Free to Explore a Museum

Embodied Inquiry and Multimodal Expression of Meaning

Nan Renner, Ph.D.
Primary data: Video, 2 POVs

child’s perspective

children’s activity in context
Theoretical framework: Distributed Cognition

Hutchins, 1995, 2005; Greeno, 2006; Kirsh, 2010; Cole & Engeström, 1993
Learning as **product** — conceptual knowledge

Learning as **process** — adaptation and use
Embodied, situated, distributed cognition
Cognitive Ethnography

Hutchins, 1995
Williams, 2006
Johnson, 2010
San Diego Natural History Museum
Multimodal analysis

Mixed methods

Quantitative analyses

Descriptive case studies
Multimodal Analysis  Goodwin, 2000; Jordan & Henderson, 1995

**multiple modalities**
- look, touch, manipulate, talk, gesture, read

**multiple individuals**
- children and adults

**multiple time scales**
- attention: < 1 second
- talk & gesture: 1–5 seconds
- interactions: 5-300 seconds
Activity structures

Participation frameworks

Discourse structures

Knowledge structures

Greeno, 2006
When free to explore...
how do children use the museum?
What can children teach us about learning in museums?
And their curiosity-driven self-organizing behavior?
Secondary data:
coding schemes
Multimodal engagement, Interactions with exhibits
Look
Look
Touch
Touch
Manipulate
Manipulate
Gesture
Gesture
What is it?
How old is it?
Where did it evolve?
How did it live?
Why did it go extinct?
Choose your mystery!

Talk
Talk
ChronoViz, Adam Fouse, UCSD Cognitive Science
Data visualization by Jamie Alexandre, sequential analysis code by Paul Ruvolo
Do particular forms of touch and talk co-occur?

Can we infer causal relationships, related to design?

What are the consequences of touch and talk?

What are the consequences of design?
A collection of specimens
How to organize?
Kinds of talk...
a starting point
Coding scheme for exhibit-related speech

Can the object of speech be perceived?

YES

Does object of speech refer to exhibit content?

YES

Does speech refer to something physically absent?

YES

CONCRETE / CONCRETE ABSTRACT

NO

CONCRETE / CONCRETE ABSTRACT

NO

Does object of speech refer to exhibit content?

NO

Does utterance perform a social conversational function?

YES

SOCIAL

NO

OTHER

ABSTRACT
Children's speech in museum
(six children, 496 speech events)

- Social: 31%
- Exhibit-related: 69%

Exhibit-related speech
(six children, 341 multimodal speech events)

- Concrete OBJECT: 44%
- Concrete ACTION: 23%
- Concrete/Abstract REPRESENTATION: 19%
- Read Aloud: 12%
- Abstract: 2%
Objects

Actions

Representation
What is it?
What can I do?
What does it mean?
Sequences of action give form to trains of thought.

Alac & Hutchins, 2004
What is it?
What can I do?
Functions of touch

n = 421 touch events, six kids
Forms and functions of gesture

n = 113 gesture events, 6 kids
Functions of action-oriented speech

n = 89 multimodal speech events, 6 kids
What can I do?
Test cause & effect
child’s perspective

children’s activity in context
What does it mean?
Functions of concrete/abstract speech

n = 73 multimodal speech events, 4 kids
Concrete/Abstract “Speech” with Hand Actions

n = 56 multimodal speech events, 4 kids

Children rarely used representational speech without involvement of the hands (“no touch”)
What does it mean?

Imagine
Where plates collide

Subduction zone

Rocks 150 to 40 million years ago, subduction of oceanic crust under western North America produced a huge slice of plutonic rock. Lower plate movement uplifted this rock to form the mountain range of the Transverse and Peninsular Ranges.

Donde chocan las placas

Zona de subducción

Hace más de 150 a 40 millones de años, la subducción de la capa oceánica bajo el oeste de América del Norte produjo un gran trozo de roca plútonica. El movimiento horizontal inferior levantó esta roca para formar las montañas de la Transversal y la Peninsular.
Theory
Methods
Practice
Theory:
Cognitive complexity
Methods:
Cognitive ecosystem forms & functions
Practice: Consequences of interactivity
What is it?
What can I do?
What does it mean?
Explore
Imagine
Express
Many thanks...

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My beloved family & friends
Opening the Black Box of Educational Reform

Computer Science as a Case Study
Educational Ecosystem

National
State
County
District
School
Classroom
Teachers & students
National agenda:

to expand and broaden participation in computer science

What?

Get more students by offering more classes

Why?

To benefit society
To create opportunities for all
Social justice in educational access

How?
CS10K

- A national initiative
- Funded by National Science Foundation
- Train 10,000 teachers for 10,000 schools
- Support curriculum development
- Launch AP Computer Science Principles
Computer Science: Creating a Village for Educators (CS-CaVE)

- Built on previous project (ComPASS) focused on training teachers
- Partnership: UCSD and 3 school districts
- Establish, scale-up, and sustain K12 CS Ed
- Research how districts do this work
  What helps?
  What hinders?
Educational Ecosystem

- National
- State
- County
- District
- School
- Classroom
- Teachers & students
Educational Ecosystem

National
State
County
District
School
Classroom
Teachers & students
What needs to change?

Educational reform:

What catalyzes change

What promotes change?

What sustains change?
How does change happen from within?
Distributed Cognition

A theoretical framework

Describes division and integration of cognitive work

Explores information flows, representation, and transformation

A fundamental feature of cognition at any scale

Hutchins, 1995
Interesting questions

How does information flow through the system?
What information flows where, when, in what form?

How do different parts of the educational ecosystem work together, or not?

Constraints—What resists change?
What supports change?
"Don't just play on your phone, program it."
Creating a Village for CS Educators

CSCaVE is a partnership connecting San Diego Unified School District, Sweetwater Union High School District, Vista Unified School District, UC San Diego's San Diego Supercomputer Center and the Center for Educational Equity, Assessment, and Teaching Excellence, in addition to UCSD's Department of Computer Science and Engineering. CSCaVE is proud to be part of the CS10K Community. CSCaVE Aims to Increase

ucsd.edu/pressrelease/sdsc_sweetwater_schools_catch_eye_of_nsf_white_house funded by the National Science Foundation
Opening the Black Box of Educational Reform

Computer Science: Creating a Village for Educators