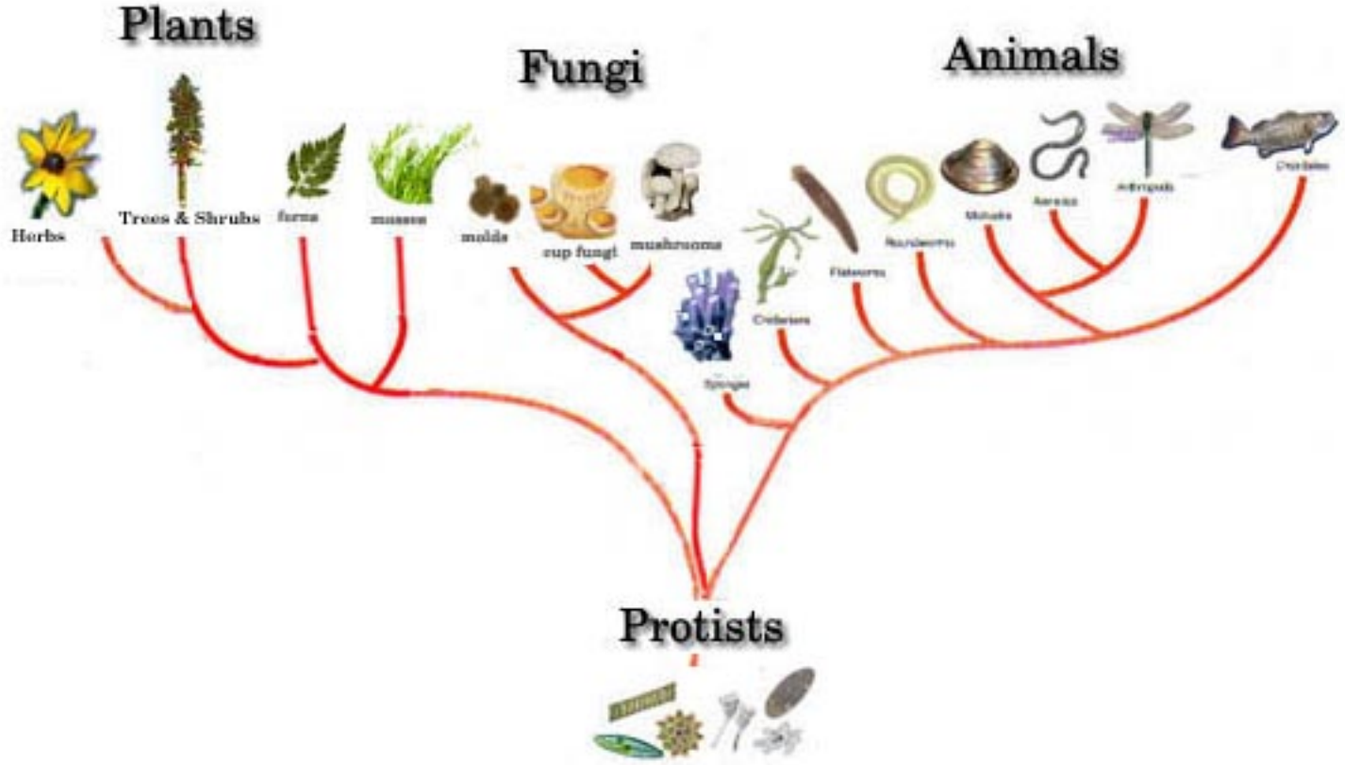
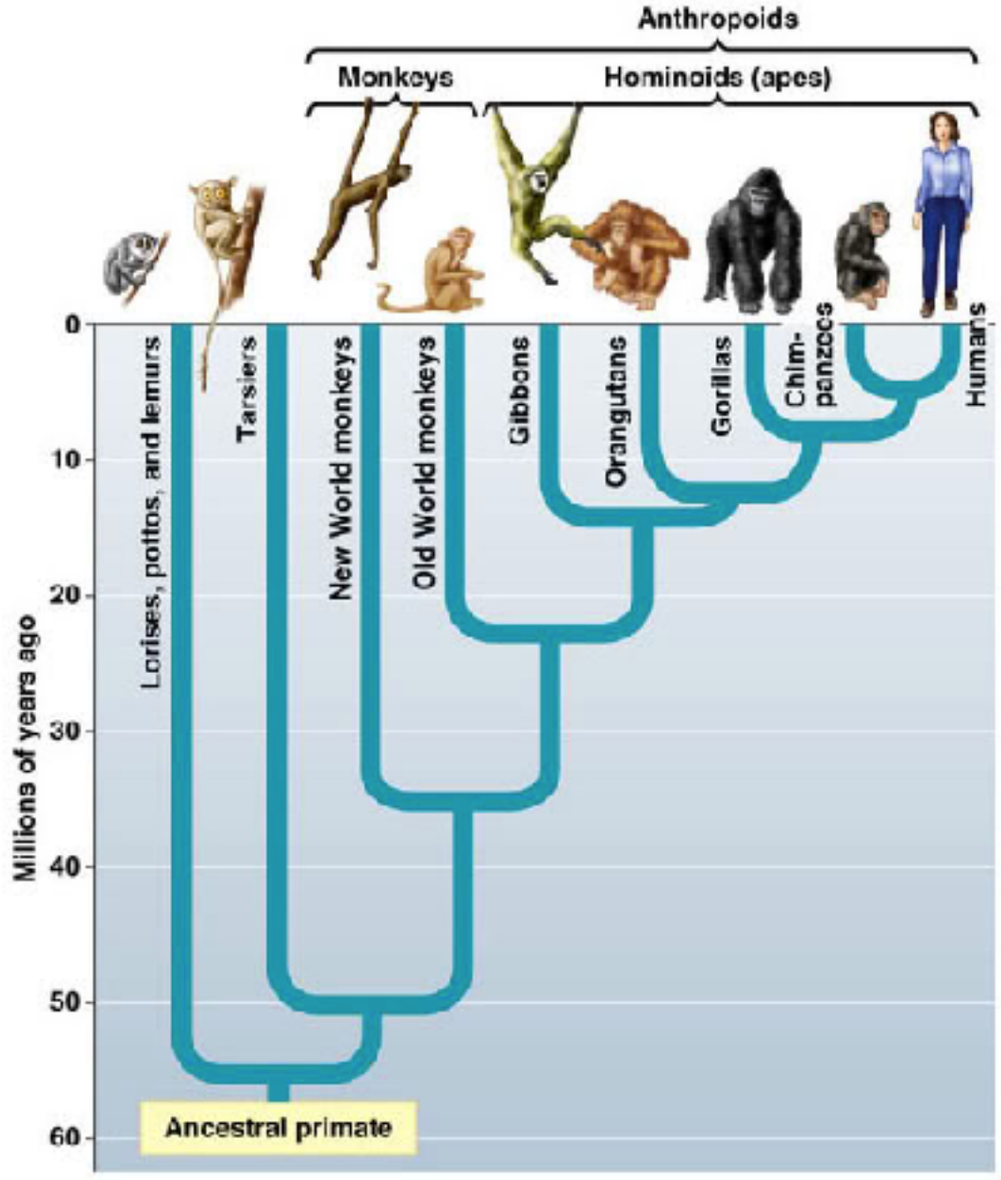
Development and Learning

Learning & Development 1:

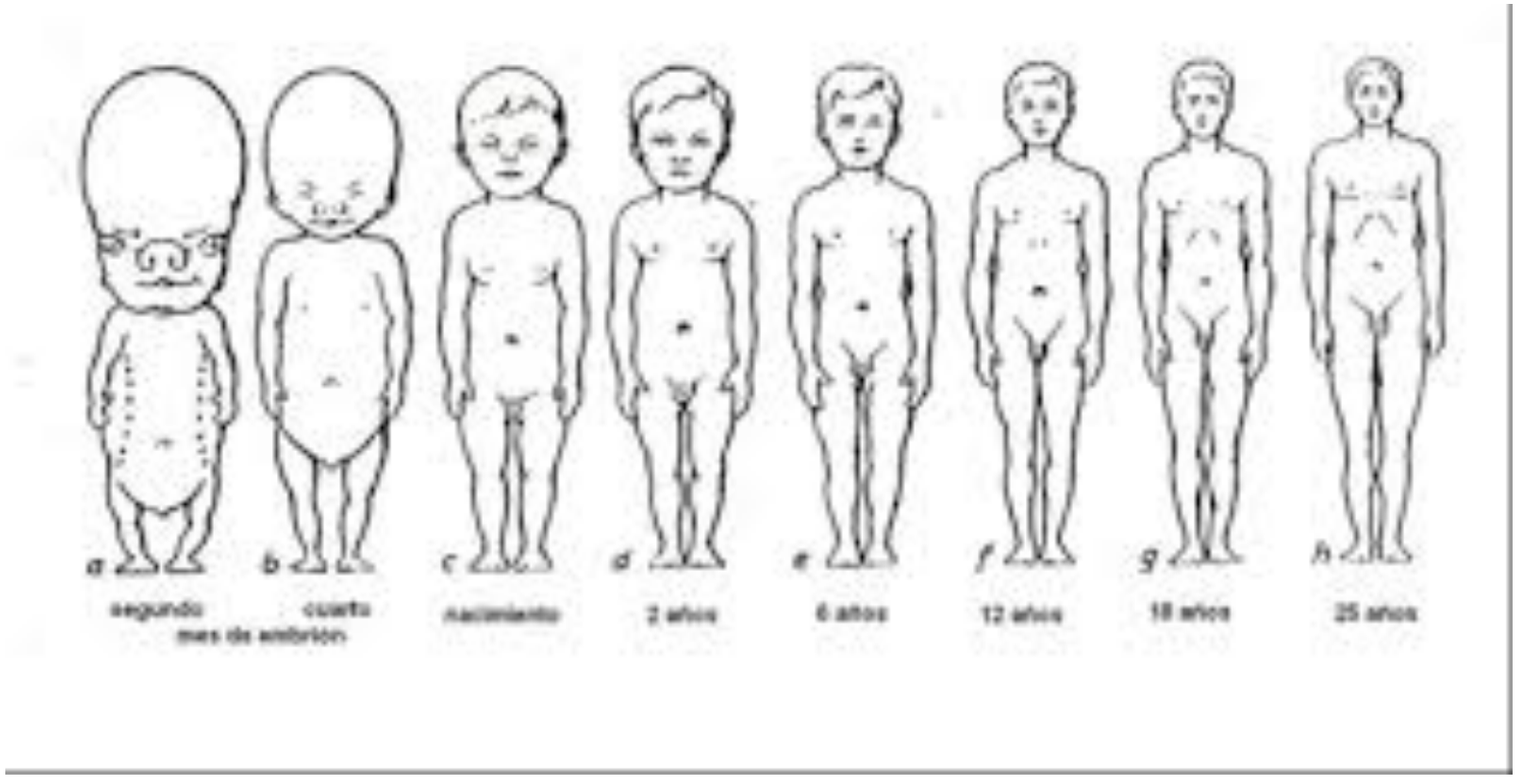
The Nature-Nurture non-dichotomy

Phylogenesis: The evolutionary history that gives rise to an individual





Ontogenesis: The developmental history of a single individual, from formation to death



What you do today depends on your ontogeny

and it depends on your phylogeny

But don’t assume you can partition your abilities, your features, your self, into two separate sets.

Innate vs Acquired

Biology (genes) vs Culture

Nature vs Nurture

These dichotomies go way back. They are fuelled, not only by scientific disagreement, but by theological assumptions, and the desire to have simple stories.

http://kevishere.wordpress.com/2014/06/10/developmental-plasticity-and-the-hard-wired-problem/

There is no organism without a genome; but there is also no such thing as an organism without an environment.

As the developmental psychologist Michael Tomasello once said: “Fish are born expecting water, and humans are born expecting culture.”

An emphasis on development as a process underscores how interwoven nature and nurture are.

Untangling the Innate and the Acquired

Identical Twins

Fraternal Twins

Caution required!!!!

Nature versus nurture is a lie. Music is not melody versus rhythm, wine is not grapes versus alcohol and we are not environment versus genes. We are their sum, their product and their expression. They dance together and we are their performance, but neither is an adversary. The art of understanding this elegant ballet is complex and arcane but you may never realise this from reading the quoted results of genetic studies, because the extent to which a trait is heritable, that is, accounted for by genetics, is usually expressed as a simple percentage.

Vaughan Bell, *The Psychologist*,
July 2009

Genes mean *nothing* without an organism in an environment. There is no rational sense in which we can separate biology from culture, or nature from nurture, or society from biology, and so forth.

Simplistic and misguided interpretation of twin studies is common.

Suggested reading:

On the Nature and Nurture of Intelligence and Specific Cognitive Abilities

The More Heritable, the More Culture Dependent

Kees-Jan Kan[1,3]
Jelte M. Wicherts[2,3]
Conor V. Dolan[1,3]
Han L. J. van der Maas[3]

Abstract

To further knowledge concerning the nature and nurture of intelligence, we scrutinized how heritability coefficients vary across specific cognitive abilities both theoretically and empirically. Data from 23 twin studies (combined N = 7,852) showed that (a) in adult samples, culture-loaded subtests tend to demonstrate greater heritability coefficients than do culture-reduced subtests; and (b) in samples of both adults and children, a subtest's proportion of variance shared with general intelligence is a function of its cultural load. These findings require an explanation because they do not follow from mainstream theories of intelligence. The findings are consistent with our hypothesis that heritability coefficients differ across cognitive abilities as a result of differences in the contribution of genotype-environment covariance. The counterintuitive finding that the most heritable abilities are the most culture-dependent abilities sheds a new light on the long-standing nature-nurture debate of intelligence.

The Altricial - Precocial Spectrum

Altricial

- Helpless at birth
- Underdeveloped

Precocial

- Able to cope at birth
- Relatively developed

The difference is NOT intelligence, or sophistication, or closeness to humans.

Every animal has its ecological niche. Some processes may require *being and living* in that niche in order to suitably constrain development.

Some niches do not offer the luxury of parental care and guidance.

Precocial skills (walking, suckling, etc) do not require much fine tuning, and are relatively invariant.

Altricial skills may show huge variation in the mature animal.

Distribution of the brown rat

Two Ways of Looking at This

[1] Altricial animals bear the hallmarks of flexible, adaptable behavior, and contrast with inflexible, rigid instinct.

or

[2] Altricial animals illustrate the tight intertwining of an animal and its environment. For humans, this includes the social environment, and language is part of that intertwining.

Learning and Development 2:

Two Big Theories of Learning and Development in Humans

Jean Piaget

(1896-1980)

Lev Vygotsky

(1896-1934)

Jean Piaget

Development, maturation and change *within* the individual

Lev Vygotsky

Development of the child *within* a society and culture

1896 - 1980

Described himself as a *genetic epistemologist.*

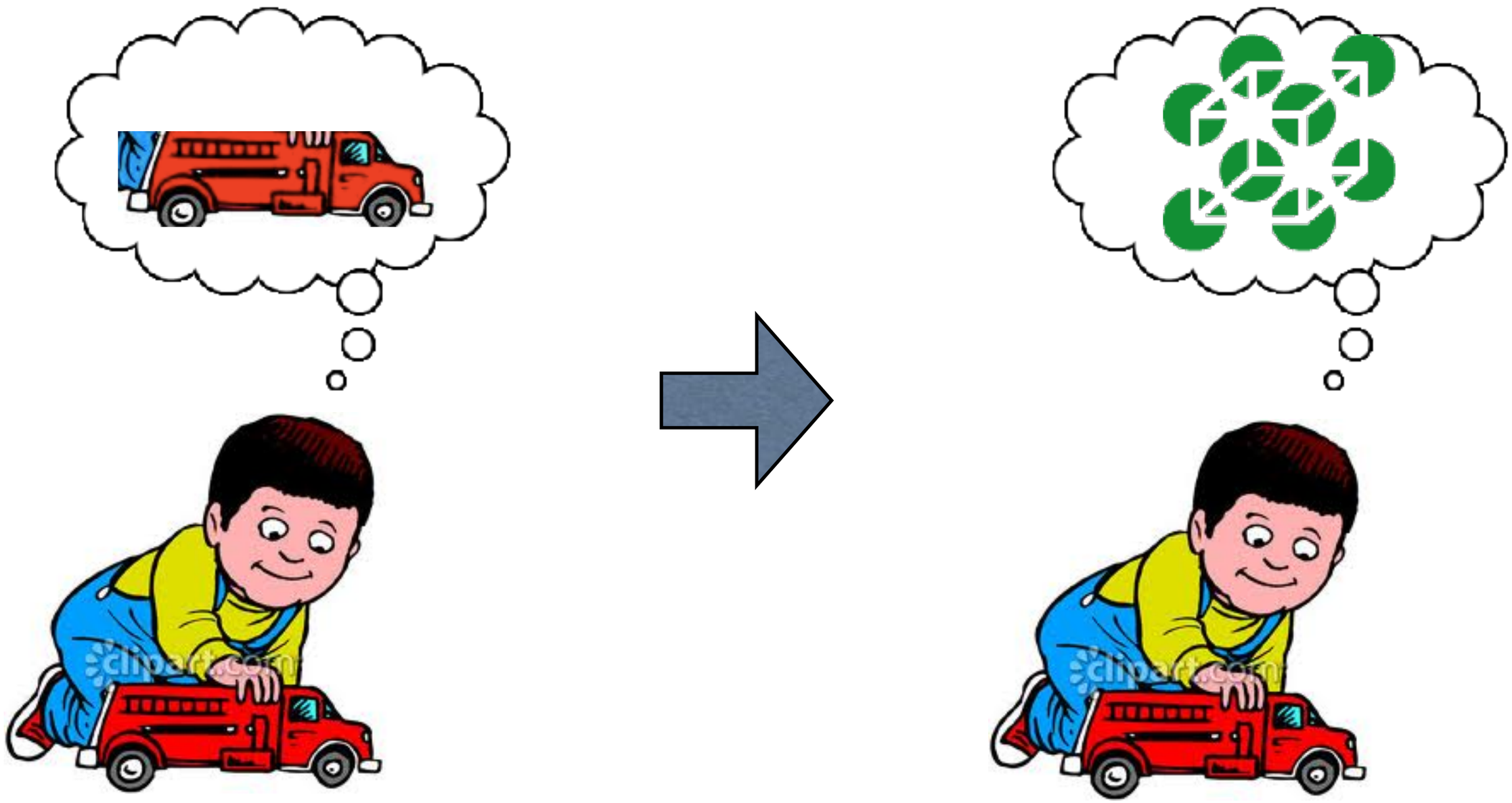
He endeavored to trace the nature and origin of knowledge from sensory-motor actions in infancy to formal cognition and logical operations in adulthood.

Viewed humans as meaning making. This is one flavour of *constructivism.*

Jean Piaget

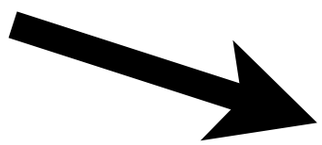
What changes take place
within the child?
In which sequence?
At which times?

Cognitive Structures: from simple, concrete to complex, abstract

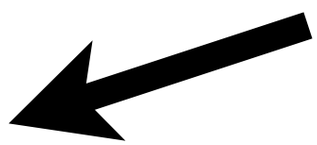


4 Developmental stages

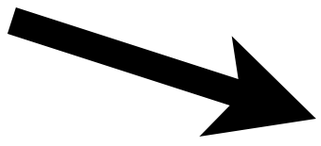
Sensorimotor (0-2y)



Pre-operational stage (2-7)



Concrete operational stage (7-11)



Formal operational stage (11-15)

Adaptation

Accommodation

Mental structures are adjusted based on novel experience

Assimilation

Experience is incorporated into existing structures

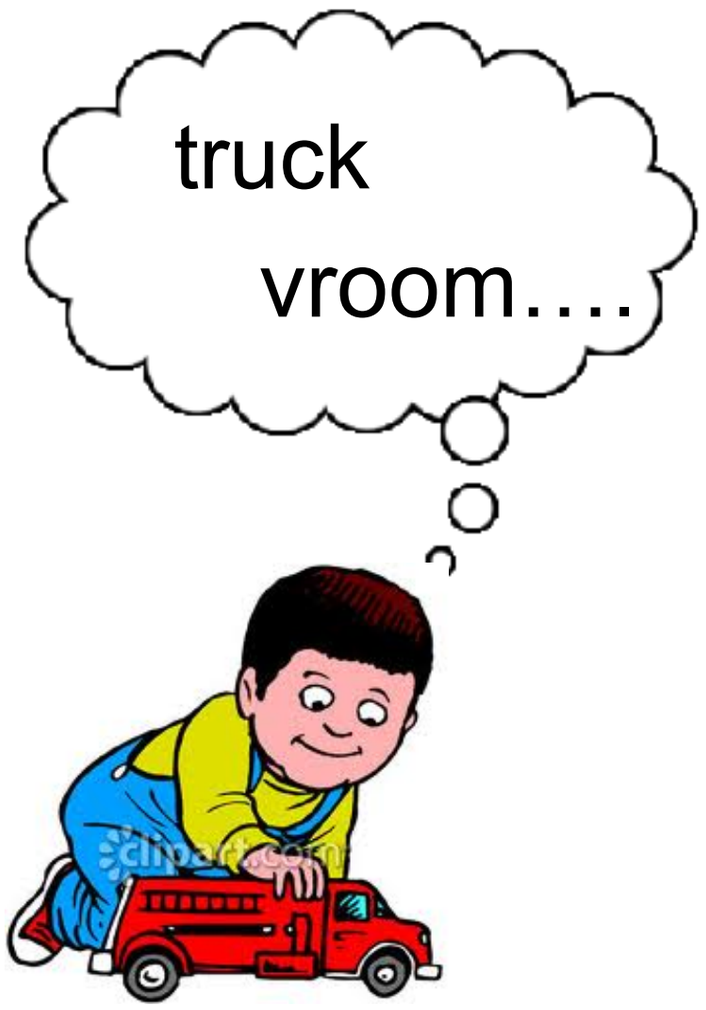
Sensorimotor stage (0-2 y)

The child interacts with their environment through physical actions

Emphasis on the concrete and the physically present

Unaware that objects persist when not seen

Pre-operational stage (2-7)



Object permanence now acquired.

Language use has started: the child uses *symbols*

Thinking is fanciful and wishful

Understanding of time is limited

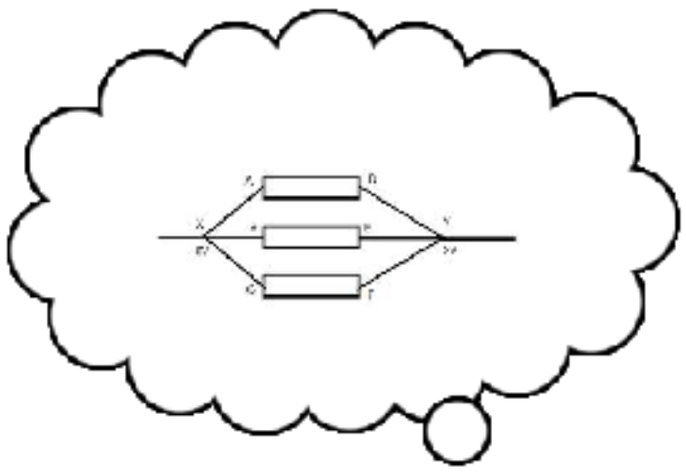
Reasoning is restricted to concrete operations in the here-and-now

Concrete operational stage (7-11)

Abstract thinking and reasoning appear

Reasoning supported by practical, physical aids

Formal operational stage (11-15)



Abstract reasoning about abstract concepts

Logic and reason well developed (?)

Jean Piaget

Development, maturation and change *within* the individual

Lev Vygotsky

Development of the child *within* a society and culture

1896 - 1934

His seminal work, *Thought and Language* was not published in English until 1962

Part of an important Russian/Soviet school of psychology whose effect on the literature in the West has been somewhat delayed.

Others: Bernstein, Luria, Leont'ev, Bakhtin, etc.

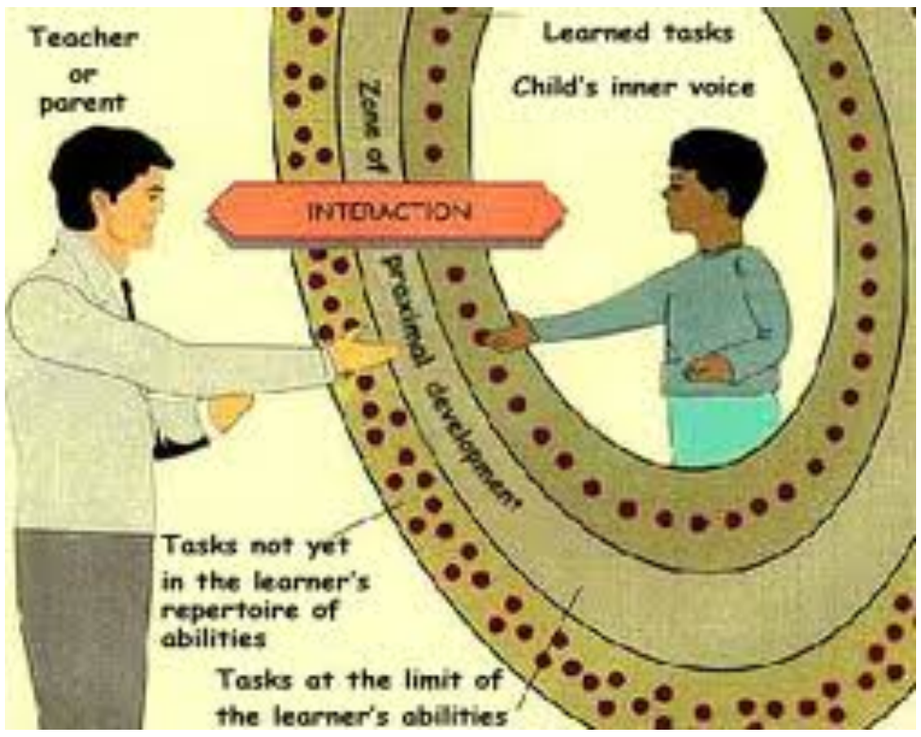
Lev Vygotsky

Learning is done in a social context.

Cognitive functions develop first between people, and only later become internalized

Lev Vygotsky

Zone of Proximal Development



A child who can do something (say, X) alone, can do X+Y together with a teacher or competent peer. Y belongs to the Zone of Proximal Development. Tasks within the ZPD gradually enter the child's own repertoire.

Cultural Mediation

Lev Vygotsky

Meaning and significance come from the web of social relations we live within.

We first encounter meaning in an inter-personal context, and later appropriate this for our selves: *internalization*

Vygotsky on Language and Thought

Inner speech develops from vocal speech

Young children literally think out loud

Inner language becomes compressed

Joint attention in early language learning

Jean Piaget

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Development of the child *within* a society and culture

Theories of development necessarily feed into theories of education.

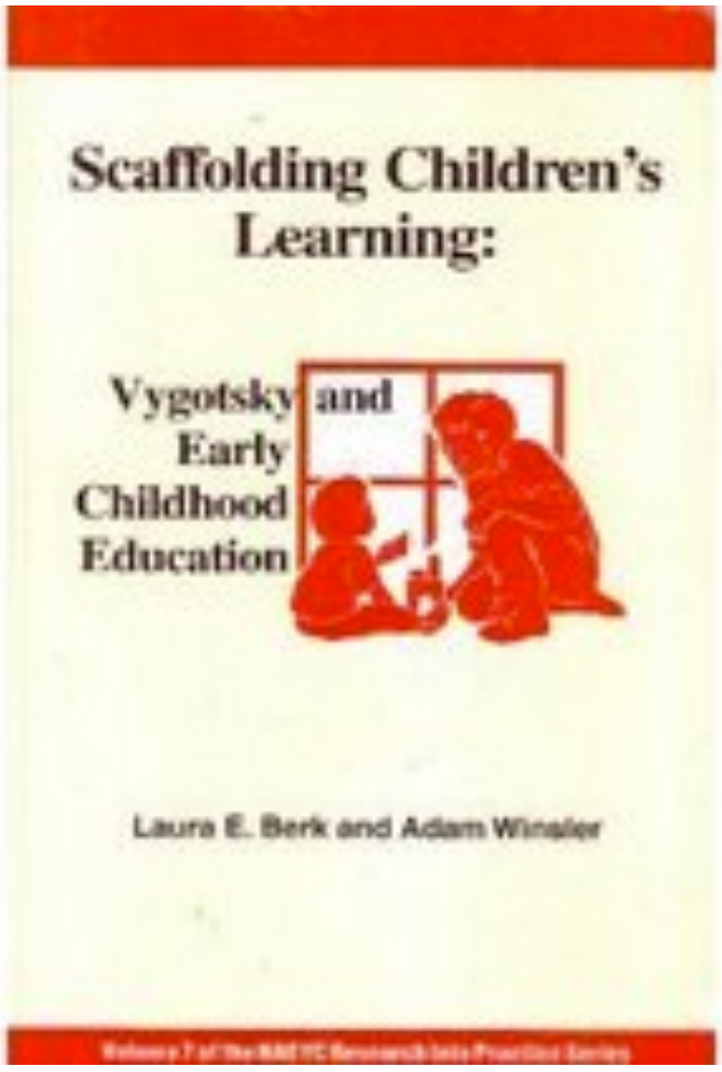
What are the more obvious dangers here?

What are the implications of the notion of the Zone of Proximal Development for educators?

What are the implications of Piaget's notion of developmental stages?

One implication of the ZPD for educators is the need to provide personalised supports during learning:

Scaffolding



Learning & Development 3:

Social behaviour in the very young and the difficulty of interpreting infants

In these studies, fascinating glimpses are caught of the emerging social nature of the infant.

Each seminal study suggests that the infant is deeply social from a very early age.

Very difficult problems remain in the description of infant behavior, in its interpretation, and in replicating results from one study to the next.

Example 1: Murray and Trevarthen, "Emotional Regulation of Interactions between Two-Month Olds and their Mothers" (1985)

Infant interacts with either its mother (live) or a tape recording of its mother (tape)

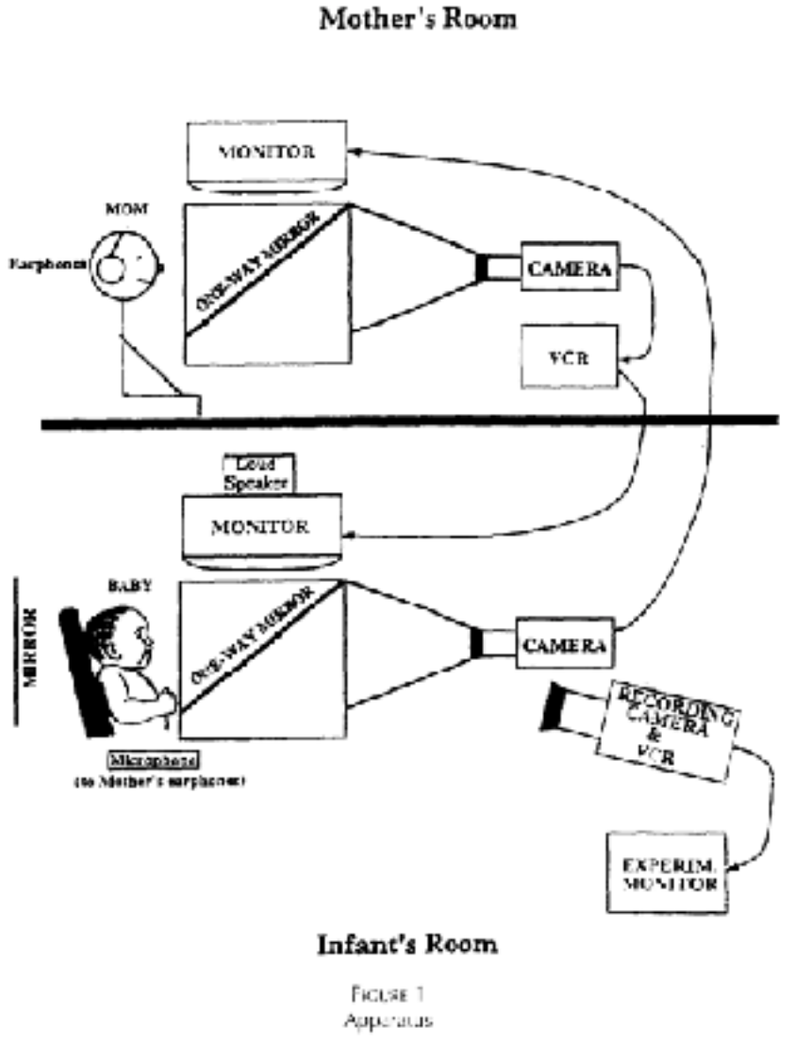


FIGURE 1
Apparatus

Basic finding:

Infants interact happily with the mother in the *live* condition, but show signs of distress and disinterest in the *tape* condition.

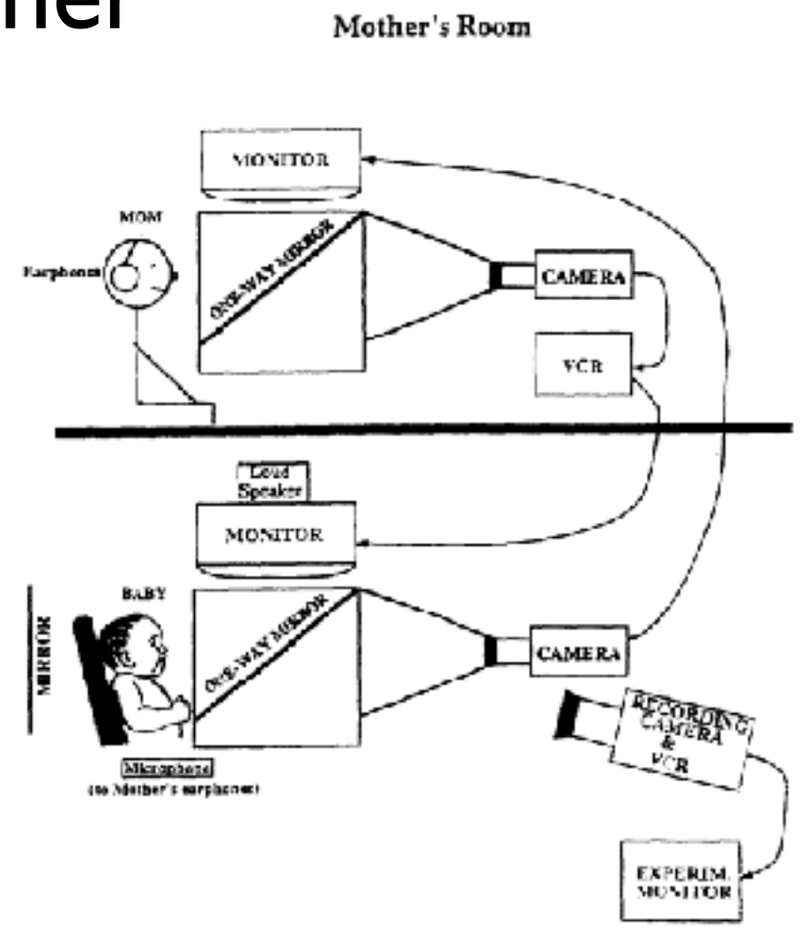


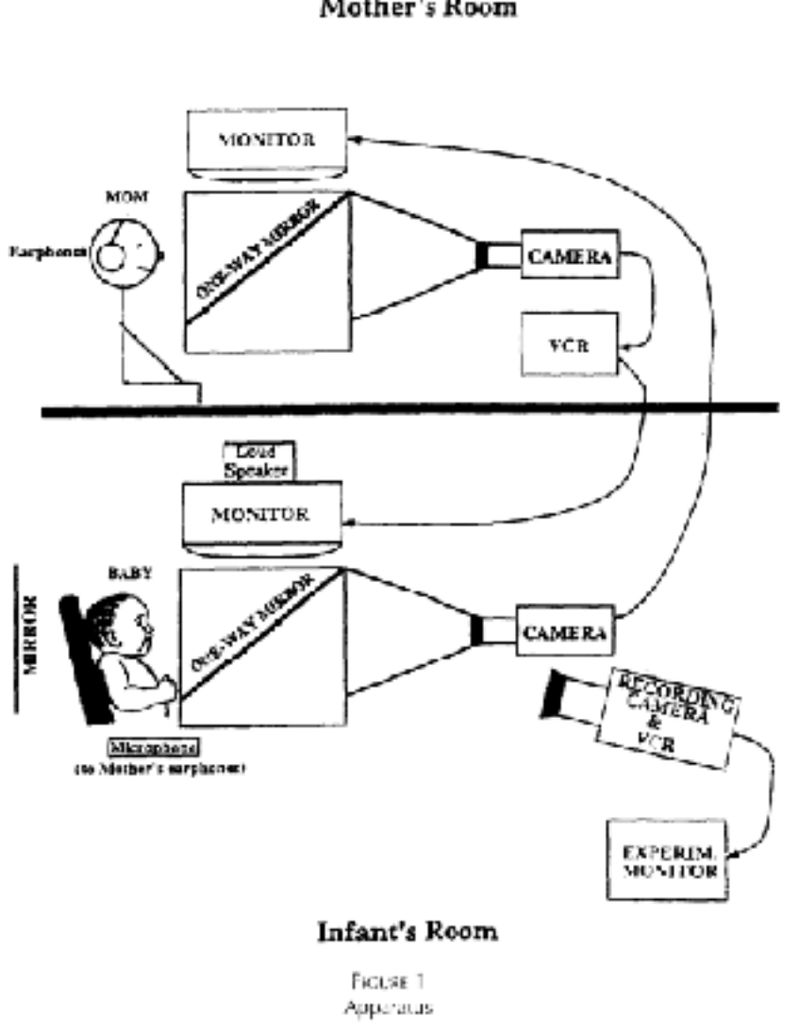
FIGURE 1
Apparatus

Some studies claim to have found similar effects

Other studies have failed to replicate these findings

Much depends on how you interpret infant behavior

Note the importance of developing methods of measurement that are not subjectively biased!



Rochat, P., Neisser, U., & Marian, V. (1998). Are young infants sensitive to interpersonal contingency?. Infant behavior and development, 21(2), 355-366.

Example 2: Meltzoff and Moore, Imitation of facial and manual gestures by human neonates, (1977)

Fig. 1. Sample photographs from videotape recordings of 2- to 3-week-old infants imitating (a) tongue protrusion, (b) mouth opening, and (c) lip protrusion demonstrated by an adult experimenter.

Infants tested were 2-3 *weeks* old

They thus had absolutely no experience of seeing themselves

Fig. 1. Sample photographs from videotape recordings of 2- to 3-week-old infants imitating (a) tongue protrusion, (b) mouth opening, and (c) lip protrusion demonstrated by an adult experimenter.

Imitation of both facial gestures (open mouth, tongue protrusion, pouting) and manual gestures (finger pointing)

As before, there are grave problems in interpreting the infant's "response". Recent meta-studies have claimed that only tongue protrusion is reliably copied. Is this still "imitation"?

Baby chimps may produce similar reactions.

Jones, S. S. (2009). The development of imitation in infancy. Philosophical Transactions of the Royal Society B: Biological Sciences, 364(1528), 2325-2335.

The study of "imitation" raises several interesting issues.

Fig. 1. Sample photographs from videotape recordings of 2- to 3-week-old infants imitating (a) tongue protrusion, (b) mouth opening, and (c) lip protrusion demonstrated by an adult experimenter.

The "Correspondence Problem":

How do you define a successful imitation?
Why does one sequence of movements, rather than another, count as an instance of a specific behavior?

When studying infants, how "objective" can, and should, we try to be?

Requried reading: Vasudevi Reddy & Colwyn Trevarthan

We have deliberately slanted the emphasis in our title to 'engaging with' babies, because we want to show evidence that engagement is how we gain psychological knowledge about others, including babies, and that this is as true for the psychologist as it is for other folk. If we want to know what a baby, an adult or, indeed, any animal feels or thinks, we have to engage with them, allowing ourselves to feel the sympathetic response that the other's actions and feelings invite.

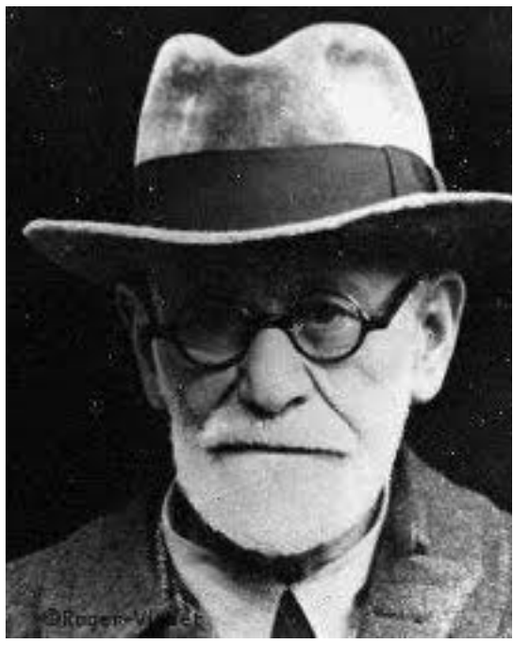
Learning & Development 4:

The Human Speechome project

Scientists studying their own children:

Charles Darwin

Sigmund Freud



Deb Roy

Also Jean Piaget(!)

Human Speechome Project

Deb Roy

Attempt to capture almost the entire linguistic output and environment of a child over three years

11 Video cameras
14 Microphones
200 GB data per day
Over 140,000 hours of data
Ca. 2005 - 2008

Human Speechome Project

Deb Roy

Human Speechome Project

Deb Roy

One child's development of one word: "*water*"

Human Speechome Project

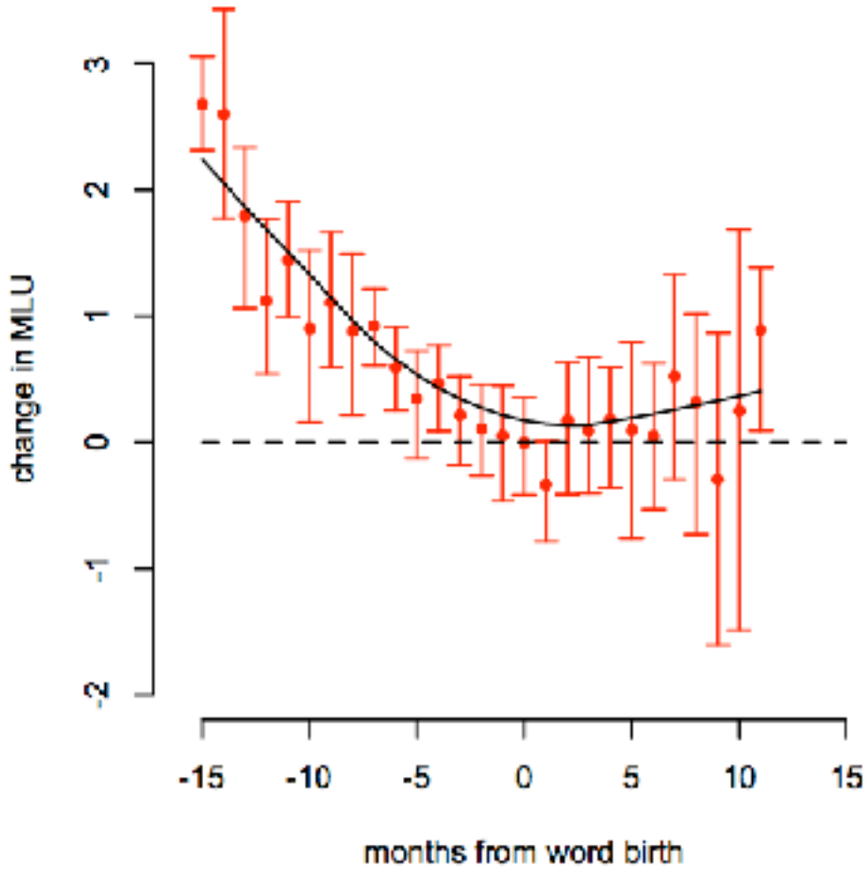


Figure 8: *Change in mean length of one caregiver's utterances in relation to word births. Error bars are 95% confidence intervals.*

Deb Roy

One sample finding: caregivers simplify their utterances prior to the "birth" of a word

c.f. Vygotsky's ZPD!

Rich audio-visual sampling.

Here: the word “ball”

From the required reading, using spatial, temporal, and linguistic contexts to predict word appearance:

[W]ords used in distinctive spatial, temporal, and linguistic contexts are produced earlier, suggesting they are easier to learn. These findings support the importance of multimodal context in word learning for one child and provide new methods for quantifying the quality of children's language input.

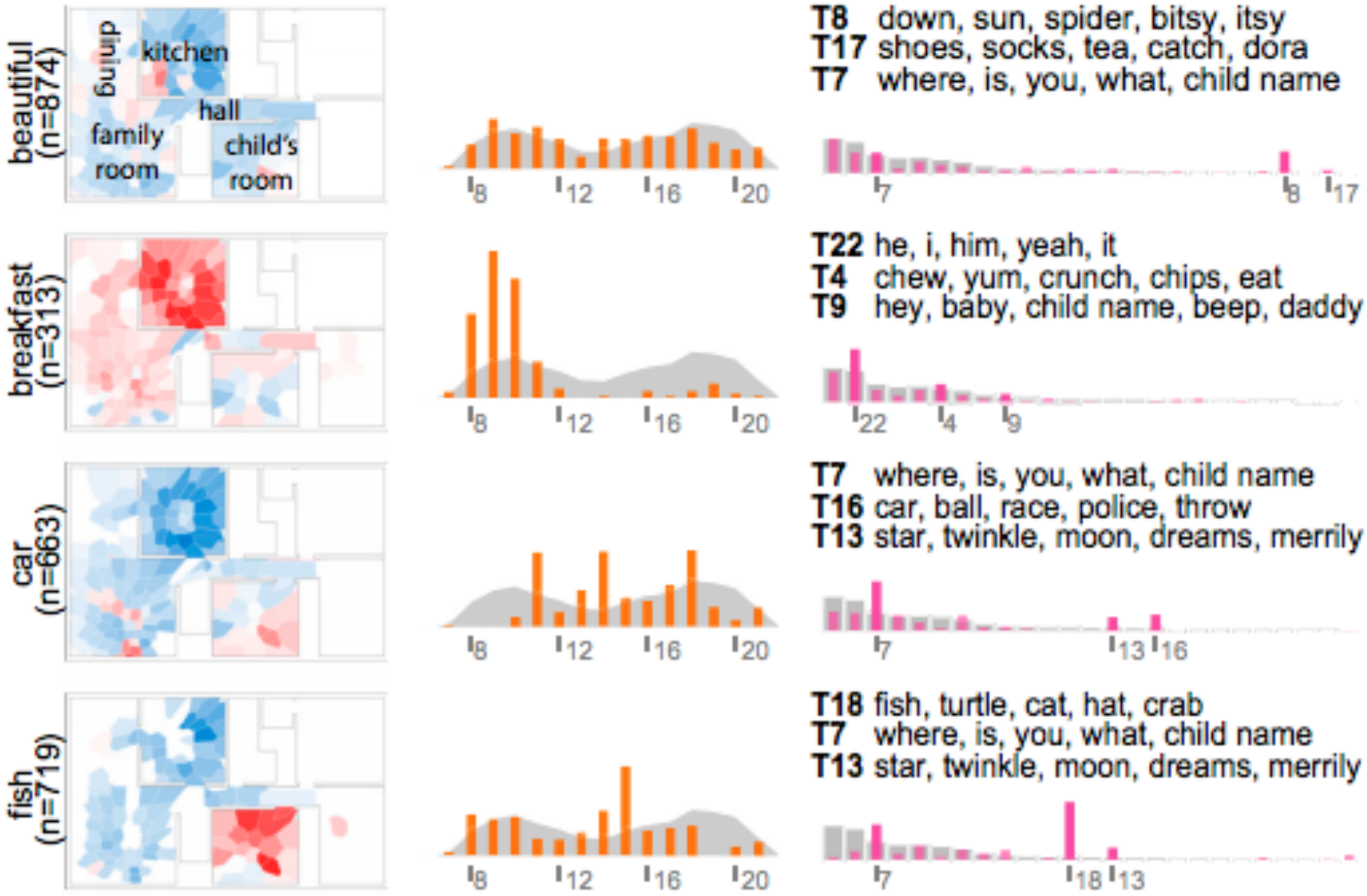
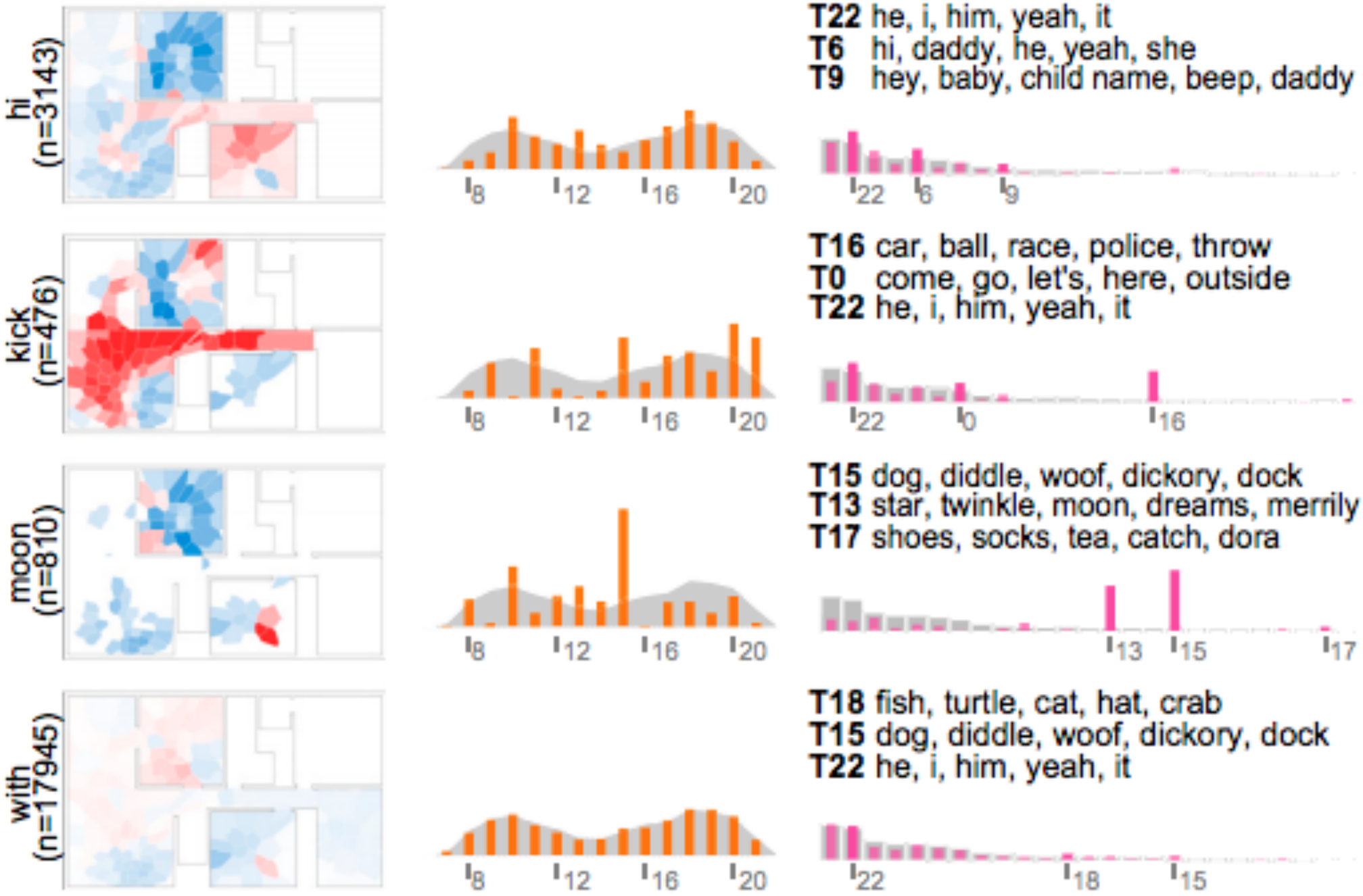


Fig. 3. Examples of eight spatial, temporal, and linguistic context distributions for words. Spatial distributions show the regions of the house where the word was more (red) and less (blue) likely than baseline to be used. Rooms are labeled in the topmost plot. Temporal distributions show the use of the target word throughout the day, grouped into 1-h bins (orange) and compared with baseline (gray). Linguistic distributions show the distribution of the word across topics (purple), compared with the baseline distribution (gray). The top five words from the three topics in which the target word was most active are shown above the topic distribution.


hi (n=3143)
T22 he, i, him, yeah, it
T6 hi, daddy, he, yeah, she
T9 hey, baby, child name, beep, daddy
8 12 16 20
22 6 9
kick (n=476)
T16 car, ball, race, police, throw
T0 come, go, let's, here, outside
T22 he, i, him, yeah, it
8 12 16 20
22 0 16
noon (n=810)
T15 dog, diddle, woof, dickory, dock
T13 star, twinkle, moon, dreams, merrily
T17 shoes, socks, tea, catch, dora
8 12 16 20
13 15 17
with (n=17945)
T18 fish, turtle, cat, hat, crab
T15 dog, diddle, woof, dickory, dock
T22 he, i, him, yeah, it
8 12 16 20
22 18 15

The human speechome project allows a direct observation of the linguistic environment of the child.

It is thus very relevant to the "poverty of the stimulus" argument by Chomsky, which claims that the linguistic environment is simply too poor to allow language learning on the basis of it.

As is to be expected, the situation is not quite as simple as was previously thought.