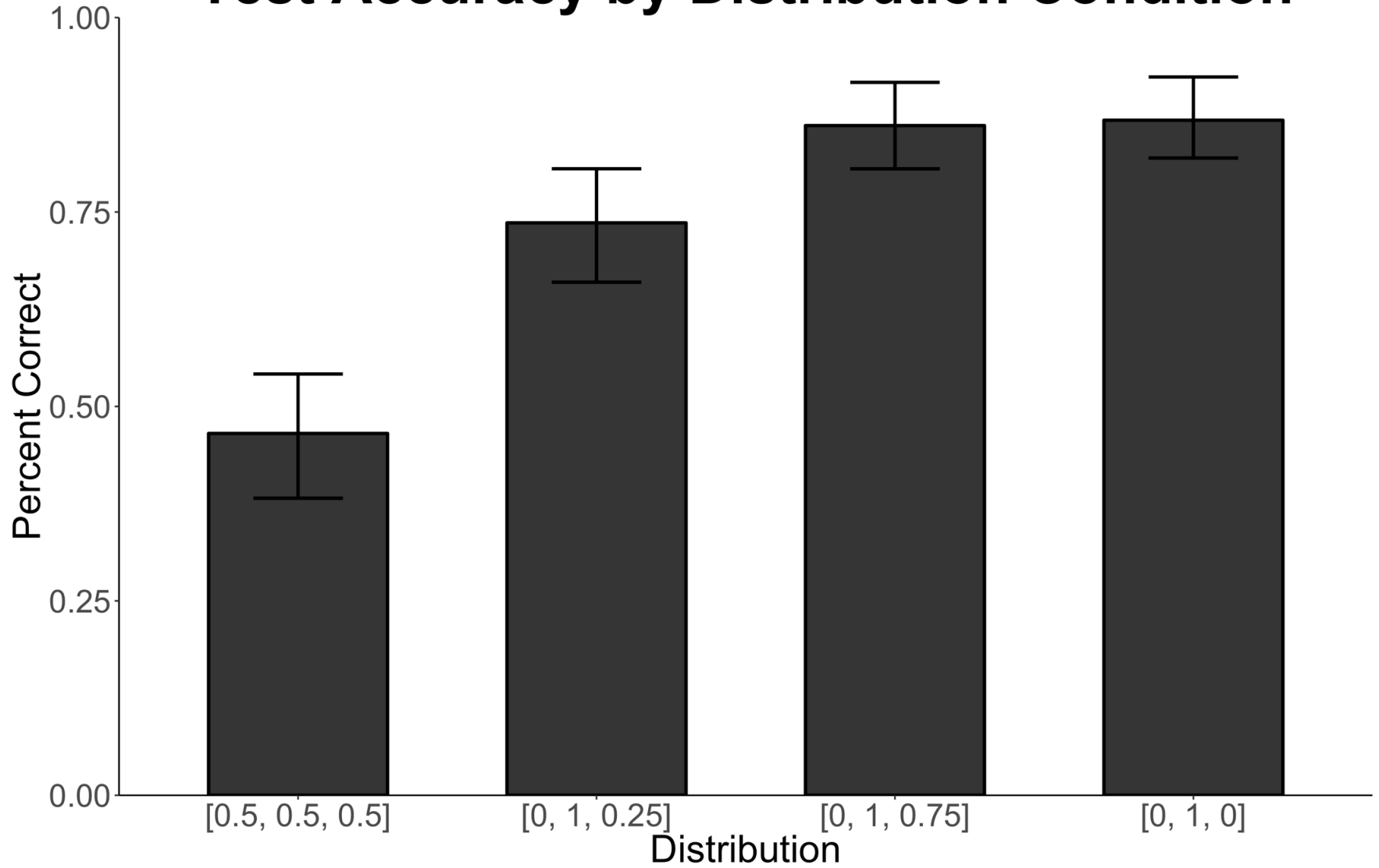
Continue

Experiment Block Design



Test Data Analysis

Test Accuracy by Distribution Condition



Language Analysis

playerA: morseth has crocodiles; none others

playerB: I learned that "kaz" plants grow leaves and the others do not.
"Kaz" plants are purple.

playerB: What color was Morseth?

playerA: I think it came in a few colors; all had crocs nearby

playerB: ok

playerB: you ready to continue to the thing?

playerA: sure!

playerB: ok, let's make some money

Distributions: playerA: [0, 1, 0] playerB: [0, 1, 0]

playerA: a zoov lives near crocodiles

playerB: kaz and jav colelct [sic] leaves

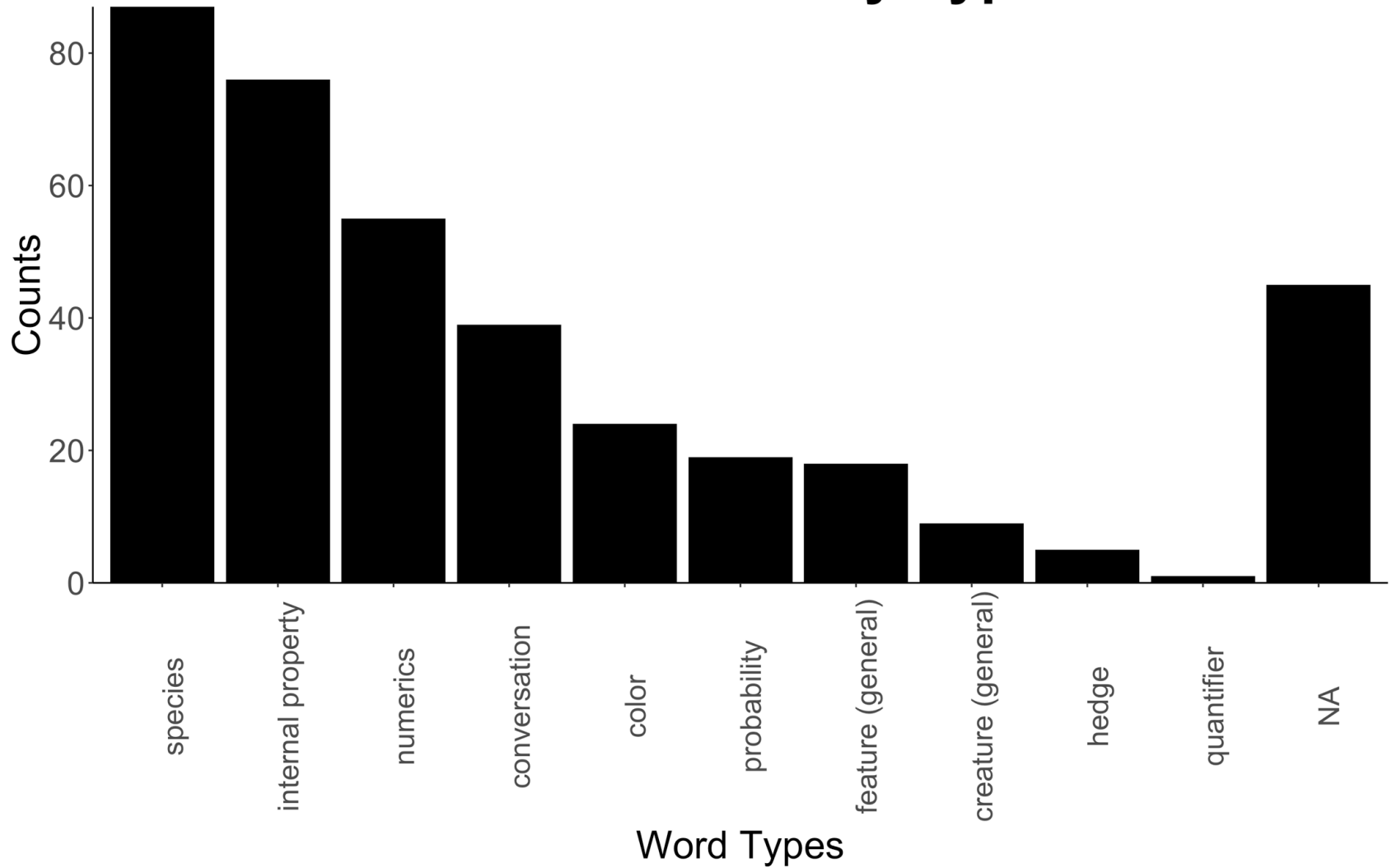
Distributions: playerA: [0, 1, 0] playerB: [0, 1, 0.25]

playerB: cheeba and fram have eggs. thup don't

playerA: at least two members of each creature are poisonous; it will be difficult to determine which ones are the poison ones

Distributions: playerA: [0.5, 0.5, 0.5] playerB: [0, 1, 0.75]

Context Word by Type



Summary

- Players are able to
 - Induce some generalization about categories
 - Communicate generalization to other player
 - Make prediction about new instances of category

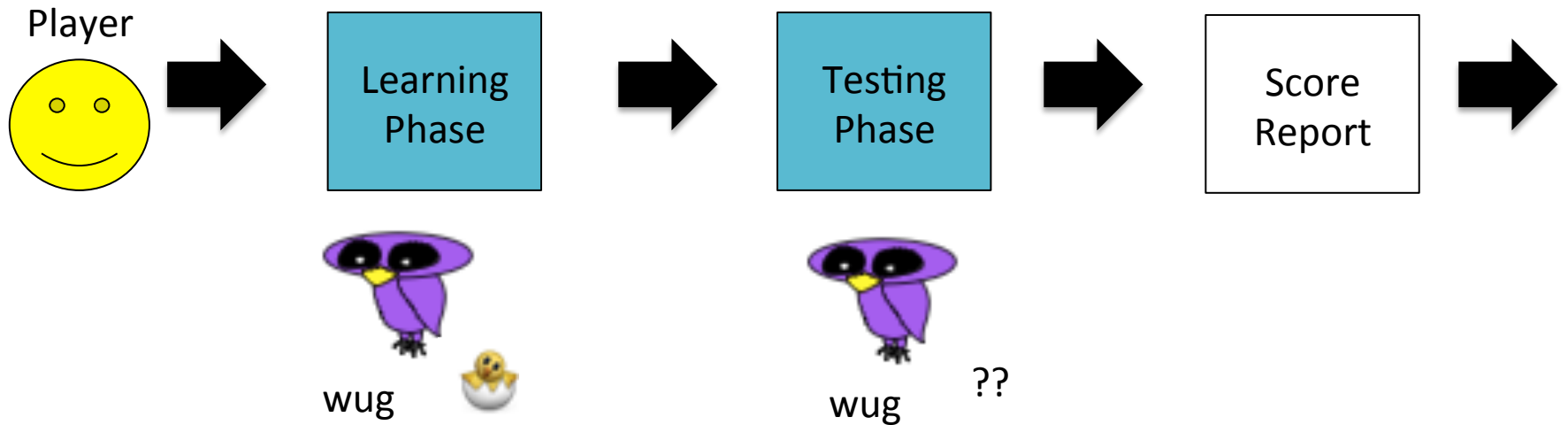
Discussion

- Experiment design as helpful tool to study:
 - Learning through exemplars
 - Knowledge transmission
 - Social learning

Future Work

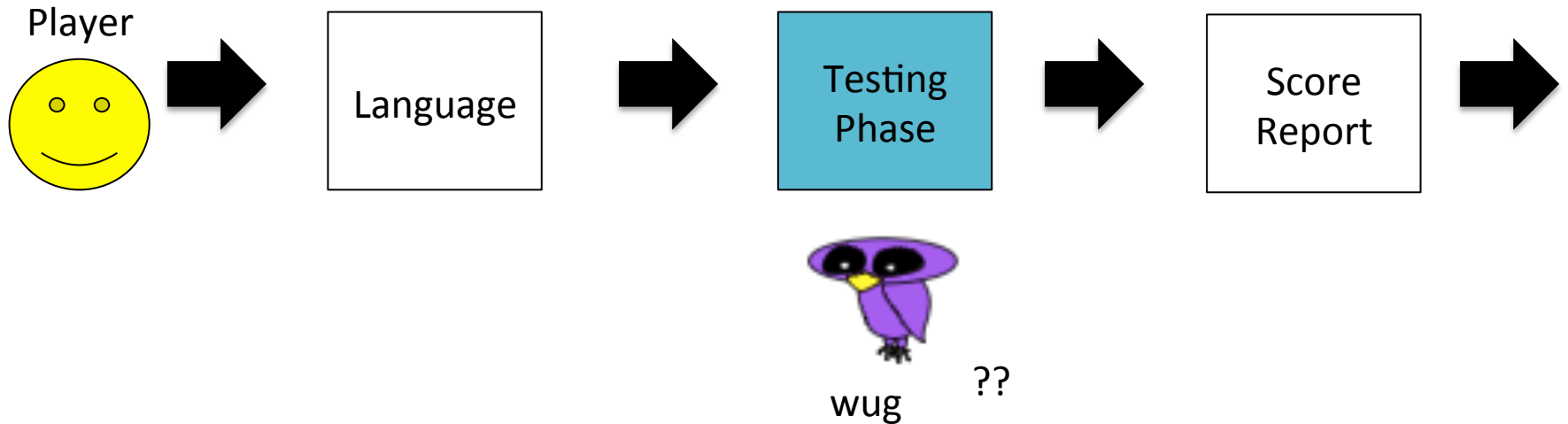
1. Social vs Individual learning
2. Compilation of knowledge

Individual Learning



VS

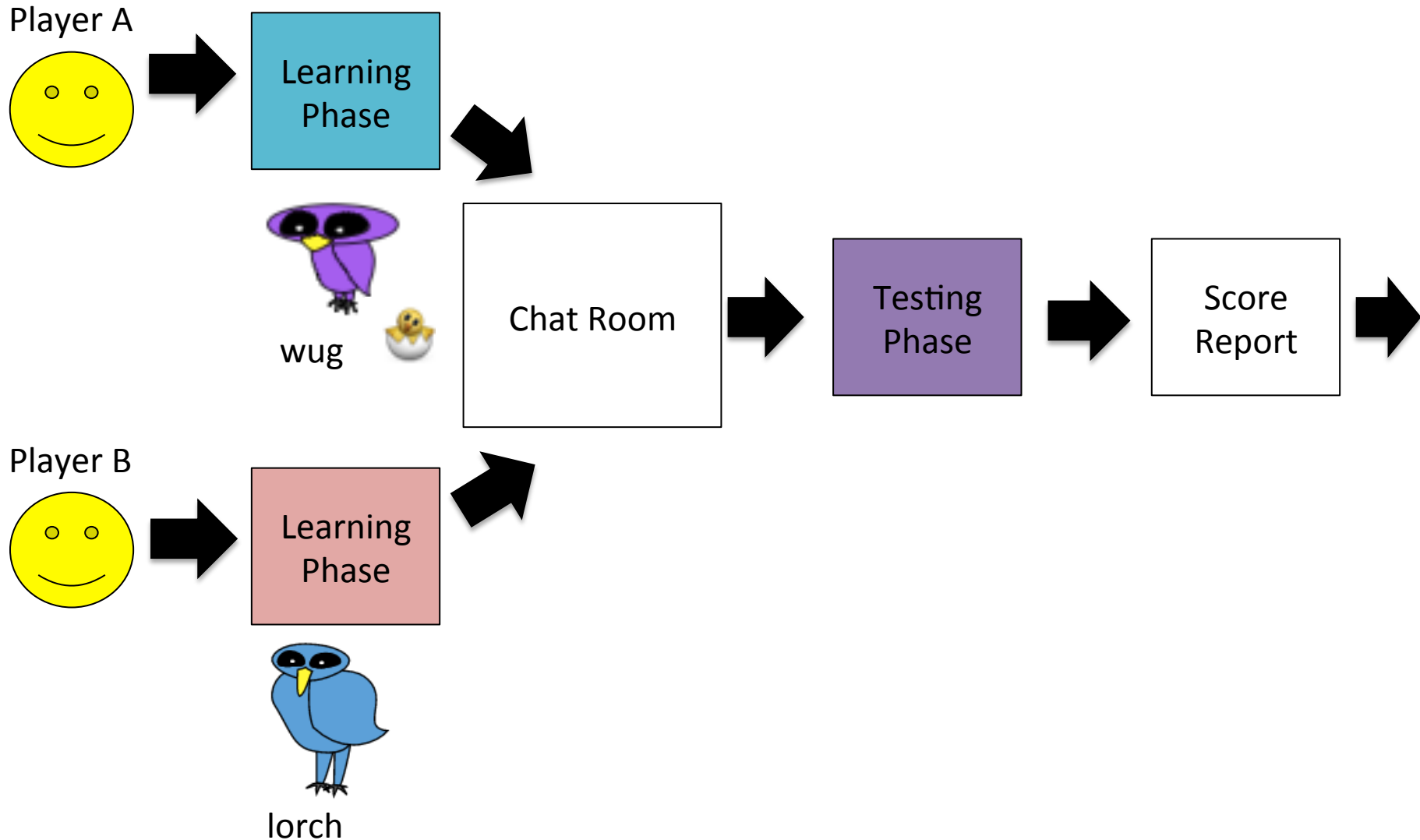
Social Learning



Future Work

1. Social vs Individual learning
2. Compilation of knowledge

Compilation Design



Special Thanks To

- MH Tessler
- Andrea Shulman
- Karl Mulligan
- Robert X.D. Hawkins, Judy Fan, Noah Goodman
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- Fellow CSLI Interns