Learning and Development
Topic 1: 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 skills are the hallmarks of flexible, adaptable behavior, and contrast with inflexible, rigid instinct.

or

[2] Altricial skills illustrate the tight intertwining of an animal and its environment. For humans, this includes the social environment, and language is part of that intertwining.
Pre-frontal cortex:

Develops remarkably late in humans.

Not fully developed until about 21 yrs of age

Social cognition crucially involves this brain area. Its physiological development occurs at the same time as the social development of the individual.
Pre-frontal cortex:

Also often implicated in the exercise of conscious control of behavior (we will later meet Mr Phineas Gage . . .)

Immature or damaged PFC ➞ inability to exercise self-control
Learning and Development Topic 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
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)

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
Lev Vygotsky

Learning is done in a social context.

Cognitive functions develop first between people, and only later become internalized.
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.
Q: What are the implications of the notion of the Zone of Proximal Development for educators?

A: Don’t just look at what a child can do alone, but what they can do in an appropriate inter-personal context.

Skills & abilities will manifest first in an inter-personal context. Internalisation comes later.
Meaning and significance come from the web of social relations we live within.

We first encounter meaning in an interpersonal 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

Development, maturation and change *within* the individual

Concern with the inner cognitive economy of the individual

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Lev Vygotsky

Development of the child *within* a society and culture

Provides a means for understanding how our physical, social & cultural environments become saturated with meaning
Learning & Development, Topic 3: Innateness
An Age Old Debate

Rationalism
- Nature
- Innateness
- Built-in Knowledge
- Built-in Concepts

Empiricism
- Nurture
- Tabula rasa
- Knowledge gained through senses
- Concepts based on experience
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.

Simplistic and misguided interpretation of twin studies is common.
Learning and Development Topic 4:
The Human Speechome project
Scientists studying their own children:

Charles Darwin

Sigmund Freud

Deb Roy
Human Speechome Project

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

Deb Roy
Human Speechome Project

Deb Roy
Human Speechome Project

One child’s development of one word: “water”

Deb Roy
Human Speechome Project

One sample finding: caregivers simplify their utterances prior to the “birth” of a word
c.f. Vygotsky’s ZPD!

Figure 8: Change in mean length of one caregiver’s utterances in relation to word births. Error bars are 95% confidence intervals.
Rich audio-visual sampling.

Here: the word “ball”
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.
Learning and Development Topic 5:

Experiments demonstrating social behavior in very young infants
Also illustrating the difficulties in interpreting infant behavior
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)
Basic finding:

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

They are clearly sensitive to the real live presence of their mother.
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!
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

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”?

(Very young chimps seem to react similarly!)
The study of “imitation” raises several interesting issues.

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?