PSY3016: Developmental Psychology

Welcome!

Acknowledgement of Country

I would like to acknowledge the Traditional Owners of Australia and recognise their continuing connection to land, water and culture.

I am currently on the land of the Gadigal people of the Eora Nation and pay my respects to their Elders, past and present.

PSY3016: Developmental Psychology Introduction

Lecturers

Associate Professor
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Associate Professor
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Tutors

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Micah Goldwater (Course co-ordinator)
Caroline Moul

PSY3016: Developmental Psychology Introduction

Lectures: 1 x 2 hours/week x 13 weeks

Tuesdays (1-3) Old Geology Lecture Theatre

Face to face

Tutorials: 1 x 2 hours/week x 10 weeks
(note 1 tutorial schedule difference between 3016 and 3916)

Face-to-face: Monday (8-10, 10-12, 1-3, 3-5);
Tuesday (3-5);
Wednesday (12-2)
Thursday (2-4, 4-6)
Friday (9-11, 1-3)

LECTURE AND TUTORIAL SCHEDULE 2025

Wk	Lecture	Lecture	Lecturer	Tutorials
1	**L1.** 5 Aug	**Introduction** What is developmental psychology?	Moul	**NO TUTORIAL THIS WEEK**
	L2. 5 Aug	**Nature vs. Nurture**		
2	**L3.** 12 Aug	**Behaviour Genetics 1** The data is in!	Moul	**T1. The early care giving environment**
	L4. 12 Aug	**Behaviour Genetics 2** What does the data mean?		
3	**L5.** 19 Aug	**Social cognition 1** A comparative approach	Moul	**T2. It's in the genes! (Or is it?)**
	L6. 19 Aug	**Social cognition 2** Knowledge versus misinformation		
4	**L7.** 26 Aug	**Social cognition 3** Theory of mind	Moul	**T3. Arrested or Accelerated Development**
	L8. 26 Aug	**Moral Development 1** The cognitive component		
5	**L9.** 02 Sep	**Moral Development 2** Emotions and integration	Moul	**T4. Child Abuse**
	L10. 02 Sep	**Affect and conduct disorders**		
6	**L11.** 09 Sep	**Adolescence**	Moul	**T5. Research methods (3916 only)**
	L12. 09 Sep	**Working with children:** research and practice		
7	**L13.** 16 Sep	**Juvenile Criminal Law and Detention Theories of Cognitive Development**	Guest	**T6. Piaget: Cognitive or Social Development**
	L14. 16 Sep	**Theories of Cognitive Development**	Goldwater	
8	**L15.** 23 Sep	**Infant Cognition**	Goldwater	**T7. Development gone wrong**
	L16. 23 Sep	**Object Knowledge in Infancy**		
		MID SEMESTER BREAK		
9	**L17.** 07 Oct	**Emergence in Infancy**	Goldwater	**NO TUTORIAL THIS WEEK**
	L18. 07 Oct	**Abstract Cognition in Infancy**		
10	**L19.** 14 Oct	**Development of Abstract Thought**	Goldwater	**T8. Cognitive development: conceptual change**
	L20. 14 Oct	**Play and Exploration**		
11	**L21.** 21 Oct	**Development of Executive Function**	Goldwater	**T9. ADHD on trial: Is there really a disorder?**
	L22. 21 Oct	**Language Development 1**		
12	**L23.** 28 Oct	**Language development 2**	Goldwater	**T10. Development of gender identity**
	L24. 28 Oct	**Language development 3**		
13	**L25.** 04 Nov	**Cross-Cultural Differences**	Goldwater	**T11. Exam Revision (3016 only)**
	L26. 04 Nov	**Development in Aboriginal Culture**		
	10-16 Nov	**STUVAC**		
		1st Week of Exams		
		2nd Week of Exams		

PSY3016: Developmental Psychology
Assessment

Assessment Title	**Hurdle?**	Assessment Category	Assessment Type	Description	Individual/ Group	Length / Duration	Weight	Due Date & Time
Tutorial quizzes	YES	Submitted work	Quiz	Short quiz testing knowledge of readings	Individual	9 x 20 minutes	20%	Pre-tutorial
Lecture participation	No	In lecture participation	Multiple choice question	Self-assessment	Individual	13 x 2 minutes	5%	In lecture
Essay	No	Submitted work	Assignment	2000 word essay	Individual	2000 words	30%	Week 12
Final Exam	YES	Exam	Final Exam	Exam assessing content from all of the lectures and tutorials	Exam conditions – in person, individual	2 hours	45%	Central Main exam period
							100%	

Assessment Table

- *NB 3916 students complete 5% research participation. The final exam is worth 40%*

PSY3016: Developmental Psychology
Hurdle tasks

Q. What is a hurdle task?

A. A task that must pass with a certain criteria in order to pass the unit.

E.g. if you get 90% across all aspects of the course but you fail a hurdle task, you will fail the unit.

But… don't be scared…
Hurdle tasks are as follows:

- Exam: 30% overall score in the exam
  Pass exam question related to your essay
- Tutorials: Attend at least 7 (out of 10) tutorials
  (Special consideration excepted)

PSY3016: Developmental Psychology
Learning Outcomes

- **LO1**. demonstrate a deep understanding of the patterns of child development, and the mechanisms that explain these patterns. This will entail a consideration of a broad literature focusing on both how the social environment shapes development, how genetic factors shape development, and how the action of children themselves shape their own environment and then further development. You should be able to explain both the latest theories and findings, and traditional philosophical approaches that founded this discipline early last century.
- **LO2**. consider how experimental design and analysis licenses certain conclusions and examine the tight connections between method and interpretation in relation to scientific critical thinking.
- **LO3**. explain complex patterns of data clearly and relate them to experimental hypotheses and methods in written assignments. You should be able to effectively communicate ideas and engage in open discussion and debate.
- **LO4**. understand how basic research in child development informs applications outside the laboratory, such as in interventions to the family environment, the design of educational curricula and school structure, and to clinical practice, as well as consider the maintenance of ethical research practices.

PSY3016: Developmental Psychology Assessment

- Tutorial quizzes (20%)

When? - starting in week 1 for the first tutorial in week 2
- check the schedule in the unit outline in canvas

How? - Readings for each tutorial made available the Monday of the week before via canvas (readings for next week are already available)
- On Friday of that week the quiz question will be released
- You will have until Monday 8am of the following week (the week of the tutorial) to write a response and upload it to the assignment box in canvas
- No strict word limit (approx. 200 words)

Why? - to be engaging, readings need to be done ahead of time
- better learning outcomes

PSY3016: Developmental Psychology Assessment

- Tutorial quizzes (20%)

Grades? - Each quiz can gain a maximum of 2 points.
- (0 = do NOT provide a response / response suggests you did not read the material; 1 = response reflects you read the material and generally understood it; 2 = thoughtfully considered the reading and reflected on it).

- If you do the reading every week and thoughtfully reflect on it, then you should be able to get a perfect score for the semester, which adds up to a total of 20% of the unit's marks. So, your score for that 20% of the unit is X out of 18 possible points on the 9 quizzes.

- Special consideration = if you were not available to complete the quiz one week, and applied and were granted special consideration, your final score for the quizzes will be based on the average of the quizzes you did take (e.g., if you missed one quiz and get spec-con approved, your 20% quiz mark is based out of a total of 16 points. If you miss two and get spec-con approved for both, your 20% quiz mark is based out of 14 points, etc)

- NB - if special consideration is granted for at least 5 out of the 9 quizzes your 20% quiz mark will instead be based on an essay question that will ask you to integrate across many weeks' readings. Details of that will be released to you if necessary. It will be less work if you just take the quizzes.

- NB – no tutorial presentation, tutorials will be aimed at 90 minute duration to take account for time spent doing quizzes.

PSY3016: Developmental Psychology Assessment

In-person lecture attendance and self-assessment (5%)

When? - starting in week 1 (Lecture 2)

Why? - to help with self-assessment throughout the course

How? - Each lecture block (2 lectures) will include a multiple-choice question based on the content being covered in the lecture.
- During the lecture, log into canvas to upload your response
- Marks are awarded for participation – it's ok if you get it wrong!

PSY3016: Developmental Psychology Assessment

- Research essay (30%)

Released:	Essay topic released in week 3
Feedback:	(Optional) Submit an outline of the essay for feedback by Friday 26th Sep (week 8)
Due:	Week 12 (exact date and time to be confirmed)
	Submitted online
Late penalties:	5% of maximum value for each calendar day or part thereof
What is it?	2000 words max (within 5%)
	Lecture/tutorial material should be used and can be supplemented with additional references
Why?	Write effectively and concisely
	Communicate ideas
	Critical thinking and discussion
	Learning outcomes – LO1, LO2, LO3, LO4

PSY3016: Developmental Psychology Assessment

The University's Academic Integrity policy states, "we do not generally permit use of artificial intelligence content generators and tools to create or modify your assessable work. You can only use these tools if your unit of study coordinator has expressly permitted your whole class to do so. This means that the unapproved use of AI tools in the completion of assignments is considered to be a breach of academic integrity."

Generative AI is a new technology and I am happy for you to learn how to use it as it is widely available. Use it to write early drafts. It's a powerful tool that can help you research a topic. It's basically Google on steroids.

However, please be careful of generative AI - it is designed to write prose in various styles, including academic styles, and it is very good at it. However, it is not designed to assess the accuracy of what is written or its sources. Because it produces wonderful prose written in the style of an expert, it can be confidently wrong. Moreover, it has been shown to not only misrepresent its sources but to also make up sources completely (i.e., it generates fake citations in the style of real citations).

PSY3016: Developmental Psychology Assessment

- Two-Hour Examination (45% 3016, 40% 3019)
- Compulsory assessment
- MCQ and short answer
- In person
- 2 hours
- Hurdle task (30% and pass essay-related question)
- Based on: integration of lecture content
  set readings
  (material from tutorial classes may supplement answers but does not have to be restudied for the exam)

PSY3016: Developmental Psychology TIPS

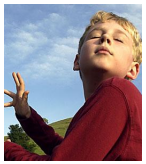
READ: quality
widely
recommended

THINK: critically
broadly
creatively

EXPLAIN: don't be a bad food critic
be a good Pilates instructor!
(particularly in the exam)

PSY3016: Developmental Psychology

What is developmental psychology?

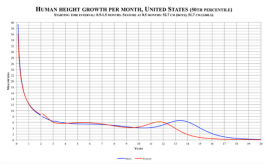


PSY3016: Developmental Psychology

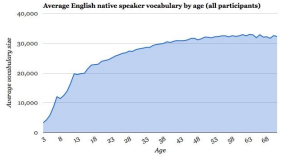
What is developmental psychology?

Rate of change:

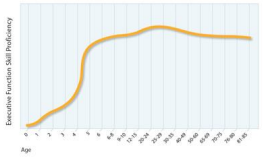
Height



Vocabulary

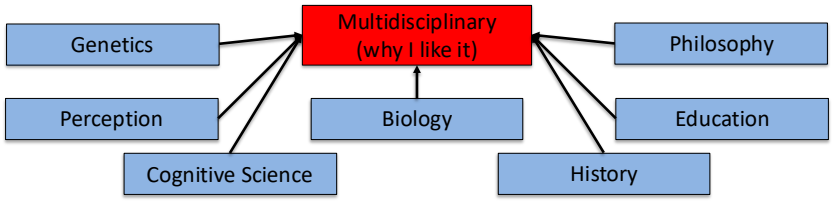


Executive function



PSY3016: Developmental Psychology

What is developmental psychology?



Perhaps the most flexible of all psychology disciplines

PSY3016: Developmental Psychology

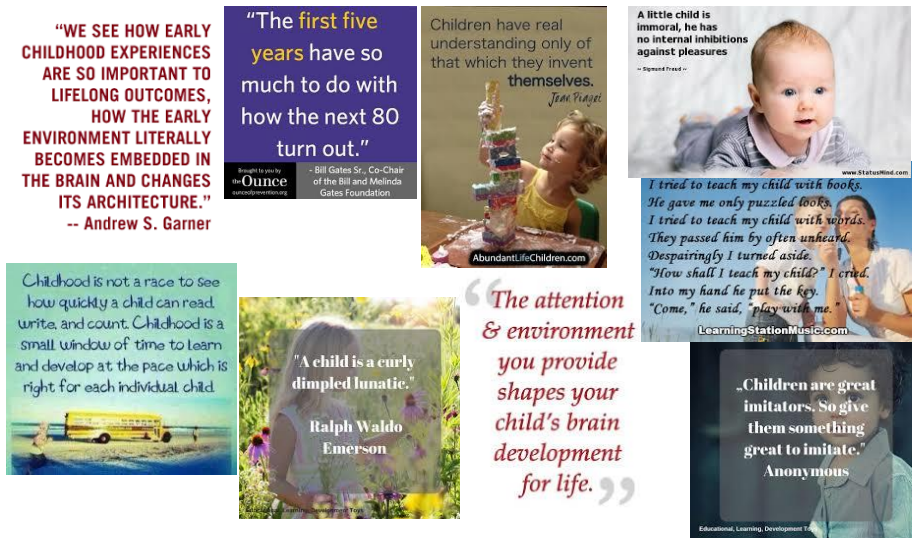
Major theme throughout course

Empiricism vs Rationalism

Nurture vs Nature

Language? Intelligence? Personality?

PSY3016: Developmental Psychology



PSY3016: Developmental Psychology

What is developmental psychology?

- A method
- A theoretical commitment
- A window
- A tool

PSY3016: Developmental Psychology

My lectures - points to consider

- To make you think
- To help with revision
- To put the topic in a wider context

❖ PTC: Is developmental psychology simply the study of change?

PSY3016: Developmental Psychology

Where are you going?

- Honours?
- Clinical psychology practice?
- Social work/education?
- Parent?

Emergency procedures (on campus)

- In the unlikely event of an emergency, we may need to evacuate the building.
- If we need to evacuate, we will ask you to take your belongings and follow the green exit signs.
- We will move a safe distance from the building and maintain physical distancing whilst waiting until the emergency is over.
- In some circumstances, we might be asked to remain inside the building for our own safety. We call this a lockdown or shelter-in-place.
- More information is available at www.sydney.edu.au/emergency.

Keeping our campus COVID-safe

- The University is following NSW Government and NSW Health guidance to prevent the spread of COVID-19, respiratory-type illnesses and other illnesses.
- All staff, students and visitors are required to follow our health and safety advice. This includes staying at home if unwell, isolating and testing, and to not return unless recovered or as advised by your health professional.
- Visit our website for more information about our COVID-19 response.

Essential information sources for students

There are two main places you need to know to set yourself up for success on your Sydney Uni journey – Getting Started is the starting point for all commencing students and the Student life, wellbeing and support page is there as your ongoing reference.

Getting Started Canvas page

Student life, wellbeing and support page

Welcome Hub

If you have a question or need help, head to the Wentworth Welcome Hub. You'll be able to connect with peer support, student advising and wellbeing support, as well as seek navigation tips, meet fellow students and register for Peer Support Advisor-led platforms and events.

Peer Support Advising (PSA)

PSAs are multilingual current students trained as an initial point of student support, information and referral.

They facilitate a sense of community and social connection via chat options & events.

Pop-Up Advising Hub
July 3 – August 31

Discuss your academic and personal goals and challenges one-to-one with an advisor, in-person or online.

Book here
https://tinyurl.com/58f4924b

Where: Level 3 Wentworth Building (G01), opposite Laneway café
When: Monday to Friday, 10.00am – 5.00pm, July 3rd – August 31st
Who: Peer Support Advisors, Student Advisors, Student Wellbeing support

Be mindful of scams and scammers

Scammers	What to do
May contact you via phone, email, text message or even in person	Discontinue contact, do not panic, do not hand over any money or personal information.
May pretend to be from an official organisation such as the government or university	If you are experiencing distress or need support due to a scam, you can contact Student Wellbeing by completing a registration form.
May pretend to know about your family, that your visa or studies may be at risk or that you are in trouble with the police	Contact the SRC or SUPRA for advice (domestic and international students).
	Get 24/7 support through Sonder (international students).
	Common scams are listed on the Scamwatch website: www.scamwatch.gov.au

For more information, or to contact Student Wellbeing for support, follow the QR code:

Safer Communities Office

- Support and case management for people who have experienced sexual misconduct, domestic/family violence, bullying/harassment or issues relating to modern slavery.
- Contact the team
  - 8:30 am to 5:30 pm Monday to Friday, Sydney local time
  - phone: +61 2 8627 6808
  - email: safer-communities.officer@sydney.edu.au.
  - campus: Level 5, Jane Foss Russell building, City Road, Darlington Campus
- Make a report
  - Visit the website to make a complaint or disclosure of sexual misconduct to the University.

Academic integrity

- Academic integrity refers to behaving honestly, ethically and responsibly in relation to all elements of your study at the university, including assessments.
- Always submit your own work, sit your own tests, and take your own examinations.
- Acknowledge any contributions in your assignment which are not your original thoughts, ideas or words.
- Writing technologies (e.g. ChatGPT, Grammarly, etc) cannot be used to create or modify work for submission, unless expressly permitted by your unit coordinator.
- Academic Honesty Education Module – all commencing students must complete by census date. Continuing students can self-enrol at any time.

Strategies for maintaining academic integrity

- Planning and time management
- Use citations and referencing
- Know your strengths and what you need to develop
- Know when and where to ask for help

PSYC3016: Developmental Psychology

Lecture 2: Nature versus nurture

Nature versus nurture

Overview

- First of three lectures
- L2 – Nature versus nurture
  - Cover the basics
  - Terminology and measurement
  - Myth-busting
- L3 & 4 – Behavioural genetics
  - Heritability
  - Twin studies
  - Complex interactions
  - Epigenetics
  - Why, as psychologists, should we care?

Nature versus nurture
Learning Outcomes

- LO1 – understand traditional philosophical approaches to child development – what is meant by nature versus nurture
- LO2 – understand how nature and nurture might be measured in child development studies
- LO4 – understand the implications of differing philosophical approaches might be associated with broader social constructs
- LO1 – critically evaluate the flaws, and common misconceptions, regarding the nature versus nurture debate

Nature versus nurture
What do we really mean?

Nature: "innate" qualities
"nativism"
rationalism

Certain behaviours or cognitive abilities are innate – not learned from the environment but are present from birth or naturally develop over time.

- Modern nativism (Fodor, Chomsky and Pinker) argues that humans, from birth, have certain cognitive modules (**specialised genetically inherited psychological abilities**) that allow them to learn and acquire certain skills, such as language.
- E.g., children demonstrate a facility for acquiring spoken language but require intensive training to learn to read and write.
- Poverty of the stimulus (POS) is the assertion that natural language grammar is unlearnable given the relatively limited data available to children learning a language, and therefore that this knowledge is supplemented with some sort of innate linguistic capacity. (Chomsky)
- POS: a **genetically inherited neurological module** that confers a somewhat universal understanding of syntax that all neurologically healthy humans are born with, which is fine-tuned by an individual's experience with their native language.

Nature versus nurture
What do we really mean?

Nurture: personal experiences
behaviourism
empiricism
"tabula rasa" – blank slate, John Locke (1690s)

Purist behaviorism:
"Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select – doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors."
(John Watson, *Behaviorism*, 1930, p. 82)

Nature versus nurture
What do we really mean?

The debate gets complicated…

Why?
- Innate qualities *sound* inflexible.

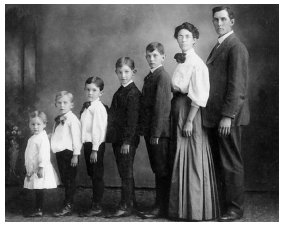
In "Not in Our Genes: Biology, Ideology and Human Nature" (1984), Lewontin, Rose and Kamin criticise "genetic determinism" from a Marxist framework, arguing that "Science is the ultimate legitimator of bourgeois ideology […] If biological determinism is a weapon in the struggle between classes, then the universities are weapons factories, and their teaching and research faculties are the engineers, designers, and production workers."

Nature versus nurture
What do we really mean?

Heritability: how much of the variation of a trait (phenotype) in a population is due to genetic differences in that population

Phenotype (P) = genetic effects (G) + environmental effects (E)

- "Heritable" is not the same as "inherited"
- E.g. "Height" in one family
  - Heritability may increase if the genetic variation increases (marriage, babies, out-breeding)
  - Heritability may increase if the environmental variation decreases (poor diet)



Nature versus nurture
How do we measure them?

- How is each measured?
  - **Heritability estimates** are used to measure the relative contributions of genetic and environmental factors
  - We will look at these in L3

- **Nature**: Genetics
  - Single nucleotide polymorphisms (SNP)
  - AA, Aa, aa
  - Association with disease

- Two groups of participants: with the disease and similar people without the disease
- DNA from blood/cheek/saliva
- Each person's complete set of DNA, or genome, is then purified from the blood or cells, placed on tiny chips and scanned on automated laboratory machines for SNPs.
- If certain genetic variations (e.g. aa) are found to be significantly more frequent in people with the disease compared to people without disease, the variations are said to be "associated" with the disease.
- NB: the associated variants themselves may not directly cause the disease. They may just be "tagging along" with the actual causal variants. (Problem for GWAS in particular)

Nature versus nurture
How do we measure them?

- **Nurture**: Environment
  - Physical environment (no garden versus garden)
  - Internal environment (diet)
  - Social environment (communal living)
  - Family environment (parenting practices)
  - Emotional environment (warmth, love, discipline)

- Measurement
  - Direct observation
  - Self-report questionnaire
  - Parent, teacher reports
  - Clinical interviews
  - Public, social records and data (ABS)

  - Pro: quick, easy, "real", objective
  - Con: subjective, may not correlate, biases

Nature versus nurture
Myths and misconceptions

1. Genes dictate
   Eye colour – ok
   Favourite food – ok
   Intelligence - ?!

   - Implications for social mobility, "designer" babies, predestination?

   Do genes dictate what is **possible**?
   E.g. height – diet

   "Limiting factor"

Nature versus nurture
Myths and misconceptions

Do genes dictate what is possible?

- MINI MYTH: biological differences must be due to genetic factors.
- **Environment can influence biology. Biology can influence environment.**
- Do genes **dictate** anything?
  Mutations - ok
  Complex traits - no

Nature versus nurture
Myths and misconceptions

2. "Tabula rasa"– is society failing?

- Crime, illiteracy, poverty, racism, drug use…
- Families, schools, community, religion…

- Genes are an easy scape-goat

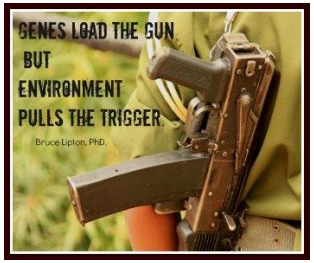
- Human bias: negative attributes – "not my fault"
  positive attributes – "all because of me"

- Happiness, generosity, kindness, well-being…
- Families, schools, community, religion…

A phenotype can be positive or negative – all are influenced by both genes and environment

Nature versus nurture
Myths and misconceptions

The problem of violence



Criminal responsibility: **the "warrior" gene (MAOA)**

- **High proportion of violent offenders have low activity variant of MAOA gene**
- **BUT, majority of people with low activity variant do not commit violent crime**
- **MAOA genetic testing used to reduce prison sentence**
- **Recommended reading:** http://www.nature.com/news/2009/091030/full/news.2009.1050.html

Nature versus nurture
Myths and misconceptions

3. All traits are heritable so heritability is irrelevant

- A problem of communication?

Navel gazing – broader utility of genetics

Too far removed from the application of psychology

Nature versus nurture
Myths and misconceptions

3. All traits are heritable so heritability is irrelevant

- A problem of understanding?
- Variability in heritability (10% versus 80%)
- The gene matters: e.g. neurotransmitter systems
- Heritability estimates associated with treatment resistance (e.g. conduct disorder with callous-unemotional traits)

Low CU
Heritability estimate for conduct problems = 30%

High CU
Heritability estimate for conduct problems = 81%

Nature versus nurture
Myths and misconceptions

4. What about the mechanism? Genetics tells us nothing about the aetiology

Fair point?

- E.g. GWAS "fishing trip" can identify regions of DNA coding for seemingly unrelated proteins

- Identified DNA might not even be of functional relevance
- How do we get from genotype to phenotype?
  - Just because it is difficult doesn't mean it is not worthwhile

Nature versus nurture
Myths and misconceptions

- So, we need to be hypothesis-driven – molecular genetics
  - Gene function
  - Targeted systems
  - Previous research
  - Shared data and free access
  - Replication across samples

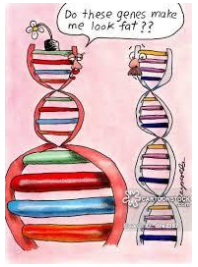
"The future of genetic research in developmental psychology lies in molecular genetic studies of DNA that will eventually identify specific DNA variants responsible for the widespread influence of genes in psychological development. Identifying these DNA variants will make it possible to address questions about developmental, multivariate, and gene-environment mechanisms with far greater precision and power.
For example, in 1993 a gene was identified that increases risk fivefold for dementia later in life (late-onset Alzheimer's disease, or LOAD; Corder et al., 1993). Study of this gene can now be used to investigate its effects earlier in life (developmental), its effect on other types of dementia and other comorbid disorders such as depression (multivariate), and its correlation and interaction with environmental factors, such as its role in worsening the effects of such head injuries as those caused by boxing (gene-environment interplay)."
(Robert Plomin, 2004)

Recommended reading: http://psychology.uchicago.edu/academics/doctoral/developmental/plomin_2004.pdf

Nature versus nurture
Myths and misconceptions

5. Genetic literacy: "The general public will misinterpret genetic findings"

- E.g. "Fat" genes
  - Locus of control
- Hope for improvement
  e.g. boy with ADHD
- Solution?
  - Education (including psychologists)
  - Communication



PTC: What can psychology do to alter genes?!
PTC: Is "early intervention" only concerned with reducing future *environmental* risk factors?

Nature versus nurture
What do we **not** mean?

- We do **not** mean **either/or**
  - Phenotype = G + E
  - The “versus” debate is over
- We do **not** mean that genetic and environmental factors are **equally** important for all traits
- High heritability does **not** mean that psychological study is worthless

Nature versus nurture
Overview

- First of three lectures
- L2 – Nature versus nurture
  - Cover the basics
  - Terminology and measurement
  - Myth-busting
  - Keep all this in mind as you progress through the course!
- L3 & 4 – Behavioural genetics
  - Heritability
  - Twin studies
  - Complex interactions
  - Epigenetics
  - Why, as psychologists, should we care?

PSYC3016: Developmental Psychology
Lectures 3 & 4: Behavioural Genetics

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Room: 338

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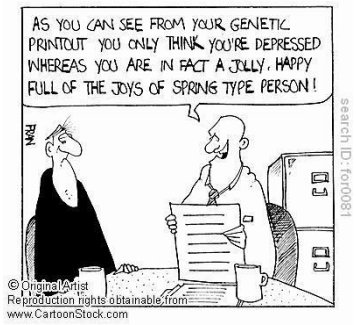


Behavioural Genetics
Overview

Lecture 3:

- Heritability estimates
- Twin studies
- Types of environment

Lecture 4:

- The missing heritability problem!
- Interactions
- Why, as psychologists, do we care?

Behavioural Genetics
Learning Outcomes

Lecture 3:

- LO1 – how genetic and environmental variables can shape development
- LO2 – understand the benefits and limitations of twin study designs
- LO3 – understand how to interpret results from behavioural genetic twin studies
- LO4 – understand how data obtained from behavioural genetic twin studies can inform understanding of child psychopathology

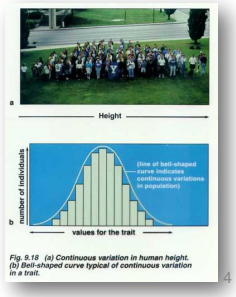
Lecture 4:

- LO1 – understand the missing heritability problem and what challenges this creates for understanding the mechanisms to explain child development.
- LO2 – be able to describe the theoretical and methodological reasons for missing heritability
- LO2 – be able to describe mediation and moderation interactions in the context of child development
- LO3 – understand the differential susceptibility hypothesis and how it can be demonstrated through gene-environment interaction analyses.
- LO4 – be able to critically evaluate the importance of understanding the relative roles of genes, the environment, and their interaction in public policy and psychological research.

Behavioural genetics

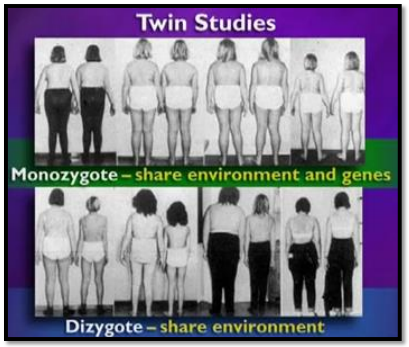
Recap – all psychological traits are heritable

- **Heritability (h^2)**: how much of the variation of a trait (phenotype) in a population is due to genetic differences in that population
- Phenotype (P) = genetic effects (G) + environmental effects (E)
- Let's look at something simple…
- Is height genetically determined?



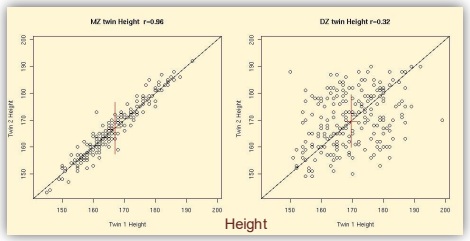
Where does the heritability index come from?

- By and large, we estimate the extent to which something is heritable by using a 'naturalistic experiment', the existence of twins
- Monozygotic = identical
- Dizygotic = non-identical (siblings)



Where does the heritability index come from?

- The power of twin studies, as noted, is grounded in the appealing naturalistic experimental design they so obligingly provide us with:
  - MZ: Monozygotic, all genetic information is shared
  - DZ: Dizygotic, an average of 50% of genetic information is shared
- You need to grapple with two important statistical constructs to understand the basic logic of twin studies
  - Correlation
  - Variation



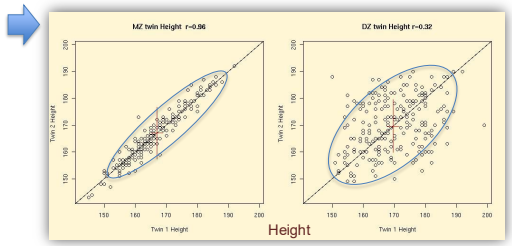
Where does the heritability index come from?

Correlation:

Correlation refers to the fact that there is a systematic relationship between Twin 1 and Twin 2, here seen in the cluster of points around the straight line summarizing the data in each image (which is a line of *best fit* or a *regression line*)

The correlation is stronger for MZ twins than DZ twins, see how the points cluster more tightly around the line – we often refer to this as the 'cloud'

(Another important feature is that the relation between Twin 1 and Twin 2 is linear. Practically, that means that your co-twin is likely to be the same height as you irrespective of whether you are short or tall)



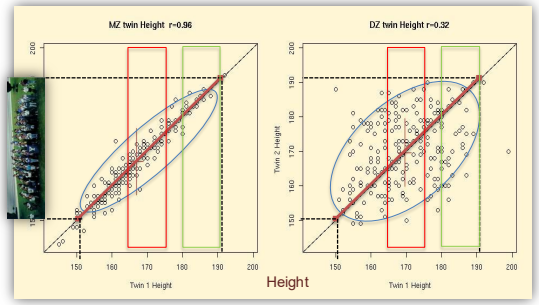
Where does the heritability index come from?

Variation:

Variation refers to the way the points are distributed over the measurement scale, or spread out around the line in these Figures

In both of these Figures you can see that the *Range* (smallest to largest observation) is approximately the same for both the MZ twins and the DZ twins. However, if you think back to the normal curve, they are not distributed quite the same way over that Range.

(There is an important assumption underlying the statistical models used to do twin analyses, which says that the variance should be approximately equal for different groups)



Where does the heritability index come from?
A simple model and a little bit of maths…

- Phenotype (P) = genetic effects (G) + environmental effects (E)
  - Heritability estimate (h^2) = genetic influences on the phenotype
- ~~Phenotype (P)~~ **1** = ~~genetic effects (G)~~ **h^2** + environmental effects (E)
- $1 = h^2 + E$
- So… if we can work out E we know what the heritability estimate is.
- Help us twins!
- MZ twins share 100% genes and 100% environment
- DZ twins share 50% genes and 100% environment
- Right?
- Nope…
- It is a little bit more complicated…

Where does the heritability index come from?
A simple model and a little bit of maths…

- There are *different types* of environment
  - **Common** environment **(C) – events that happen to both twins, influencing them in the same way**
    - e.g. (uterine conditions, same family members, same house, same school etc)
  - **Unique** environment **(E) – events that occur to one twin but not the other, or events that happen to both twins but influence them in different ways**
    - e.g. (accidental injury, death of a parent, bullying)
- So… the *environment* comprises (C) + (E)
- Phenotype (P) = genetic effects (G) + common environment (C) + unique environment (E)
- $1 = h^2 + C + E$
- Ok, now we can use the twins…

Where does the heritability index come from? A simple model and a little bit of maths…

- MZ twins share 100% genes and 100% **common** environment
  - The correlation between identical twins (r_{mz}) provides an estimate of $h^2 + C$
  - E.g. Correlation of 0.96 (height) = $h^2 + C$
  - So, in MZ twins only 0.04 (4%) due to unique environment (E)
- DZ twins share 50% genes and 100% common environment
  - So the correlation between DZ twins (r_{dz}) is a direct estimate of $½ h^2 + C$
- So, for any given phenotype…
- $r_{mz} = h^2 + C$
- $r_{dz} = ½ h^2 + C$

Here comes the maths… rearrange the equations…

- h^2, therefore, is twice the difference between identical and fraternal twin correlations (Falconer's formula)
- $h^2 = 2 (r_{mz} - r_{dz})$
- $C = r_{mz} - h^2$
- $E = 1 - r_{mz}$

Are we done…?

Nope, sorry!

Where does the heritability index come from? A simple model and a little bit of maths…

- Think of our height example…
- $h^2 = 2 (r_{mz} - r_{dz})$
- $h^2 = 2 (0.96 - 0.32)$
- $= ?! > 1$

- This simple model makes an assumption about the genetic effects
- Assumes **additive** genetic effects – also known as "narrow sense heritability"
  - AA, Aa, aa
  - The risk conferred by an allele is increased r-fold for heterozygotes and 2r-fold for homozygotes
  - Aa = rAA
  - aa = 2rAA

- What is wrong with this assumption?
  - Effects can be dominant, recessive, heterozygous…
  - Gene-gene interactions
  - Gene-environment interactions

- But, it is a nice simple model to get the idea
  - You will see additive genetic effects referred to as (A) in models…
- Phenotype (P) = additive genetic effects (A) + common environment (C) + unique environment (E)

Behavioural Genetics
Criticisms of the twin model

Heritability values are strongly tied to the populations in which they were gathered (in more diverse environments, we'd expect the degree of heritability to go down)

Heritability values depend on the extent to which twin pairs actually reflect genetic and environmental variation in the population

- Most twin pairs are raised under highly similar conditions (low variation in unique environment)

- Assumes no assortative mating
  - Assumes mating is random
  - In reality, people tend to choose partners based on certain traits (e.g. similarities or familiarity of ethnicity, religious/ethical beliefs, life-style choices).

Behavioural Genetics
Criticisms of the twin model

Always remember: Heritability estimates refer to the *proportion of variation between individuals* on a trait that is due to genetic factors.

- It does not indicate the degree of genetic influence on the development of a trait of an individual.
- E.g. It is incorrect to say that since the heritability of personality traits is about .6, that means that 60% of your personality is inherited from your parents and 40% comes from the environment

- **Recommended reading:** (Turkheimer, E. (2000). Three laws of behavior genetics and what they mean, *Current Directions in Psychological Science*, 9(5), 160-164)

Let's look at an example

- Burt (2009) Psychological Bulletin, 135, 608-637: Meta-analysis of genetic influences on child psychopathology (i.e., mental health)
  - A meta-analysis of 490 studies of internalizing and externalizing psychopathology prior to adulthood
  - Traditional wisdom (twin studies) says additive genetic effect and non-shared environment are of great importance for psychopathology – ALMOST NO influence of shared environment!
  - However, initial survey of literature suggests shared environment may be important prior to adulthood, and especially in more extreme environments

Genetic and environmental influences: child psychopathology

Burt (2009). *Psychological Bulletin*, 135, 608-637

- Areas of interest
  - Externalizing Disorders (EXT)
  - Conduct Problems (CP)
  - Oppositional Defiant Problems (ODP)
  - Attention Deficit/Hyperactivity Problems (ADHP)
  - Internalizing (INT)
  - Depression (DEP)
  - Anxiety (ANX)

Table 4
Parameter Estimates From Better-Fitting Overall Model by Phenotype

Phenotype	a^2	c^2	d^2	e^2
EXT (N = 16 samples with 10,957 sibling pairs)	.590 (.552, .629)	.153 (.118, .187)		.258 (.248, .269)
CP (N = 38 samples with 28,709 sibling pairs)	.576 (.550, .602)	.145 (.121, .169)		.280 (.273, .287)
ODP (N = 9 samples with 12,692 sibling pairs)	.591 (.547, .636)	.101 (.062, .140)		.308 (.297, .319)
ADHP (N = 26 samples with 25,712 sibling pairs)[a]	.259 (.198, .320)		.444 (.383, .505)	.297 (.289, .305)
INT (N = 17 samples with 13,099 sibling pairs)	.507 (.467, .547)	.164 (.129, .198)		.330 (.318, .343)
DEP (N = 17 samples with 21,027 sibling pairs)	.437 (.400, .474)	.139 (.110, .169)		.424 (.411, .438)
ANX (N = 23 samples with 20,786 sibling pairs)	.475 (.438, .512)	.122 (.091, .153)		.404 (.392, .416)

Note. a^2 = additive genetic influences; c^2 = shared environmental influences; d^2 = dominant genetic influences; e^2 = nonshared environmental influences; EXT = externalizing; CP = conduct problems; ODP = oppositional defiant problems; ADHP = attention-deficit/hyperactivity problems; INT = internalizing; DEP = depression; ANX = anxiety.
[a] ADE model is presented.

Genetic and environmental influences: child psychopathology

Burt (2009). *Psychological Bulletin*, 135, 608-637

Conclusions

- The shared environment accounted for a modest to moderate amount of variance in psychopathology outcomes for every domain except ADHP
- It is also notable that the non-shared environment (i.e., e^2) also had a very profound impact on psychopathology, even in the case of ADHP

How does the shared environment influence child psychopathology?

Child psychopathology

- Increasing evidence shows that certain parental styles and behaviours increase children's risks for psychopathology outcomes
- Parental over-protection and over-control promotes children's anxiety
- Parental hostility and poor boundary setting increase the likelihood that children will have externalizing problems
- Externalizing problems in childhood are the best predictor of **all** of the common forms of mental health problems in adulthood

Genetic and environmental influences

General conclusions

- We have some pretty good ideas about how the shared (and non-shared) environment may actually have an influence
- That is to say, we know something about the environmental **processes** that may be important
- It matters when you measure something and how you measure it (e.g. balance between unique and shared environment)
- We find it harder to think about what the genetic influence actually means!!

Genetic and environmental influences

General conclusions

- Turkheimer: *"There is an interesting parallel between the search for individual genes that influence behavior and the failed attempt to specify the nonshared environment in terms of measured environmental variables"*

❖ PTC – why would an environmental influence on a phenotype change as a function of time?

Behavioural genetics
Next time…

- The missing heritability problem
- Interaction, interaction, interaction
- Some very cool biological processes – I will require some volunteers!

PSYC3016: Developmental Psychology
Lectures 3 & 4: Behavioural Genetics

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Behavioural Genetics
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- Types of environment

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- Why, as psychologists, do we care?

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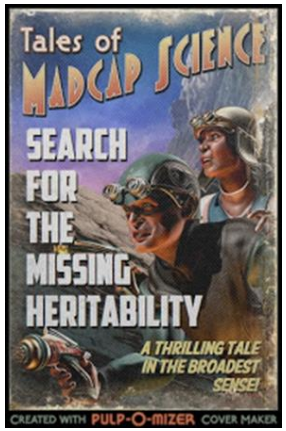
The missing heritability problem

- What is the problem?
  - We know that all traits are heritable but finding the source of this heritability has remained elusive.
  - Replications of gene-disorder associations are rare, and even when they have been found, genome-wide studies indicate that only tiny proportions of the variance in diagnostic phenotypes are attributable to common genetic variations (Burmeister, McInnis, & Zollner, 2008).
  - This is annoying – we want to understand the origin of behaviours, traits etc.
  - So far, we have been fairly limited to working with shared, and unique, environmental variables, and with the few genotypes that have been found to be reliably associated

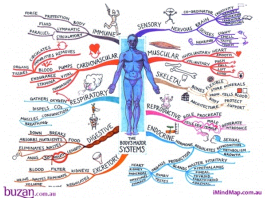


The missing heritability problem

- What could the reason be?

1. We are not looking at the correct genes

- Hypothesis-driven research
  - The hypothesis is wrong or incomplete
- Functionality of the genes
  - The genes do not do what we think they do
  - The genes do what we think they do but so do lots of other genes (gene network, gene-gene interactions)
  - The proteins do not do what we think they do
- Relationship between protein function and biological function
  - The proteins do not do what we think they do
  - The proteins do what we thought they did but that does not influence brain function in the way we thought it did



The missing heritability problem

- What could the reason be?

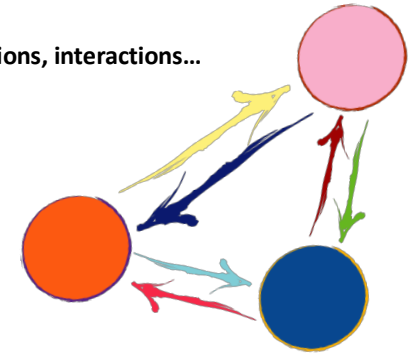
2. We are not looking in the right samples
- Samples need to be as "pure" as possible
  - Overlap between phenotypes with different aetiologies (e.g. impulsivity, ADHD, executive control, traumatic brain injury)
    - Carefully describe the phenotype
  - Different distribution of genotypes in different ethnicities
    - Genotype-phenotype association in some ethnicities but not others
  - Range of descriptives too large
    - For a developmental disorder the phenotype may not be clear until a certain age (abnormal vs normal development)

The missing heritability problem

- What could the reason be?

3. We are not thinking about it in the right way
   - We have already mentioned gene-gene interactions
   - Let's be a bit smarter…

Interactions, interactions, interactions…

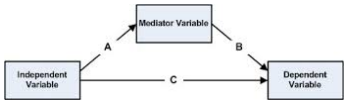


The missing heritability problem
Interactions

What is an interaction?

- Where one variable influences the relationships between two other variables

Mediation:
- Mediator variables specify how or why a particular effect or relationship occurs.
- E.g. Time spent doing homework is associated with better exam performance but this is **mediated** by the time spent doing practice papers. (this is a made-up example!)
  - I.e. doing homework is only really associated with better examination performance because doing homework is associated with doing more practice papers. Doing practice papers is associated with better exam performance

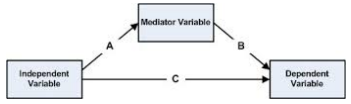


The missing heritability problem
Interactions

Genetic interaction effects

Mediation: commonly referring to understanding the association between a genotype and phenotype

E.g. Serotonin 1B polymorphism associated with callous-unemotional traits (personality/behaviour)
- What mediates this relationship? What is the real reason for this relationship?
- The effect of serotonin neurotransmission in a particular brain region? The involvement of serotonin in basic cognitive and attention processes?



The missing heritability problem
Interactions

What is an interaction?

Moderation:

- A moderator variable changes the strength of an effect or relationship between two variables.
- Moderators indicate when or under what conditions a particular effect can be expected.
- A moderator may increase the strength of a relationship, decrease the strength of a relationship, or change the direction of a relationship.

– E.g. there may be a positive association between revising and exam performance for time periods of less than 120 minutes per day. But for time periods of more than 120 minutes the relationship is negative. (This is a made-up example!)

Figure 1. The interaction effect of drinking to cope (DTC) and negative social contacts on drinking at home.

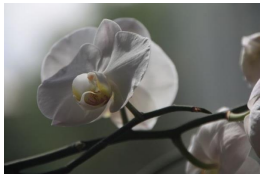
The missing heritability problem
Interactions

Genetic interaction effects

Moderation: when a genotype (or genotypic effect) changes the relationship between an environmental independent variable and a dependent variable

- Can this answer important questions…?
- E.g. we know that child abuse and maltreatment is associated with adult psychopathology – but why not for everyone?

What is this?



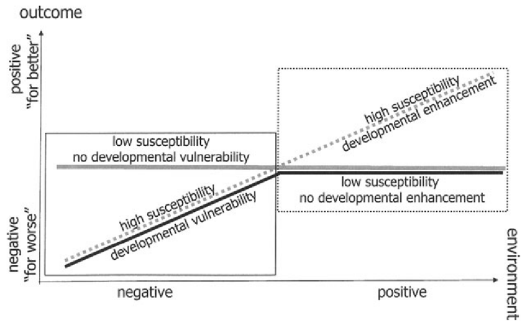
Differential susceptibility

- You need to, at least for some important outcomes, take account of important genetic differences and parenting behaviours simultaneously – That is, you need to look at the **interaction**

The missing heritability problem
Interactions

- Ellis et al. (2011) Differential susceptibility to the environment: An evolutionary–neurodevelopmental theory, *Developmental Psychopathology*, 23, 7-28

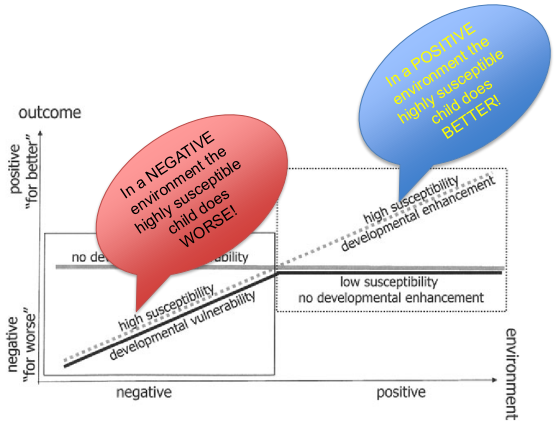
This model says that the environment will have a different effect on you depending on how susceptible you are



The missing heritability problem
Interactions

This model says that the environment will have a different effect on you depending on how susceptible you are

So, for a highly susceptible child

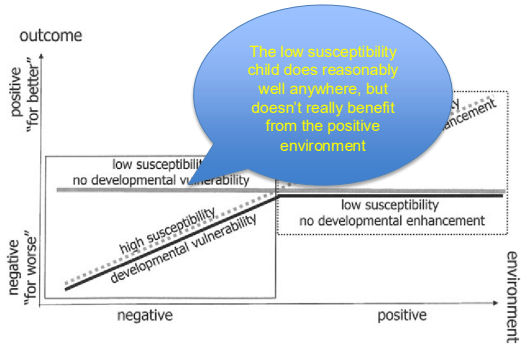


The missing heritability problem
Interactions

This model says that the environment will have a different effect on you depending on how susceptible you are

So, for a low susceptibility child

- PTC – what would the theory of evolution have to say about differential susceptibility?



The missing heritability problem
Interactions

Differential susceptibility

- E.g. "Can Genetics Predict Response to Complex Behavioral Intervention? Evidence from a Genetic Analysis of the Fast Track Randomized Control Trial, Albert et al. (2015), Journal of Policy Analysis and Management"
- High-risk first-graders
- NR3C1 gene variant (AA, AG, GG)
- Glucocorticoid receptor, involved in social-stress response

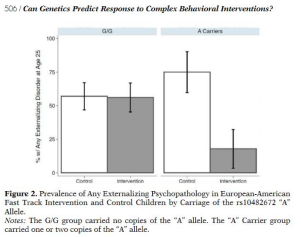
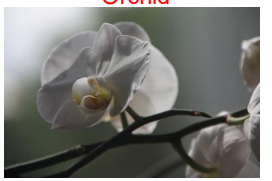


Figure 2. Prevalence of Any Externalizing Psychopathology in European-American Fast Track Intervention and Control Children by Carriage of the rs10482672 "A" Allele.
Notes: The G/G group carried no copies of the "A" allele. The "A" Carrier group carried one or two copies of the "A" allele.

- If left untreated, 75 % of high-risk "orchid" children with the NR3C1 gene variant (AA or AG) went on to develop psychological problems by age 25. These maladaptive behaviours include substance abuse, aggression, and antisocial personality disorder
- The good news is that when children with this gene variant participated in an intensive multi-pronged support services through the Fast Track Project only 18 % developed psychopathology as adults.

Orchid



The missing heritability problem

- What could the reason be?

3. We are not thinking about it in the right way
   - Let's be even smarter…
   - What if we are looking at the right genes but not looking close enough?
   - What if there can be heritable changes to DNA?

Epigenetics…

- Functionally relevant changes to the genome that do not include a change in the nucleotide sequence
- Dynamic alterations in the transcriptional potential of a cell
- One such process = **methylation**

Epigenetics – a bug on a stick

Epigenetics:

- **A quick visual review of how DNA works – 2 volunteers required**

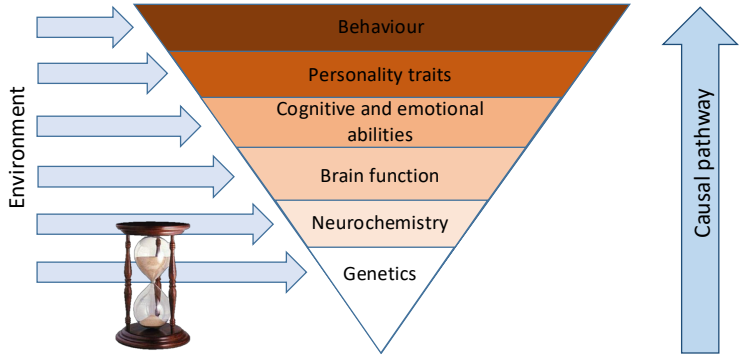
Epigenetics and the missing heritability problem

Epigenetics:

- Offers a plausible solution to the missing heritability problem
  - The genotype alone does not dictate gene expression
  - A mechanism for gene-environment interactions
- Provides a challenge
  - Further interactions – genotypic effects on methylation!
  - Further complexities… DNA *structure* and function – 2 more volunteers please!
- Provides hope – epigenetics is a dynamic process
  - It can be slowed down, sped up, prevented, reversed
- Sheds light?
  - Critical periods? Could epigenetic processes be involved?
- Is exciting!
  - This is a relatively new field
  - Based on an understanding of gene **function**
  - Time for a paradigm shift?

Why, as psychologists, do we care?

… because we are scientists!



Extra curricular activity: Sapolsky

Robert Sapolsky – Stanford University (accessible through iTunesU)
http://www.youtube.com/watch?v=e0WZx7lUOrY

The whole series is worthwhile…

Make it a date…! Popcorn, beverages, comfy chair… and behavioural genetics

Psychology 3016: Lecture 5
Social Cognition 1

Caroline Moul

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Social Cognition Learning Outcomes

Learning Outcomes across the Social Cognition mini-course

LO1 – demonstrate a deep understanding of the evidence to show different aspects of social cognition in human children and the great apes.

LO2 – consider the strengths and limitations of experiments used to test social cognition in humans and apes.

LO3 – explain how results from experiments used to test social cognition provide evidence to show different aspects of social cognition.

LO4 – understand how experimental results of tests of social cognition can inform knowledge and practice regarding child social-cognitive development and autism spectrum disorder.

LO1 – critically consider what the research evidence tells us about the development of social cognition and determine what questions remain.

Essential Course Readings

Three theoretical papers:

1. Tomasello, M., Carpenter, M., Call, J., Behne, T., & Moll, H. (2005). Understanding and sharing intentions: The origins of cultural cognition. *Behavioral and Brain Sciences, 28*(5), 675-691.
   Open peer commentary is not obligatory reading
2. Liszkowski, U. (2013). Using Theory of Mind. *Child Development Perspectives, 7*(2), 104-109.
3. Low, J., & Perner, J. (2012). Implicit and explicit theory of mind: State of the art. British Journal of Developmental Psychology, 30, 1-13.

Two empirical papers:

1. Senju, A., Southgate, V., White, S., & Frith, U. (2009). Mindblind Eyes: An Absence of Spontaneous Theory of Mind in Asperger Syndrome. *Science, 325*, 883-885.
2. Buttelmann, D., Carpenter, M., & Tomasello, M. (2009). Eighteen-month-old infants show false belief understanding in an active helping paradigm. *Cognition, 112*(2), 337-342.

Basics

- Mirror self recognition
- Empathy
  - Contagion
  - Helping
- Goal and intentions
- Perception and knowledge
- False belief understanding

Basics

- Mirror self recognition
- Empathy
  - Contagion
  - Helping
- Goal and intentions
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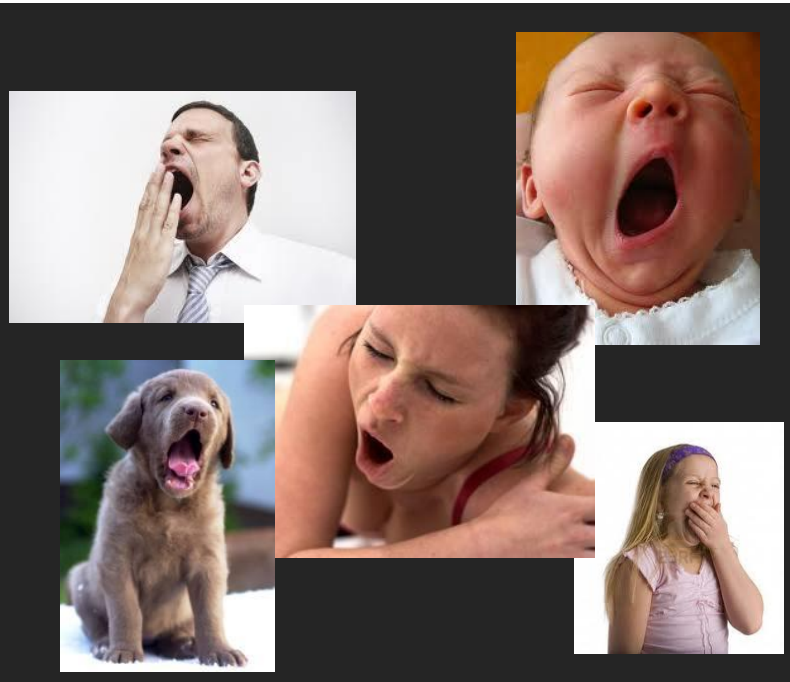
- False belief understanding

Empathy: contagion

- Basic building block of empathy?
- Mirror neurons for emotion?
  - You smile, I smile, I feel happy so I know you must also feel happy

- AFFECTIVE EMPATHY:
  - I feel the way you feel
  - I resonate
  - I don't necessarily understand why you feel that way



Empathy: contagion

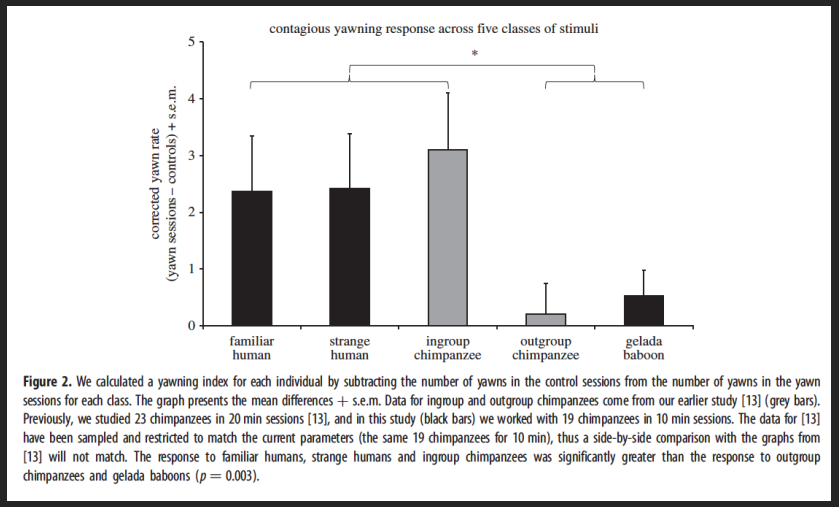
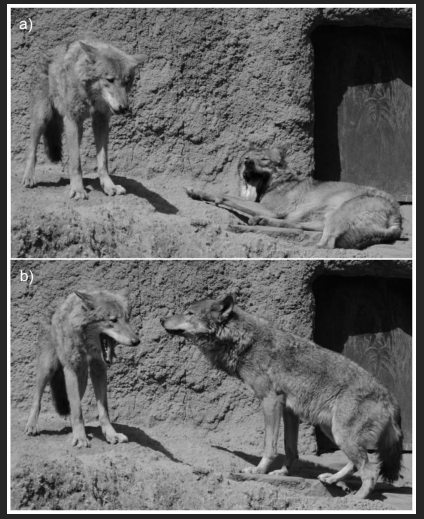


Figure 2. We calculated a yawning index for each individual by subtracting the number of yawns in the control sessions from the number of yawns in the yawn sessions for each class. The graph presents the mean differences + s.e.m. Data for ingroup and outgroup chimpanzees come from our earlier study [13] (grey bars). Previously, we studied 23 chimpanzees in 20 min sessions [13], and in this study (black bars) we worked with 19 chimpanzees in 10 min sessions. The data for [13] have been sampled and restricted to match the current parameters (the same 19 chimpanzees for 10 min), thus a side-by-side comparison with the graphs from [13] will not match. The response to familiar humans, strange humans and ingroup chimpanzees was significantly greater than the response to outgroup chimpanzees and gelada baboons ($p = 0.003$).

Campbell & de Wall (2014)

Empathy: contagion



A social mechanism – but perhaps not very sophisticated

Romero et al. (2014)

Basics

- Mirror self recognition
- Empathy
  - Contagion
  - Helping
- Goal and intentions
- Perception and knowledge
- False belief understanding

Empathy: helping

OPEN ACCESS Freely available online PLoS BIOLOGY

Spontaneous Altruism by Chimpanzees and Young Children

Felix Warneken*, Brian Hare, Alicia P. Melis, Daniel Hanus, Michael Tomasello

Department of Developmental and Comparative Psychology, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

People often act on behalf of others. They do so without immediate personal gain, at cost to themselves, and even toward unfamiliar individuals. Many researchers have claimed that such altruism emanates from a species-unique psychology not found in humans' closest living evolutionary relatives, such as the chimpanzee. In favor of this view, the few experimental studies on altruism in chimpanzees have produced mostly negative results. In contrast, we report experimental evidence that chimpanzees perform basic forms of helping in the absence of rewards spontaneously and repeatedly toward humans and conspecifics. In two comparative studies, semi–free ranging chimpanzees helped an unfamiliar human to the same degree as did human infants, irrespective of being rewarded (experiment 1) or whether the helping was costly (experiment 2). In a third study, chimpanzees helped an unrelated conspecific gain access to food in a novel situation that required subjects to use a newly acquired skill on behalf of another individual. These results indicate that chimpanzees share crucial aspects of altruism with humans, suggesting that the roots of human altruism may go deeper than previous experimental evidence suggested.

Citation: Warneken F, Hare B, Melis AP, Hanus D, Tomasello M (2007) Spontaneous altruism by chimpanzees and young children. PLoS Biol 5(7): e184. doi:10.1371/journal.pbio.0050184

Empathy: helping

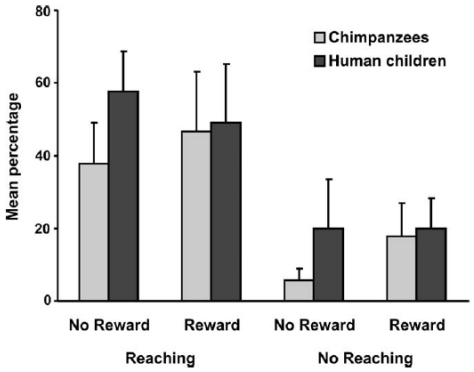


Figure 2. Experiment 1

Mean percentage of trials with target behavior (handing the out-of-reach object to the recipient) as a function of species and condition. Error bars represent the standard error of the mean (SEM). Each subject participated in one of the four conditions in a between-subject comparison.

Empathy - helping

- Intentional helping – seems so
- Reaching associated with reward – no
  - Both children and chimpanzees retrieve the item when the adult seems to be reaching for it
  - But – a non-tangible reward of helping?
- Hierarchical bonds – delayed reward/reciprocation?
  - No - same behaviour with unfamiliar humans

Empathy - helping

- Is this because they are humans?
  - Trained chimpanzees
  - Used to performing behaviours to get a reward
  - Are they acting in their own interest?
- What about when it is another chimpanzee that needs help?

Empathy: helping

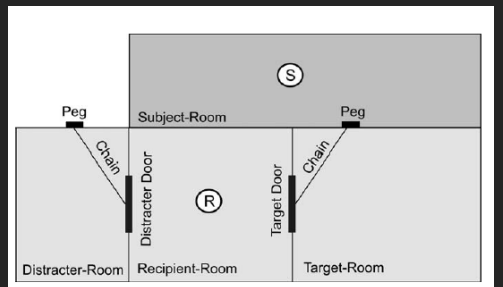


Figure 4. Test Area and Setup in Experiment 3

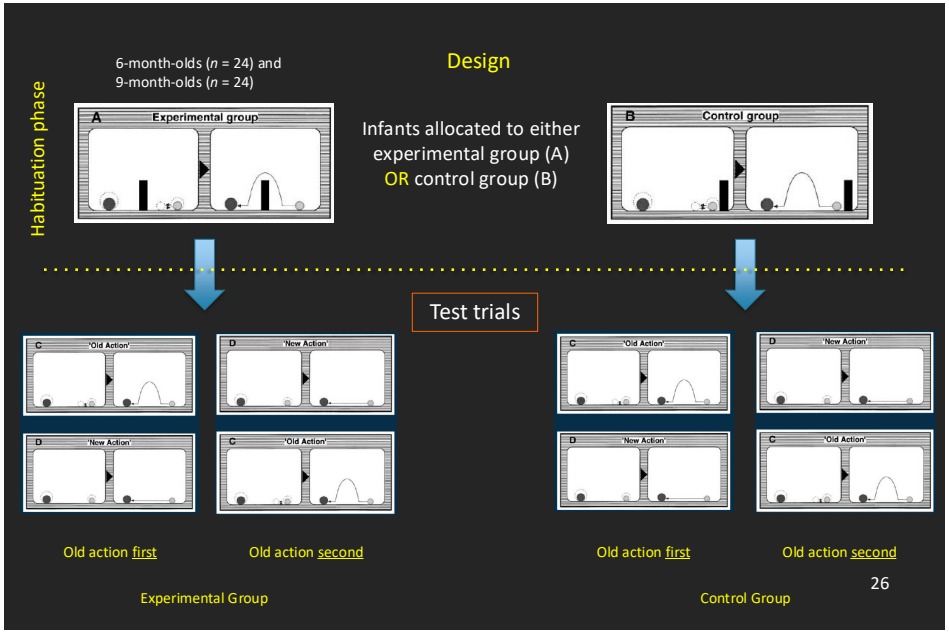
Both the target and the distracter door were held shut by chains. The recipient (R) could not access either chain, but the subject (S) could release the chain of the target door. In the experimental condition, food was placed in the target room, so that the recipient would try to open the target door and the subject could help by releasing the target chain. In the control condition, food was placed in the distracter room, so that the recipient would try to open the distracter door. In this situation, it was irrelevant (with respect to the recipient's attempt to open the distracter door) whether the subject released the target chain. The target measure in both conditions was whether the subject released the target chain.

Basics

- Mirror self recognition
- Empathy
  - Contagion
  - Helping
- Goal and intentions
- Perception and knowledge
- False belief understanding

Infant sensitivity to Goal Directed Agency

Gergely et al. (1995); Csibra et al., (1999)



Infant sensitivity to Goal Directed Agency

Gergely et al. (1995); Csibra et al., (1999)

Results: In the control group at 9 months, no major differences

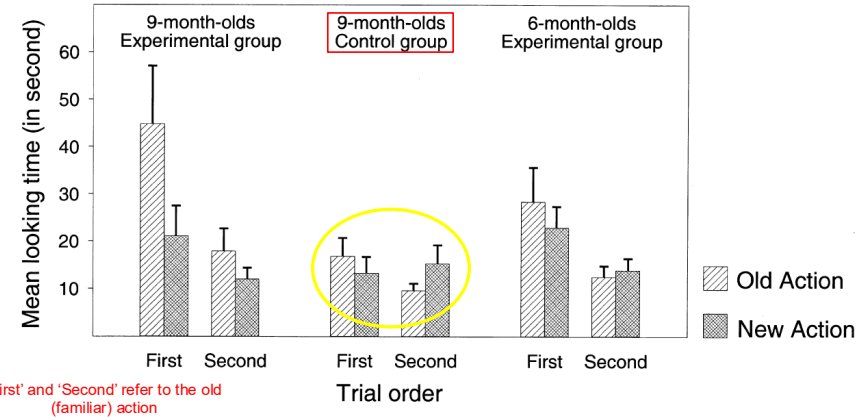


Fig. 2. Mean looking times (and standard errors) in the test phase of Expt. 1 as a function of event type and order of presentation.

Infant sensitivity to Goal Directed Agency

Gergely et al. (1995); Csibra et al., (1999)

Results: In the experimental group at 9 months, a strong attention recovery for OLD action!

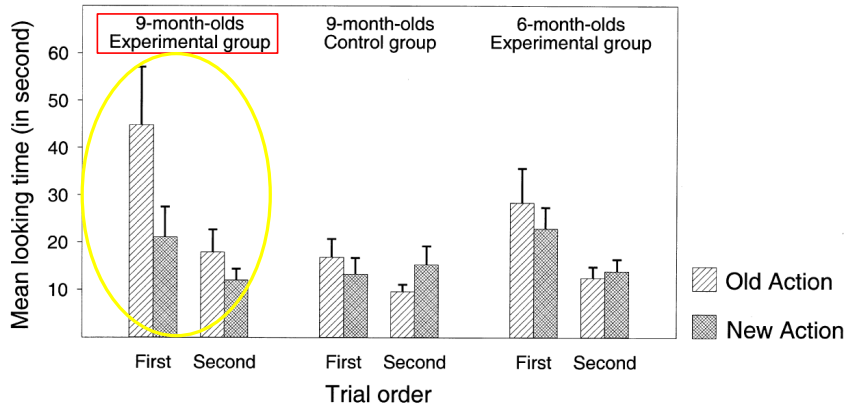
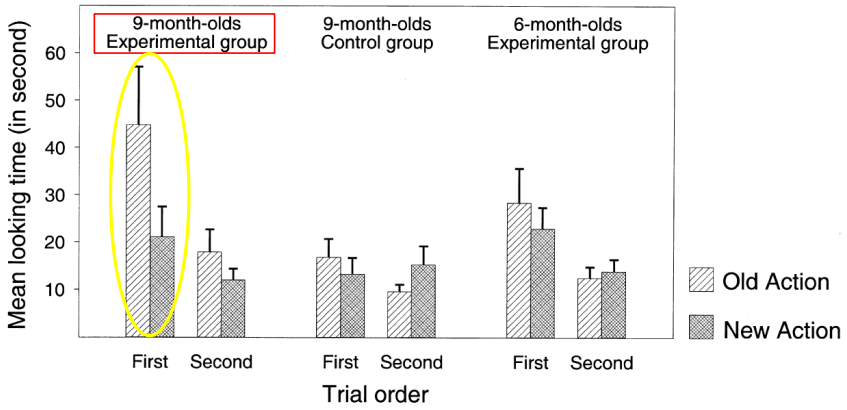


Fig. 2. Mean looking times (and standard errors) in the test phase of Expt. 1 as a function of event type and order of presentation.

Infant sensitivity to Goal Directed Agency

Gergely et al. (1995); Csibra et al., (1999)

Results: Particularly marked when the old action was first



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Infant sensitivity to Goal Directed Agency

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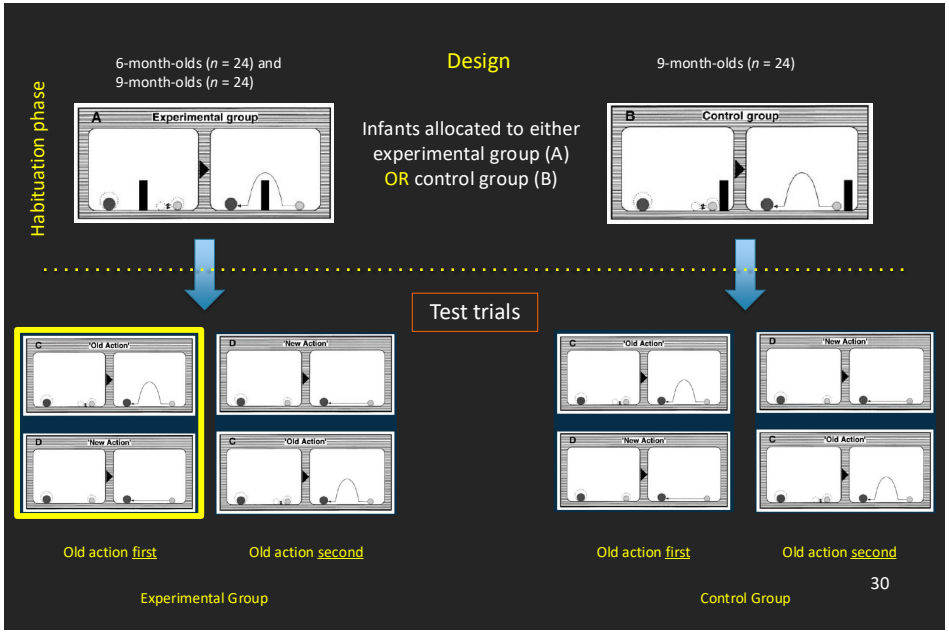

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Infant sensitivity to Goal Directed Agency

Gergely et al. (1995); Csibra et al., (1999)

Results: Not much going on for the 6 month olds (compare with 9 months)

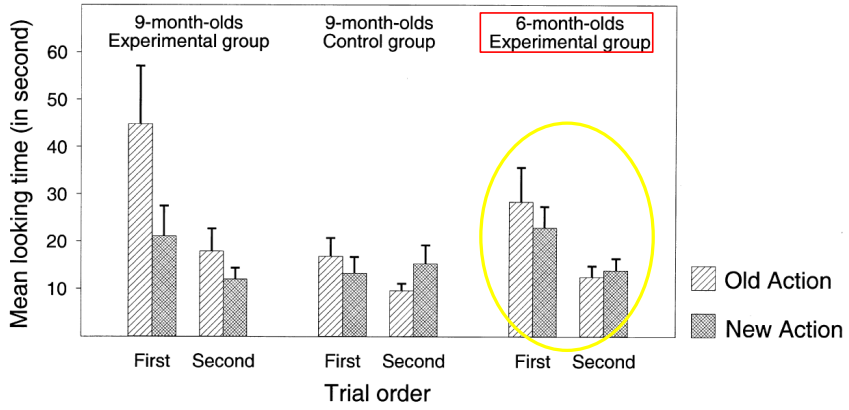

Fig. 2. Mean looking times (and standard errors) in the test phase of Expt. 1 as a function of event type and order of presentation.

31

Infant sensitivity to Goal Directed Agency

Gergely et al. (1995); Csibra et al., (1999)

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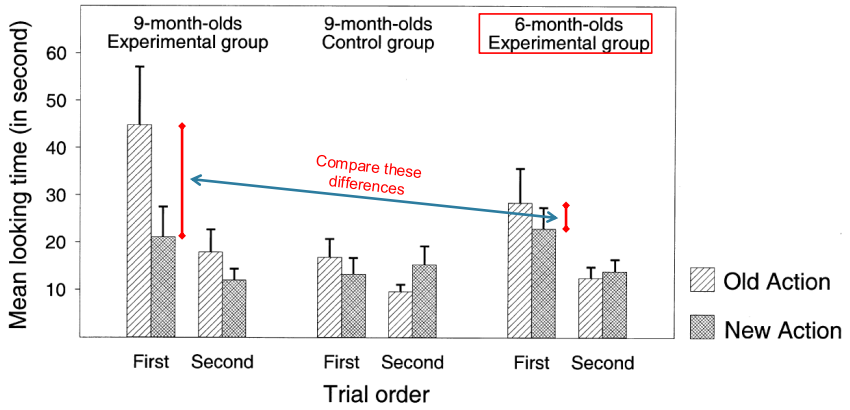

Fig. 2. Mean looking times (and standard errors) in the test phase of Expt. 1 as a function of event type and order of presentation.

32

Goals and intentions

Review

Cell PRESS

Does the chimpanzee have a theory of mind? 30 years later

Josep Call and Michael Tomasello

Max Planck Institute for Evolutionary Anthropology, Deutscher Platz 6, D-04103 Leipzig, Germany

33

Goals and intentions

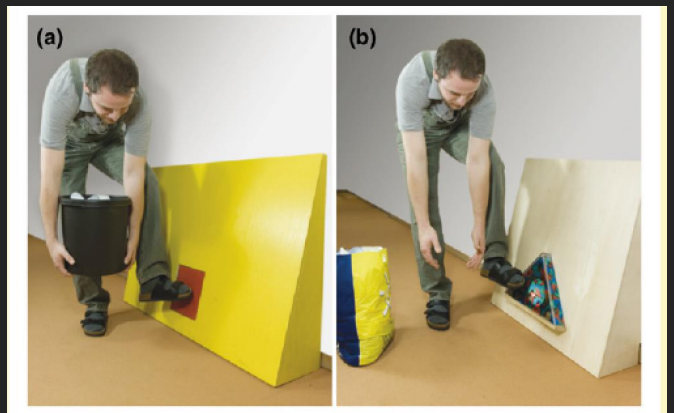

Figure I. Turning on the light with the foot because **(a)** E wanted to or **(b)** E had to (because his hands were occupied) in the Buttelmann *et al.* [28] experiments.

Psychology 3016
Social Cognition 2

Caroline Moul

Brennan MacCallum
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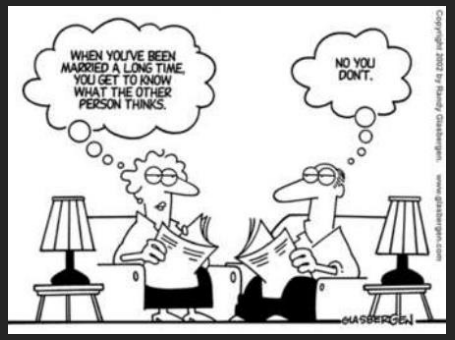

Social Cognition Learning Outcomes

Learning Outcomes across the Social Cognition mini-course

LO1 – demonstrate a deep understanding of the evidence to show different aspects of social cognition in human children and the great apes.

LO2 – consider the strengths and limitations of experiments used to test social cognition in humans and apes.

LO3 – explain how results from experiments used to test social cognition provide evidence to show different aspects of social cognition.

LO4 – understand how experimental results of tests of social cognition can inform knowledge and practice regarding child social-cognitive development and autism spectrum disorder.

LO1 – critically consider what the research evidence tells us about the development of social cognition and determine what questions remain.

Basics – let's recap

- Mirror self recognition
- Empathy
  - Contagion
  - Helping
- Goal and intentions
- Perception and knowledge
- False belief understanding

Basics – let's recap

- Mirror self recognition
- Empathy
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Granted, young infants (<6 months) can do some pretty remarkable things but,

Despite this high degree of sociality, however, in none of these interactive behaviors do infants demonstrate their own interests and attention to outside entities. Overt evidence for this understanding first emerges in the latter half of the first year of life as infants begin to incorporate outside objects into their social interactions with adults (p. 3)

What does this mean?

- Very social with face-to-face interaction
  - smiling, giggling, shared affect, listening, vocalisations etc
- This does not mean that they realise the other person has thoughts, feelings or goals that may be different from their own
- The lack of referential communication (shared attention, following of gaze etc) suggests that infants < 6 months old do not appreciate that the other person has their own "mind".

❖ PTC: would language have developed without a theory of mind?

1. Sharing attention (triadic interactions):
   - Joint engagement
2. Following attention:
   - Skill of attention following
     - Gaze-following
     - Point-following
   - Skill of imitation (remember the foot button?)
     - Instrumental action
     - Arbitrary action
3. Directing attention and behavior:
   - Declarative gesture
   - Imperative gesture

Joint attention

Triadic interactions

- Sharing attention
- Following attention
- Directing attention

Trevarthen & Hubely (1978)

Gaze alternation between infant and parent (e.g., Tracey)

Methodologically, want to be sure that looks to object and parent are not incidental

Scaife & Bruner (1975)

Deliberate attention following, much less ambiguous

Follow attention via gaze
Follow behavior via imitation

Bates, Camaioni & Volterra (1975)

Imperative gestures

Declarative gestures

Verbal communication

Social cognition and communication from 9 to 15 months of age

Carpenter, Nagell & Tomasello (1998)

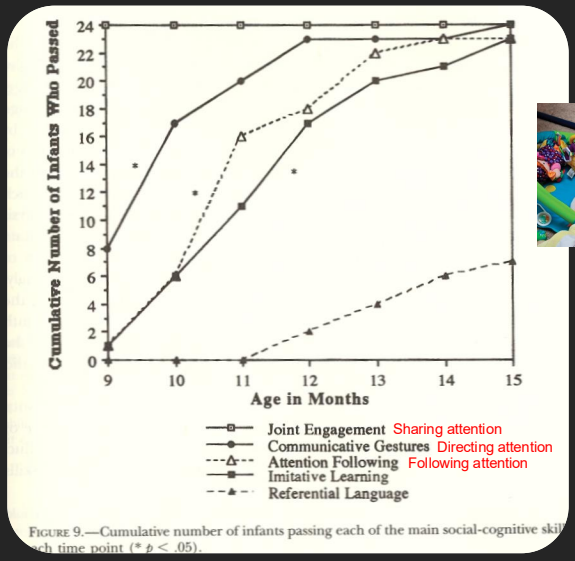
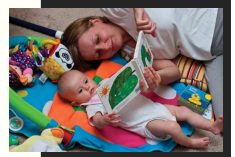


FIGURE 9.—Cumulative number of infants passing each of the main social-cognitive skil
ach time point (* $p < .05$).

NB: Not referred to – already there in diadic context



Social cognition and communication from 9 to 15 months of age

Carpenter, Nagell & Tomasello (1998)

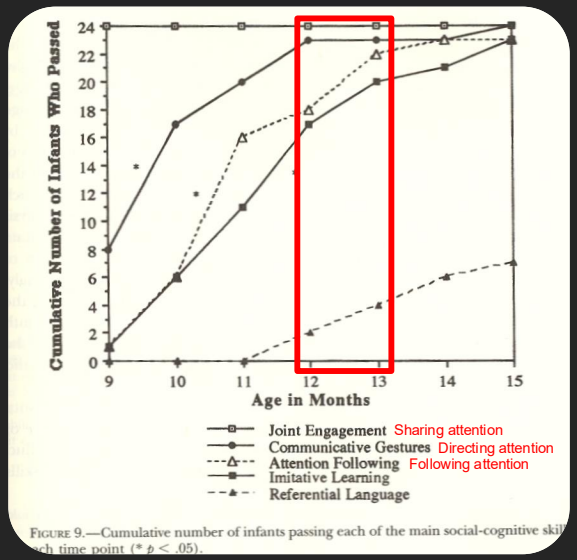


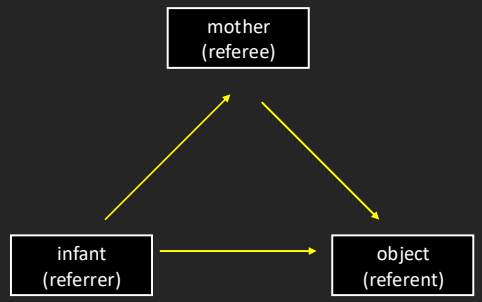
FIGURE 9.—Cumulative number of infants passing each of the main social-cognitive skil
ach time point (* $p < .05$).

Social referencing (PSYC1002):

The coming together of social information gathering (Baldwin & Moses, 1996)

When infants (~12 months) encounter a novel object they sometimes look towards a parent and (sometimes!) subsequently respond to the object in accord with the affect displayed by the parent

E.g.…



Social referencing: The visual cliff

Sorce, Emde, Campos & Klinnert (1985)

Table 1
Effect of Mothers' Facial Expressions on Infant Behavior

Variable	Study 1		Study 2		Study 3
	Joy (N = 19)	Fear (N = 17)	Interest (N = 15)	Anger (N = 18)	Sadness (N = 19)
Percentage of infants crossing deep side	74%	0	73%	11%	33%
Mean number of retreats per minute to shallow side	.420	1.08	.420	.72	.660
Mean rating of hedonic tone	1.62	2.12	2.00	1.92	1.92
Mean number of references per minute	3.60	2.46	5.70	2.94	4.59

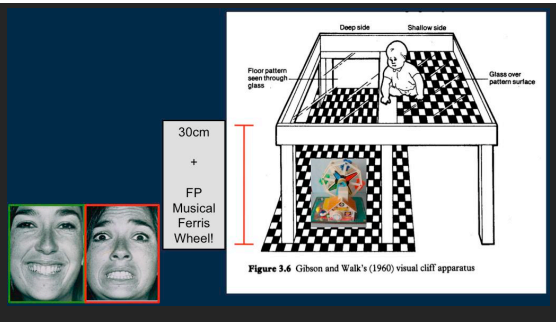


Figure 3.6 Gibson and Walk's (1960) visual cliff apparatus

Social referencing

Implications

- Infants appreciate that parents can supply information–in the form of an emotional appraisal–about novel *objects* (i.e., person, thing or situation)
- Infants spontaneously use such information from a third party or *referee* (e.g., parent or experimental confederate) to resolve their own uncertainty and to guide their actions

Social referencing

Pre-requisites (Baldwin & Moses, 1996)

- Infant needs to be able to *decode* signal
- Infant must understand *referential quality* of information
- Infant must appreciate the *potential for social communication* of information

Informing and sharing in social communication at 12 months

Liszkowski, Carpenter and Tomasello (2007). *Developmental Science, 12*(2), 1-7

Is it *shared* attention or *communication* of information?

Do infants update you if a change occurs in your absence?

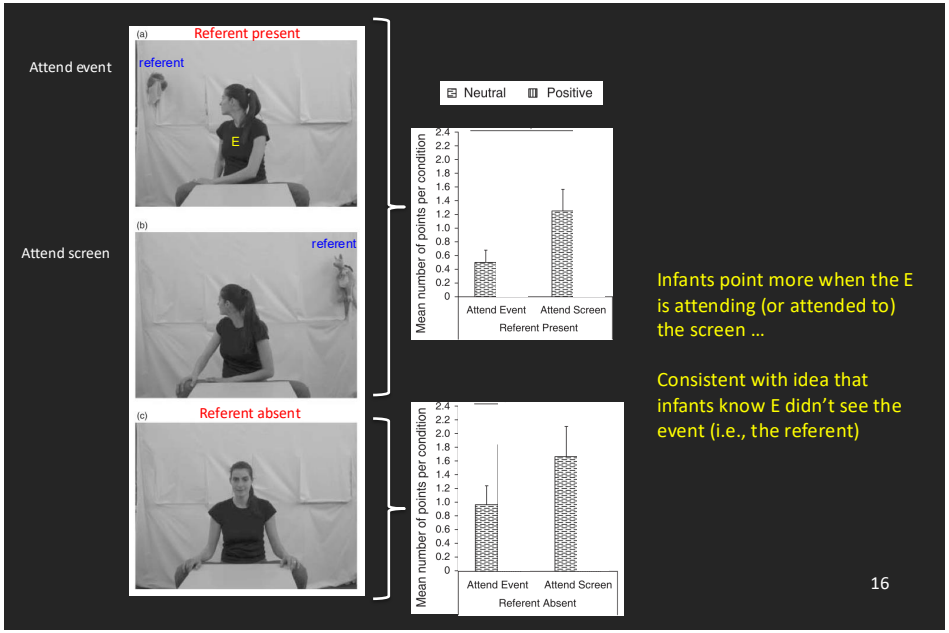
Do 12 month old infants use social gestures (i.e., pointing) to:

1. Inform others of new or changed information
2. Share *mental attitudes* – that is, communicate with the intention of … communicating

If they do these things, particularly the first, then it is extremely likely that infants know what other people are likely to know on the basis of what they can see

Under what conditions do infants (12 months) point?

Liszkowski, Carpenter and Tomasello (2007). *Developmental Science, 12*(2), 1-7

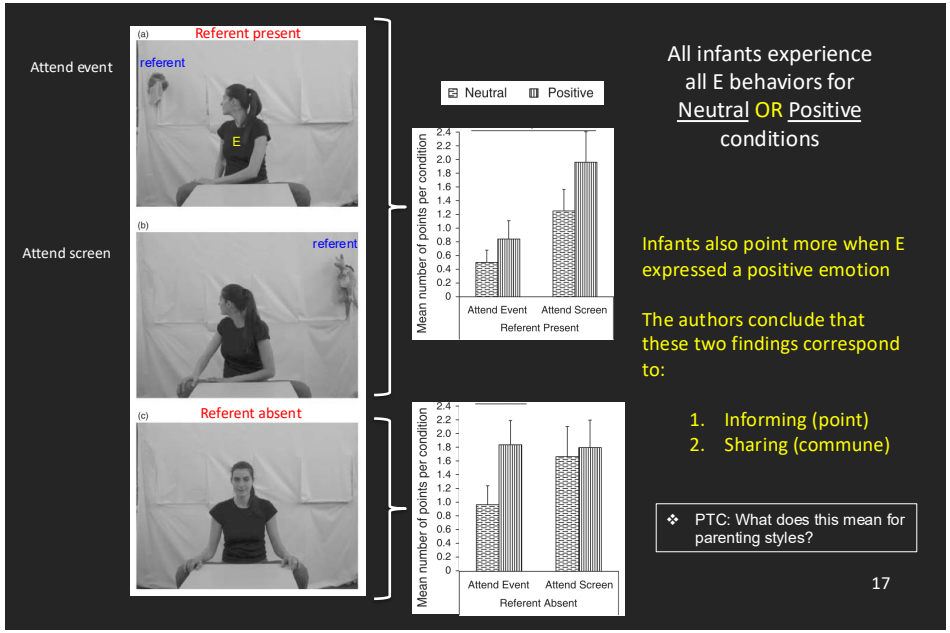


Infants point more when the E is attending (or attended to) the screen …

Consistent with idea that infants know E didn't see the event (i.e., the referent)

Under what conditions do infants (12 months) point?

Liszkowski, Carpenter and Tomasello (2007). *Developmental Science, 12*(2), 1-7



All infants experience all E behaviors for Neutral OR Positive conditions

Infants also point more when E expressed a positive emotion

The authors conclude that these two findings correspond to:

1. Informing (point)
2. Sharing (commune)

❖ PTC: What does this mean for parenting styles?

Updating – basic experiment

- Interact positively with one toy
- Someone else puts toy in cupboard
- Adult doesn't see, baby sees
- Adult comes back – what does baby do?
- Point to cupboard (12-14 months)
- *Don't point* if adult sees the move

Can apes update you?

- Apes really don't point (but they kind of gesture)
- Apes don't do eye tracking, as far as we can establish (but they seem to follow gaze by movements of the head)
- So how do we establish whether apes understand others' perception and knowledge states?

Food competition
Hare et al. (2006), Melis et al. (2006)

- When competing with others for food, chimpanzees take into account what others can and cannot see (also what others can and cannot hear!) (Naturalistic observation)
- Indeed, there even seems to be some evidence that chimps will try to influence what someone can see or hear
- Chimpanzees, "know what others know in the sense that they keep track of what another has just seen a moment before" (Call and Tomasello, 2008)

Food competition
Brauer et al. (2007)

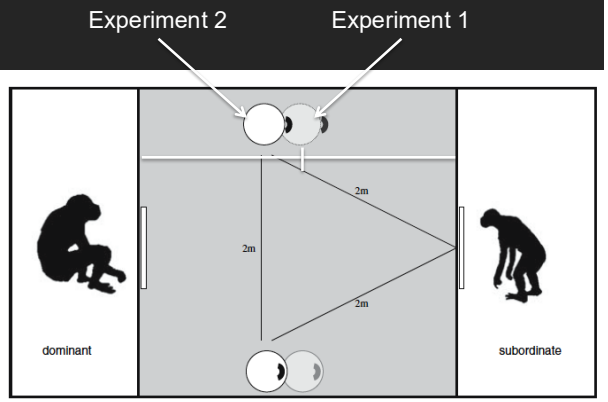


Fig. 1 Experimental set-up to scale in the condition Hidden–Visible for Experiment 1 (*gray buckets*) and Experiment 2 (*white buckets*)

Normally: one bit of food – dominant gets it most of the time

Food competition
Brauer et al. (2007)

Three conditions
- Visible1:
  one piece of food on top of bucket, visible to all
- Hidden1:
  one piece of food inside bucket (only visible to subordinate)
- Hidden-Visible:
  one piece of food on top and one inside bucket (only visible to subordinate)

Procedure
- Training
- Experiment: subordinate allowed out first

Food competition
Brauer et al. (2007)

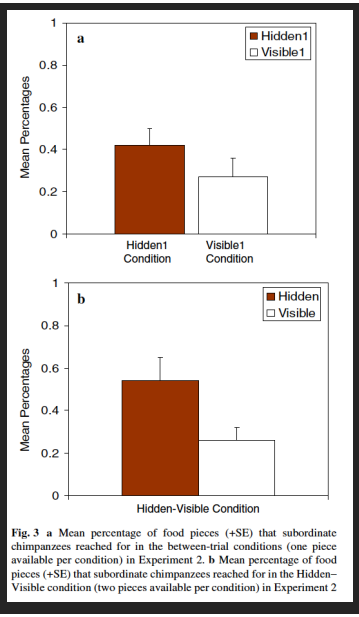


Fig. 3 **a** Mean percentage of food pieces (+SE) that subordinate chimpanzees reached for in the between-trial conditions (one piece available per condition) in Experiment 2. **b** Mean percentage of food pieces (+SE) that subordinate chimpanzees reached for in the Hidden–Visible condition (two pieces available per condition) in Experiment 2

Here we can see that the subordinate chimp gets more food when only he/she can see where it is

Here we can see when only one piece of food is visible, the subordinate chimp selects the hidden piece much more often

Food competition

Call and Tomasello, 2008, p. 190

Again, we believe that there is only one reasonable conclusion to be drawn from the totality of the studies reviewed here: chimpanzees, like humans, understand that others see, hear and know things. We have many different methodologies involving several different experimental paradigms and response measures all leading to the same conclusion. Again, behavioral rules might be concocted to explain the results of each of the various studies individually, but again this will require creating a variety of post hoc explanations on the basis of no direct evidence of the requisite past experiences. And again, if one were to use the behavioral rules critique rigorously and fairly across the board, one would have to conclude that human infants and young children also have no understanding of the perception or knowledge of others because many of the studies correspond rather closely to studies conducted with infants.

An aside: primate research

- Appropriate task
- Testing environment
- Different motivation
- Human exposure
- Personality
- Dominance hierarchies
- Rewarding paradigms
- No language (same problem until children are about 2 ½ years old)

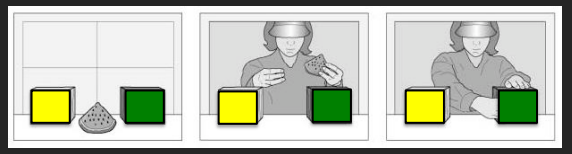
Basics

- Mirror self recognition
- Empathy
  - Contagion
  - Helping
- Goal and intentions
- Perception and knowledge
- False belief understanding

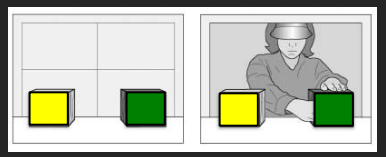
Onishi & Baillargeon (2005): Familiarlization phase

Science, vol. 308, pp 255-258

Time



1. All infants (15 months) see C put watermelon in green box



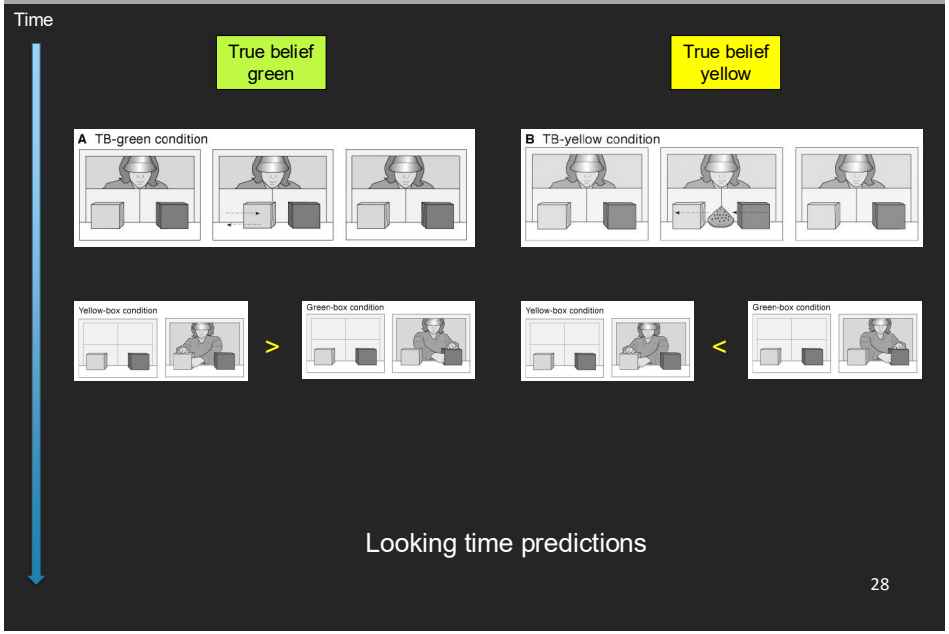
2/3. All infants see C put put hand in green box as if reaching for watermelon

Infants divided into four groups

- True belief green
- True belief yellow
- False belief green
- False belief yellow

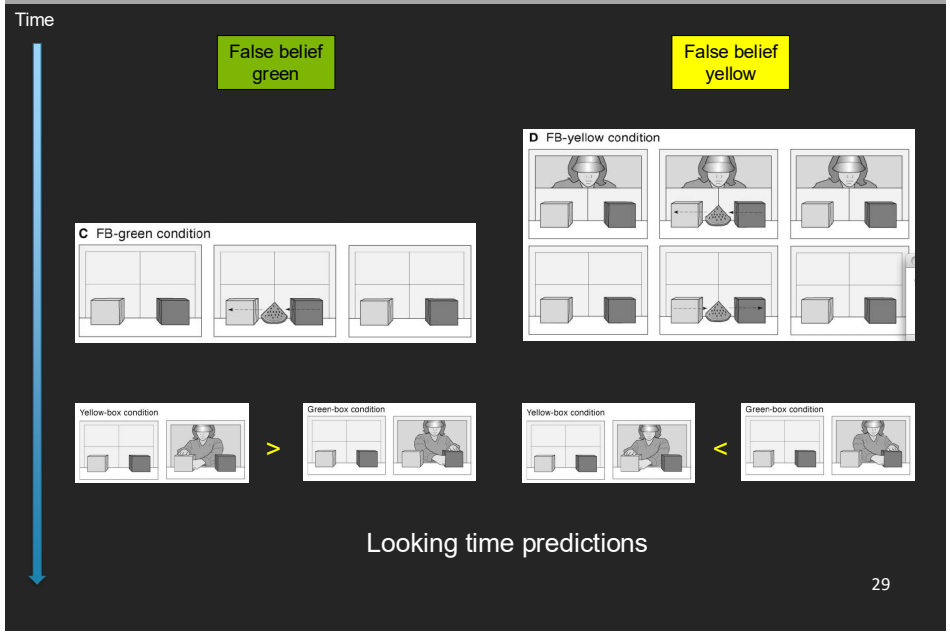
Onishi & Baillargeon (2005): True belief conditions and predictions

Science, vol. 308, pp 255-258



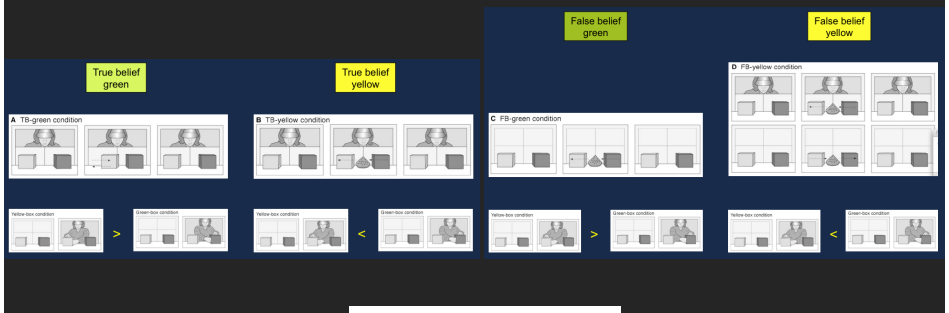
Onishi & Baillargeon (2005): False belief conditions & predictions

Science, vol. 308, pp 255-258

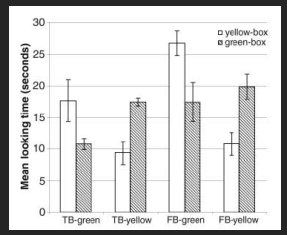


Onishi & Baillargeon (2005): Results

Science, vol. 308, pp 255-258



Results of infant looking times confirm predictions



Do apes track FB?

- How would you test this?
  - 2 chimps in competition
  - Evidence to show that they can understand whether another chimp is informed or uninformed (e.g. hidden food)
  - What about if the other chimp is misinformed (e.g. one piece of food is moved without the dominant's knowledge).
- 2 pieces of hidden food. Both apes see the two pieces of food put in one location. BUT only the subordinate chimp sees one of those pieces of food being moved to a new location.
- Does the subordinate choose the piece of food that the dominant saw or does it choose the piece that was moved when the dominant couldn't see it?

Do apes track FB?

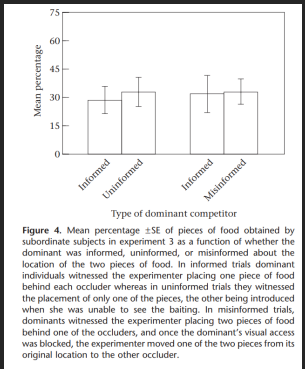


Figure 4. Mean percentage ±SE of pieces of food obtained by subordinate subjects in experiment 3 as a function of whether the dominant was informed, uninformed, or misinformed about the location of the two pieces of food. In informed trials dominant individuals witnessed the experimenter placing one piece of food behind each occluder whereas in uninformed trials they witnessed the placement of only one of the pieces, the other being introduced when she was unable to see the baiting. In misinformed trials, dominants witnessed the experimenter placing two pieces of food behind one of the occluders, and once the dominant's visual access was blocked, the experimenter moved one of the two pieces from its original location to the other occluder.

Finally, chimpanzees' behaviour in this experiment may reflect an inability to keep track of what others have seen with respect to two significant events; this may simply be an information overload that reflects a genuine cognitive limitation but not a limitation in judging what others have and have not seen. In this regard, note that in the traditional 'change location' false belief tests commonly used with human children (Wimmer & Perner 1983), subjects need only track another person's belief about a single object, the same as in experiments 1 and 2. Chimpanzees may track what their competitor has seen when two objects are hidden, but simply cannot organize this amount of information in a way that enables them to integrate it into their behavioural strategy.

32

Do apes track FB?

- They distinguish between an informed and uninformed competitor at a basic level (what the other knows by what they have seen)
- But not between an informed and a misinformed competitor when complexity increases (Hare et al., 2001).
- Inability to keep track of other's mental state

❖ PTC: what is the difference between ignorance and false-belief?

33

Psychology 3016 – Social Cognition 3
Developmental Psychology

Caroline Moul

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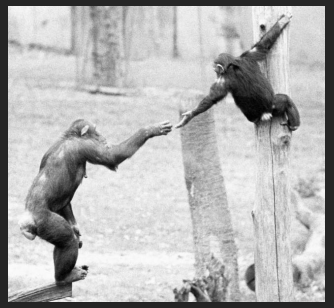


1

Social Cognition Learning Outcomes

Learning Outcomes across the Social Cognition mini-course

LO1 – demonstrate a deep understanding of the evidence to show different aspects of social cognition in human children and the great apes.

LO2 – consider the strengths and limitations of experiments used to test social cognition in humans and apes.

LO3 – explain how results from experiments used to test social cognition provide evidence to show different aspects of social cognition.

LO4 – understand how experimental results of tests of social cognition can inform knowledge and practice regarding child social-cognitive development and autism spectrum disorder.

LO1 – critically consider what the research evidence tells us about the development of social cognition and determine what questions remain.

2

How do we explain early social cognitive understanding?

- Familiar from 1st and 2nd year?
- Trevarthen (Trevarthen & Hubely)
  - Innate infant intersubjectivity (two subjects and we can understand one another)
  - Secondary intersubjectivity (incorporate objects into their interactions)

- Tomasello and Carpenter
  - "Shared intentionality"

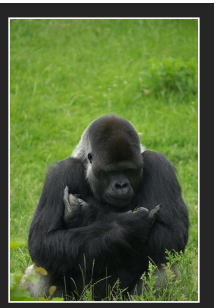
Michael Tomasello:

Shared intentionality

- "Human cognition seems very different"
- "The big Vygotskian idea is that what makes human cognition different is not more individual brainpower, but rather the ability of humans to collaborate with others in collective activities"
- *Shared intentionality* is the mechanism put forward to explain this cultural achievement. (Sounds like secondary intersubjectivity!)
- Consider these four domains, each of which is seen in an individualistic manner with chimpanzees but which is transformed by shared intentionality
  - Gaze following → joint attention
  - Group activity → collaboration
  - Social learning → instructed learning

Michael Tomasello:

Shared intentionality



Gaze following → joint attention

What can we learn from other apes?
(Behne et al., 2005; Call & Tomasello, 2005)

- Apes are good at following "head" gaze, even human: Therefore, they do not have trouble following directionality from pointing cue
- But they do not seem to grasp that partners in communication share a joint attentional frame, or *common ground*
- Thus, in a game of hide-and-seek, 14-month-olds understand that adult pointing to a bucket may reveal something within; such an assumption follows from the joint attentional frame
- In a similar game with a chimp, a point or look to the very same bucket elicits a response of the type: A bucket, so what? Where's the food?

Crucial distinctions

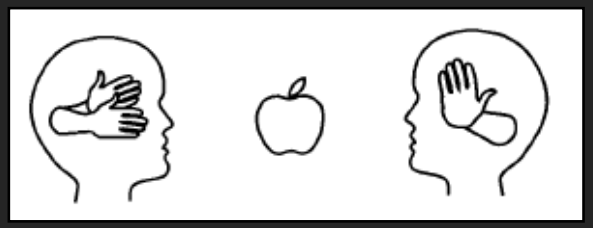
- Belief *versus* ignorance
- Coordination *versus* collaboration
- Implicit *versus* explicit ToM

Basics

- Mirror self recognition
- Empathy
  - Contagion
  - Helping
- Goal and intentions
- Perception and knowledge
- False belief understanding: what is involved?

The child's 'mental-state' understanding
The special case of FB

What is involved in understanding desires?



Bartsch and Wellman (1995), Wellman (1990)

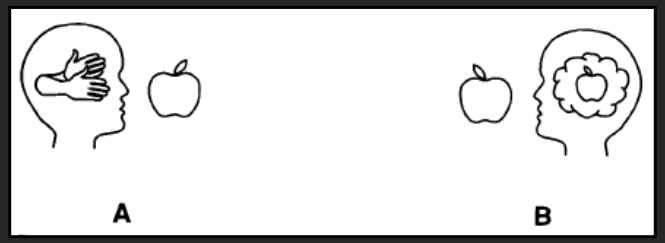
Young children understand the subjective nature of desires: *you may want an apple and I may not!*

Here, the different desires of two individuals toward the same object are represented schematically

Note, desires can be construed as a "subjective connection between a person and an objective state of affairs"

The child's 'mental-state' understanding
The special case of FB

What is involved in understanding beliefs?



Bartsch and Wellman (1995), Wellman (1990)

A subjective understanding can be contrasted with an understanding of mental states as representations

Thinking, *that object is an apple* involves construing B as representing an apple in his mind

Note, "simple desires […] could require no attribution to the target person of a representation"

The child's 'mental-state' understanding
The special case of FB

Desires versus beliefs

Beliefs trump desires

Bartsch and Wellman (1995), Wellman (1990)

A belief-desire framework allows us to conceive of two very different kinds of mental states:

Beliefs can explain why two people with identical desires (A and B both *want* an apple) might do different things:
One thinks there is an apple in the fridge and the other does not

Desires can account for why two people with the same beliefs (A and B both believe there is an apple in the fridge) might do different things:
one want an apple and goes to the fridge; the other doesn't want an apple, so does not go to the fridge

The child's 'mental-state' understanding
The special case of FB

What is involved in understanding false-beliefs?

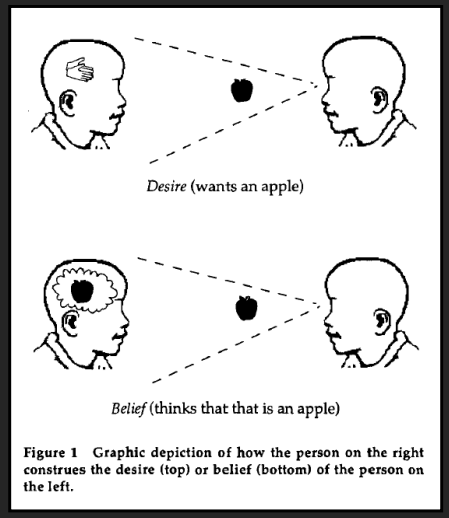


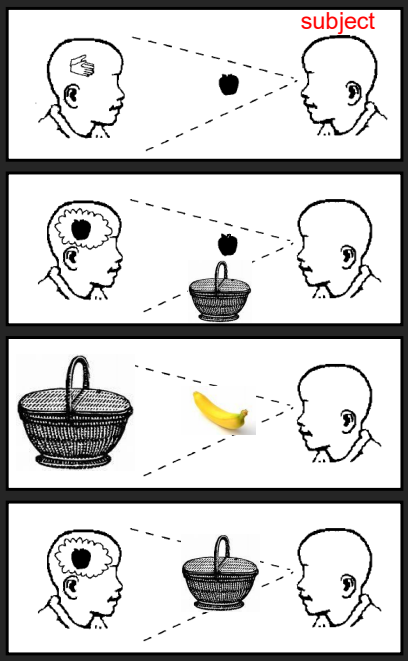
Figure 1 Graphic depiction of how the person on the right construes the desire (top) or belief (bottom) of the person on the left.

Bartsch and Wellman (1995), Wellman (1990)

Here the child on the right knows that the child on the left likes apples

He also knows that the child on the left *believes there to be an apple*

To understand false-beliefs, the child on the right needs to be able to think separately about the real state of the world (*there is an apple*) and the represented state of the world (*child on left thinks there is an apple*) … PTO

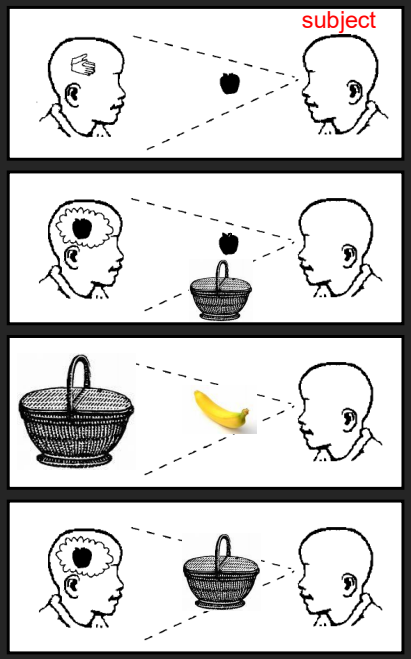


The classic false-belief test situation

1. Subject and story protagonist share a common understanding of the 'true' state of the world
There is an apple in the basket

2. Subject (only) sees a transformation in the true state of the world
Apple is replaced with banana

3. Protagonist returns and his belief no longer matches the true state of the world
The protagonist has a false-belief concerning the basket's contents



The classic false-belief test situation

We can now establish (directly or indirectly on the basis of actions) whether the subject understands that the protagonist has a false-belief

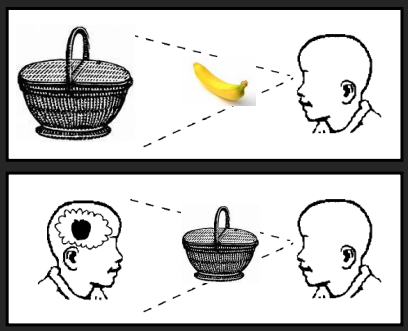
1. Subject and story protagonist share a common understanding of the 'true' state of the world
There is an apple in the basket

2. Subject (only) sees a transformation in the true state of the world
Apple is replaced with banana

3. Protagonist returns and his belief no longer matches the true state of the world
The protagonist has a false-belief concerning the basket's contents

The child's 'mental-state' understanding
The special case of FB

Herein lies the key for the representational theory of mind proponents



Wellman (1990)
The child acquires the ability to represent mental states and so moves from being a desire psychologist to a belief-desire psychologist

Another way to think about this is …

- Human's understand (or perceive) that *behaviour is not guided by objective reality*
- Instead, behaviour is guided by
  - What we want, AND
  - What we think
- So, people's actions are based on their intentions, which balance their desires and their beliefs – this is the complex claim of ToM
- (Don't think that reality is irrelevant, but you will never understand humans if you do not account for the role of their beliefs in moderating their actions)

A classic study, launching 1000s of others

Cognition, 21 (1985) 37–46

Does the autistic child have a "theory of mind"?*

SIMON BARON-COHEN
ALAN M. LESLIE
UTA FRITH

MRC Cognitive Development Unit, London

Abstract

We use a new model of metarepresentational development to predict a cognitive deficit which could explain a crucial component of the social impairment in childhood autism. One of the manifestations of a basic metarepresentational capacity is a 'theory of mind'. We have reason to believe that autistic children lack such a 'theory'. If this were so, then they would be unable to impute beliefs to others and to predict their behaviour. This hypothesis was tested using Wimmer and Perner's puppet play paradigm. Normal children and those with Down's syndrome were used as controls for a group of autistic children. Even though the mental age of the autistic children was higher than that of the controls, they alone failed to impute beliefs to others. Thus the dysfunction we have postulated and demonstrated is independent of mental retardation and specific to autism.

Can't hold in mind the other person's represented state of the world…

Never assume their point of view…

Motivation to communicate?

Baron Cohen et al. (1985): Sample

Table 1. *Means, SDs and ranges of Chronological Age (CA) and Mental Age (MA) in years; months*

Diagnostic groups	*n*		CA	Nonverbal* MA	Verbal** MA
Autistic	20	Mean	11;11	9;3	5;5
		SD	3;0	2;2	1;6
		Range	6;1–16;6	5;4–15;9	2;8–7;5
Down's syndrome	14	Mean	10;11	5;11	2;11
		SD	4;1	0;11	0;7
		Range	6;3–17;0	4;9–8;6	1;8–4;0
Normal	27	Mean	4;5	–	–
		SD	0;7		
		Range	3;5–5;9		

*Leiter International Performance Scale.
**British Picture Vocabulary Test.

Baron Cohen et al. (1985): Sample

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		Range	6;3–17;0	4;9–8;6	1;8–4;0
Normal	27	Mean	4;5	–	–
		SD	0;7		
		Range	3;5–5;9		

*Leiter International Performance Scale.
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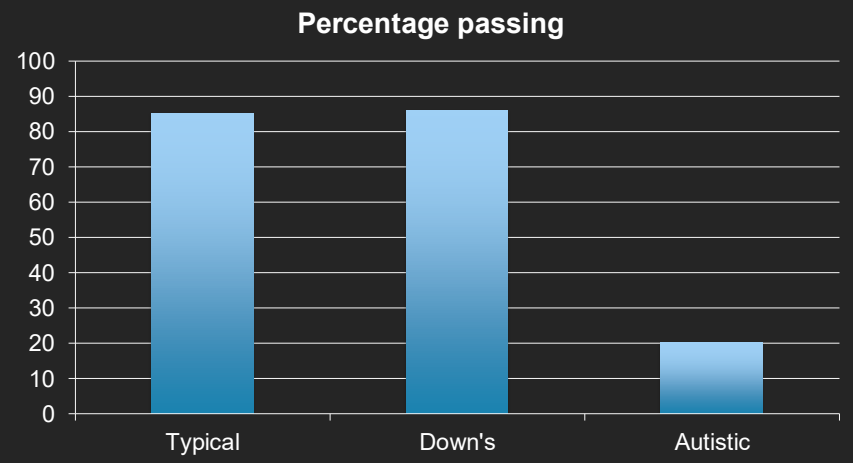
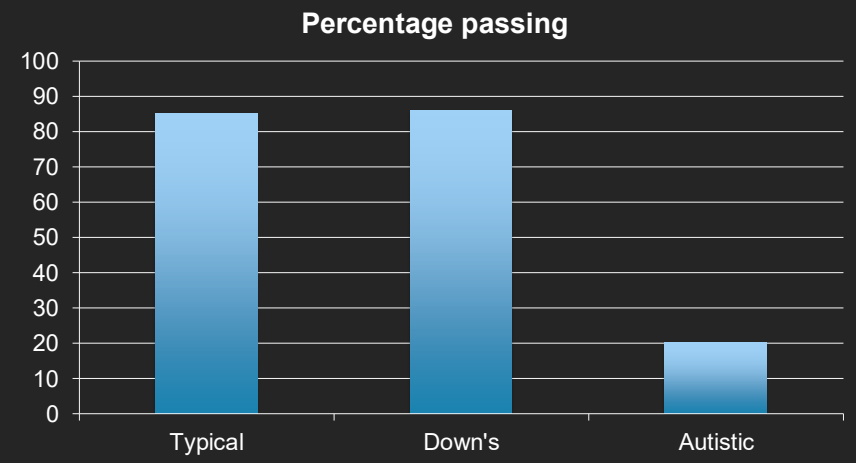
Baron Cohen et al. (1985): Results



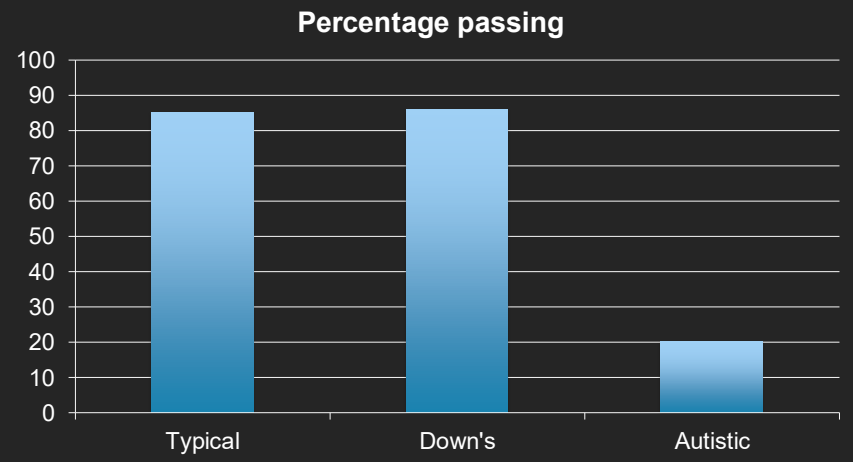
It seems ASD kids don't have a ToM

Baron Cohen et al. (1985): Results



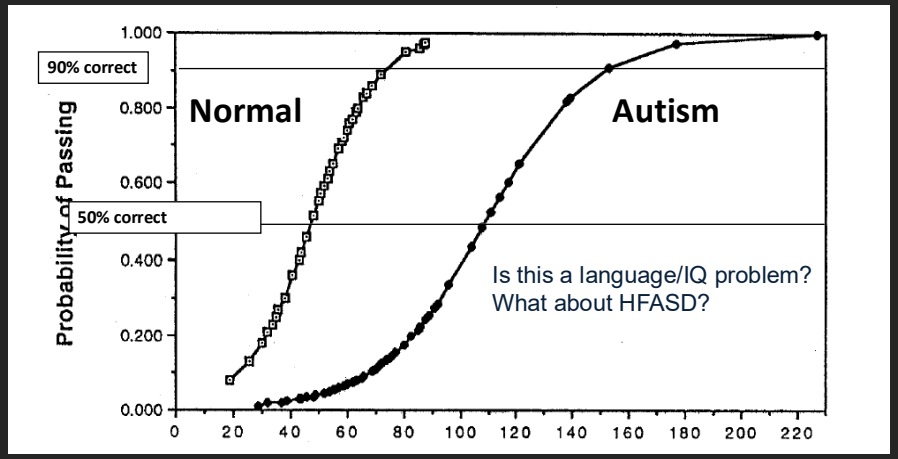
But 4 kids did pass …

Baron Cohen et al. (1985): Results



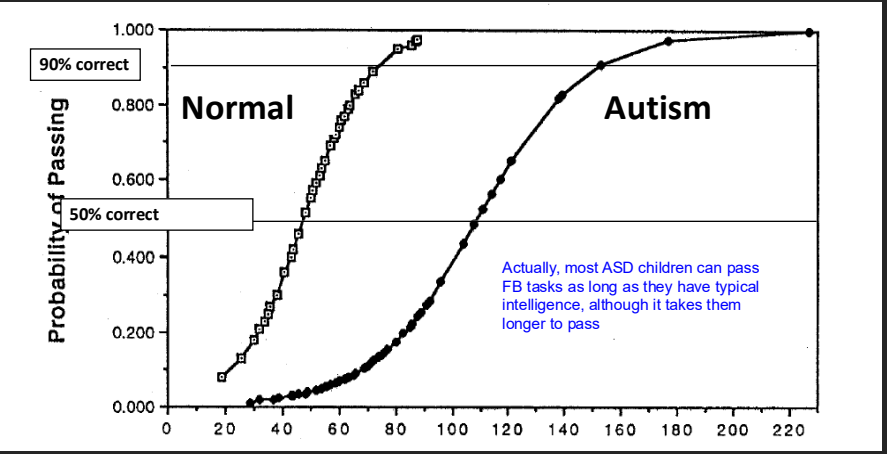
Why did 4 kids pass ..?

How does the FB task perform?



Happé, et al, (1995)

How does the FB task perform?



Happé, et al, (1995)

Is the FB task too simple? Maybe we need advanced ToM tasks

"I think …"

"I think he thinks…"

"I think she thinks I think…"

"I know you think you understand what you thought I said, but I don't think you realise that what you heard was not what I meant."

Daniel Greenspan

But a 4 year old can't follow this…

We must get better as we get older

"I know you think you understand what you thought I said, but I don't think you realise that what you heard was not what I meant."

Advanced ToM

Advanced ToM tests are an eclectic mixture of social stories that require some form of second order reasoning

- Second order false belief
- Strange Stories task (e.g. take into account a misunderstanding)
- Irony, faux pas, display rules, white lie, joke, pretence, figure of speech

Anecdote: fairies in the garden

Advanced ToM

Advanced ToM tests are eclectic mixture of social stories that require some form of second order reasoning

- Second order false belief ASD < Typical
- Strange Stories task ASD < Typical
- Irony, faux pas, display rules, white lie, joke, pretence, figure of speech ASD < Typical
- ? Marc's question…Reporting bias?

THE JOURNAL OF CHILD PSYCHOLOGY AND PSYCHIATRY
ACAMH
Journal of Child Psychology and Psychiatry 54:6 (2013), pp 628–635 doi:10.1111/jcpp.12007

Rethinking theory of mind in high-functioning autism spectrum disorder

Anke M. Scheeren, [1] **Marc de Rosnay,** [2] **Hans M. Koot,** [1] **and Sander Begeer**[1,2]
[1]VU University Amsterdam, Department of Developmental Psychology, Amsterdam, The Netherlands; [2]University of Sydney, School of Psychology, Sydney, Australia

Background: The sociocommunicative problems in autism spectrum disorder (ASD) are traditionally linked to impairments in Theory of Mind (ToM), the ability to ascribe mental states to others. Although ToM impairments are consistently reported in young children with ASD, findings on more advanced ToM understanding in older individuals with high-functioning ASD (HFASD) are less straightforward. Therefore, we assessed the advanced ToM abilities of a large sample of school-aged children and adolescents with HFASD (n = 194; 6–20 years) and compared them to a typically developing (TD) comparison group (n = 60). **Methods:** Participants' advanced ToM was assessed with five social stories containing second-order false beliefs, display rules, double bluff, faux pas, and sarcasm. **Results:** Participants with HFASD performed equally well on each of the ToM stories as their TD peers. Consistent age effects were noticed with adolescents outperforming the children. Furthermore, advanced ToM was positively associated with participants' age, verbal abilities, and general reasoning abilities. **Conclusions:** Counter to what the ToM theory of ASD would predict, school-aged children and adolescents with HFASD seem to be able to master the theoretical principles of advanced mental state reasoning. However, they may still fail to apply these theoretical principles during everyday social interactions. **Keywords:** Autism spectrum disorder, advanced theory of mind, children and adolescents, high-functioning, social understanding.

Advanced ToM

Against an assumed deficit in advanced ToM in ASD children, we were unconvinced, but nobody likes a negative finding or a negative argument.

So, in a large sample of HFASD (= typical IQ) children and typically developing children, they examined

- 2nd order FB
- Display rules
- Double bluff
- Faux pas
- Sarcasm

Scheeren et al. (2013): Results

Table 2 Observed and predicted probability (between brackets) of passing the mental state question of each theory of mind story

	Children		Adolescents		Contrast *p*-values	
	HFASD (n = 59)	TD (n = 27)	HFASD (n = 135)	TD (n = 33)	Group	Age
1. Second-order false belief[a]	.85 (.83)	.78 (.81)	.95 (.95)	.97 (.95)	n.s.	<.01
2. Emotional display rule[b]	.92 (.91)	.89 (.90)	.96 (.97)	.97 (.96)	n.s.	n.s.
3. Double bluff[c]	.46 (.48)	.44 (.41)	.65 (.64)	.55 (.58)	n.s.	<.05
4. Faux pas[d]	.49 (.50)	.44 (.43)	.68 (.68)	.61 (.62)	n.s.	<.01
5. Sarcasm[e]	.32 (.33)	.26 (.24)	.62 (.64)	.49 (.50)	n.s.	<.001

HFASD, high-functioning autism spectrum disorder; TD, typically developing.
[a]The overall model for 1 was significant, $\chi^2_{(2)} = 10.54$, $p < .01$.
[b]The overall model for 2 was not significant, $\chi^2_{(2)} = 3.04$, $p > .10$.
[c]The overall model for 3 was significant, $\chi^2_{(2)} = 8.15$, $p < .05$.
[d]The overall model for 4 was significant, $\chi^2_{(2)} = 9.27$, $p < .05$.
[e]The overall model for 5 was significant, $\chi^2_{(2)} = 22.18$, $p < .001$.

Scheeren et al. (2013): Results

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Taking stock

- Okay, so HFASD children aren't really that bad at *explicit ToM* at all!!
- In fact, once they can pass the FB test, and assuming they have normal IQ, they are equally as good as TD children
- So, what is going on?

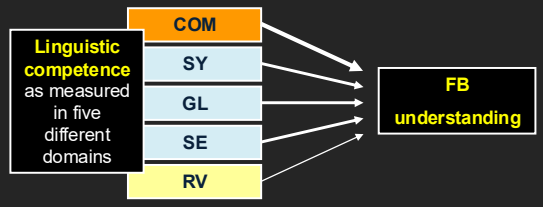
Taking stock

- Okay, so HFASD children aren't really that bad at *explicit ToM* at all!!
- In fact, once they can pass the FB test, and assuming they have normal IQ, they are equally as good as TD children
- So, what is going on?
- Perhaps ToM is anchored to a developmental variable like verbal ability?

Milligan, Astington & Dack (2007)

Conducted a meta-analysis of 104 studies examining the association between children's linguistic competence and their false-belief (FB) understanding. Only ONE study found a negative association between linguistic competence and FB understanding!!

Results: General language ability (GL), receptive vocabulary (RV), semantics (SE), syntax (SY) and memory for complements (COM) all associated with FB. However, there was some order in the strength of the relation between these aspects of linguistic competence and FB understanding



Note:
the weight of the line indicates the relative strength of the effect

Taking stock

- Okay, so HFASD children aren't really that bad at *explicit ToM* at all!!
- In fact, once they can pass the FB test, and assuming they have normal IQ, they are equally as good as TD children
- So, what is going on? Language?
- Maybe critical for **explicit** FB, but doesn't get you far with implicit or children with Down's Syndrome
- Arguably – conceptual relationship between ToM and language (part of the same thing?)

Taking stock

- Okay, so HFASD children aren't really that bad at *explicit ToM* at all!!
- In fact, once they can pass the FB test, and assuming they have normal IQ, they are equally as good as TD children
- So, what is going on?
- Perhaps HFASD children have an *implicit* ToM deficit?

Science, 325 (August), 2009

Mindblind Eyes: An Absence of Spontaneous Theory of Mind in Asperger Syndrome

Atsushi Senju,[1]* Victoria Southgate,[1] Sarah White,[2] Uta Frith[2,3]

Adults with Asperger syndrome can understand mental states such as desires and beliefs (mentalizing) when explicitly prompted to do so, despite having impairments in social communication. We directly tested the hypothesis that such individuals nevertheless fail to mentalize spontaneously. To this end, we used an eye-tracking task that has revealed the spontaneous ability to mentalize in typically developing infants. We showed that, like infants, neurotypical adults' (n = 17 participants) eye movements anticipated an actor's behavior on the basis of her false belief. This was not the case for individuals with Asperger syndrome (n = 19). Thus, these individuals do not attribute mental states spontaneously, but they may be able to do so in explicit tasks through compensatory learning.

Senju et al. (2009): Sample

Table 1. Mean chronological age (CA), verbal IQ (VIQ), performance IQ (PIQ), full-scale IQ (FIQ) (WAIS-III UK), composite ToM score (ToM), Strange Stories test score (SS), scores of autism quotient (AQ), and autism diagnostic observation schedule–generic (ADOS-G).

Group	Asperger syndrome			Neurotypical		
	Mean	SD	Range	Mean	SD	Range
CA	36.8	14.3	21–67	39.6	11.7	26–63
VIQ	116.8	14.4	85–144	116.1	13.2	91–138
PIQ	109.6	13.0	80–132	111.5	10.6	97–132
FIQ	115.6	14.9	89–144	115.3	11.0	95–129
ToM*	9.7	2.0	4–13.5	10.6	1.3	8.5–12.5
SS†	13.2	1.8	10–16	13.6	1.3	12–16
AQ‡	34.9	7.6	17–48	16.5	7.6	6–37
ADOS-G	7.9	4.7	0–17	–	–	–

*The ToM tests consisted of five first-order FBTs [Sally-Anne (*4*), Smarties (*23*), interpretational false belief (*24*), belief-emotion and real-apparent emotion (*25*)] and two second-order FBTs [ice cream van (*26*) and coat story (*6*)]. †The Strange Stories test was taken from (*27*) and required the participant to either interpret another's behavior or understand another's emotion. ‡AS and NT groups differed significantly on the autism-spectrum quotient confirming their diagnostic status [AQ: (*28*), $t(34) = 7.23$, $P < 0.001$, Cohen's $d = 2.41$, t test]. No other variables were significantly different between the two groups.

Senju et al. (2009): Method

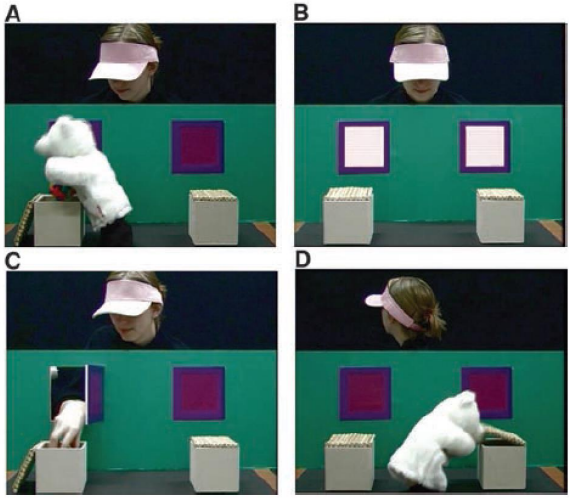


Fig. 1. Selected scenes from stimulus movies (see also movies S1 and S2). In familiarization trials, participants were familiarized to an event in which (**A**) the puppet placed a ball in one of two boxes, (**B**) both windows were illuminated and a chime sounded, and (**C**) an actor reached through the window above the box in which the ball was placed and retrieved the ball. The participants were familiarized to the contingency between (B) and (C). In (**D**), the puppet moves the ball while the actor is looking away. This operation induces a false belief in the actor about the location of the ball.

Senju et al. (2009): Results

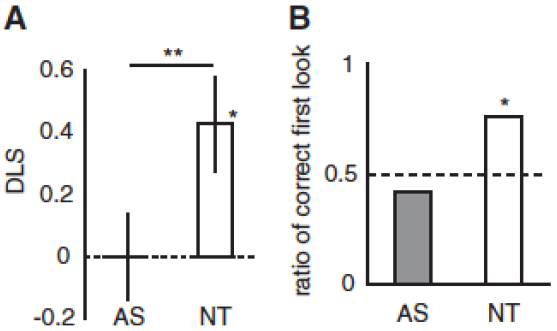


Fig. 2. (**A**) Mean (± SEM) DLS (*19*) and (**B**) the ratio of the number of participants who made correct first saccades in each group. AS, participants with Asperger syndrome (n = 19); NT, neurotypical participants (n = 17). *$P < 0.05$; **$P < 0.01$. Dotted lines indicate chance level. Statistical test used: (A), t test; (B), binominal test.

Taking stock

- Okay, so HFASD children aren't really that bad at *explicit ToM* at all!!
- In fact, once they can pass the FB test, and assuming they have normal IQ, they are equally as good as TD children
- So, what is going on? Implicit deficit in HFASD?
- Well, actually, this looks plausible – but it creates a huge headache explaining explicit ToM!!

Taking stock: summary

- Apes are pretty sophisticated, they have many of the precursor skill of ToM (mirror-self recognition, joint attention, perhaps also social referencing)
- However, apes fail explicit false-belief understanding tasks (fruit in the buckets)
- Perhaps apes just lack language? And this is the bridge between their social cognition and a truly mentalistic understanding of mind?

Taking stock: summary

- Apes are pretty sophisticated, they have many of the precursor skill of ToM (mirror-self recognition, joint attention, perhaps also social referencing)
- However, apes fail explicit false-belief understanding tasks (fruit in the buckets)
- Perhaps apes just lack language? And this is the bridge between their social cognition and a truly mentalistic understanding of mind? NO
- This language hypothesis doesn't really seem to cut it
- HFASD kids have good explict ToM and poor implicit ToM – how can this be?

But wait…

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MINI-REVIEW

OPEN ACCESS

Eye tracking uncovered great apes' ability to anticipate that other individuals will act according to false beliefs

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ABSTRACT

Using a novel eye-tracking test, we recently showed that great apes anticipate that other individuals will act according to false beliefs. This finding suggests that, like humans, great apes understand others' false beliefs, at least in an implicit way. One key question raised by our study is why apes have passed our tests but not previous ones. In this article, we consider this question by detailing the development of our task. We considered 3 major differences in our task compared with the previous ones. First, we monitored apes' eye movements, and specifically their anticipatory looks, to measure their predictions about how agents will behave. Second, we adapted our design from an anticipatory-looking false belief test originally developed for human infants. Third, we developed novel test scenarios that were specifically designed to capture the attention of our ape participants. We then discuss how each difference may help explain differences in performance on our task and previous ones, and finally propose some directions for future studies.

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KEYWORDS
anticipatory look; eye-tracking; false belief; great ape; theory of *Mind*

- Evidence of false-belief tracking in apes using an implicit measure (eye-tracking)
- 15 month-old infants and great apes demonstrate implicit false belief understanding
- By 4 years old, children can start to pass explicit false-belief tasks
- Apes do not pass explicit false belief tasks
- Individuals with HFASD can learn to pass explicit false-belief tasks (including sophisticated ones) but children with HFASD do not demonstrate implicit false belief.

Links

- Kanzi

  https://www.youtube.com/watch?v=dBUHWoFnuB4

PSYC3016: Developmental Psychology

Moral Development 1

Caroline Moul

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Reading – MD1

Recommended reading

- Social regulations and domains of social concepts (Turiel, 1978)
- Preschool children's conceptions of moral and social rules (Smetana, 1981)
- Kohlberg

What are morals?

Are they…

- Code of conduct?
- Necessary rules to maintain social structures?
- Universal right/wrong?
- An emotion?
- Avoidance of negative feelings?
- Avoidance of punishment?
- Evolution of survival?

- Black and white?
- Grey?

- Context dependent?

The feeling of conscience
and the growth of moral understanding

Today and next lecture we will:

1. Discuss some important developmental components of conscience and the growth of moral understanding
2. Introduce classical cognitive developmental theories of the growth of moral understanding
3. Contrast this classical approach with the social domain theory approach

Learning outcomes

- LO1 – understand what is meant by moral reasoning and know the developmental pattern outlined by Kohlberg
- LO2 – be able to articulate the theoretical and methodological strengths and limitations of Kohlberg's theory
- LO1 – be able to discuss the differences between moral prescriptions and social conventions and how they can be used to inform us about the way in which children appraise different types of behaviour
- LO1 – understand the developmental and theoretical differences between moral reasoning and moral appraisal

Background: Self conscious emotions

- Self-awareness is THOUGHT to emerge at about 18 months (Rouge/Mark Test)
- Turns out that apes (maybe also elephants and dolphins) can pass the Rouge Test!
- *Identity formation* is generally thought to consist in a lessening of egocentricity and increasing of self-other differentiation

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- *Identity formation* is generally thought to consist in a lessening of egocentricity and increasing of self-other differentiation
- Sense of self is required to become a "moral agent"
  - If "you" does not exist then "you" have no responsibilities
- Even very young children (2 years) appear to display pride and embarrassment, though such displays are hard to interpret and are linked to current circumstances
- Pride ≠ happiness
- Shame ≠ sadness
- **Social** emotions require an audience… feedback
- A 2 year old may experience pride in front of an audience whereas an 8 year old can appraise his/her own actions as pride-worthy (or not) **even in the absence of an audience**

Background: Self conscious emotions

- Self-awareness is THOUGHT to emerge at about 18 months (Rouge/Mark Test)
- Turns out that elephants, apes and monkeys can pass the Rouge Test!
- *Identity formation* is generally thought to consist in a lessening of egocentricity and increasing of self-other differentiation
- Even very young children (2 years) appear to display pride and embarrassment, though such displays are hard to interpret and are linked to current circumstances – so a 2 year old may experience pride in front of an audience whereas an 8 year old can appraise his/her own actions as pride-worthy (or not) even in the absence of an audience
- Self-conscious emotions imply some thought(s) about the actions of the *self as good or bad*, which probably arise because of awareness of the audience
- While developmentally critical, the presence of the *actual* audience becomes increasingly less important for self-conscious emotions: appears to be a process of internalization

Classical theories of moral development

- Both Piaget (1932) and Kohlberg (1971) use structured tasks (clinical interview) to establish how children are able to *reason* about moral dilemmas or ethical situations

  One afternoon, on a holiday, a mother had taken her children for a walk along the Rhône. At four o'clock she gave each of them a roll. They all began to eat their rolls except the youngest, who was careless and let his fall into the water. What will the mother do? Will she give him another one? What will the older ones say?

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- Both concluded that there is a clear developmental sequence in the child's capacity to *reason* about moral dilemmas

What is moral *reasoning*?

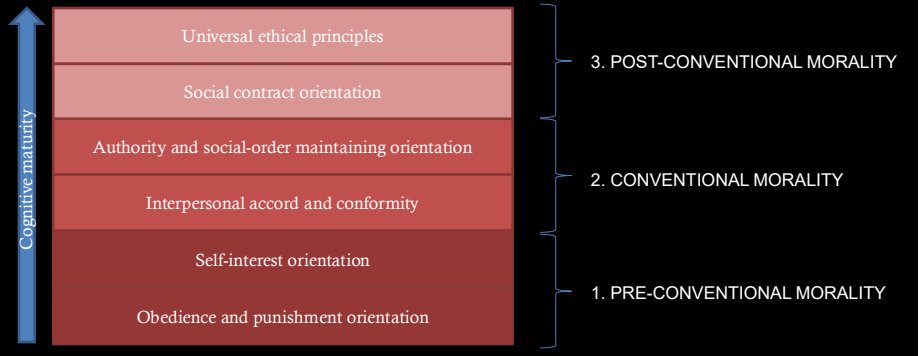
- *Cognitive* component of moral development
- Working out what you *should* do in any given situation
- Kohlberg's stages of moral reasoning

Brief background to Kohlberg

- "Stages of Moral Reasoning" – 1958
  - 6 stages within 3 levels
  - Progression through the stages as age increases
  - Each new stage reflects a qualitatively different, more adequate way of thinking than the one before it
  - Measured using "Moral Judgement Interview"

- Built on the theories of Piaget
  - Discrete stages
  - Hierarchical structure

Kohlberg's stages of moral reasoning



Level 1 – Pre-conventional morality

- External consequences
- Early childhood
- Behave in a way to avoid punishment
- "If someone is punished they must have done something wrong"
  - E.g. Drawing on the wall

Obedience and punishment orientation

Level 1 – Pre-conventional morality

- Early-mid childhood
- "What is best for me?"
- Does not include consideration of how others would view their behaviour
- E.g. " If you do your homework I will take you to the cinema".

Self-interest orientation

Obedience and punishment orientation

❖ **PTC**: How influential is parenting to a child's development of moral reasoning?

Level 2 – Conventional morality

- Typical for adolescents and adults
- Takes account of the views and expectations of the **society**
- "Good girl / good boy"
- Moral action decisions based on what would be considered best by others
  - E.g. helping an elderly person cross the road

Interpersonal accord and conformity

Self-interest orientation

Obedience and punishment orientation

Level 2 – Conventional morality

- Moral actions obey laws and social conventions
- Main focus is to maintain social order

Authority and social-order maintaining orientation

Interpersonal accord and conformity

Self-interest orientation

Obedience and punishment orientation

- "Beyond the individual"
- E.g. Reporting an incident of stealing

❖ PTC: Would someone without "theory of mind" be able to develop conventional morality?

Level 3 – Post-conventional morality

- Laws and social rules are not set in stone
- Different opinions and beliefs are respected

Social contract orientation

Authority and social-order maintaining orientation

Interpersonal accord and conformity

Self-interest orientation

Obedience and punishment orientation

- Rules can be changed by the majority to benefit the majority
- Moral dilemmas
  - E.g. steal food in order to feed child?
- Only 10 – 15% of adult population

Level 3 – Post-conventional morality

Universal ethical principles

Social contract orientation

Authority and social-order maintaining orientation

Interpersonal accord and conformity

Self-interest orientation

Obedience and punishment orientation

- Considered rare by Kohlberg
- "Beyond the law"
- Overarching ethical principles – e.g. human rights
- Personal ideals may guide behaviour over and above social rules, laws and expectations

❖ PTC: What happens when societal laws are considered immoral?

What is moral reasoning not?

Moral reasoning is not the same as moral behaviour

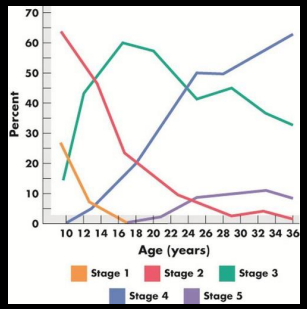
- E.g. A woman is being harassed by a man…
  - Another man punches him in the face.
  - What level of moral reasoning is he functioning at?
  - 2 – self-interest? 3 – other people's opinion?
- E.g. Level 2, stage 3 (interpersonal accord and social conformity)

Moral reasoning (according to Kohlberg) is not gender fair

- Gilligan (1982)
- Kohlberg's results based on a male sample
- Ethics of care (female) vs ethics of justice (male)
- Stage 3 – good-girl vs stage 4 – law and justice
- Focus on relationships (emotional facet of morality) more than laws (cognitive facet of morality)

The development of moral reasoning is not strictly hierarchical

- Different situations – different stage of moral reasoning
  - Social factors
  - Consequences
- People can reason at two stages simultaneously



Other criticisms…

- Kohlberg's scenarios were not ecologically valid - Nancy Eisenberg
  - People might answer differently if they were actually in a situation not just imagining it
- Cultural variability in the relationship between morality and convention
  - Individualist versus collectivist
- Stage 6 is too rare
- Children under about 7 years of age find it very difficult to articulate reasons

Lecture Quiz

- Kohlberg's theory of the development of moral reasoning is concerned with…

a) What people use to guide their moral compass.
b) What people think they should do in a given situation
c) What people think they would do in a given situation
d) How people feel in a given situation
e) How people think other people would want them to behave in a given situation

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Children's understanding of right and wrong, good and bad, and the moral-conventional distinction

- Whereas Piaget and Kohlberg pressed children in order to see what they thought they should *do* in hypothetical situations, and why they would do it, a different research tradition has grown based on the theoretical work of Turiel (1979, 1983), which is concerned with how children appraise (or judge) actions in *moral* terms (*right or wrong*)
- *Reasons* versus *feelings (is it right or wrong?)*
- Turiel and others (Smetana, 1983, 1993) have argued that even very young children, 36 months or younger, make a distinction between *moral (feeling)* and *conventional (rules)* social rules

Social conventions are … behavioral uniformities which coordinate interactions of individuals within social systems. … Consequently, conventions (e.g., modes of greeting, forms of address) provide people with means of knowing what to expect of each other … Conventions involve coordinations at the level of social organization; they are uniformities that coordinate the stable interactions of individuals functioning within a social system and the ends are social organizational.

… In contrast with convention, moral prescriptions are not perceived to be alterable by consensus. … Again, in contrast with convention, in the moral domain actions are not arbitrary, and though moral prescriptions form part of social organization, they are not defined by social organization nor is their rationale based on their status as implicit or explicit regulations. The individual's moral prescriptions (e.g., regarding killing and the value of life) are determined by factors inherent to social relationships, as opposed to a particular form of social organization. An individual's perception of an act such as the taking of a life as a transgression is not contingent on the presence of a **rule**, but rather stems from the factors intrinsic to the event … The moral theories formed by individuals are based on concepts regarding the welfare of persons, the rights of persons, and justice, in the sense of comparative treatment of individuals and means of distribution. (pp. 38-40)

Example: is it wrong to not wear clothes?

Elliot Turiel (1984)
Domains and Categories in Social Development

Children's understanding of right and wrong, good and bad, and the moral-conventional distinction

The evidence for a moral–conventional distinction in children's appraisals of certain acts is pretty good: For example, Smetana (1981) showed that,

- Moral transgressions (e.g., hitting, not sharing, shoving, stealing) are judged to be more wrong in the absence of rules than conventional transgressions (e.g., not sitting on the rug at story time, not saying grace, not putting toys away correctly) by children as young as 30 months!
- These children also agreed that moral transgressions were more serious, more deserving of punishment, and less contextually bound (wrong at home and at school)
- Finally, despite a diverse age-range, 30-57 months, there were no age differences

Children's understanding of right and wrong, good and bad, and the moral-conventional distinction

In sum,

- There is good evidence that children are, very early, sensitive to different kinds of transgressions, regarding those that relate to harm, suffering or interpersonal tension (*moral*) as worse than those that relate to social conventions
- To some extent at least, the origins of such differential understanding lie in the different meaning that such events have and the different responses they provoke in children and adults
- What if a transgression of convention caused harm?
- We might well ask, WHY is it so obvious to children that some transgressions have a different status and why does it apparently take so long for children to fully comprehend the emotional implications of moral transgression?
- We might also ask how children's moral understanding is related to their feelings and empathy development

If you get lost… come back to this slide!

- The philosophy of morality and ethics are huge areas of study!
- We are not trying to compete – focus on aspects that lend themselves to developmental psychology
- In the realm of moral development there are some grand theories
  - *rationalist and sentimentalist*
  - *rules and reason (Kohlberg) versus emotional consequences and feelings*

Next time…

- Today we looked at moral judgements (Kohlberg)
- He is as far as we go into the foray of the rationalist tradition and moral reasoning
- Next lecture will focus on the sentimentalist tradition
  - The inherent social basis of moral systems
  - The analysis of intentions in moral situations
  - Both of these approaches are important for understanding children's moral development

PSYC3016: Developmental Psychology
Moral development 2

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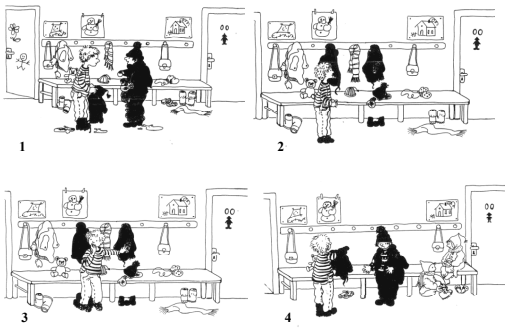

Reading – MD2

Recommended reading (not required)

- Young children use motive information to make trait inferences. Heyman & Gelman, Dev Psychol. 34(2):310-21
- Children's Understanding of Moral Emotions. Nunner-Winkler & Sodian, Child Development, 1988

Learning Outcomes

- LO1 – understand the violence inhibition mechanism and how it can fit into a sentimentalist view of moral development
- LO2 – understand the developmental trajectory of the balance between outcomes and intentions when forming a moral judgement
- LO4 – consider how the balance between outcomes and intentions is relevant when thinking about current trends in moral judgement and social behaviour
- LO2 – consider how experimental design has enabled us to learn about the developmental of moral judgements with respect to outcomes and intentions
- LO3 – explain how different moral development tasks inform us of the different aspects of children's moral development and behaviour

A developmental model from psychopathy

R. J. R. Blair

A cognitive developmental approach to morality: Investigating the psychopath. *Cognition, 57*, 1-29

"Psychopaths are impaired in their ability to form associations between their behaviour and socially-relevant cues (aversive unconditioned stimuli)"

In other words, violence and aggression are overcome by processes of sympathy and empathy in non-psychopaths

Central to Blair's original hypothesis is the *Violence Inhibition Mechanism* (VIM)

"[Blair] considered the VIM to be a cognitive mechanism which, when activated by non-verbal communications of distress (i.e., sad facial expression, the sight and sound of tears), initiates a withdraw response; a schema will be activated predisposing the individual to withdraw from the attack. Consistent with this suggestion, Camras (1977) has observed that the display of distress cues (a sad facial expression) does result in the termination of aggression in 4- to 7-year-olds"

(p. 3)

A developmental model from Psychopathy

R. J. R. Blair

Moral reasoning and conduct problems in children with emotional and behavioral difficulties.
***Personality and Individual Differences, 31*, 799-811**

While the subjects did not judge the conventional transgressions to be any more permissible than the moral transgressions, they did judge them to be less serious, more under the jurisdiction of authority and more rule contingent

The high PSD group made significantly less of a moral/conventional distinction than the low PSD group for Welfare authority and Rule contingency

So, looking at Seriousness, for example, the distinction (i.e., difference) between M and C was smaller for High PSD (7.86 – 6.63) than Low PSD (8.58 – 6.74)

Table 1
The means and standard deviations of the criterion judgements for both subject groups and for both transgressions and positive acts

Group[a]	Biographical details		Criterion judgements									
	Age	Verbal ability	Permissibility		Seriousness		Welfare authority			Rule contingency		
			M	C	M *	C	M *	C	M	C	M *	C
High PSD scorers	12.22	82.33	0.92	0.92	7.86	6.63	0.26	0.01	0.57	0.36	0.64	0.54
	(2.50)	(13.31)	(0.21)	(0.19)	(2.10)	(1.88)	(0.37)	(0.06)	(0.43)	(0.37)	(0.40	(0.35)
Low PSD scorers	12.88	76.62	0.94	0.90	8.58	6.74	0.46	0.00	0.77	0.43	0.82	0.43
	(2.05)	(10.57)	(0.19)	(0.19)	(1.49)	(2.06)	(0.30)	(0.00)	(0.33)	(0.36)	(0.28)	(0.35)

[a] PSD, Psychopathy Screening Device.

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***Personality and Individual Differences, 31*, 799-811**

What if we turn the question round? Does M/C distinction group predict psychopathic traits?

Table 3
Moral/conventional distinction group and rated levels of behavioural disturbance as indicated by the Psychopathy Screening Device (PSD)[a]

	Failers	Passers	$F(1, 59)$	P
Biographical data				
Age	12.83 (2.01)	12.54 (2.09)	0.299	n.s.
Verbal ability	81.70 (14.58)	83.29 (11.22)	0.229	n.s.
Total behavioural performance				
Total behavioural performance				
PSD	21.95 (7.01)	18.39 (5.64)	4.799	<0.05
Motivational	5.70 (2.31)	4.34 (1.97)	6.140	<0.05
Impulsivity	11.18 (3.76)	9.42 (3.30)	3.794	<0.05
Other	4.95 (1.77)	4.37 (1,50)	1.907	<0.1

[a] 'Failers', those who scored 0 or less on the moral/conventional distinction measure under modified rule conditions (see Section 2.5); 'Passes', those who scored 4 or greater on the moral/conventional distinction measure under modified rule conditions; PSD, score on PSD; Motivational, score on the interpersonal and motivational factor of the PSD; Impulsivity, score on the impulsivity and conduct disorder factor of the PSD; Other, score on the four items not included in the interpersonal and motivational factor or the Impulsivity and Conduct Disorder factor.

A developmental model from Psychopathy

R. J. R. Blair

The VIM, however it is constituted, is the reason for psychopathy

"Psychopathy is associated with the inability to feel empathy with the victim (Hare, 1985a)… not only does VIM interrupt violent action on line (in the context of distress cues) but it also developmentally inhibits violent action. The child with VIM will be … negatively reinforced following any action that results in the display of distress cues by a victim. The child without VIM would not be negatively reinforced; he would, therefore, be much more likely to show violent tendencies from a very early age. Psychopaths are associated with considerable violent tendencies from a very early age …" (pp. 10-11)

Update: what James Blair says now…

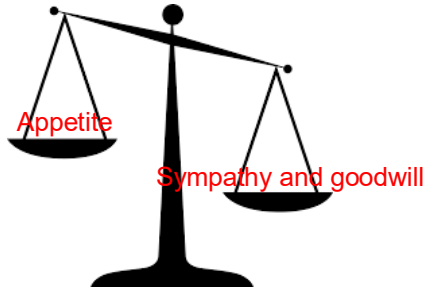
The sentimentalist tradition

- Blair's research is a kind of extreme form of what is known as the *sentimentalist tradition* in moral philosophy (Hume)
- Another sentimentalist was Darwin, who proposed something not too different to Blair (see extra slides at end of lecture)
- Darwin thought that we are driven by different sorts of *instincts*:
  - **Social** (affiliative), impulsions which are constant and moderate
  - **Appetites**, which are sudden and strong (e.g. aggression, sex drive)

The sentimentalist tradition

Darwin says:

> Thus, as man cannot prevent old impressions continually passing through his mind, he will be compelled to compare the weaker impressions of, for instance, past hunger, or of vengeance satisfied or danger avoided at the cost of other men, with the instinct of sympathy and good-will to his fellows, which is still present and ever in some degree active in his mind. He will then feel in his imagination that a stronger instinct has yielded to one which now seems comparatively weak; and then that sense of dissatisfaction will inevitably be felt with which man is endowed … in order that his instincts may be obeyed" (Decent of Man, p. 90)



According to Darwin this "dissatisfaction" is regret or remorse, and its painful character ultimately teaches us to control our appetites when they conflict with our social instincts (Korsgaard, p.12)

Children's moral understanding

- In sentimentalist theories, children are moral because they are empathic (or something like that), so one challenge is to figure out HOW empathic they are!
- But even those child researchers with a sentimentalist orientation (e.g., Eisenberg, Smetana) realize what Aristotle articulated long ago: just because we feel *pity* does not imply that we will act on that feeling
- Behaviour is how we *communicate* what we feel

Children's moral understanding

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- But even those child researchers with a sentimentalist orientation (e.g., Eisenberg, Smetana) realize what Aristotle articulated long ago: just because we feel *pity* does not imply that we will act on that feeling
- those interested in children's moral reasoning or thinking have more recently focused on children's abilities to identify and evaluate simple *reasons* for people's actions: that is, children's capacity to identify the *intentions motivating people's actions*
- This 'capacity' implies Theory of Mind (in the broad sense), because **it is people's motives and intentions that are the main objects of moral approval or disapproval**

Children's moral understanding

- So let's go back to Kohlberg!
- Kohlberg characterized the young child's morality as one of constraint: they justify acts as good/bad, right/wrong in terms of *consequences* (pre-conventional) or in terms of social norms and *conventions* (moral realism/conventional)

Children's moral understanding

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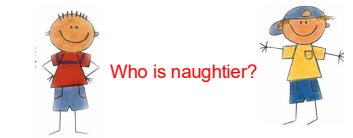

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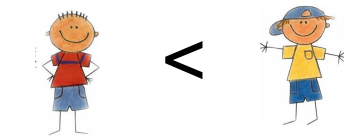
Under 7 years, Billy is judged to be naughtier and more deserving of punishment than Chris



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But wait, this experiment isn't well balanced

	Low damage	High damage
Low intention	?	
	A: Breaks 1 cups accidentally	B: Breaks 15 cups accidentally
High intention		?
	C: Breaks 1 cup doing something naughty	D: Breaks 15 cups doing something naughty

Children's moral understanding

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	Low damage	High damage
Low intention	?	
	A: Breaks 1 cups accidentally	B: Breaks 15 cups accidentally
High intention		?
	C: Breaks 1 cup doing something naughty	D: Breaks 15 cups doing something naughty

It turns out that young children privilege outcome, but they are not blind to intention

They judge B worse than C – true

But they also judge
C worse than A
D worse than B

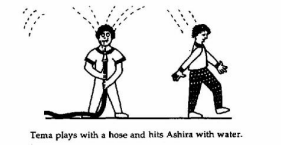
So they are using both sorts of information (see Hayman & Gelman)

Children's moral understanding
Intentions and motives

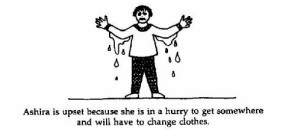
- Young children DO in fact balance motive – but they DO privilege outcome
- In fact, when judging whether someone is a nice or a nasty person, children as young as about 5 years old do show some capacity to associate the actors' intentions with his/her traits (Heyman & Gelman, 1998)

Tema (the actor) plays with a hose and hits Ashira (the recipient) with water.

Heyman & Gelman (1998)


Tema plays with a hose and hits Ashira with water.


Ashira is happy because she was really hot and wanted to cool off.


Ashira is upset because she is in a hurry to get somewhere and will have to change clothes.

Tema (the actor) plays with a hose and hits Ashira (the recipient) with water.

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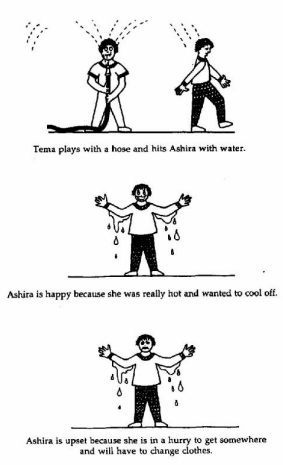

Motive of the actor	Positive:Tema thought that Ashira would be happy to cool off
	Negative:Tema thought that Ashira would be upset about getting wet
	Incidental: Tema wanted to have fun shooting water all around
Story outcome	Positive:Ashira feels happy because she was really hot and wanted to cool off
	Negative outcome: Ashira feels upset because she is in a hurry to get somewhere and will have to change clothes

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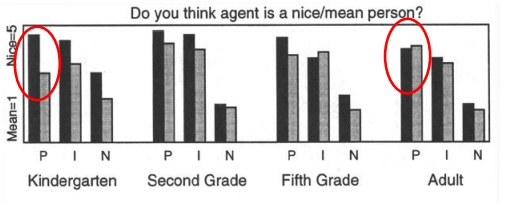
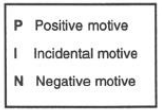
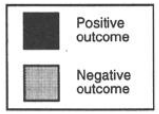


But the outcome does matter in terms of behaviour…remorse for unintentional harm?





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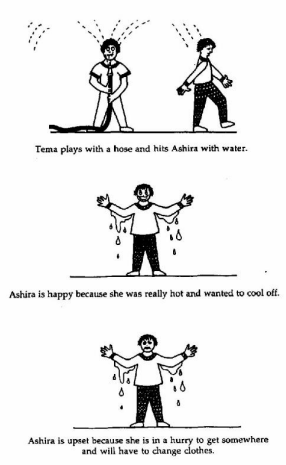

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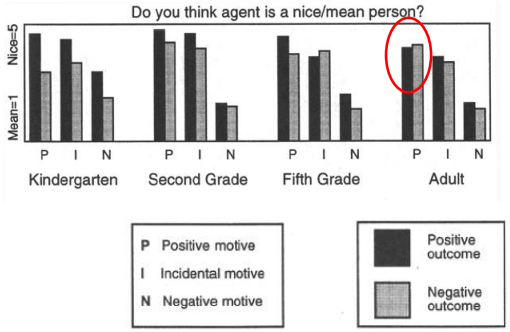

Lecture quiz

- Which of the following best represents how a 6-year-old understands the roles of consequences and social norms (conventions) in judging the morality of acts?

a) Billy broke a cup so he must be naughty
b) Billy is only naughty if he broke the cup on purpose
c) Billy tried to break the cup, but it didn't break so he isn't naughty
d) Billy is only naughty if he broke the cup by accident
e) Billy is naughty for breaking the cup, more so because he did it on purpose.

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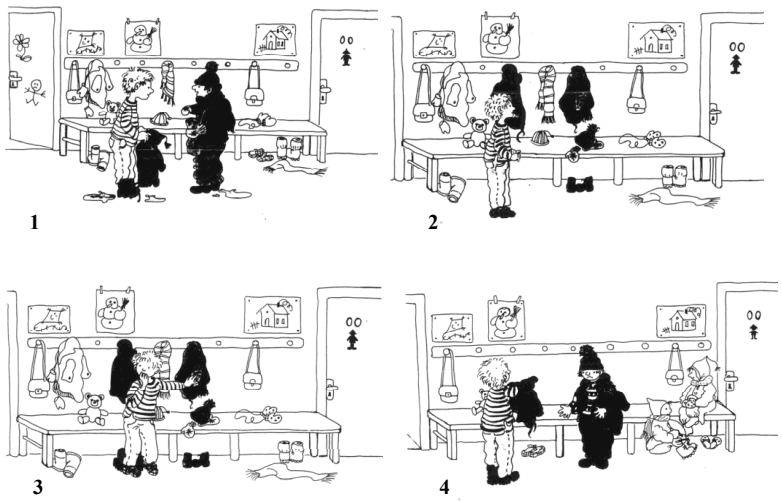
Children's moral understanding
Intentions and motives

- So Piaget's deep assumption is somewhat incorrect, young children DO in fact balance motive
- In fact, when judging whether someone is a nice or a nasty person, children as young as about 5 years old do show some capacity to associate the actors' intentions with his/her traits (Heyman & Gelman, 1998)
- However, their performance is not identical to adults; they do weigh outcome more heavily than adults
- We will come back to children's understanding of people as nice or nasty, good or bad (which is essentially a moral decision)
- But first, let us ask, can we use emotion attributions to directly access children's moral thinking?



Moral emotions
Nunner-Winkler & Sodian (1988)

- Question 1: Is it wrong to steal?
  4 years: Yes
  8 years: Yes

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  8 years: bad (guilty or ashamed)

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- Nunner-Winkler & Sodian's task is a benchmark task because it appears to show that, despite their awareness of moral rules, 4-year-olds do not understand the emotionally binding nature of moral rules, whereas 8-year-olds do

- (We will return to this idea toward the end of the lecture)

Children's moral understanding
Intentions and motives

- How do children understand intentions in Nunner-Winkler and Sodian's (1988) HV task?

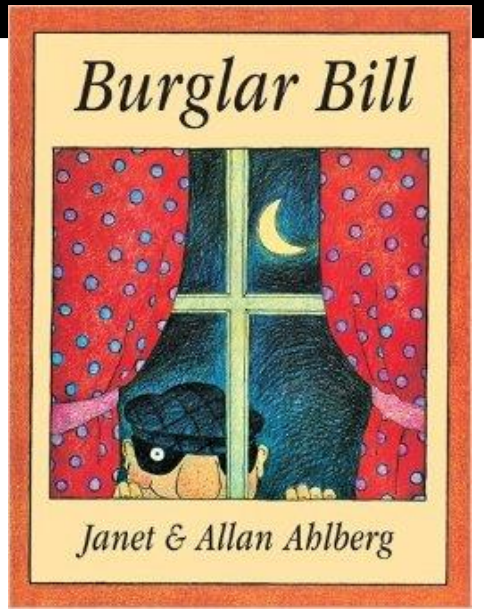
- Question 1: Is it wrong to steal?
  4 years: Yes
  8 years: Yes

- Question 2: How do you feel when you steal something that you want?
  4 years: good
  8 years: bad (guilty or ashamed)

- Yuill and colleagues (1996) found that when children between 5 and 7 years of age were directed to a transgressor's wish (e.g., to cause harm/to steal) they subsequently attributed more intensely positive emotions to the protagonist's successful action (= stronger HV phenomenon!) than when they were first directed to a moral evaluation of the act itself and then asked to make the emotion attribution

- So even 5-year-olds seem to attuned to the transgressor's intent

Children's moral understanding
Intentions and motives



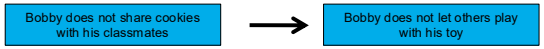
Children's moral understanding: Personality
Intentions and motives

Children's predictions of others' behaviors on the basis of past actions: the mediating role of *personality*

- The process of making behaviour-to-behaviour inferences can be decomposed into two components: behaviour-to-trait inferences and trait-to-behaviour predictions (Liu, Gelman, & Wellman, 2007)

– 4 to 5 years of age: make both behaviour-to-trait inferences AND trait-to-behaviour predictions separately

– 7 to 8 years of age: put the two processes together to make behaviour-to-behaviour inferences



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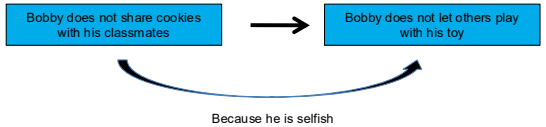

Children's moral understanding
Summary

- Young children, as young as 4 or 5, are attuned to intentions and motives
- However, they do not privilege intention and motive as much as their older counterparts
- They understand that the actor in the HV scenario is a bad person, motivated by bad intentions, but …
- … they don't so easily balance their awareness of right/wrong and emotional concerns as older kids
- Nevertheless, from about 5, children are starting to make enduring assumptions about people's character on the basis of their actions

Where are we up to?

- Children are able to identify the moral domain very early (e.g., Smetana) – but what does that imply?
- We've seen that the Happy Victimizer task allows a distinction to be made between children who attribute moral emotions and those who don't – but what does that imply?
- We've seen that very strong arguments have been put forward for the emotional basis of morality – but that doesn't seem to be enough of a story, we need to know about children's capacity to judge the person's intention as *good* or *bad*
- We've seen that even very young children are sensitive to people's intentions, although they don't seem to put the same emphasis on motives and intentions as older children and adults

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- We've seen that the Happy Victimizer task allows a distinction to be made between children who attribute moral emotions and those who don't – but what does that imply? IS THERE MORE TO BE LEARNED FROM THIS PARADIGM?
- We've seen that very strong arguments have been put forward for the emotional basis of morality – but that doesn't seem to be enough of a story, we need to know about children's capacity to judge the person's intention as good or bad
- We've seen that even very young children are sensitive to peoples intentions, although they don't seem to put the same emphasis on motives and intentions as older children and adults

MALTI & KRETTENAUER (2013):

The relation of moral emotion attribution to prosocial and antisocial behavior
Child Development, 84(2), 397 - 412

- The HV tasks seems to tell us a lot – it balances understanding of events and motives (the cognitive part) with emotional outcomes (the affective part)
- There is a consistent relation between moral emotion attribution (on the HV task) and social outcomes

More (stronger) moral emotions	=	more prosocial / less antisocial
Fewer (weaker) moral emotions	=	less prosocial / more antisocial

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Conducted a meta-analysis of 4 -20 year olds
42 studies with > 8000 participants

MALTI & KRETTENAUER (2013):

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Results

- There was a moderately strong relation between moral emotion attribution and antisocial behavior: More moral children (i.e., fewer HV responses) showed less antisocial behavior
- There was a weaker relation between moral emotion attribution and prosocial behavior: More moral children (i.e., fewer HV responses) showed more prosocial behavior
- *Moral self-concept in which you do not find the consequences of moral transgressions to be very personally emotionally binding*

End.

Additional materials: filial affections

to eat. The feeling of pleasure from society is probably an extension of the parental or filial affections, since the social instinct seems to be developed by the young remaining for a long time with their parents; and this extension may be attributed in part to habit, but chiefly to natural selection. With those animals which were benefited by living in close association, the individuals which took the greatest pleasure in society would best escape various dangers; whilst those that cared least for their comrades, and lived solitary, would perish in greater numbers. With respect to the origin of the parental and filial affections, which apparently lie at the base of the social instincts, we know not the steps by which they have been gained; but we may infer that it has been to a large extent through natural selection. So it has almost certainly

Darwin (1882), p. 105

Additional materials: Sympathy

106 *The Descent of Man.* PART I.

been with the unusual and opposite feeling of hatred between the nearest relations, as with the worker-bees which kill their brother-drones, and with the queen-bees which kill their daughter-queens; the desire to destroy their nearest relations having been in this case of service to the community. Parental affection, or some feeling which replaces it, has been developed in certain animals extremely low in the scale, for example, in star-fishes and spiders. It is also occasionally present in a few members alone in a whole group of animals, as in the genus Forficula, or earwigs.

The all-important emotion of sympathy is distinct from that of love. A mother may passionately love her sleeping and passive infant, but she can hardly at such times be said to feel sympathy for it. The love of a man for his dog is distinct from sympathy, and so is that of a dog for his master. Adam Smith formerly argued, as has Mr. Bain recently, that the basis of sympathy lies in our strong retentiveness of former states of pain or pleasure. Hence, "the sight of another person en-"during hunger, cold, fatigue, revives in us some recollection of "these states, which are painful even in idea." We are thus impelled to relieve the sufferings of another, in order that our own painful feelings may be at the same time relieved. In like manner we are led to participate in the pleasures of others.[21] But I cannot see how this view explains the fact that sympathy is excited, in an immeasurably stronger degree, by a beloved, than by an indifferent person. The mere sight of suffering, independently of love, would suffice to call up in us vivid recollections and associations. The explanation may lie in the fact that, with all animals, sympathy is directed solely towards the members of the same community, and therefore towards known, and more or less beloved members, but not to all the individuals of the same species. This fact is not more surprising than that the fears of many animals should be directed against special enemies. Species which are not social, such as lions and tigers, no doubt feel sympathy for the suffering of their own young, but not for that of any other animal. With

[21] See the first and striking chapter in Adam Smith's 'Theory of Moral Sentiments.' Also Mr. Bain's 'Mental and Moral Science,' 1868, p. 244, and 275–282. Mr. Bain states, that "sympathy is, in-"directly, a source of pleasure to "the sympathiser;" and he accounts for this through reciprocity. He remarks that "the person benefited, "or others in his stead, may make "up, by sympathy and good offices "returned, for all the sacrifice." But if, as appears to be the case, sympathy is strictly an instinct, its exercise would give direct pleasure, in the same manner as the exercise, as before remarked, of almost every other instinct.

CHAP. IV. *Moral Sense.* 107

mankind, selfishness, experience, and imitation, probably add, as Mr. Bain has shown, to the power of sympathy; for we are led by the hope of receiving good in return to perform acts of sympathetic kindness to others; and sympathy is much strengthened by habit. In however complex a manner this feeling may have originated, as it is one of high importance to all those animals which aid and defend one another, it will have been increased through natural selection; for those communities, which included the greatest number of the most sympathetic members, would flourish best, and rear the greatest number of offspring.

It is, however, impossible to decide in many cases whether certain social instincts have been acquired through natural selection, or are the indirect result of other instincts and faculties, such as sympathy, reason, experience, and a tendency to imitation; or again, whether they are simply the result of long-continued habit. So remarkable an instinct as the placing sentinels to warn the community of danger, can hardly have been the indirect result of any of these faculties; it must, therefore, have been directly acquired. On the other hand, the habit followed by the males of some social animals of defending the community, and of attacking their enemies or their prey in concert, may perhaps have originated from mutual sympathy; but courage, and in most cases strength, must have been previously acquired, probably through natural selection.

Of the various instincts and habits, some are much stronger than others; that is, some either give more pleasure in their performance, and more distress in their prevention, than others; or, which is probably quite as important, they are, through inheritance, more persistently followed, without exciting any special feeling of pleasure or pain. We are ourselves conscious that some habits are much more difficult to cure or change than others. Hence a struggle may often be observed in animals between different instincts, or between an instinct and some habitual disposition; as when a dog rushes after a hare, is rebuked, pauses, hesitates, pursues again, or returns ashamed to his master; or as between the love of a female dog for her young puppies and for her master,—for she may be seen to slink away to them, as if half ashamed of not accompanying her master. But the most curious instance known to me of one instinct getting the better of another, is the migratory instinct conquering the maternal instinct. The former is wonderfully strong; a confined bird will at the proper season beat her breast against the wires of her cage, until it is bare and bloody. It causes young salmon to leap out of the fresh water, in which they could

Additional materials: habit

CHAP. IV. *Moral Sense.* 99

behind it a very vivid impression. It is clear that many instinctive desires, such as that of hunger, are in their nature of short duration; and after being satisfied, are not readily or vividly recalled. *Thirdly*, after the power of language had been acquired, and the wishes of the community could be expressed, the common opinion how each member ought to act for the public good, would naturally become in a paramount degree the guide to action. But it should be borne in mind that however great weight we may attribute to public opinion, our regard for the approbation and disapprobation of our fellows depends on sympathy, which, as we shall see, forms an essential part of the social instinct, and is indeed its foundation-stone. *Lastly*, habit in the individual would ultimately play a very important part in guiding the conduct of each member; for the social instinct, together with sympathy, is, like any other instinct, greatly strengthened by habit, and so consequently would be obedience to the wishes and judgment of the community. These several subordinate propositions must now be discussed, and some of them at considerable length.

Darwin (1882)

PSYC3016: Developmental Psychology
Abnormal Development: Behavioural Disorder

Caroline Moul

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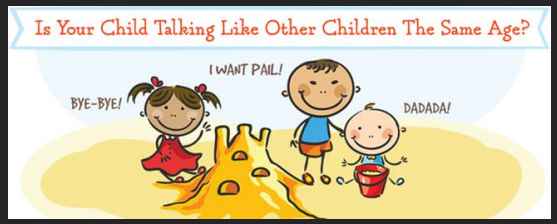
Abnormal Development: why is it important?

- Understanding abnormal behaviour helps our understanding of normal behaviour
  - And vice versa
- Example:
  - Language delay
  - We can recognise when a child has a delay in language acquisition (abnormal)



Abnormal Development: why is it important?

- Early identification – abnormal development in childhood puts the child at risk for difficulties in adulthood
- Intervening early in the developmental course has been associated with…
  - Better treatment outcomes
  - Lessened impact on child
  - Lessened impact on others
  - Better value for money!

Learning outcomes

- LO1 – understand the historical and current theoretical explanations for callous-unemotional traits in children
- LO1 – consider how studying callous-unemotional traits can inform our understanding of social cognition and moral development
- LO4 – understand how research in callous-unemotional traits can have implications for broader social issues such as parenting and clinical treatment.

Abnormal Development: Behavioural Disorder

- What can we learn from studying antisocial behaviour problems in children?
  - How best to help them
  - The developmental trajectory of antisocial behaviour (remember the tutorial?)
  - Where, what and on whom to spend government funding?

  - Social cognition
  - Moral development
  - Family dynamics
  - Impulse control
  - Reward and punishment systems
  - Associative learning systems
  - Attention systems
  - Biology of aggression
  - Genetic risk factors
  - Environmental risk factors

Abnormal Development: Behavioural Disorder

- Antisocial behaviour in more detail – remember the tutorial

Children with antisocial behaviour disorders are a heterogeneous group

Emotionally volatile
Reactive aggression
May have anxiety
Typical for ODD
Low genetic risk
High environmental risk

Unemotional
Reactive and proactive aggression
Typically low anxiety
About 1/3 of children with ODD and CD
High genetic risk
Biological correlates

Callous-unemotional traits

Reduced empathy
Low levels of guilt and shame
Limited prosocial emotions
Reduced affect

Childhood analogue of psychopathic personality traits: defined by personality traits, described by behaviours

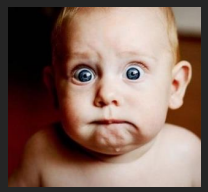
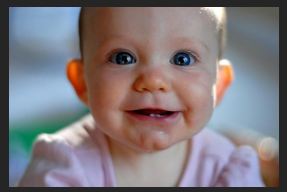
Focus of this lecture

What does antisocial behaviour characterised by high levels of CU traits look like?

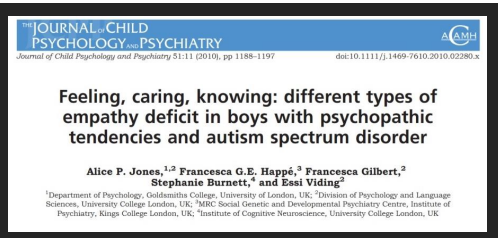
Callous-unemotional traits: theories

- LACK OF EMPATHY

- "I know what the effect of my actions are but I don't care"
- Observational evidence they might lack empathy…
  - proactive aggression, bullying, reduced shame, reduced guilt
- Empirical evidence: deficits in experimental tests of empathy (Do you feel like the person in the story would feel?), emotion recognition deficits

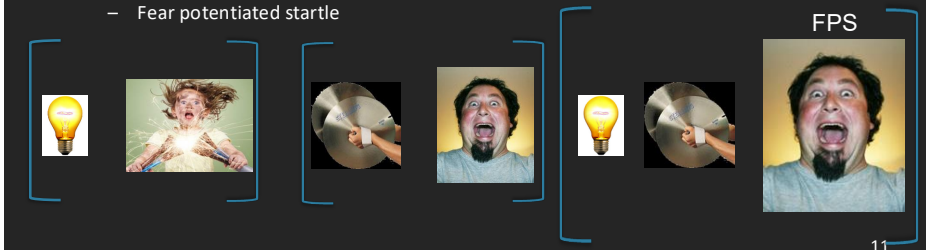

Callous-unemotional traits: theories



- CU – affective empathy impairment
- ASD – cognitive empathy impairment
- Remember the discussion of the development of theory of mind in ASD?
  - In HFASD, explicit ToM is intact
  - In HFASD, implicit ToM is impaired
- High CU seem to be associated with an implicit deficit in empathy
  - What could cause this…?

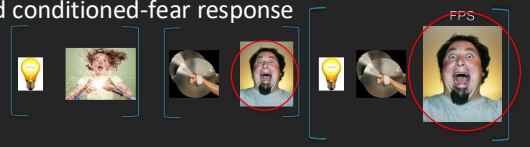
Callous-unemotional traits: theories

- LOW-FEAR HYPOTHESIS – (LYKKEN, 1957)
- A reduced ability to feel fear and thus a reduced influence on behaviour
- "I know what the effect of my actions are but I don't care"
- Observational evidence they might have low levels of fear…
  - Cleckley's original description, insensitive to punishment, risky "impulsive" behaviour, failure to recognise fear in others
- Empirical evidence: reduced conditioned-fear response
  - Fear potentiated startle



Callous-unemotional traits: theories

- Yes, people with high levels of psychopathic personality traits have reduced conditioned-fear response



- BUT – normal **unconditioned** fear response
  - What does this mean about the fear system?
- They also report the same levels of subjective fear and discomfort as non-psychopaths
  - What does a **physiological response** mean anyway?
- Low-fear hypothesis? Nope!

Callous-unemotional traits: theories

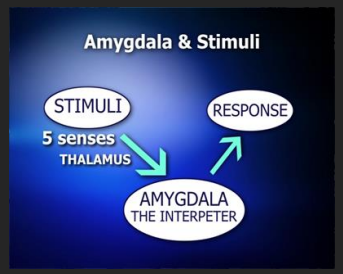
- PUNISHMENT INSENSITIVITY HYPOTHESIS
- Observational evidence: respond poorly to punishment aspects of parenting interventions – don't change behaviour, treatment failure in adult populations
- Empirical evidence: poor passive avoidance learning, poor response reversal
- So, suggests a serious learning problem as demonstrated in the following video…

Callous-unemotional traits: theories

- But neither children with high levels of CU traits nor adults with psychopathic personality traits are characterised by learning difficulties
- Also, acquisition is intact – they learn to form association as well as normal
- Also, only punishment insensitive in the presence of rewards – evidence from response-reversal paradigms (we will get to these later)
- So perhaps punishment insensitivity is a partial explanation but it doesn't explain other deficits such as poor emotion recognition

Callous-unemotional traits: theories

- AMYGDALA DYSFUNCTION
- Broadly: the amygdala is involved in…
  - Emotion recognition and processing
  - Associative learning
  - Fear response
  - Fear conditioning
  - "Emotion centre"
  - Autonomic and affective responses



Callous-unemotional traits: theories

- Empirical evidence…
- The amygdala is abnormally structured
- The amygdala is smaller
- The amygdala is overactive
- The amygdala is underactive
- ?!!!


ORIGINAL ARTICLE

Localization of Deformations Within the Amygdala in Individuals With Psychopathy

Yaling Yang, PhD; Adrian Raine, DPhil; Katherine L. Narr, PhD; Patrick Colletti, MD; Arthur W. Toga, PhD

Behavioral Sciences and the Law
Behav. Sci. Law 26: 7–28 (2008)
Published online in Wiley InterScience
(www.interscience.wiley.com) DOI: 10.1002/bsl.802

Structural Brain Abnormalities in Psychopaths—a Review

Sabrina Weber, M.Sc.,* Ute Habel, Ph.D.,† Katrin Amunts, M.D.‡,‡ and Frank Schneider, M.D., Ph.D.†

Functional Imaging of Conditioned Aversive Emotional Responses in Antisocial Personality Disorder

Frank Schneider[a] Ute Habel[a] Christoph Kessler[a] Stefan Posse[b] Wolfgang Grodd[c] Hans-Wilhelm Müller-Gärtner[a]

[a]Department of Psychiatry, University of Düsseldorf, [b]Institute of Medicine, Research Center Jülich, [c]Department of Neuroradiology, University of Tübingen, and [d]Department of Nuclear Medicine, University of Düsseldorf, Germany

Abnormalities in Emotion Processing within Cortical and Subcortical Regions in Criminal Psychopaths: Evidence from a Functional Magnetic Resonance Imaging Study Using Pictures with Emotional Content

Jürgen L. Müller, Monika Sommer, Verena Wagner, Kirsten Lange, Heidrun Taschler, Christian H. Röder, Gerhardt Schuierer, Helmfried E. Klein, and Göran Hajak

ORIGINAL ARTICLE

Deficient Fear Conditioning in Psychopathy

A Functional Magnetic Resonance Imaging Study

Niels Birbaumer, PhD; Ralf Veit, PhD; Martin Lotze, MD; Michael Erb, PhD; Christiane Hermann, PhD; Wolfgang Grodd, MD, PhD; Herta Flor, PhD

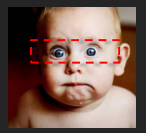
Callous-unemotional traits: theories

- Some great theories – some big problems
- No full explanation
  - Only affective empathy
  - Only conditioned-fear response
  - Only punishment-insensitive in certain conditions
  - Role of the amygdala is unclear

- Psychopathy and CU traits are subtle – the behaviours associated with them are not
- So, what if we take a developmental approach?
- What if we think about the effect of minor deficits over time?

Callous-unemotional traits: three main replicated findings

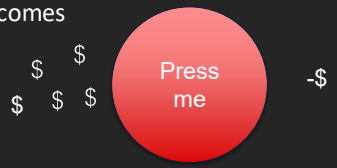
- FEAR-RECOGNITION DEFICITS



- Reliable finding – adults and children, with or without antisocial behaviour
- Two extra important bits of data…
- 1. Dadds et al., 2006 "Attention to the eyes and fear recognition deficits in child psychopathy"
- 2. Fear recognition and the brain
  - Subcortical visual pathway (terminates in activation of the basolateral amygdala) directs gaze towards salient social stimuli (**implicit** fear recognition)
  - Shift in gaze to attend to the eye-region of a fear face
  - Activation of the central amygdala and **explicit** fear recognition
- What would be the result of this snowball?

Callous-unemotional traits: three main replicated findings

- POOR RESPONSE-REVERSAL LEARNING (passive avoidance)
- Intact acquisition but reduced ability to modify response in light of changing outcomes

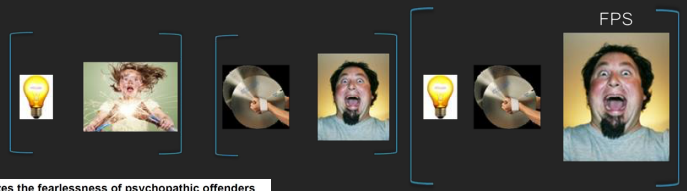


What could be the result of this snowball?

- Punishment insensitive? Reward dominant?
- Does reward/punishment actually matter?
  - Just less behavioural flexibility?

Callous-unemotional traits: three main replicated findings

- REDUCED CONDITIONED FEAR RESPONSE



Attention moderates the fearlessness of psychopathic offenders

Joseph P. Newman, John J. Curtin, Jeremy D. Bertsch, and Arielle R. Baskin-Sommers
Department of Psychology, University of Wisconsin, Madison, WI 53706, USA

Abstract

Background—Psychopathic behavior is generally attributed to a fundamental, amygdala-mediated deficit in fearlessness that undermines social conformity. An alternative view is that psychopathy involves an attention-related deficit that undermines the processing of peripheral information including fear stimuli.

Methods—We evaluated these alternative hypotheses by measuring fear-potentiated startle (FPS) in a group of 125 prisoners under experimental conditions that (a) focused attention directly on fear-relevant information or (b) established an alternative attentional focus. Psychopathy was assessed using Hare's (1) Psychopathy Checklist-Revised (PCL-R).

Results—Psychopathic individuals displayed normal FPS under threat-focused conditions but manifested a significant deficit in FPS under alternative-focus conditions. Moreover, these findings were essentially unchanged when analyses employed the interpersonal-affective factor of the PCL-R instead of PCL-R total scores.

Conclusions—The results provide unprecedented evidence that higher-order cognitive processes moderate the fear deficits of psychopathic individuals. These findings suggest that psychopaths' diminished reactivity to fear stimuli, and emotion-related cues more generally, reflect idiosyncrasies in attention that limit their processing of peripheral information. Although psychopathic individuals are commonly described as cold-blooded predators who are unmotivated to change, the attentional dysfunction identified in this study supports an alternative interpretation of their chronic disinhibition and insensitive interpersonal style.

Just to make it even stranger…

← Read me

Callous-unemotional traits: why a developmental approach fits

- Psychopathy and CU traits are SUBTLE
- TIME is the crucial variable
- Sometimes you NEED to take a developmental approach in order to see the whole picture

Callous-unemotional traits: a possible explanation

Psychological Review

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0033-295X/12/$12.00 DOI: 10.1037/a0029342

A Model of Differential Amygdala Activation in Psychopathy

Caroline Moul, Simon Killcross, and Mark R. Dadds
University of New South Wales

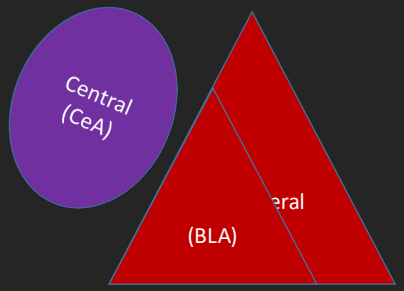
This article introduces a novel hypothesis regarding amygdala function in psychopathy. The first part of this article introduces the concept of psychopathy and describes the main cognitive and affective impairments demonstrated by this population; that is, a deficit in fear-recognition, lower conditioned fear responses and poor performance in passive avoidance, and response-reversal learning tasks. Evidence for amygdala dysfunction in psychopathy is considered with regard to these deficits; however, the idea of unified amygdala function is untenable. A model of differential amygdala activation in which the basolateral amygdala (BLA) is underactive while the activity of the central amygdala (CeA) is of average to above average levels is proposed to provide a more accurate and up-to-date account for the specific cognitive and emotional deficits found in psychopathy. In addition, the model provides a mechanism by which attentional-based models and emotion-based models of psychopathy can coexist. Data to support the differential amygdala activation model are provided from studies from both human and animal research. Supporting evidence concerning some of the neurochemicals implicated in psychopathy is then reviewed. Implications of the model and areas of future research are discussed.

Keywords: psychopathy, basolateral amygdala, central amygdala, model

- Note: I am biased!

A differential amygdala activation model of psychopathy

- Theory: The amygdala is differentially activated in people with high levels of psychopathic personality traits
- Specifically: The basolateral amygdala is under-activated and the central amygdala functioning at normal, or above, levels



A differential amygdala activation model of psychopathy

- What does this theory predict?
- The basolateral amygdala is involved with the **automatic** allocation of attention
- The central amygdala is involved with explicit emotion recognition and the physiological fear response
- The basolateral amygdala encodes the specific features of stimuli (e.g. $1 versus $5, chicken or a dog)
- The central amygdala encodes the general valence of a stimulus (good versus bad, I want versus I don't want)
- The learning parameters are different
- PTC: Imagine your amygdalae function like this from birth…

Is a psychopath born or made?

- Silly question
- But…
- Evidence shows that CU are highly heritable ~ 80%
- Recent research has identified two types of psychopathy
  - Primary psychopathy
  - Secondary psychopathy

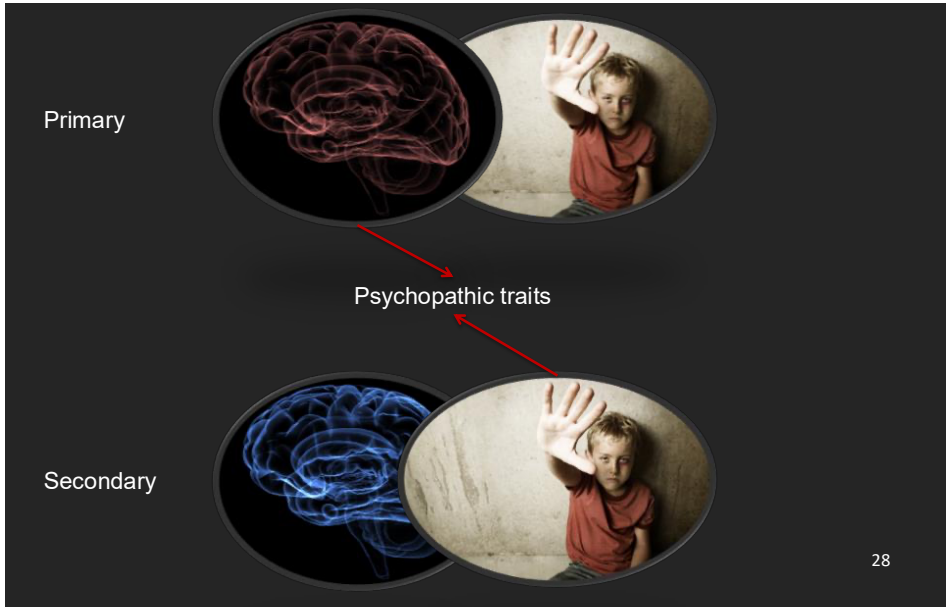
Primary versus secondary psychopathy

- Both characterised by
  - High levels of CU traits
  - High levels of antisocial behaviour
- Differ in
  - Anxiety (high in secondary, low in primary)
  - Sex ratio (more even sex ratio in secondary)
  - Aetiology (child maltreatment associated with secondary but not primary)
- Current thinking
  - Primary psychopathy has a (mainly) biological, genetically-based aetiology
    - Serves both as a risk factor for antisocial behaviour and as a protective factor against environmental risk (differential susceptibility)
  - Secondary psychopathy arises as a response to abuse/maltreatment
    - Biological component still relevant but possibly different pathways involved

Primary versus secondary psychopathy

- Secondary psychopathy
  - Reactive attachment disorder

Primary versus secondary psychopathy



Three take home messages:

- The development of psychopathy provides a good example of the importance of psychological research
  - The same treatment does not work for all children
  - There are reasons why the same treatment does not work for all children
  - Similar behaviours and personality traits can have very different aetiological pathways
- Psychopathy is a "hot" topic
  - Do not believe anything unless you read it in a scientific journal!
  - And even then be critical
- Who will be an advocate for these children if not you?
  - These children (with high CU traits) are the ones you hear about in the news
  - The odds are stacked against them through biology or environment from the very beginning
  - Everyone knows about the cognitive difficulties associated with ADHD. No-one knows about the cognitive difficulties associated with CU
  - They are just children

Adolescent Development

Learning Outcomes

- LO1 – a comprehensive understanding of the physical, hormonal and cognitive development that occurs during adolescence
- LO1 – understand the research evidence regarding the cognitive changes that occur during adolescence and how they are associated with chronological age and hormone levels (tanner stage).
- LO4 – be able to articulate how the changes that occur during adolescence can interact with environmental variables and the potential impact of this on well-being, social experience, and family dynamics.

Adolescence defined

Divided into three stages:

Early (10-15):
Rapid growth and development of secondary sexual characteristics
Concrete thinking
Developing body image
Frequent mood changes
Struggles with being dependent
Intense friendships
Exploration of sexuality

Middle (14-17):
Brain growth – prefrontal cortex
Moves towards abstract thinking
Creates body image
Risky behaviours; argues with authority
Powerful influence of peer group
Form stable relationships

Late (16-19):
Physically mature
Abstract thinker, plans for the future
Usually comfortable with body image
Family dynamics shift toward equal adult-adult relationship
Less influence of peers – individual friendships and relationships most important
Mutual and balanced sexual relations

Changes in the definition

Adolescence in 1920

Puberty onset – age 14.6 for girls

School leaving age – 14 (UK)

Employment age (full-time) - 14

Teenage pregnancy – approx. 2.5%

Adolescence now

Puberty onset – age 10.5 for girls

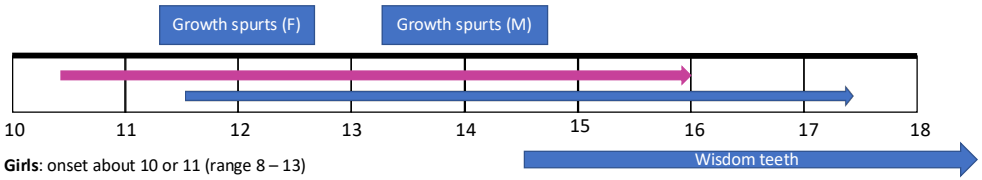
School leaving age – 17 (in Australia)

Employment age (full-time) - 17

Teenage pregnancy – 2.8%

Basic timeline of adolescence - biological

Physical changes



Girls: onset about 10 or 11 (range 8 – 13)
- breast development
- changes in body shape and height
- growth of pubic and body hair
- the start of periods (menstruation)

Boys: onset about 11 or 12 (range 9 – 14)
- growth of the penis and testes (testicles)
- changes in body shape and height
- erections with ejaculation
- growth of body and facial hair
- changes to voice

Increases in weight, height, heart and lung size, muscular strength

Bone growth is faster than muscle development – poor coordination

Increase in appetite and sleep requirements

Year 10 group photo

Puberty onset and obesity

Obese girls, defined as at least 10 kilograms (22 pounds) overweight, had an 80% chance of developing breasts before their ninth birthday and starting menstruation before age 12 – the western average for menstruation is about 12.7 years.

Joyce Lee of the University of Michigan, US, followed 354 girls who were either normal weight, at risk of being overweight, or overweight from age 3 to age 12. Lee found a strong association between elevated body weights at all ages and the early onset of puberty as determined by breast development and the onset of menstruation.

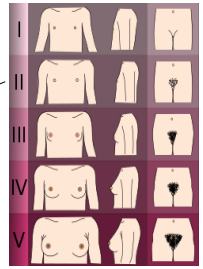
While previous studies have noted a relationship between obesity in girls and early puberty, it remained unclear which condition caused the other. By tracking the girls from such an early age, Lee says, “our study shows that it is increased body fatness that causes the early onset of puberty and not the other way around”.

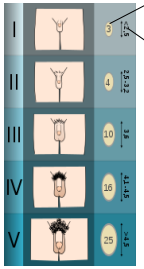
Basic timeline of adolescence - biological

How do you measure pubertal maturation?

Tanner scale - female

Tanner scale - male

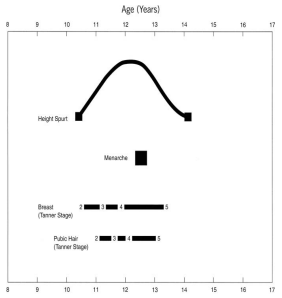


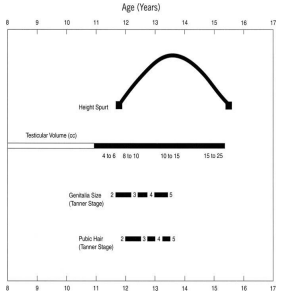


Testicular volume (cc)

Testicular longest dimension (cm)

Breast buds form: elevation of breast as a small mound and enlargement of areolar diameter





Basic timeline of adolescence - biological

Hormonal changes: males

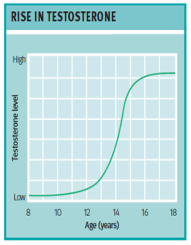


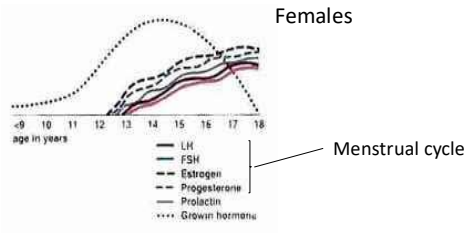
Table 3 T levels by tanner stage and age (19)

Tanner stage and age group	T (ng/dL)
Tanner stage	
4	288 [29-455]
5	326 [144-691]
Age	
13-15	226 [3-507]
16-18	350 [115-691]

Age	Hormone	Normal Range
10 – 11 Years	Total Testosterone	5 to 50 ng/dL
	Free Testosterone	0.6 to 5.7 ng/dL
12 – 14 Years	Total Testosterone	10 to 570 ng/dL
	Free Testosterone	1.4 to 156 ng/dL
15 – 17 Years	Total Testosterone	220 to 800 ng/dL
	Free Testosterone	80 to 159 ng/dL

DeGroot, Leslie, *Endocrinology*, 4th Edition, W. B. Saunders Company, New York, 2001.

Females



Menstrual cycle

"Individuals become more capable of abstract, multidimensional, planned and hypothetical thinking as they develop from late childhood into adolescence"

That's great…but…

"Whereas studies of people's responses to hypothetical dilemmas involving the perception and appraisal of risk show few reliable age differences after middle adolescence, studies of actual risk-taking (e.g. risky driving, unprotected sex, etc) indicate that adolescents are significantly more likely to make risky decisions than are adults"

Why?

Cognitive changes in adolescence

Deductive reasoning

Information processing (including social)

→ Executive functions ← Changes in brain structure with age

Trends in Cognitive Sciences
Volume 9, Issue 2, February 2005, Pages 69-74

Cognitive and affective development in adolescence

Laurence Steinberg

1. Developments in the prefrontal cortex

Dorsolateral prefrontal cortex: working memory
planning

Ventromedial prefrontal cortex: calibration of risk and reward
e.g. Iowa Gambling Task

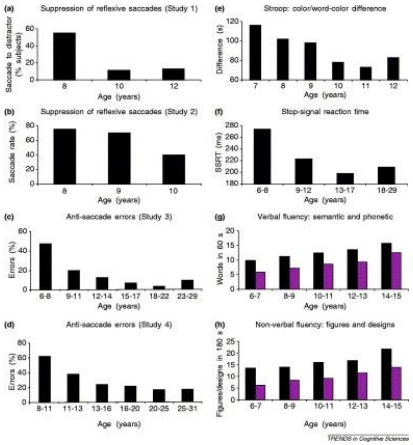
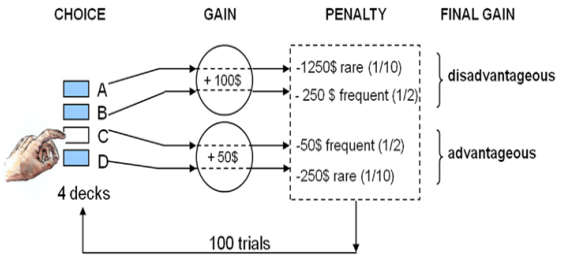


Figure 4. Age-related changes in executive functions. **(a–d)** Results of four studies of response inhibition assessed in the oculomotor domain. **(a)** An unexpected visual stimulus was flashed in the periphery while children were moving their eyes along a dimly illuminated arc; shown is the percentage of 8-, 10-, and 12-yr-old children (24–26 subjects per age group) who were unable to suppress reflexive saccades to the peripheral stimulus [81]. **(b)** Children were instructed to maintain fixation in the centre of the computer screen while unexpected visual stimuli were flashed in the periphery; shown is the percentage of unsuppressed eye movements made by 8-, 9-, and 10-yr-old children (15–18 subjects per age group) [82]. **(c)** Subjects (12–22 subjects per age group) were asked to gaze at the fixation point and, after the appearance of a peripheral target, look to the opposite side; shown is the percentage of eye movements directed incorrectly towards the actual target ('anti-saccade errors'). In this version of the task, the fixation point remained lit while the peripheral target appeared [83]. **(d)** The same anti-saccade task as **(c)** but here the fixation point disappeared 200 ms before the presentation of the peripheral target, making the task more difficult (19–43 subjects per age group) [84]. **(e,f)** Developmental trends in two other tasks of inhibitory control. In the Stroop task, children (12–33 subjects per age group) were asked to name the ink colour of either 100 patches of the colours red, blue and green or 100 colour names printed in a discrepant ink colour; shown is the difference in the time required to complete the two tasks (colour-words minus colour-patches) [85]. In the Stop-signal task (f), children (29–55 subjects per age group) were told to stop responding with button presses to a visual stimulus (letter X or O) when hearing a tone ('stop' signal); shown is the minimum delay between the onset of stimulus and tone necessary to stop the response, the so called stop-signal reaction time (SSRT) [86]. **(g,h)** Developmental trends in verbal and non-verbal fluency [87]. In the two verbal-fluency tasks (g), children (18–51 subjects per age group) were asked to name fruits (semantic fluency; black bars) or as many words starting with 'm' (phonetic fluency; purple bars) as they could in 60 s. In the two non-verbal fluency tasks, the same groups of children were asked to draw, as fast as possible, different meaningful designs (semantic; black bars) or linear geometric figures (non-semantic; purple bars) as they could in 180 s

Trends in Cognitive Sciences

Mapping brain maturation and cognitive development during adolescence

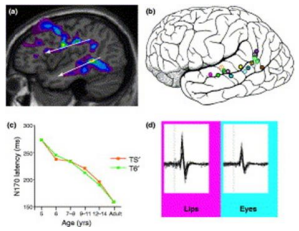
Iowa Gambling Task



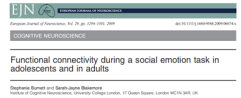
6-9 year olds – drew equally from good and bad decks
10-12 year olds and **13-15 year olds** – improved over time. By the final block they were drawing from the good decks about 55% and 60% of the time, respectively
18-25 year olds – drawing from the good deck nearly 75% of the time by the last block

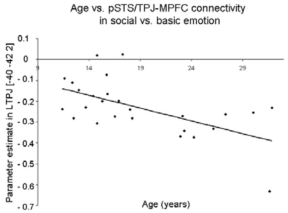
2. Increased efficiency

- Myelination and localised synaptic pruning in PFC
  - (both of which increase the efficiency of information processing)



Brain and social cognition. **(a)** Age-related changes in white-matter density along the putative fronto-temporal (top arrow) and the occipito-temporal (bottom arrow) pathways [48]; 36 children and adolescents, aged 10–19 years, were scanned at least twice (average interval of 3.5 yrs). Note that the changes in the fronto-temporal pathway replicate the original cross-sectional data [16] whereas those in the occipito-temporal pathway suggest maturation of a system involved in processing of biological motion. **(b)** Activation of regions along the left superior temporal sulcus during the perception of biological motion by adult subjects [55]. **(c)** Developmental changes in the latency, recorded with electroencephalography, of the cortical response to the presentation of black-and-white photographs of faces (9–14 subjects per age group) [59].





Negative correlation between age and left pSTS / TPJ–arMPFC connectivity during imagining scenarios resulting in social (embarrassment/guilt) relative to basic emotions (disgust/fear).

An interpretation of the age-related decrease in connectivity is that, in order to accomplish this task, adolescents require not only higher activity in arMPFC but also stronger co-activation of the mentalising system than do adults. This may be because the maturing network in adolescents is less efficient in accomplishing the task. Continuing synaptic elimination and axonal myelination and perhaps developing axonal calibre during adolescence, within regions of the brain involved in mentalising, may act to increase the efficiency of the system.

3. Decreased connectivity between PFC and limbic system

"The interplay between cognitive and emotion-related processes" – social cognition

Important for…
- Peer-peer interactions
- Processing of verbal and non-verbal cues (processing biological motion)
- Discrimination of facial expressions
- Attentional enhancement of the neural response to socially salient stimuli

E.g. maturation of the adolescent's ability to extract quickly the relevant cues from the face of a peer

Two things are happening as age increase during adolescence:
1) The neural systems involved in social information processing are becoming more efficient
2) The influence of the affective systems on the decision-making systems is decreasing

Impact of social environment

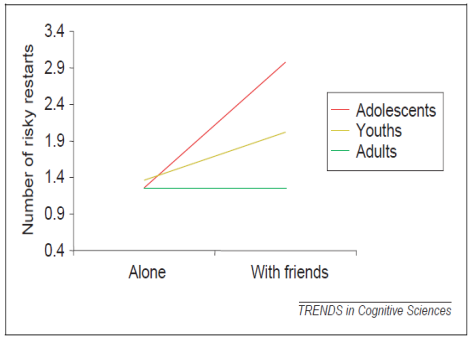
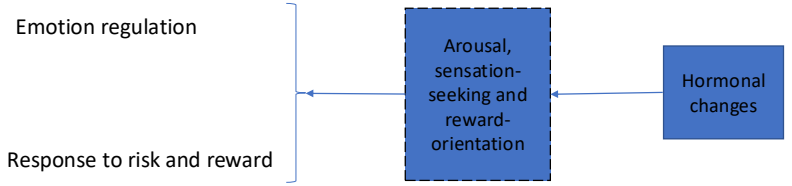


Figure 2. In a study designed to investigate age differences in risk-taking [37], participants were asked to play a computerized game in which they had opportunities to take driving risks, such as continuing to drive after a traffic light had turned yellow in order to drive the car further and earn more points. Individuals were randomly assigned to one of two conditions: playing the game alone, or playing it while two friends were watching and giving advice. The graph shows the number of times individuals risked crashing the car by stopping and then restarting it to try to drive a bit further after the yellow light had appeared. Adolescents (aged 13–16), youths (aged 18–22), and adults (aged 24 and older) demonstrated equivalent degrees of risk-taking when alone, but in the presence of peers, adolescents and youths, but not adults, took more risks.

Socio-emotional changes in adolescence



- Changes in frequency of parent-adolescent conflict more closely linked to pubertal maturation than to age
- In a large group of 11-14 year olds, there was no significant correlation between age and sensation-seeking, but a significant correlation between sensation-seeking and pubertal stage
- There is substantial evidence that adolescents engage in dangerous activities ***despite*** knowing and understanding the risks involved

Effects of estrogen and testosterone on the brain

Organisation:
- Occur pre- and perinatally
- In males, testosterone influences the development of neural circuits
- The absence of testosterone results in a female neural phenotype

Activation:
- Occur at puberty
- Gonadal steroid hormones (estrogen and testosterone) act on dormant neural circuits to elicit adult reproductive behaviours, in context.

The development of regulatory competence

During adolescence, regulatory systems are gradually brought under the control of central executive functions

INTERFACE OF COGNITION AND EMOTION

1. The development of an integrated and consciously controlled "executive suite" of regulatory capacities is a complex and lengthy process. Yet, adolescents confront major, emotion-laden life dilemmas from a relatively early age. E.g. sexual relationships, school assessments

2. Cognitive development (e.g. executive control) generally occurs later than puberty-linked emotional changes

As puberty gets earlier and the gap widens, are future generations of adolescents at greater risk of poor outcomes and psychopathology typical of externalising problems?

POWERFUL ENGINE BUT AN UNLICENCED DRIVER

Why is adolescence so hard?

Layers of changes: physically, cognitively, emotionally

Different rates of change: chronologically versus hormone-linked, cognitively versus emotionally, from peers, from the environment, from society

While all this happens you look like a small adult – and sometimes behave like one too!

PSYC3016: Developmental Psychology

Adult-child interaction: implications for research and professional practice

Caroline Moul

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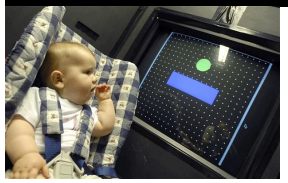
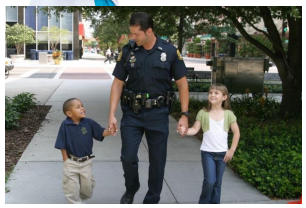
Learning Outcomes

- LO1 – have a deep understanding of the factors that should be considered when working with children across all contexts
- LO1 – understand that flexibility in approach may be required in difference contexts and for different children
- LO4 – be able to discuss the relevance of working-with-children skills for different contexts (e.g. legal system, clinical practice, research).

Adult-child interaction





- Forensic psychologist
- Clinical psychologist
- Medical practitioner
- School counsellor
- Teacher
- Police officer
- Lawyer
- Social worker
- Research psychologist
- …

What else...?

What are the important questions?

- What sort of job do you want?
- What sort of lifestyle do you want?
- Where does money fit in?

Other considerations...

- Flexibility?
- Travel?
- Interests?
- Enjoyment?
- Personality?

What else...?

What skills do you have?

- Within your degree...
  - Understanding data
  - Understanding scientific quality
  - Read, assimilate, communicate
  - Presenting information
  - Knowledge base
  - Working with others
  - Interpersonal
- Outside your degree
  - Hobbies
  - Interests
  - Skills
  - Experience

Everything but...?

Game Plan!

3 options

1. With really good Honours mark
2. With Honours
3. Without Honours

But it's ok to not have a plan!

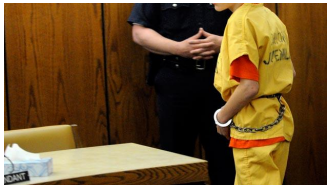
Everything but...?

Which careers came to my careers event because they want YOU?

- PWC
- IDcare
- Genetic counsellor
- Defence
- Speech pathology
- Occupational therapy
- Teaching
- Journalism
- Social services (child protection)
- NSW police
- ARTD consulants
- Graduate medicine
- School counsellor
- ...

Adult-child interaction

Forensic – child as victim/child as perpetrator



Psychological research

Clinical interview/treatment

Adult-child interaction

Across all contexts…

What matters?

- Consent
- Comfort of the child
- Reliability of data
- Do no harm

Adult-child interaction: consent

Adult-child interaction: consent

- What do we mean by consent?
  - **Research**
  - Remember your research participation
    - Age of child – assent/consent
    - Written/verbal/indication of agreement
    - How do we know if a child wants to stop?
    - How do we know if a child is informed?
    - What factors do we need to be mindful of?
      - Explaining versus cajoling
      - Incentivising versus bribing
    - What details might be important?
      - Where will the research take place?
      - Will mum/dad be there?
      - Will they be on camera/recorded?
      - Can they leave to use the toilet?
      - Have they had a snack recently?

Adult-child interaction: consent

- What do we mean by consent?
  - **Legal**

Witness	Suspect
Freedom to speak/not	Understanding of rights
Influence of others	Understanding of situation
Understanding of truth	Understanding of implications
	Authority effect

The implications of consent vary according to the context

Adult-child interaction: consent

- What do we mean by consent?
  - **Clinical**
    - Does a child need to agree to treatment?
    - Is lack of engagement the refusal of consent or a challenge to be overcome?
    - Can a child request parent presence/absence?
      - Separation anxiety
    - What if the child is in the care of social services?
      - Who gives consent?
    - Should a child be informed as to the nature of their participation?

Adult-child interaction: comfort of the child

Adult-child interaction: comfort of child

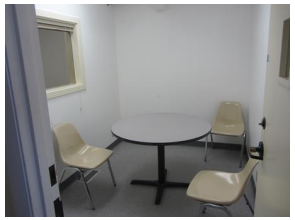
Comfort of child - general

- Familiarity
  - Home, school, office?
  - Have you met before?
  - Interviewed before?
- Environment
  - Novel?
  - Welcoming?
  - "Child-friendly"?
  - Confidential? – soundproof?
  - Physically comfortable?
- Explanation
  - Duration
  - Process
  - Expectations
  - Tour
  - Honesty
  - Transparency
- Affect
  - Appropriate expression
  - Paying attention
  - Video yourself!

Adult-child interaction: comfort of child

Comfort of child – child "at risk"

- Appropriate language
  - Age of child
  - Mental age
  - Professional
  - "In your own words"
  - Don't try to be cool!
- Appropriate body-language
  - Engaged with child
  - Relaxed, professional
  - Personal space
  - Interpersonal space
- Predict behaviour
  - Trauma triggers
  - Relevant stimuli
  - Read child's body language and affect
- Time



Adult-child interaction: comfort of child

Comfort of child

- Building rapport

Adult-child interaction: reliability of data

Extracting information – all contexts

- Quantity of information
  - Complete the tasks/interviews
  - Sufficient evidence
  - Single versus repeat interactions
- How to maximize data quantity
  - Build rapport
  - Take breaks
  - Inform child of likely duration – honestly!
  - Discuss options for completion

Adult-child interaction: reliability of data

Extracting information - general

- Quality (veracity) of information
  - Understanding of truth
  - Authority effect
  - Expectations – "right answer"
  - Aim to please

Adult-child interaction: reliability of data

Extracting information - forensic

- Quality (veracity) of information
  - Witness/victim testimony
  - Disclosure
- Problem: how do you interview a child in a way that minimises the effects of authority/wanting to please? How do you determine what the truth is?

Adult-child interaction: reliability of data

- Problem: how do you interview a child in a way that minimises the effects of authority/wanting to please and maximises truth and detail?
- Prof. Michael Lamb – University of Cambridge
  - Developed best-practice guidelines for interviewing children in cases of child sex abuse
  - NICHD Investigative Interview Protocol (National Institute of Child Health and Human Development)
  - It has been developed with reference to child development issues, including linguistic capabilities, memory, and suggestibility, forensic needs, interviewer behaviour, and the effects of stress and trauma by a team of researchers, interviewers, police officers, and legal professionals.
  - More than a decade of research has shown that effective interviewer training can begin with the proper use of the NICHD Protocol because it allows interviewers to maximize the amount of information obtained from free-recall memory by using open-ended prompts.
  - The NICHD Protocol requires fewer more risky focused questions be used and does not advocate the use of anatomical dolls and other risky techniques.
  - The overarching goal for effective training is to operationalize these evidence based professional recommendations.

Adult-child interaction: reliability of data

Recommended reading:
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2180422/pdf/nihms35447.pdf
(Not as long as it seems!)

Published in final edited form as:
Child Abuse Negl. 2007 ; 31(11-12): 1201–1231.

Structured forensic interview protocols improve the quality and informativeness of investigative interviews with children: A review of research using the NICHD Investigative Interview Protocol

Michael E. Lamb,
University of Cambridge
Yael Orbach,
National Institute of Child Health and Human Development
Irit Hershkowitz,
University of Haifa, Israel
Phillip W. Esplin, and
Private Practice, Phoenix AZ
Dvora Horowitz
Ministry of Labour and Social Affairs, Israel

Abstract

Objective—To show how the results of research on children's memory, communicative skills, social knowledge, and social tendencies can be translated into guidelines that improve the quality of forensic interviews of children.

Method—We review studies designed to evaluate children's capacities as witnesses, explain the development of the structured NICHD Investigative Interview Protocol, and discuss studies designed to assess whether use of the Protocol enhances the quality of investigative interviews.

Results—Controlled studies have repeatedly shown that the quality of interviewing reliably and dramatically improves when interviewers employ the NICHD Protocol. No other technique has been proven to be similarly effective.

Conclusions—Use of the structured NICHD Protocol improves the quality of information obtained from alleged victims by investigators, thereby increasing the likelihood that interventions will be appropriate.

Adult-child interaction: reliability of data

- **Program Components**
  The NICHD protocol trains interviewers to use open-ended prompts and guides them through the phases of the investigative interview to increase the amount of information elicited from children's free recall memory. Based on evidence that free recall memory and prompts are likely to elicit accurate information, whereas prompts that depend on recognition processes are associated with more erroneous responses
- The protocol has three phases: introductory, rapport building, and substantive or free recall.
- **Introductory phase**, the interviewer introduces him/herself, explains the child's task (including the need to describe events in detail and tell the truth), and explains the ground rules and expectations (i.e., that the child can and should say "I don't remember," "I don't know," "I don't understand," or correct the interviewer when necessary).
- **Rapport-building phase**: designed to create a relaxed, supportive environment for children and to establish rapport between the interviewer and child. The interviewer may ask the child to talk about events unrelated to the suspected abuse to encourage him or her to be comfortable leading the conversation. This step was designed to familiarize children with the open-ended investigative strategies and techniques that will be used during the next phase of the interview, while demonstrating the specific level of detail expected of them.
- During the transition between the pre-substantive and **substantive phases** of the interview, a series of non-suggestive prompts are used to identify the incident under investigation.
- If the child makes an allegation, the substantive or free recall phase begins with an invitation, such as "Tell me everything that happened from the beginning to the end as best as you can remember," followed by other free-recall prompts, such as "Then what happened?" As soon as the narrative is complete, the interviewer prompts the child with cued invitations based on the child's response in order to obtain incident-specific information. E.g., the interviewer might say, "Earlier you mentioned a [person/object/action]. Tell me everything you can about that."
- The interviewer may reference details mentioned by the child to elicit uncontaminated free recall accounts of the alleged incident. Only after exhaustive open-ended questioning should interviewers begin to ask more direct questions, such as "Where were you when that happened?" If important details are still missing at the end of the interview, interviewers may ask limited option-posing questions (such as yes/no and forced-choice questions).
- Throughout the phases of the interview, **suggestive** utterances that may communicate to the child which response is expected are strongly discouraged. Following initial disclosure, interviewers use a scripted prompt to obtain an indication of the number of incidents experienced by the child (i.e., "one" or "more than one"). From that point on, interviewers are only given general guidance regarding the types of utterances to employ, undesirable practices to avoid, and appropriate open-ended free recall and cued recall prompts to use, without having to follow an inflexible script

Adult-child interaction: do no harm

Interaction

- Inappropriate – what does this mean?
- Talk about the child when they are in ear shot
- Pretend to know things that you do not
- Keep secrets
- Cause fear/concern

Data-related

- Presume a debriefing is not required
- Guess the child's answer
- Provide the answer for the child and look for confirmation

Adult-child interaction: do no harm

What are the things you should do?

- Working with children check
- Criminal records check
- Child protection training
- Be a positive role model
  - E.g. don't let the child see you smoking outside the office
  - Manage your own emotions and behaviour
- Practice!
  - Volunteer
  - Babysit
  - Role play

Adult-child interaction

Child Development Lecture (but really about young people)

Garner Clancey

THE UNIVERSITY OF SYDNEY

Acknowledgement of country

We recognise and pay respect to the Elders and communities – past, present, and emerging – of the lands that the University of Sydney's campuses stand on. For thousands of years they have shared and exchanged knowledges across innumerable generations for the benefit of all.

THE UNIVERSITY OF SYDNEY

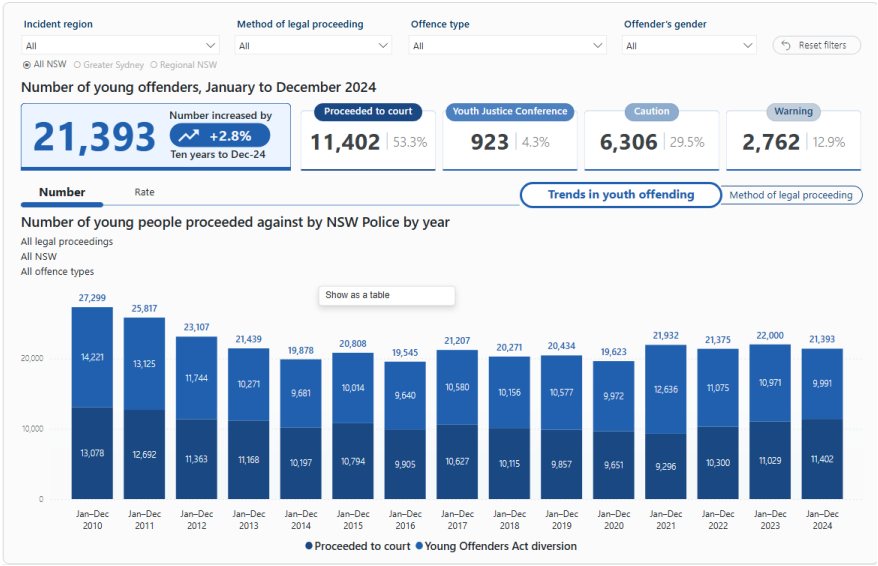
My Background

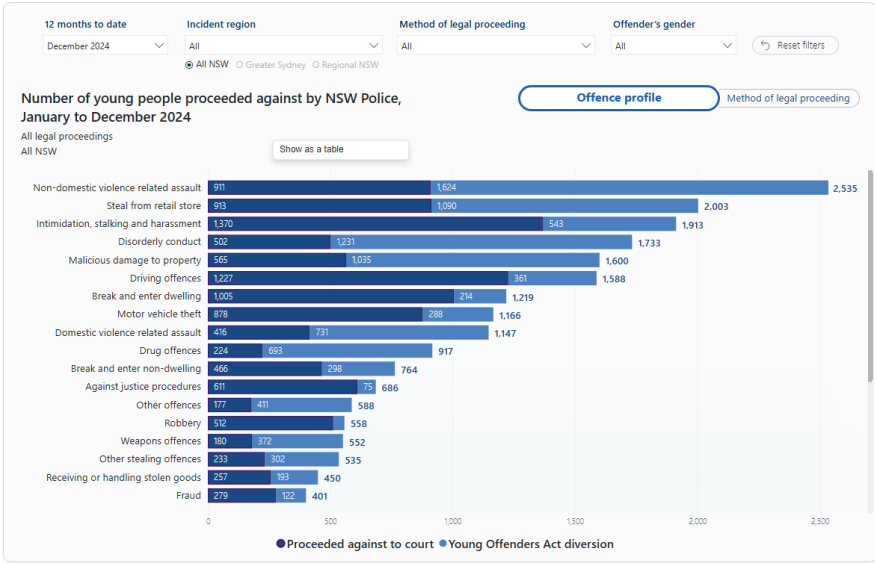
- **Study:**
  - BA (Psychology Major); Masters Criminology (Honours); two non-award urban planning units; PhD.
- **NSW Public Service Work (1992-2002):**
  - NSW Dept. of Juvenile Justice & NSW Police Force
- **Relevant Research and Consultancy Projects (2002-2025):**
  - Young People and Performance Crime for Australian Institute of Criminology
  - 'What works' crime prevention review for Australian Institute of Criminology
  - Review of Funded Services for Youth Justice NSW
  - Review of prisoners legal needs for Legal Aid NSW
  - Review of a security classification methodology used in custodial environments for Youth Justice NSW
  - Impact of population growth on crime
  - Staying Home Leaving Violence residential security training and guide
  - Evaluation of a public space CCTV network
  - Research for a Victorian Parliamentary Inquiry into CPTED
  - Authored 'Considerations for establishing a public space CCTV network' for the Australian Institute of Criminology
  - Developed crime prevention plans for NSW and other councils and completed multiple community safety audits and crime risk assessment reports
- **Tertiary Teaching (2000-2024):**
  - Taught/teach undergraduate and postgraduate courses on crime prevention, policing and security at USYD, UNSW, UWA, UNE, UWS, CSU

- **Recent Select Publications:**
- Clancey, G., Lulham, R. (2024). *Youth Crime, Youth Justice and Children's Courts in NSW*. Australia: LexisNexis.
- Clancey, G., Drumore, C., Metcalfe, L. (2024). A whole-of-university response to youth justice: Reflections on a university–youth justice partnership. *Trends and Issues in Crime and Criminal Justice*, 691.
- Metcalfe, L., Little, C., Clancey, G., Evans, D. (2024). The Changing Nature of Education in Youth Justice Centres in New South Wales (Australia). *Journal of Prison Education Research*, 8(1, article 5), 1-22.
- Clancey, G., Evans, J., Friedlander, L. (2023). Some long-term positive trends in youth detention in New South Wales (Australia). *Safer Communities*, 22(1), 15-27.
- Clancey, G., Metcalfe, L. (2022). Inspections, Reviews, Inquiries and Recommendations Pertaining to Youth Justice Centres in New South Wales Between 2015 and 2021. *Current Issues in Criminal Justice*, 34(3), 255-274.
- Sutton, A., Cherney, A., White, R., Clancey, G. (2021). *Crime Prevention: Principles, Perspectives and Practice - 3rd Edition*. Cambridge, UK: Cambridge University Press.
- Clancey, G., Lin, B. (2020). Crime Prevention and Reduction. In D. Dalton, W. de Lint and D. Palmer (Eds.), *Crime and Justice: A Guide to Criminology, 6th Edition*. Pyrmont, NSW: Thomson Reuters.
- Clancey, G. (2020). Teaching Crime Prevention and Community Safety. In Darren Palmer (Eds.), *Scholarship of Teaching and Learning in Criminology*, (pp. 59-85). Cham: Palgrave Macmillan.
- Clancey, G., Lin, B., Delahunty, B. (2019). 'Law and order' policy. In P. Chen, N. Barry, J. Butcher, D. Clune, I. Cook, A. Garnier, Y Haigh et al (Eds.), *Australian Politics and Policy: Senior Edition*, (pp. 645-666). Sydney: Sydney University Press.

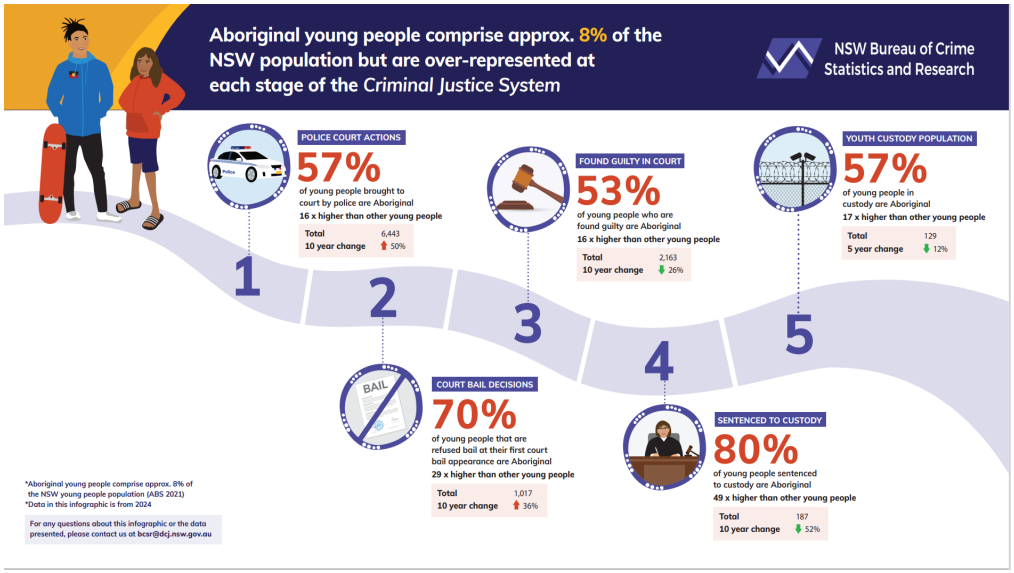
Quick Quiz

- What is the minimum age of criminal responsibility in NSW?
- What is *doli incapax* and why does it matter?
- What types of offences to young people commit?
- What are the long and short term trends in youth crime in NSW?
- How many young people in custody at any one time in NSW?
- How much does it cost per annum to lock up one young person?
- How might we prevent youth crime?





Last updated: 17 Feb 2025



Young People in Custody Health Survey Data

NSW Young People in Custody Health Surveys	2003	2009	2015
Demographics			
In care before age of 16	28.40	27.20	21.00
Education			
Not attending school prior to custody	81.50	62.10	73.00
Accommodation			
No fixed abode prior to custody		6.10	13.00
Children of detainees			
Have children	10.10	8.20	8.30
Family			
Parent ever in prison	42.90	44.60	54.00
Offending behaviour			
Previous juvenile detention custody	72.30	78.70	84.70
Drug use			
Weekly illicit drug use in year prior to custody	78.60	65.00	81.00
Substance-related disorders	61.00	63.50	64.50
Intellectual ability			
Extremely low (<70) IQ score	17.40	13.60	18.10
Borderline (70–79) IQ score	27.00	32.20	39.20
Childhood abuse and neglect			
Any childhood abuse or neglect	68.10	59.90	69.70
Severe abuse of neglect	25.00	22.80	29.90

Picture is worse for young women

- 2015 Young People in Custody Health Survey in NSW to demonstrate this:
  - 32% girls placed in care before 16 – 20% boys
  - 74% have had a parent in prison – 51% males
  - 45% had experienced severe abuse – 27% males
  - 73% met criteria for 2 or more psych disorders – 62% males
  - 50% had engaged in self-harm – 12% males / 26% girls done so in custody compared with 9% males
  - 60% had severe difficulties in core language skills – 47% males
  - 53% had a head injury resulting in unconsciousness – 23% males
  - 32% had ever been pregnant and average age of 14.2 years for first pregnancy

(2015 Young People in Custody Health Survey factsheet: key findings for young females | NSW Government / 2015 Young People in Custody Health Survey: full report | NSW Government)

Shameless plug – look away if you need to

THE UNIVERSITY OF SYDNEY

USYD Justice Collaboration (Research Centre)

- The University of Sydney's Justice Collaboration aims to improve justice outcomes.
- The University of Sydney has numerous strengths in this area and has a track record of work across disciplines, faculties and research centres directly and indirectly relevant to justice systems.
- Through a whole-of-university approach, the University of Sydney can have a significant positive impact on justice systems and outcomes.

USYD multidisciplinary initiatives and research centres

- Matilda Centre
- Brain and Mind Centre
- Research Centre for Children and Families
- CREATE Centre
- Centre for Disability Research and Policy
- Gambling Research and Treatment Clinic
- Cyberpsychology Research Group
- National Centre for Cultural Competence
- Rural Health Centres
- Sydney Informatics Hub
- Sydney Policy Lab
- Communication Disorders Treatment & Research Centre
- The Nano Institute
- Centre for Continuing Education
- Sydney Institute of Criminology

- Plus involvement in the Wellbeing Health and Youth Centre of Research Excellence in Adolescent Health, the Life Course Research Centre, Centre for Research Excellence: Indigenous Health and Alcohol (amongst others)

Co-producing knowledge

Youth Crime, Youth Justice and Children's Courts (in NSW)

- A must have contemporary overview into the complex web impacting youth crime, youth justice and Children's Courts.
- Edited by Garner Clancey and Rohan Lulham. Authors include: Jackie Fitzgerald (BOCSAR); Judge Skinner (Children's Courts NSW); Janet Killgallon, Tim Warton and Steve Barracosa (YJNSW), Lobna Yassine, Jioji Ravulo (USYD), Kasey Tyler (former USYD student), Luke Butcher (now NT Health), Lisa Ewenson (now UNSW), Joseph Clarke (Bourke).
- Launch event in early 2024.

Australian Government
Australian Institute of Criminology

Trends & issues in crime and criminal justice

No. 691

A whole-of-university response to youth justice: Reflections on a university–youth justice partnership

Garner Clancey, Cecilia Drumore and Laura Metcalfe

Abstract | The University of Sydney and Youth Justice New South Wales signed a memorandum of understanding (MoU) in July 2021. This MoU builds on various prior collaborative activities between the two organisations and related work in other jurisdictions. This paper reflects on the progress and challenges of collaboration of this kind. Specifically, there has been tentative progress in engaging non-traditional parts of the university in youth justice projects.

The initial stage of the collaboration highlighted challenges, including structures within the university which can frustrate interdisciplinary work. Time lines, staff turnover and resources also impacted this collaboration. We conclude with an outline of what might be achieved through ongoing collaboration and signal the importance of ongoing research to capture data and insights regarding the nature of this relationship as it develops.

The University of Sydney and Youth Justice New South Wales (YJNSW) entered into a formal memorandum of understanding (MoU) in July 2021. This whole-of-university approach to youth justice builds on various successful relationships that are broadly similar in many respects. Universities have the potential to offer academic expertise, knowledge and new ideas to different industries which can support innovation (Bacon & Williams 2022). As social issues become increasingly complex, these multidisciplinary partnerships are considered vital to the resolution of these issues (Bacon & Williams 2022). It is unsurprising that universities, youth justice and other criminal justice agencies have formed partnerships of various kinds over the years.

A whole-of-university response to youth justice: Reflections on a university–youth justice partnership

JOURNAL OF CRIMINAL JUSTICE EDUCATION
https://doi.org/10.1080/10511253.2025.2485986
ACJS Routledge Taylor & Francis Group
OPEN ACCESS Check for updates

Reflections from an Industry and University Youth Justice Partnership

Laura Metcalfe[a], Garner Clancey[a], Melanie Simpson[b], Cathy Little[c] and David Evans[c]

[a]Sydney Law School, University of Sydney NSW, Australia; [b]Youth Justice NSW, Australia; [c]School of Education and Social Work, University of Sydney NSW, Australia

ABSTRACT
Youth Justice New South Wales (YJNSW) and the University of Sydney (USYD) signed a Memorandum of Understanding (MoU) in July 2021. This MoU established broad parameters for collaboration between both organisations, building on many prior ad hoc joint activities. Research was undertaken to collect insights during the period of the MoU (July 2021 to July 2024), in the hope that these insights might inform and shape similar university and industry collaborations. This article reports on initial findings from interviews with YJNSW staff and survey data from USYD students. Insights gleaned from interviews highlight successes and challenges typical of a nascent collaboration of this kind: building trust and mutual understanding, navigating competing bureaucracies and administrative barriers, and maintaining momentum with time-poor staff. Surveys conducted with USYD students highlight the numerous benefits of student-led projects and placements both for the student cohort and YJNSW, including: student exposure to youth justice work and systems and real-world applicability of research outputs. While many benefits are highlighted from the data across the life of the MoU, wider forces ultimately resulted in its cessation in July 2024, providing a salutary reminder of the challenges of maintaining collaborations of this kind over time.

ARTICLE HISTORY
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Accepted 12 March 2025

KEYWORDS
Youth justice; university collaboration; university-youth justice partnership; university-industry partnership; whole-of-university approach to youth justice

https://www.tandfonline.com/doi/full/10.1080/10511253.2025.2485986

Concerns reported by Police

Decreasing regard for others and social norms.	Dynamics of offending - the desire for notoriety.	Increasing trend of police being filmed and provoked.	Loss of lives in increasingly dangerous car chases.	Competitions between regional areas / towns.
Escalating behaviour and increasing violence.	Virtual victimisation, continuous victimisation.	The involvement of very young people.	The recruitment of young people by organised crime groups.	Sending videos of hits and jobs to gangs as proof of work.

Sydney Today 10 °/ 16 °

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National World Lifestyle Travel Entertainment Technology Finance Sport Shopping

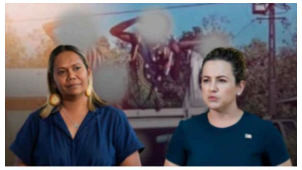
News > Northern Territory

Wannabe teenage gangsters in the Northern Territory post histories of crime on social media

WANNABE teenage gangsters are posting photos on social media of themselves brandishing weapons, smoking drugs and boasting about stolen items.

ZACH HOPE

2 min read January 21, 2015 - 9:06AM NT News 0 Comments



Social media sting: Seven charged with online boasting offences

Since passing 'posting and boasting' legislation more than six months ago, just seven people have been charged under the offence. What the CLP government said about the figure.

'Ban them': 90 youth criminals nabbed over social media boasts

There are calls for social media giants to ban juvenile criminals from posting about their law-breaking activities, as tough new laws nab 90 youths. SUBSCRIBE for details

Selfie incrimination: Dumb young crims entrapped by posting, boasting

Alleged youth lawbreakers are being caught bragging on social media daily, and in some cases being intercepted during live streams. SUBSCRIBE for details

WHAT IS THE ROMAN NUMERAL FOR THE NUMBER 50? TAKE THE SHARK QUIZ P30

The Courier Mail

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200 KID CRIMS CAUGHT OUT ON SOCIAL MEDIA

BUSTED FOR BOASTING

EXCLUSIVE
Andreas Nicola

Almost 200 young offenders have been charged for boasting about their crimes on social media, as toughened-up post-and-boast laws nab more juveniles across Queensland.

Alleged law-breakers have even been intercepted while live streaming.

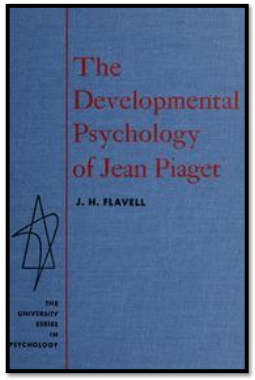
Report P7

Sick still

Garner Clancey
garner.clancey@sydney.edu.au

THE UNIVERSITY OF SYDNEY

PSY3016: Cognitive Development Lecture 1



The Developmental Psychology of Jean Piaget

Micah B. Goldwater
Room 320, Griffith Taylor
School of Psychology
e: micah.goldwater@sydney.edu.au

http://faculty.frostburg.edu/mbradley/psyography/jeanpiaget.html

Cognitive development: The next 7 weeks

- Classic theories of cognitive development.
  - Today
- Modern theories of conceptual development, some of it built on top of or in direct opposition to Piaget's work
  - 3.5 weeks
- Return to Language development (and Chomsky)
  - 1.5 weeks
- Cognitive development across cultures
  - 1 week

Learning outcome for every lecture in this series:

- **Scientific argumentation**
- What is the argument for the theory in question?
- To build an argument for or against a theory you have to understand empirical research
- You will primarily be assessed on your understanding of the empirical research in how it supports some argument
- Primarily: Arguments to explain key developmental patterns of behaviors in one way or another
- Also: Arguments for interventions to improve outcomes

What is everyone arguing about? For Piaget, and for cognitive development as a whole?

Where does knowledge come from?

- How is it that we know anything?

How does knowledge change with development?

How do we use knowledge to understand and reason about our world?

- How does how we use knowledge change with development

What's the big question? For Piaget, and for cognitive development as a whole?

Where does knowledge come from?

For Piaget, this means structured, symbolic knowledge. His concept of adult thought is logico-mathematical operations, operating over structured symbolic representations.

He rejected innate knowledge. How does the child go from no knowledge at birth, to structured symbolic representations?

What should we hope to achieve in the next two lectures?

These lectures are NOT designed to give you a full overview of Piagetian theory, and the empirical work that has followed

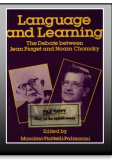
What should we hope to achieve in the next two lectures?

These lectures are NOT designed to give you a full overview of Piagetian theory, and the empirical work that has followed

What I would like you to take away from these lectures is:

- an appreciation of what drives important theories
- a sense for the kinds of assumptions that the major theories have had to make or grapple with … and will continue to have to make and grapple with!
- So why don't we start with Piaget!

Readings on Piaget's Theoretical conception



http://en.wikipedia.org/wiki/Piaget's_theory_of_cognitive_development

(Excellent Wiki page which covers all the basic territory)

Miller, P. *Theories of Developmental Psychology* (4th and 5th Editions)

(note that Piaget is dealt with in Ch. 1 of 4th Ed. and Ch. 2 of 5th Ed.)

Essential Reading

Jean Piaget (1896 – 1980)

- You have already been acquainted with the basic shape of Piaget's theory in 1st year

PIAGET: STAGES OF COGNITIVE DEVT.

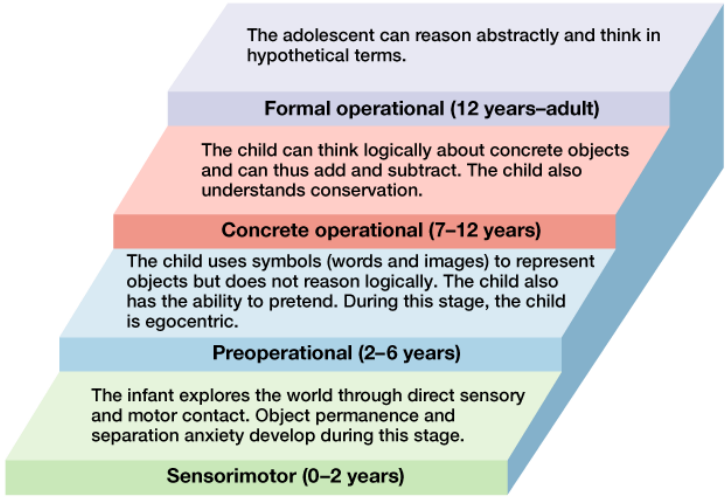
4 MAIN STAGES:

1. SENSORI-MOTOR
   (approx. 0 -2 years)
2. PREOPERATIONAL
   (approx. 2 – 7 years)
3. CONCRETE OPERATIONS
   (approx. 7 – 11 years)
4. FORMAL OPERATIONS
   (approx. 11 years +)

WHAT IS A SCHEME?

A cognitive structure; an organized pattern of thought or action which is constructed by the individual to make sense of or respond to some aspect of experience.

- behavioural schemes
  e.g. suck, grasp
- concepts (mental schemes)
  e.g. "round","dog"
- operational schemes
  e.g. add, compare, classify



http://mcmetec5303.wikispaces.com/My+Stance+on+Educational+Technology,+by+Jean+Piaget

Jean Piaget (1896 – 1980)

- You have already been acquainted with the basic shape of Piaget's theory in 1st year
- You have also encountered some of the important processes
- Stage independent processes
- In sensory motor periods, e.g., attempts to grasp a newspaper after only grasping rattles. Adjustment of grasping schema
- As an adult traveling to a new country: adjust your social behavior schemes to a new country

ADAPTATION
Continuous process of adjusting to the environment.

TWO COMPLEMENTARY PROCESSES:

ASSIMILATION	ACCOMMODATION
Deal with new experiences in terms of existing schemes.	Modify existing schemes to deal with new experiences.

Jean Piaget (1896 – 1980)

- You have already been acquainted with the basic shape of Piaget's theory
- You have also encountered some of the important processes
- But have you wondered what Piaget was on about?

  What did he care about?

  What did he want to explain?

Jean Piaget (1896 – 1980):
The basic shape of the theory

Periods of Development
- Hierarchical
- Universal
- Transformative

Stages of Development
- Hierarchical
- Universal
- Transformative
- … But smaller!

1. SENSORI-MOTOR
(approx. 0 -2 years)

2. PREOPERATIONAL
(approx. 2 – 7 years)

3. CONCRETE OPERATIONS
(approx. 7 – 11 years)

4. FORMAL OPERATIONS
(approx. 11 years +)

Sensorimotor (approx. 0-2 years)

1. Modification of reflexes
2. Primary circular reactions
3. Secondary circular reactions
4. Coordination of secondary schemes
5. Tertiary circular reactions
6. Invention of new means through mental combinations

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed)

Stage 6: *Mental Combinations* (~18 to 24 months)

- Innovation in how they are combining all their different behavior schemes to solve novel problems.

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed.; also see Flavell Ch. 3 & 4)

Stage 6: *Mental Combinations*

- Before stage 6, "[…] children have displayed their thinking to the world; now the overt is becoming covert. External physical exploration gives way to internal mental exploration. All of this is possible because children can now use mental symbols to *represent* objects and events"
- Playing with a match box, opening and closing it, the child may open and close her mouth *in correspondence*
- The mouth opening can then stand for the box opening
- It has a "representational stance"

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed.; also see Flavell Ch. 3 & 4)

Stage 6: *Mental Combinations*

- Before stage 6, "[…] children have displayed their thinking to the world; now the overt is becoming covert. External physical exploration gives way to internal mental exploration. All of this is possible because children can now use mental symbols to *represent* objects and events"

- "When faced with a problem that past methods do not solve, Lucienne thinks through the problem, partly by means of movements of the mouth and partly by thinking. She is in transition to a true use of mental symbols"

Jean Piaget (1896 – 1980):
What happens AT THE END of the sensorimotor period?

Sensorimotor (approx. 0-2 years)

1. Modification of reflexes
2. Primary circular reactions
3. Secondary circular reactions
4. Coordination of secondary schemes
5. Tertiary circular reactions
6. Invention of new means through mental combinations

Semiotic function

The ability to use one object or event to stand for another: a *signifier* evokes a *significate*

(see Miller 5th Ed. pp. 38-44)

- Think about how a child comes to engage in symbolic play [e.g., pretending his hand is an airplane]
- By the end of our description, the child had 'acquired' something Piaget described as the *Semiotic Function*
- Piaget has solved, to his own satisfaction, one of the great problems of epistemology, the establishment of nascent mental representation

  (which allows the child to act on the world in a more adequate manner)
- The sensory motor period ends with the child rapidly learning words. After the insight of one object standing for another in physical correspondence, another insight is that there does not need to be physical correspondence for something to stand for something else (e.g., the sound of the *"cat"* has nothing to do with cats

Piaget has solved one of the great problems of epistemology

Language and learning: The debate between Jean Piaget and Noam Chomsky
Piatelli-Palmarini, Ed. (1980, p. 23)

The Psychogenesis of Knowledge and Its Epistemological Significance

Jean Piaget

Fifty years of experience have taught us that knowledge does not result from a mere recording of observations without a structuring activity on the part of the subject. Nor do any a priori or innate cognitive structures exist in man; the functioning of intelligence alone is hereditary and creates structures only through an organization of successive actions performed on objects. Consequently, an epistemology conforming to the data of psychogenesis could be neither empiricist nor preformationist, but could consist only of a constructivism, with a continual elaboration of new operations and structures. The central problem, then, is to understand how such operations come about, and why, even though they result from nonpredetermined constructions, they eventually become logically necessary.

This is *constructivism* at its heart

It is a rejection of any form of *nativism* ("preformation"), and also *empiricism*

To Piaget: what is innate?

The ability to construct one's own knowledge of the world

Piaget has solved one of the great problems of epistemology

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I would like to highlight an idea

This notion of "logical necessity" is very important to Piaget's ideas about the development of intelligence

If you like, the development of intelligence has direction; in *a logico-mathematical* sense, it becomes more adequate in so far as it reflects true (truer) relations between the individual and the world

The world is defined by mathematical operations, and so cognitive development is the continuing approximation of reflecting the world's mathematical structure.

There is a kind of *idealism* to Piaget's notion of intelligence

Piaget has solved one of the great problems … or has he?

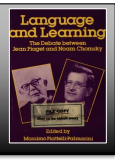
Language and learning: The debate between Jean Piaget and Noam Chomsky
Piatelli-Palmarini, Ed. (1980, p. 28)

Formation of the semiotic function

So, what is going on in Piaget's scheme?

- You can't get to the semiotic function just via experience, that is anathema to Piaget's complete rejection of empiricism
  - If all there was, were Skinnerian reinforcement, how does symbolic reasoning emerge?
- Piaget is trying to explain not just the form of development (i.e., stages 1 though 6) and its relation to experience, but also the mechanisms pushing it forward: One such mechanism is assimilation/accommodation, etc.

Readings on Piaget's Theoretical conception and critiques



Miller, P. *Theories of Developmental Psychology* (4th and 5th Editions)

(note that Piaget is dealt with in Ch. 1 of 4th Ed. and Ch. 2 of 5th Ed.)

Vygotsky and the Sociocultural Approach
Miller, P. *Theories of Developmental Psychology* (5th Ed.: Chapter 4)
(available from the library)

Things no Amount of Learning can Teach
(Chomsky interview by Gliedman, November, 1983)
http://www.chomsky.info/interviews/198311--.htm

Lev Vygotsky (1896 – 1934)

Thought and Language (Lev Vygotsky)
Alex Kozulin, Ed. (1986/1999)

- We are not going to cover Vygotsky's theory in general
  - Brief intro
- We are going to consider some points that characterize his approach, in comparison with Piaget
- Luckily, Vygotsky did this himself: "Piaget's Theory of the Child's Speech and Thought" (Ch.2)
- Vygotsky had lofty ambitions, so let's stick with nature of the relation between thought and language!

Lev Vygotsky (1896 – 1934)

Thought and Language (Lev Vygotsky)
Alex Kozulin, Ed. (1986/1999)

- Socio-cultural theory: the-child-in-context is the unit of study, it is what develops
- For example, between 3 and 5, it is not just the child that changes, but how the parent interacts with the child, e.g., speaking more abstractly to the child because the perception the child is more capable
- The whole system develops at once
- Child-in-context is constrained by culture, passes culture on, and changes the culture
- What is internalised in the child is the culture. Piaget said the world is internalised across development, Vygotsky says culture is internalised across development

Lev Vygotsky (1896 – 1934)

Thought and Language (Lev Vygotsky)
Alex Kozulin, Ed. (1986/1999)

- Culture provides ways of thinking and tools for thinking
- Language is critical in showing how cultures think and helping children think
- Children speak to others, and then to themselves when solving a problem, and then eventually internalize that speech
- But when more challenging problem, they speak out loud again to themselves
- Think of when you are doing your taxes, or planning an essay, do you mutter to yourself?
- Now back to Vygostky's critique of Piaget
- Egocentrism is at the core of the issue

Infant is autistic

Infant is autistic

The world impinges on the infant and he has to assimilate what he encounters, and accommodate himself

Infant is autistic

The world impinges on the infant and he has to assimilate what he encounters, and accommodate himself

Infant, confronted with the world, becomes less egocentric – experience and its assimilation increases the opportunity for understanding

Piaget

Infant is autistic

The world impinges on the infant and he has to assimilate what he encounters, and accommodate himself

Infant, confronted with the world, becomes less egocentric – PROCESSES OF REFLECTIVE ABSTRACTION AND CONSTRUCTIVE GENERALISATION CAUSE CHANGE

Piaget

~~Infant is autistic~~
Infant is social

The world impinges on the infant and he has to assimilate what he encounters, and accommodate himself

Vygotsky

The infant struggles to engage with the world, and is assisted in doing so. He appropriates (internalizes) cultural objects (like language) to assist in this endeavor

Infant, confronted with the world, becomes less egocentric – PROCESSES OF REFLECTIVE ABSTRACTION AND CONSTRUCTIVE GENERALISATION CAUSE CHANGE

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Infant, confronted with the world, becomes less egocentric – PROCESSES OF REFLECTIVE ABSTRACTION AND CONSTRUCTIVE GENERALISATION CAUSE CHANGE

Infant, assisted by cultural structures, is extended into the *zone of proximal development*, which allows him to act beyond his current capacity, and thereby extend himself

Piaget

The social world slowly breaks through egocentrism

Enculturation is learning – knowledge is social

Vygotsky

~~Infant is autistic~~
Infant is social

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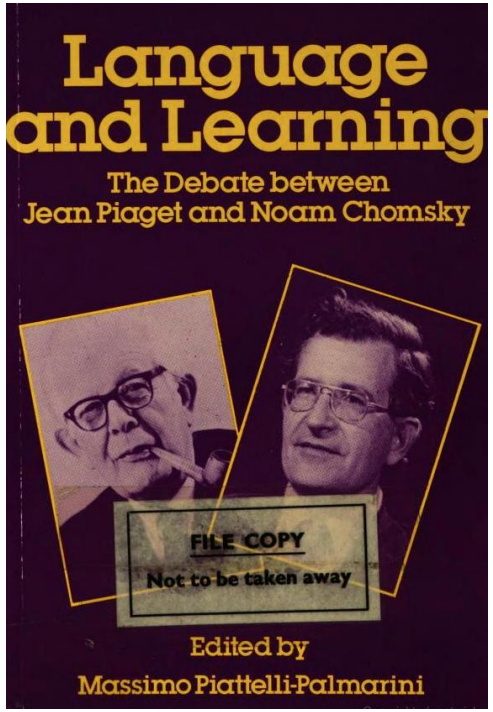
- Piaget says the child constructs knowledge on his own
- Only gradually becomes social: begins egocentric
- Vygotsky says that human knowledge is cultural knowledge, that knowledge is essentially social. The infant is social from the beginning.
- Vygotsky says that Piaget hides behind "the wall of facts"
  - Can't explain how the semiotic function is discovered by the child because it is not.
- Vygotsky says the semiotic function is learned from culture, not self-discovered.



Chomsky's not convinced!

Language and learning: The debate between Jean Piaget and Noam Chomsky
Piatelli-Palmarini, Ed. (1980, pp. 35-52)

So this is Chomsky's deep assumption

On Cognitive Structures and Their Development: A Reply to Piaget

Noam Chomsky

In his interesting remarks on the psychogenesis of knowledge and its epistemological significance, Jean Piaget formulates three general points of view as to how knowledge is acquired: empiricism, "preformation" ["innatism"], and his own "constructivism." He correctly characterizes my views as, in his terms, a variety of "innatism." Specifically, investigation of human language has led me to believe that a genetically determined language faculty, one component of the human mind, specifies a certain class of "humanly accessible grammars." The

[…]

development. My guess would be that, as in the case of grammars, a fixed, genetically determined system of some sort narrowly constrains the forms that they can assume. I would also speculate that other cognitive structures developed by humans might profitably be analyzed along similar lines.

Chomsky's not convinced!

Language and learning: The debate between Jean Piaget and Noam Chomsky
Piatelli-Palmarini, Ed. (1980, pp. 35)

"Against this conception Piaget offers two basic arguments"

1. The mutations, specific to humans, that might have given rise to the postulated innate structures are "biologically inexplicable"
2. What can be explained on the assumption of fixed innate structures can be explained as well as "the necessary" result of constructions of sensorimotor intelligence

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- The evolutionary development is "biologically unexplained", yes, but not "biologically inexplicable"
- The same can be said of any human organ – evolutionary development is biologically unexplained!
- *Although it is quite true that we have no idea how or why random mutations have endowed humans with the specific capacity to learn a human language, it is also true that we have no better idea how or why random mutations have led to the development of the particular structures of the mammalian eye or the cerebral cortex*

Chomsky's not convinced!

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- *Little is known concerning evolutionary development, but from ignorance, it is impossible to draw any conclusions. In particular, it is rash to conclude either [A] that known physical laws do not suffice in principle to account for the development of particular structures, or [B] that physical laws, known or unknown, do not suffice in principle*

Chomsky's not convinced!

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- *The second argument seems to me a more important one. However, I see no basis for Piaget's conclusion. There are, to my knowledge, no substantial proposals involving "constructions of sensorimotor intelligence" that offer any hope of accounting for the phenomena of language that demand explanation*

Chomsky then takes two approaches:

- critique on history of ideas
- evidence from the specific properties of this mental organ (i.e., knowledge of language)

Chomsky's not convinced!

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critique on history of ideas

- There is no reason why a neutral scientist, unencumbered by traditional doctrine, should adopt the view that cognitive structures of the mind should be studied separately from physical structures developed by the body
- Chomsky defines an approach for doing such investigation (p. 37)

Chomsky's not convinced!

Language and learning: The debate between Jean Piaget and Noam Chomsky
Piatelli-Palmarini, Ed. (1980, pp. 37)

Suppose that we set ourselves the task of studying the cognitive growth of a person in a natural environment. We may begin by attempting to delimit certain cognitive domains, each governed by an integrated system of principles of some sort. It is, surely, a legitimate move to take language to be one such domain, though its exact boundaries and relations to other domains remain to be determined. In just the same way, we might proceed to study the nature and development of some organ of the body. Under this quite legitimate assumption, we observe that a person proceeds from a genetically determined initial state S_0 through a sequence of states $S_1, S_2, \ldots$, finally reaching a "steady state" S_s which then seems to change only marginally (say, by the addition of new vocabulary). The steady state is attained at a relatively fixed age, apparently by puberty or somewhat earlier. Investigating this steady state, we can construct a

Language development unfolds in a regular sequence, just as any other maturing aspect of the child

Chomsky's not convinced!

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evidence from the specific properties of this mental organ
(i.e., knowledge of language)

- *The expectation that constructions of sensorimotor intelligence [via some General Developmental Mechanism] determine the character of a mental organ such as language seems to me hardly more plausible than a proposal that the fundamental properties of the eye or the visual cortex or the heart develop on this basis. Furthermore, when we turn to specific properties of this mental organ, we find little justification for any such belief, so far as I can see*

Chomsky's not convinced!

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evidence from the specific properties of this mental organ
(i.e., knowledge of language)

- *The expectation that constructions of sensorimotor intelligence [via some GDM] determine the character of a mental organ such as language seems to me hardly more plausible than a proposal that the fundamental properties of the eye or the visual cortex or the heart develop on this basis. Furthermore, when we turn to specific properties of this mental organ, we find little justification for any such belief, so far as I can see*

QUESTION: You mean that school grammars fill in the gaps left by heredity? They teach everything about French or Russian, for example, that can't be taken for granted by virtue of the fact that you're human?

CHOMSKY: That's right. It is precisely what seems self-evident that is most likely to be part of our hereditary baggage. Some of the oddities of English pronoun behavior illustrate what I mean. Take the sentence, "John believes he is intelligent." Okay, we all know that "he" can refer either to John or to someone else; so the sentence is ambiguous. It can mean either that John thinks he, John, is intelligent, or that someone else is intelligent. In contrast, consider the sentence, "John believes him to be intelligent." Here, the pronoun "him" can't refer to John; it can refer only to someone else.

Now, did anyone teach us this peculiarity about English pronouns when we were children? It would be hard to even imagine a training procedure that would convey such information to a person. Nevertheless, everybody knows it -- knows it without experience, without training, and at quite an early age. There are any number of other examples that show that we humans have explicit and highly articulate linguistic knowledge that simply has no basis in linguistic experience.

Noam Chomsky: we will get to him a lot more later!

There are many more such examples

"Sam is waiting for Fred" can be asked, "Who is Sam waiting for?"

"Susan asked why Sam was waiting for Fred." cannot be asked as "Who did Susan ask why Sam was waiting for __?

How could we learn that from sensori-motor exploration? How could that be constructed from modifications of reflexes? (also, motor disabled children still can learn language)

Additional readings: Noam Chomsky , and we will get to him a lot more later!

Review of B F Skinner's *Verbal Behavior* (1959/1967)

- http://cogprints.org/1148/1/chomsky.htm

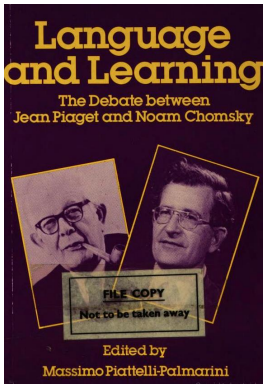
If you like some of the ideas in the interview with Gliedman, see readings, especially about the limits of human understnading, then you may also like the following recent lecture by Chomsky: *The Machine, the Ghost, and the Limits of Human Understanding*

- http://www.youtube.com/watch?v=D5in5EdjhD0

Piaget vs. Vygotsky, & Chomsky: Summed up

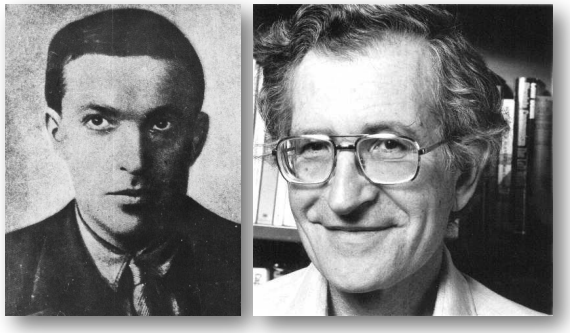
- Piaget goes to great lengths to describe the sensorimotor period to explain how the child born with only reflexes and mechanisms of knowledge construction, constructs symbolic mental representations.
  - Sensorimotor period is so critical to Piaget because his theory rejects innate symbolic knowledge and so needs such an explanation.
- Vygotsky says "why go to such lengths? Symbols are provided by the culture. The child does not need to construct them. This is why Piaget's explanation is inadequate"
- Chomsky says "Why reject the idea of innate knowledge of symbolic structure? 1. There is no need to 2. There is no way to explain human knowledge of language (e.g., a form of symbolic representation) without positing innate preformation of some kind. Construction from action will not get you there."

Conclusions



Piaget, Vygotsky and Chomsky:

Different concerns, different assumptions, divergent theories



Infant Cognition 1: Research Methods

Micah B. Goldwater, PhD
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Challenge of Studying Infants

- Cannot talk
- Cannot follow instructions
- Short attention span
- Limited behavioral repertoire
- Develop rapidly, so different tasks need to be used at different ages

Experimental Methods

- Behavioral Tasks
- Dependent variables: Sucking, head turning, reaching, surprise, looking time

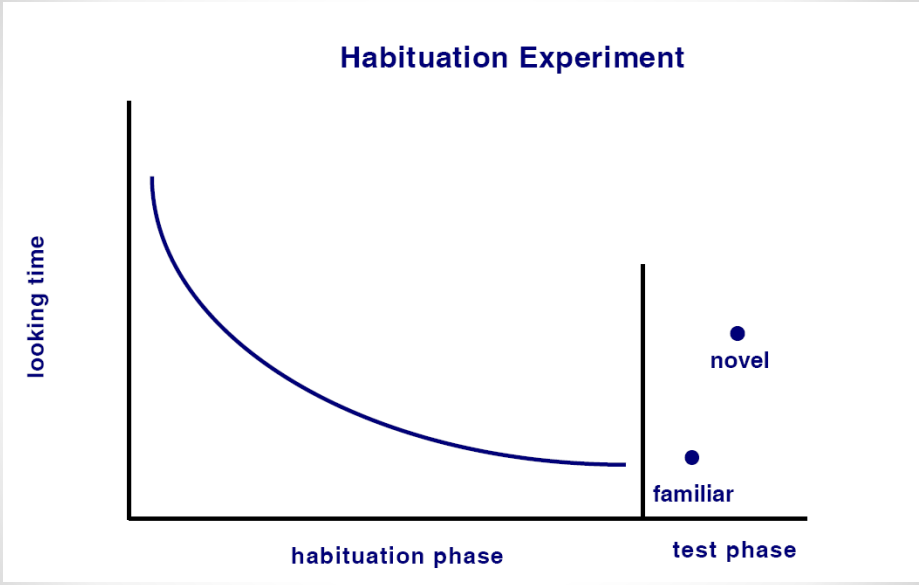
- Physiological Tasks
- Dependent variables: Heart Rate, Event Related Potentials (ERPs), Hemodynamic response (e.g. fMRI, Optical Imaging)

Experimental Methods

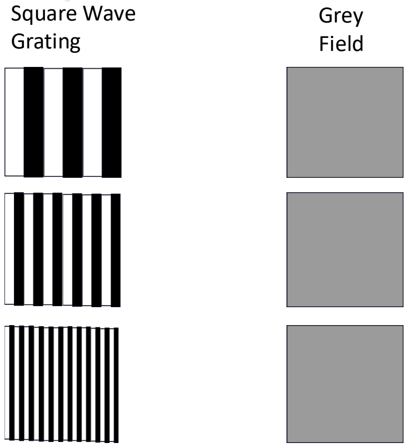
- Behavioral Tasks
- Dependent variables: Sucking, head turning, reaching, surprise, looking time

- Physiological Tasks
- Dependent variables: Heart Rate, Event Related Potentials (ERPs), Hemodynamic response (e.g. fMRI, Optical Imaging)

Habituation: Looking

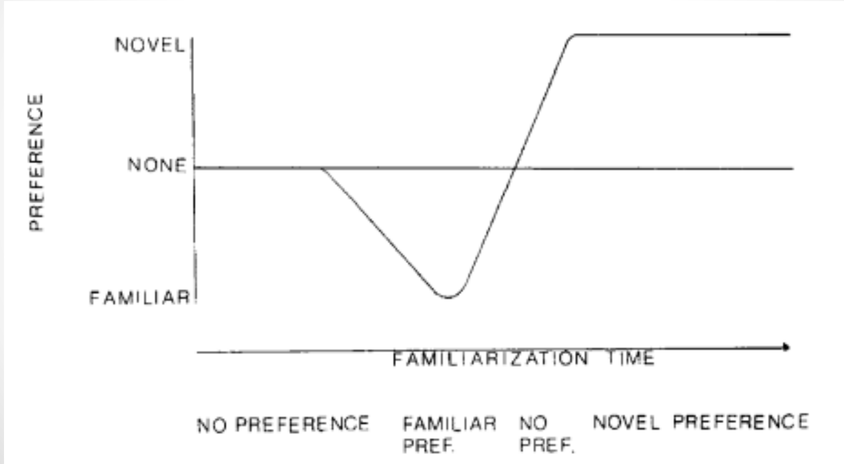


First uses of habituation: Tests of Perceptual Discrimination

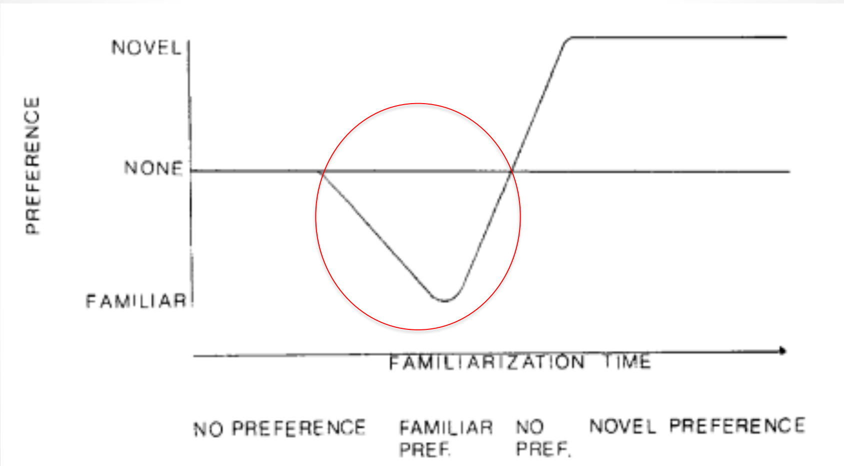


- Very young infants wouldn't necessarily dishabituate to grey field following thinnest lines: visual acuity to low to discriminate the two

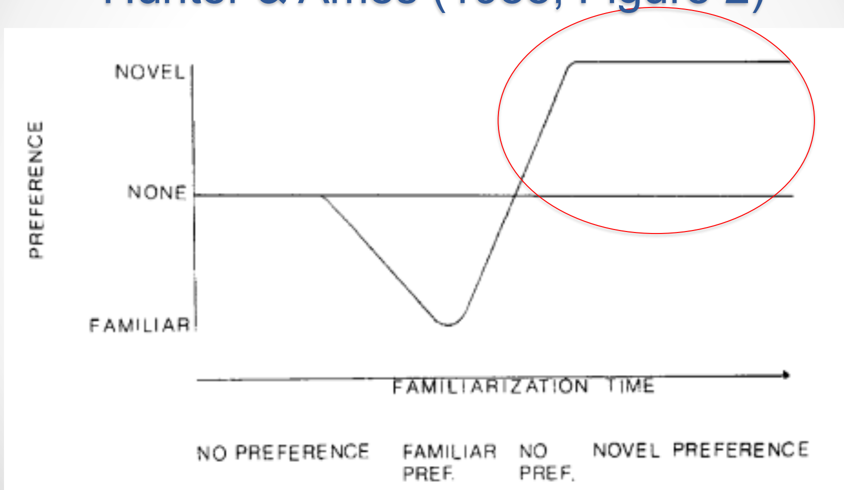
More complex model of looking time Hunter & Ames (1988, Figure 2)



More complex model of looking time Hunter & Ames (1988, Figure 2)



More complex model of looking time Hunter & Ames (1988, Figure 2)



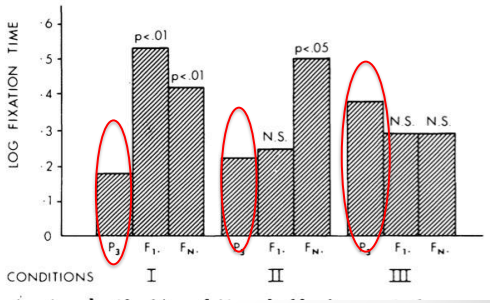
Beyond discrimination: Generalization of habituation

- Cohen & Straus 1979
- 30 week old infants habituate to faces
- 3 Habituation conditions

1. Habituate to a single face at a single orientation
2. Habituate to a single face at multiple orientations.
3. Habituate to multiple faces at multiple orientations

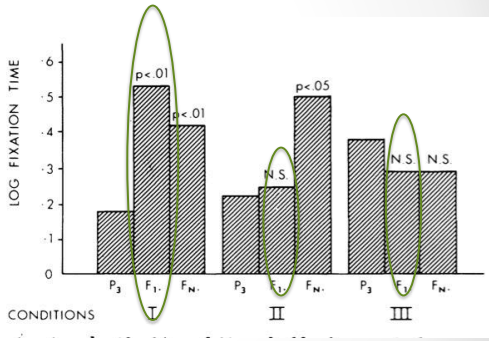
Beyond discrimination: Generalization of habituation

- Cohen & Straus 1979
- 30 week old infants habituate to faces
- 3 Test trials
- 1. P_3 = Familiar face at familiar orientation stimulus



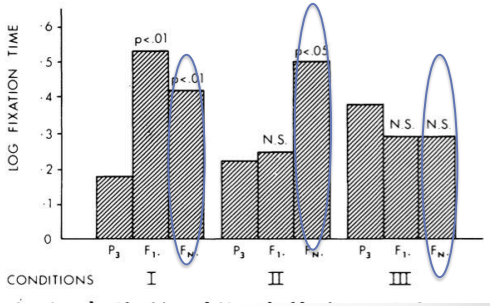
Beyond discrimination: Generalization of habituation

- Cohen & Straus 1979
- 30 week old infants habituate to faces
- 3 Test trials
- 2. F_1 = Familiar face at a novel orientation



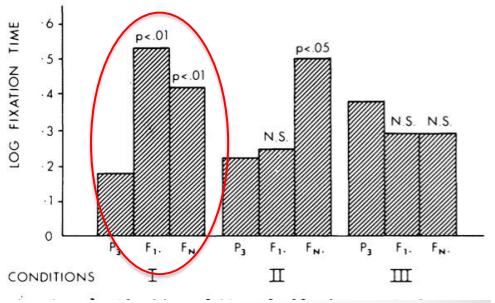
Beyond discrimination: Generalization of habituation

- Cohen & Straus 1979
- 30 week old infants habituate to faces
- 3 Test trials
- 3. F_N = Novel face at a novel orientation



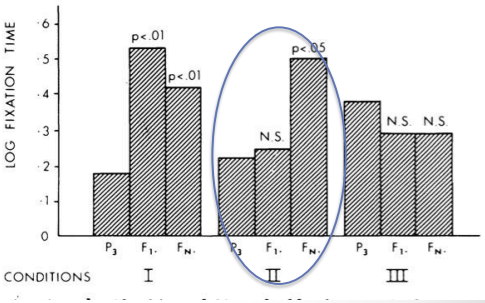
Beyond discrimination: Generalization of habituation

- Cohen & Straus 1979
- 30 week old infants habituate to faces
- 3 Habituation conditions
- 1. Habituate to 1 face 1 orientation
- They discriminate novel from familiar



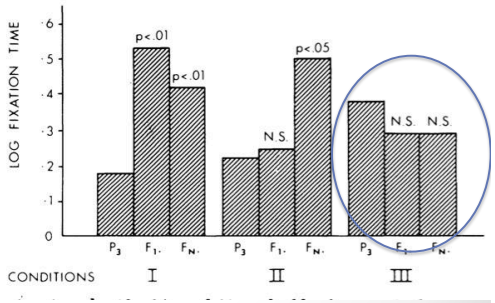
Beyond discrimination: Generalization of habituation

- Cohen & Straus 1979
- 30 week old infants habituate to faces
- 3 Habituation conditions
- 2. Habituate to same face at multiple orientations
- Do not dishabituate to familiar face at novel orientation, but does to novel face.



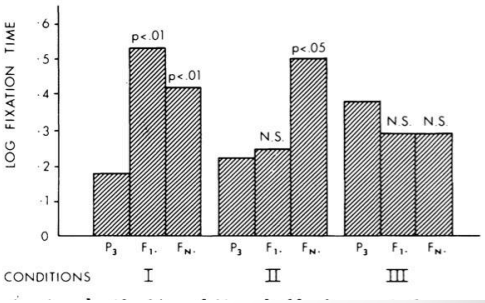
Beyond discrimination: Generalization of habituation

- Cohen & Straus 1979
- 30 week old infants habituate to faces
- 3 Habituation conditions
- 3. Habituate to multiple faces at multiple orientations
- do not dishabituate to either novel stimulus



Beyond discrimination: Generalization of habituation

- Cohen & Straus 1979
- 30 week old infants habituate to faces
- Track the pattern in the stimuli, not just individual stimuli
- Generalize their habituation based on the pattern
- Younger infants did not learn the pattern



Learning Outcome: Principles of habituation

- When first learning about a stimulus, infants may show a familiarity preference. The more complex the stimulus, the longer the familiarity preference may persist.
- After infants have fully processed the stimulus and habituate, they will develop a novelty preference.
- Infants do not just habituate to the specifics of individual stimuli, but they habituate to the pattern in the stimuli and generalize their habituation to new stimuli that fit the pattern.
  - Allows test of whether infants are capable of learning particular patterns, not just whether they can discriminate between individual stimuli.

Infant Cognition 2: Nativism vs. Constructivism

Micah B. Goldwater, PhD
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Cognitive Development: A note before beginning

- A bias in the field: we are incentivized to claim infants and children are quite sophisticated at surprisingly young ages
  - This gets high-impact publications, popular press attention, etc.
- My own bias: because of these incentives, I am extremely skeptical of any such claim.
  - I have the minority view. Right now, the trend is to argue that infants and children are genius scientist moral philosophers. I don't really buy it.

Infant Cognition: Readings

- Nativist:

Carey, S. (2011). The Origin of Concepts: A précis. *Behavioral and Brain Sciences, 34*, 113-123. (it goes further with peer commentary)

  - This is relevant for both infant cognition and concepts and reasoning.
  - Reading the section on the development of scientific theories is not necessary

- Constructivist:

Cohen, L. B., & Cashon, C. H. (2006). Infant Cognition. In W. Damon & R. M. Lerner (Series Eds.) & D. Kuhn & R. S. Siegler (Vol. Eds.), *Handbook of child psychology: Vol. 2. Cognition, Perception, and Language* (6th ed., pp. 214-251). New York: Wiley.

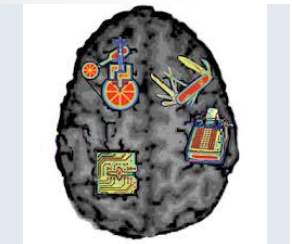
  - Feel free to skip sections on: object exploration and sequential touching, deferred imitation, object individuation, complex causal scenes, complex event sequences, connectionist models, perceptual vs. conceptual categories, infant face processing, animate-inanimate distinction,

Where does knowledge come from?

Nativism vs. Constructivism

- What is the debate really about?
- Everything has a genetic component, every domain involves learning.
- Innate knowledge of specific domains, with domain-specific learning mechanisms vs. no innate knowledge but innate domain-general learning mechanisms.

Nativism often means cognitive modularity



- Information Encapsulation
- Sensitive to specific inputs
- Given the specific perceptual inputs, then the module takes over

Nativism: Domain-Specific Learning Mechanisms & Core Knowledge

- MODULES: specialized capabilities
  - Perhaps specialized brain tissue
- Designed to 'pick up' certain kinds of information from the sense organ
- Given particular perceptual input, modules are activated and apply their Core Knowledge
  - e.g., given certain cues, infant will interpret a percept as an object and make certain inferences, such as still existing while out of sight.
- Learns specific things about domains
  - e.g., the properties of particular categories of objects: size, shape, etc.

Anti-Piagetian

Constructivism: Domain-General Learning Architectures (see Cohen & Cashon, 2006)

- Some Key Principles
- Innate domain general information processing system that detects low-level featural information, such as color, motion
- Higher-level units formed from relationships among these.
- Higher-level units formed from these units. Learning is hierarchical & constructive
  - Cohen & Straus (1979): Older infants better able to perceive the higher-level generalizations.
- This is critical for all expertise. Infants start with the physical and social world.

Neo-Piagetian

Where does knowledge come from?

- Object knowledge

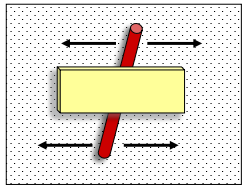
Where does knowledge come from?

- Object knowledge
- Object Unity: Do infants represent parts of objects that they cannot see?
- Object Permanence: Do infants understand that objects exist that they cannot see?
- Piaget said infants do not start out with this ability. Cohen & Cashon agree.
- Core knowledge theorizers (e.g., Carey, Spelke, Baillargeon) argue that they do start with object knowledge

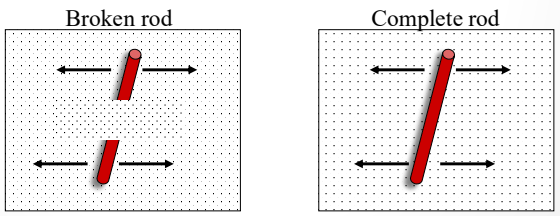
Kellman & Spelke (1983): Perception of object unity in 4 month-olds
Moving rod condition

Habituation stimulus:

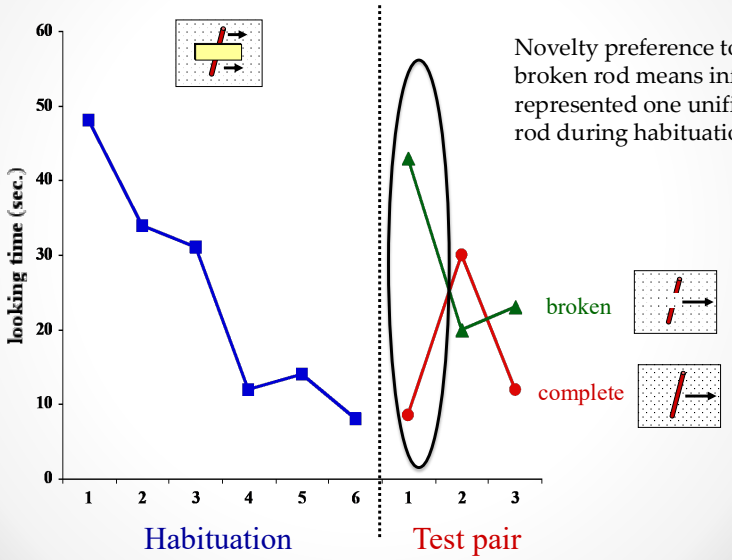
Partly-occluded rod



Test stimuli:



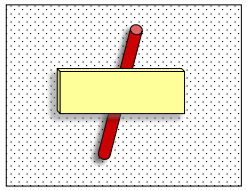
Kellman & Spelke (1983): Perception of object unity in 4 month-olds
Moving rod condition



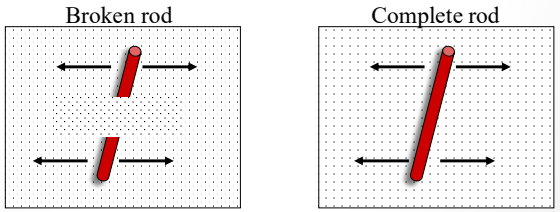
Novelty preference to broken rod means infants represented one unified rod during habituation

Kellman & Spelke (1983): Perception of object unity in 4 month-olds
Stationary rod condition control

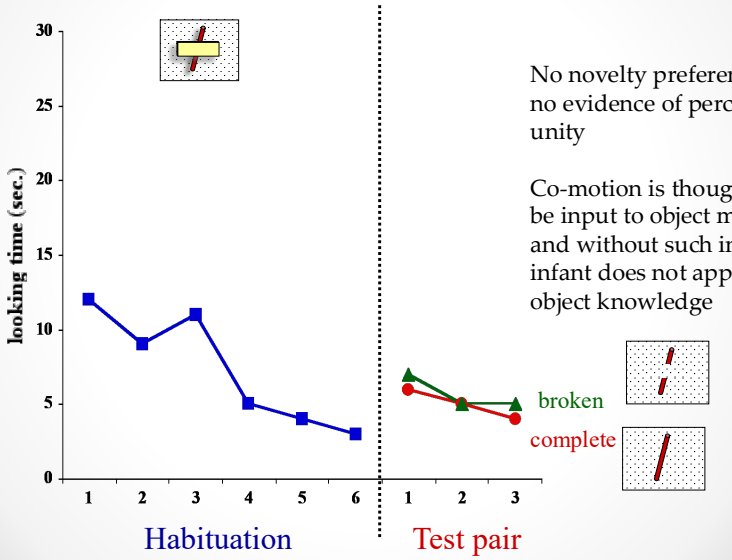
Habituation stimulus:



Test stimuli:



Kellman & Spelke (1983): Perception of object unity in 4 month-olds
Stationary rod condition control



No novelty preference, so no evidence of perceived unity

Co-motion is thought to be input to object module, and without such input, infant does not apply core object knowledge

Constructivism: Domain-General Learning Architectures (see Cohen & Cashon, 2006)

- How to explain perception of object unity?
- Perceive object unity from similar surfaces moving together because those are relationships that exist in the world.
- Suggests there will be developmental changes in the first 4 months.
  - Changes in ability to construct a object percept from visual input

Constructivism: Domain-General Learning Architectures (see Cohen & Cashon, 2006)

- Johnson & Aslin (1998): 2 month olds see rod as unified only when a greater area of the rod is visible
  - 2 month olds look longer to whole rod unless there is just a little bit occluded during habituation
- Slater, Johnson, Brown, & Badendoch (1996): Newborns show preference for whole rod.

The Reply from Core Knowledge (Carey, 2011).

Fourth, success at some task provides support for some target representational capacity needed to perform it, whereas failure is not necessarily good evidence that the target capacity is lacking. Some other capacity, independent of the target one, may be needed for the task and may not yet be available (not yet learned or not yet matured). *TOOC* provides several worked-out examples of successful appeals to performance limitations masking putatively innate competences. For example, the A/not B error made by infants between ages 7 and 12 months is at least in part explained by appeal to immature executive function. For another example, infants' failure until 2 months of age to create representations of a complete rod partially hidden behind a barrier when they are shown the protruding ends undergoing common motion is at least partly explained by their failure to notice the common motion across the barrier. Thus, they lack the critical input to the putatively innate computation.

Object Unity

- Constructivists point to gradual development as gradual development of object unity.
- Nativists say that development is the developing ability to perceive motion, allowing object core knowledge to be applied.

Object Permanence

- Piaget claimed object permanence was not achieved to 8-9 months of age; was still quite fragile until 12 months.
- Looking time measures are more sensitive

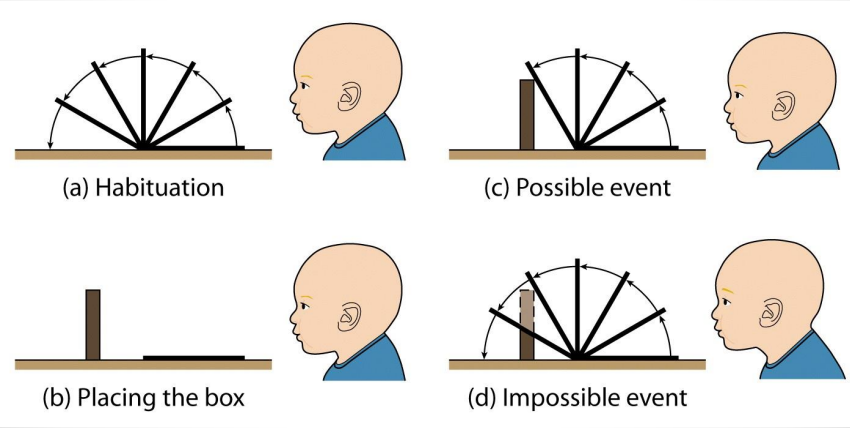
Violation of Expectation Paradigm

- Habituate/familiarize to some event, & two critical test trials:

1. Perceptually more familiar but physically impossible
2. Perceptually novel by physically possible

Violation of Expectation Paradigm

Baillargeon, 1987



4.5-monh-olds show "surprise" to the impossible event

Violation of Expectation Paradigm

- Complete board lowering is perceptually familiar but with the object there, it is impossible (but only if infants represent the occluded object)
- Claim is that if infants show novelty preference from perception alone, they should be surprised by the partial movement. But they are not, suggesting they represent the physical object

- However….

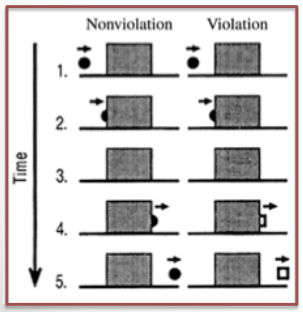
Violation of Expectation Paradigm

- Could it really just be a familiarity preference?
  - Baillergeon included infants in the analysis who did not fully habituate. Remember Hunter & Ames? Infants who aren't fully habituated often show familiarity preferences.
- Or general preference for more complex/rich complete drop? (more motion)
  - Hunter & Ames say more complexity has even longer familiarity preference
- Constructivists have argued this (see Cohen & Cashon, 2006), but the evidence is mixed/jury is out
  - well, most people agree with Baillargeon

Object Memory vs. Object Permanence

- Meltzoff & Moore (1998) consistent with constructivism
- Perception mismatching memory can be surprising without understanding object permanence
- 5 and 9 month olds show suprise to shape change, suggesting perception-memory mismatch

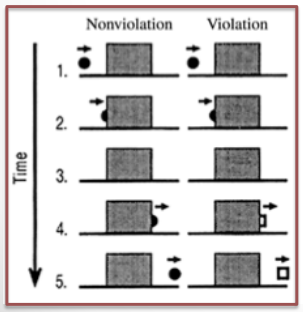
Memory task



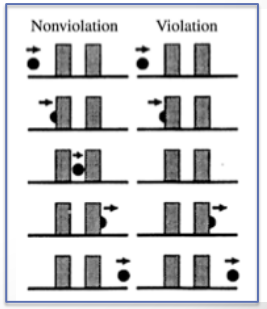
Object Memory vs. Object Permanence

- Meltzoff & Moore (1998) consistent with constructivism
- Understanding permanence means also realizing objects should re-appear when no longer occluded, as shown by surprise to violation in permanence task.
- 9 month-olds but not 5 month-olds show such surprise

Memory task



Permanence task



Object Unity & Object Permanence

- Both aspects of object knowledge appear to have a piecemeal development consistent with constructivism.
- Object unity: increases in the amount of object occluded the infant can infer with increasing age.
- Object permanence: memory for specific object features pre-dates a more complete understanding of permanence.

An advantage for posting innateness? Carey (2011)

- Given gradual development of unity and permanence, what explanatory value does innateness hold?

- Innate does not mean present at birth and 0 development
- One key prediction is that different aspects of a whole system of core cognition (e.g., object knowledge) will come online simultaneously
- For example, understanding of object unity co-develops with some abilities to differentiate two occluded objects from each other using spatial temporal cues, as well as understanding how an object being solid constrains it's paths of motion.
  - Carey (2011) reviews how evidence of these different abilities at the same ages.

Where does knowledge come from?

- Object knowledge
- Object Unity: Infants representing parts of objects that they cannot see, unifying whole objects
- Object Permanence: Infants understanding that objects exist when they cannot be seen.
- Constructivist or nativist?: evidence for both sides

Key learning outcomes:

- You can write strong arguments for both nativist and constructivist accounts of the development of object knowledge
  - There will be more on this next lecture as well you should be able to integrate with what is here
- These arguments need to link theories, methods, and data

Infant Cognition 3: Multi-sensory integration to construct knowledge

Micah B. Goldwater, PhD
University of Sydney

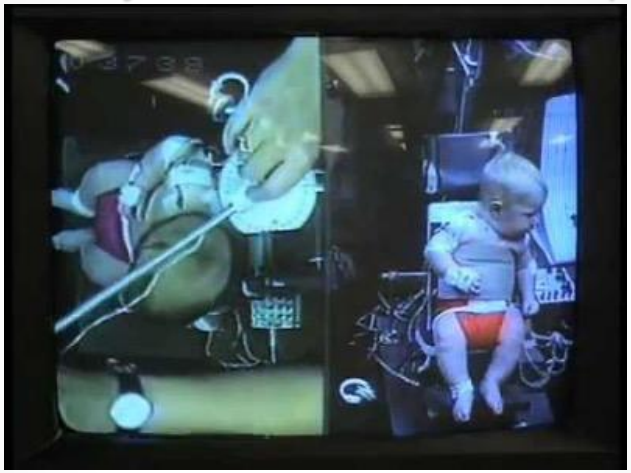
Reading

- Cohen & Cashon (2006)- still relevant
- Smith (2013) From “American Psychologist” which has a bit more of a general-audience kind of style

Building knowledge from multi-sensory integration

- 1st point- development is piecemeal

Dynamic Systems & Motor Development



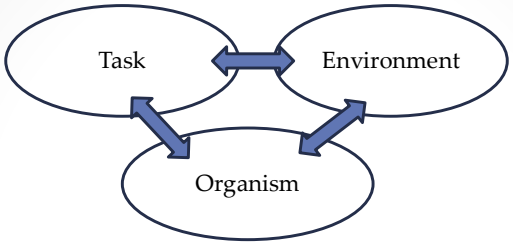
Just watching the first few minutes here, but watch the rest on your own

A key insight: motor learning/training is specific to those actions

Dynamic Systems & Motor Development

Risk perception does not generalize from sitting to crawling

Dynamic Systems & Motor Development



- Development is driven by the dynamics of these three interacting

Task-Environment- Organism

What changes in the organism?

Brain & Body

- Have some put too much emphasis on brain changes to explain development?
- For example, motor control brain regions need to mature (and learn) to walk
- Thelen showed that fat/muscle growth is also critical
- Demonstrated babies could walk in water earlier

What about conceptual knowledge?

- Piaget explains error in terms of incomplete object schemas- object knowledge tied to actions
- Linda Smith (and colleagues, 1999) shows that simply resetting the infant's posture and body (but standing and sitting) can eliminate A not B error

What are concepts, really?

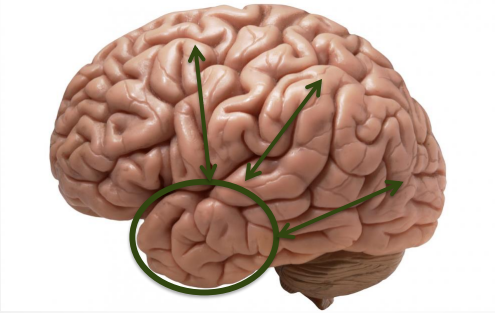
- Dynamic systems says there is no such thing as a concept in this traditional sense.
- "Concepts" emerge from a complex system of brain, the body, and the world all interacting
- Remember how Piaget failed to explain how discrete symbolic representations are created by sensorimotor exploration?
- Smith "solves" the problem by denying it: There are no discrete representations, even in adults!

So how does intelligence emerge?

- Children are sensitive to statistical contingencies in action and perception
  - Knowledge grows from sensorimotor exploration of world: Piagetian
- Other networks exist to integrate multi-sensory information, feedback to them.
  - Development of action affects the development of vision and vice-versa
- Operating at this higher-level of multi-sensory integration, new higher-order correlations can be formed.
-
- This hierarchical construction is key to human intelligence

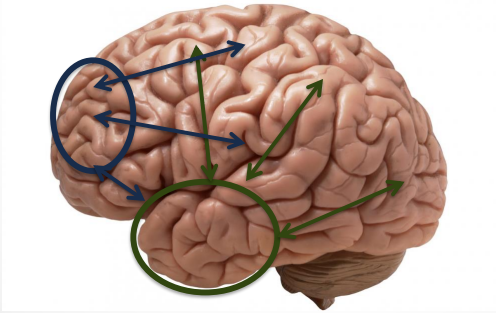
Multi-sensory integration in the brain

- Word meanings activate associated sensory systems all over the brain
  - “kick” activates the leg control part of motor cortex, “punch” activated hand part
  - “canary” activates yellow in visual cortex
- Also a “multi-modal hub” in anterior temporal lobe



Multi-sensory integration in the brain

- Highest-order integrative network: pre-frontal cortex integrates disparate information
  - Frontal pole/ Broadman’s 10/aPFC/
  - Area most associated with fluent intelligence, abstract problem solving, analogical reasoning, e.g., aspirin: pain:: muffler:noise
  - Our aPFC is way bigger/more connecty than other primates’.
  - Preview of abstract thought and executive function.

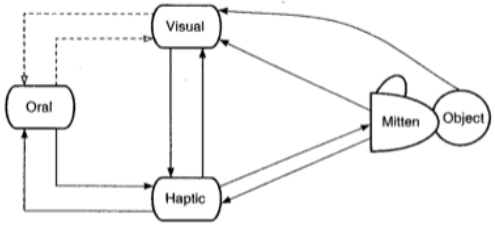


“Intelligence is multi-sensory integration”

- First 6 months infants develop systematic visual inspection, and oral & manual exploration of objects behaviors

“Intelligence is multi-sensory integration”

- First 6 months infants develop systematic visual inspection, and oral & manual exploration of objects behaviors
- Sticky mittens given to 2 month-olds allowing for better grasping of objects leads to more mature visual inspection and oral exploration of objects
  - Remember oral representation of outside world in Piaget?



Multi-sensory integration: the visual cliff

- Learning to crawl first induces the fear of the cliff, and then handling objects accelerates getting over the fear.

Generalizing actions across objects in 2020

- https://x.com/alvinfoo/status/1350729710599196674
- Unfortunately you need to log in because of "sensitive content" (it is not sensitive content)

Building knowledge through statistics: visual object categories

- Objects are typically categorized based on their common features
  - birds have wings, beak, feathers, and fly
- Features are correlated across objects
  - Across all objects, things that have beaks tend to also have wings and feathers.
- Can infants keep track of feature-correlations?
- Younger & Cohen pioneered this research

Principles of Constructivist Infant Cognition

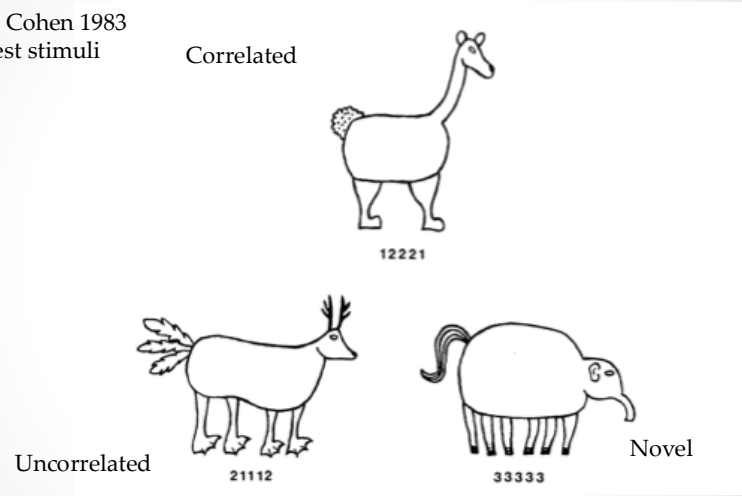
- Innate domain general information processing system that detects low-level featural information, such as color, motion
- Higher-level units formed from relationships among these.
- Higher-level units formed from these units. Learning is hierarchical & constructive
- Infants tend to use highest level units to interpret their environment
- If system gets overloaded, revert to lower-level of processing while incorporating new information

Detecting feature-correlations

- Younger & Cohen 1983
- 4, 7, & 10 month-olds habituate to novel animals
- Vary on feet, legs, ears, tail, body.
  - e.g., hoof feet, 4 legs, pointy ears, fluffy tail, giraffe body
- Some features correlated across animals
  - e.g., hoof feet always co-occur with giraffe body, but with any tail and ears.
- At test, infants see 3 novel animals:
  1. Familiar features and preserves correlations from habituation,
  2. Familiar features but violates correlations
  3. Novel features (a totally novel stimulus)
- Novel features should elicit dishabituation
- If infants learned the feature correlations, then the uncorrelated exemplar should also elicit dishabituation

Detecting feature-correlations

Younger & Cohen 1983
Example test stimuli



Detecting feature-correlations

Younger & Cohen 1983

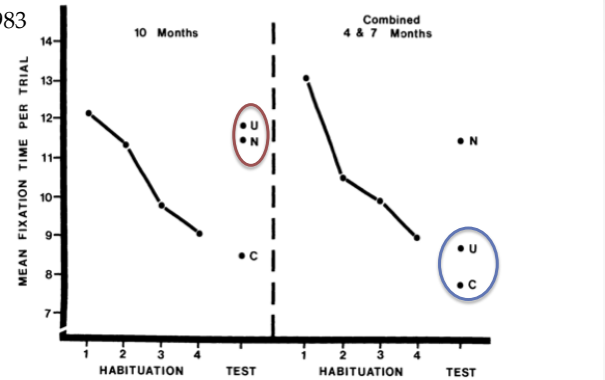


FIG. 2.—Mean fixation times in seconds for the habituation and test data from Experiments 1 and 3. The 10-month data (Experiment 1) are shown on the left, the combined 4- and 7-month data (Experiment 3) on the right. For each experiment, the eight habituation trials are shown as four blocks of two consecutive trials. *C*, *U*, and *N* refer to the Correlated, Uncorrelated, and Novel test stimuli, respectively.

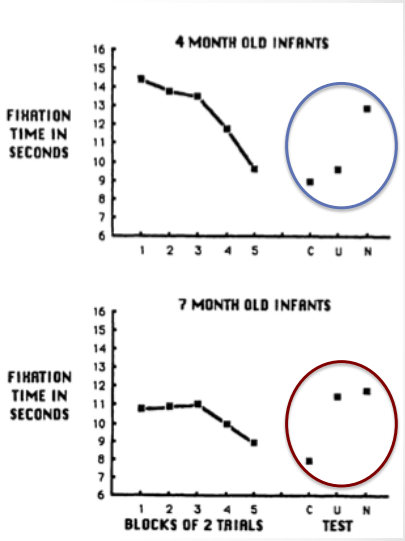
10 month-olds dishabituate to both uncorrelated familiar features and novel features. They learned the correlations.
4 & 7 month-olds stay habituated to familiar features regardless of preserving the correlation. They show no signs of learning the correlation.

Detecting feature-correlations

- Younger & Cohen 1986
- 4, 7, & 10 month-olds habituate to novel animals
- Now they vary on just 3 features
  - e.g., hoof feet, fluffy tail, giraffe body
- Experiment 1: All 3 features perfectly correlated across animals
  - Just 4 and 7 month-olds in E1
- At test, infants see 3 novel animals:
  1. Familiar features and preserves correlations from habituation,
  2. Familiar features but violates correlations
  3. Novel features (a totally novel stimulus)
- Novel features should elicit dishabituation
- If infants learned the feature correlations, then the uncorrelated exemplar should also elicit dishabituation

Detecting feature-correlations

- Younger & Cohen 1986
- Exp 1. 4 & 7 month-olds
- 4 month-olds only dishabituate to novel features.
- 4 month-olds do not learn the correlations.
- 7 month-olds dishabituate to uncorrelated and novel test examples.
- 7 month-olds do learn the correlations.

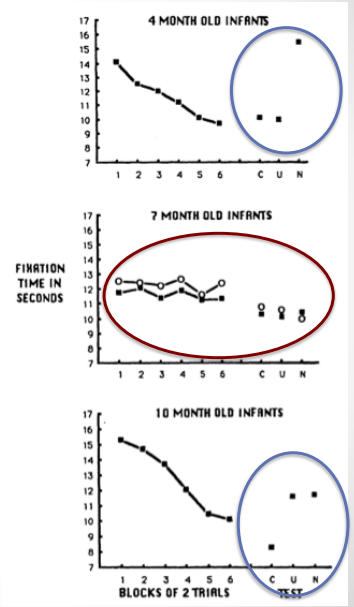


Detecting feature-correlations

- Younger & Cohen 1986
- 4, 7, & 10 month-olds habituate to novel animals
- Experiment 2: 2 out of 3 features are correlated across animals
  - e.g., hoof feet always co-occur with giraffe body, but with any tail
- Same test trials as before

Detecting feature-correlations

- Younger & Cohen 1986
- Exp 2. 4, 7, & 10 month-olds
- 4 month-olds do not learn the correlations
- 10 month-olds do learn the correlations.
- 7 month-olds do not even habituate! Show no preferences.
- After 12 habituation trials, they aren't done processing the stimuli yet.



Detecting feature-correlations

- Younger & Cohen 1986
- Experiment 2: 2 out of 3 features are correlated across animals
  - e.g., hoof feet always co-occur with giraffe body, but with any tail
- 4 month-olds habituate to the feature sets but not the correlations.
- 10 month-olds habituate to the correlations in the features.
- 7 month-olds attempt to learn the correlations, but need more time than the 10 month-olds.

Detecting feature-correlations

- Younger & Cohen 1986
- Experiment 4: 2 out of 3 features are correlated across animals
  - we're skipping E3
- 7 month-olds given more habituation trials
- They look like 4 month-olds generalizing their habituation to both correlated and uncorrelated test trials

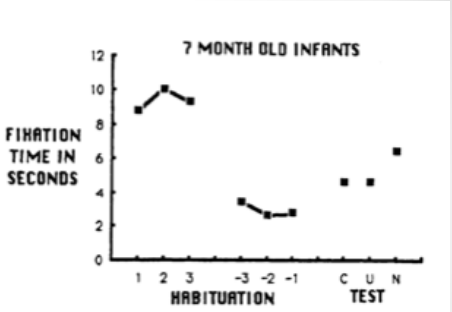


FIG. 3.—Mean fixation time in seconds for the initial and criterion blocks of three habituation trials and the test trials for Experiment 4. *C*, *U*, and *N* refer to the correlated, uncorrelated, and novel test stimuli, respectively.

Principles of Constructivist Infant Cognition

- Infants construct units from lower-level units.
- Infants tend to use highest level units to interpret their environment
- If system gets overloaded, revert to lower-level of processing while incorporating new information
- In Younger & Cohen (1983;1986)
- 4 month-olds don't learn the correlations
- 10 month-olds do
- 7 month-olds can learn the correlations in simple tasks. They attempt to learn the correlations when tasks are more complex, but ultimately fail and revert to processing like 4 month-olds.

Words and higher-order correlations

- Back to object 'concepts' specifically
- Systematic multi-modal interaction with objects help to form object categories.
- Word learning systematically builds on this ability
- A large proportion of the child's first 100 words refer to categories where common shape is most critical feature
- Children develop a *shape bias* in word learning

Developing the shape bias

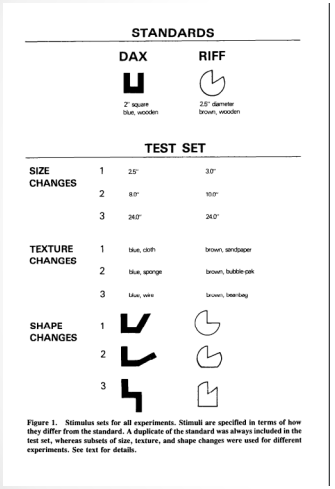


Figure 1. Stimulus sets for all experiments. Stimuli are specified in terms of how they differ from the standard. A duplicate of the standard was always included in the test set, whereas subsets of size, texture, and shape changes were used for different experiments. See text for details.

Landau, Smith, & Jones 1988

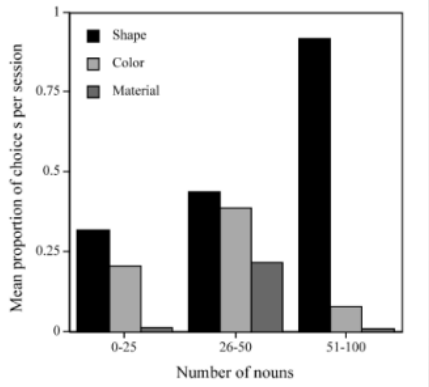


Figure 2. Mean number of shape choices in noun generalization task as a function of the number of nouns in the children's productive vocabulary.

~18 month olds

Gershkoff-Stowe, & Smith 2004

Developing the shape bias

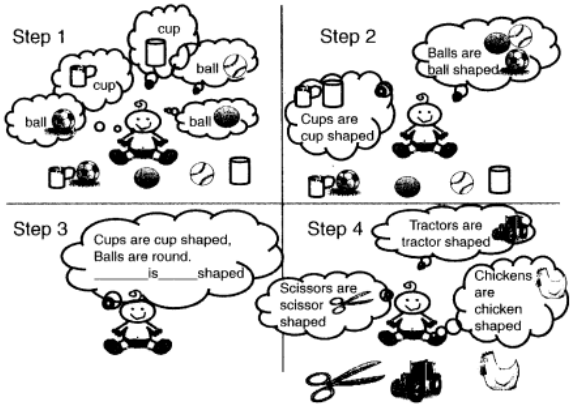


Fig. 16.6 Steps in forming a higher-order generalizations: (1) learn specific word object associations; (2) make first-order generalizations for each of the specific categories; (3) make higher-order generalizations across the regularities discovered in those first-order generalizations; and (4) use these higher-order generalizations to rapidly learn new categories.

Beyond shape

- Shape becomes particularly important for classifying new category members
- Children learn about all sorts of features, and their correlations within and across categories
  - e.g., wings, beaks, & flying co-occur
- Other systematic connections between domains and feature types
  - e.g., natural kinds vs. artefacts: texture

Dynamic systems & abstract thinking: language statistics

- According to dynamic systems:
- Language system itself becomes its own dynamic system- it does feedback to perception it does not need to
- Look at ChatGPT: entirely based on language statistics, no access to perception and action

Multi-sensory integration summary

- Infants build object “concepts” through learning correlations of features within a sensory modality and across modalities through connected action-perception systems
- There is a construction of hierarchical networks with feedback across levels of hierarchy
  - Inspired by brain structure
- These action-perception links support early word-learning, but then systematic language use feedback and accelerate action-perception category learning.
-

Infant Cognition 4: (Abstract) Relational Learning in Infancy

Micah B. Goldwater, PhD
University of Sydney

Readings

- The later sections of Carey's BBS paper cited last week, and these papers both apply to this lecture and next lecture on abstract thinking.
- Gentner, D. (2010). Bootstrapping the mind: Analogical processes and symbol systems. *Cognitive Science*, 34 (5). 752-775.
- Gopnik, A., & Wellman, H. M. (2012). Reconstructing constructivism: Causal models, Bayesian learning mechanisms, and the theory theory. *Psychological Bulletin, 138(6)*, 1085–1108.

The Natural Partitions Hypothesis

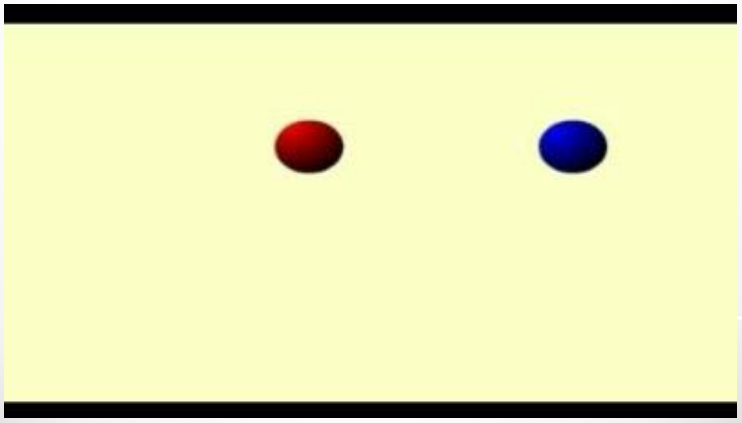
Gentner (1982)

- We parse the world into objects, and relations among the objects
  - This sort of distinction is as old as at least Aristotle
- Objects are perceptually cohesive: stable in the world, clear contrast with background, long lasting
- Relations are harder to perceive directly: dynamic/unstable, indefinite number of options
  - Spatial relations, state changes, movement towards/away

The Natural Partitions Hypothesis

Gentner (1982):

the objects vs. the relations



Relational Learning in Infancy

- Can infants learn relations, and generalize these relations across sets of objects?

- Identity relation: same vs. different
- Causal relations

Same & Different

Is B or C more like A?

A. 

B. 

C. 

Same & Different: this is very difficult or impossible for non-human animals

Is B or C more like A?

A. 

B. 

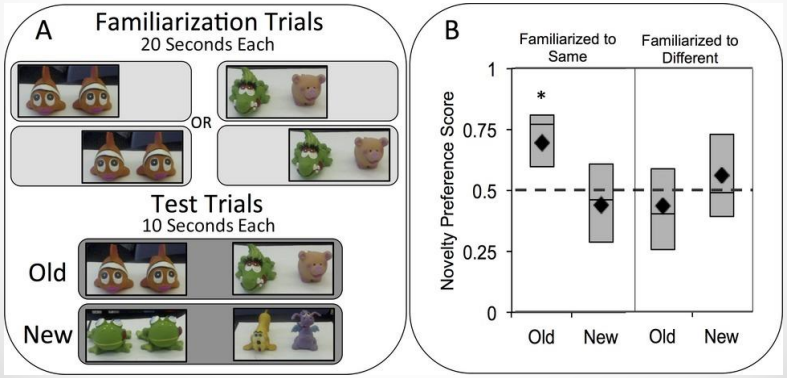
C. 

Principles of Constructivist Infant Cognition

- Innate domain general information processing system that detects low-level featural information, such as color, motion
- Higher-level units formed from relationships among these.
- Higher-level units formed from these units. Learning is hierarchical & constructive
- Infants tend to use highest level units to interpret their environment
- If system gets overloaded, revert to lower-level of processing while incorporating new information

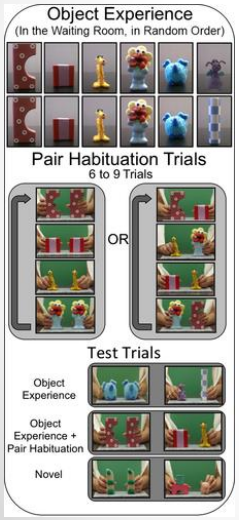
Same/Different in Infancy

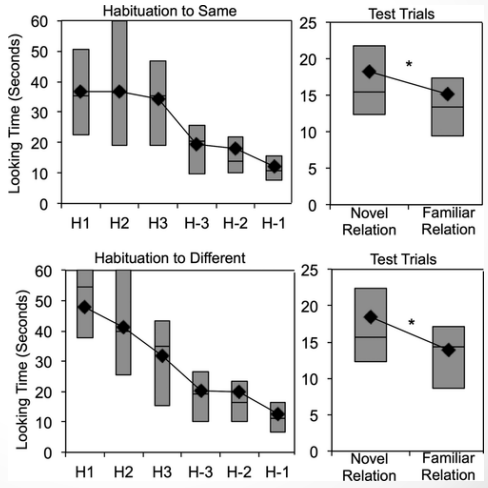
- Ferry, Hespos, & Gentner (2015)
- 7-9 month olds
- E1- 1 pair of objects during familiarization, they don't seem to generalize



Same/Different in Infancy

- Ferry, Hespos, & Gentner (2015)
- E2- 4 pairs of objects during familiarization, they do!





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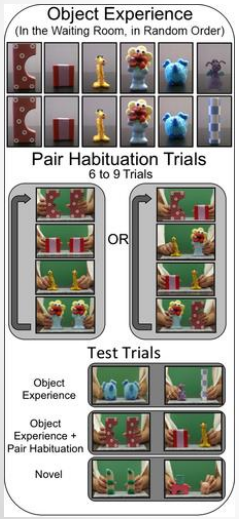
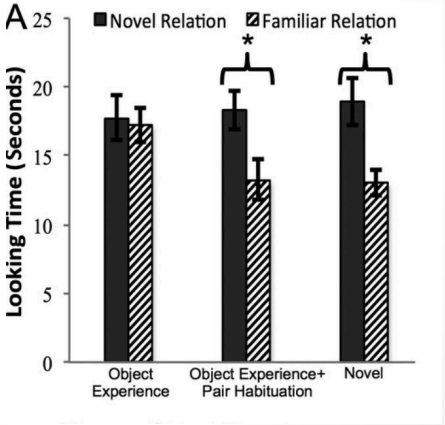
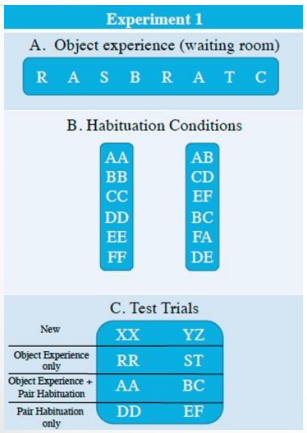
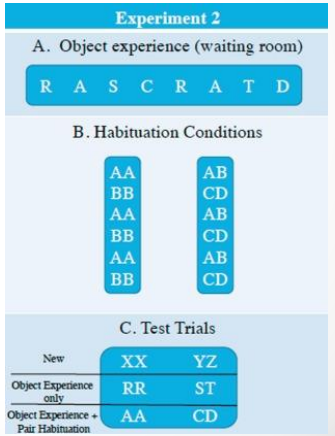




Same/Different in Infancy

- Anderson, Chang, Hespos, & Gentner (2018) 3 months
- E1- 6 pairs of objects during familiarization, they do not!
- E2 – 2 pairs of objects, they do!





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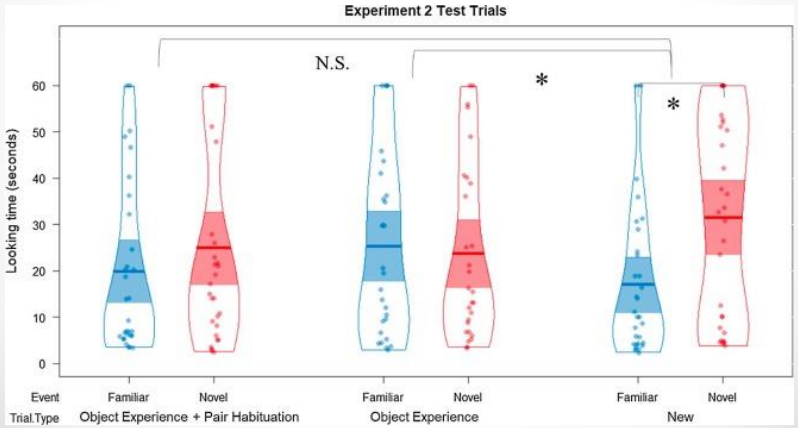
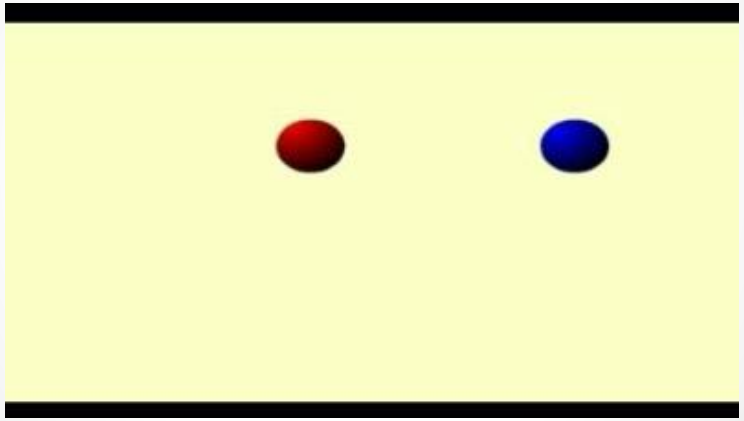


Relational Learning in Infancy

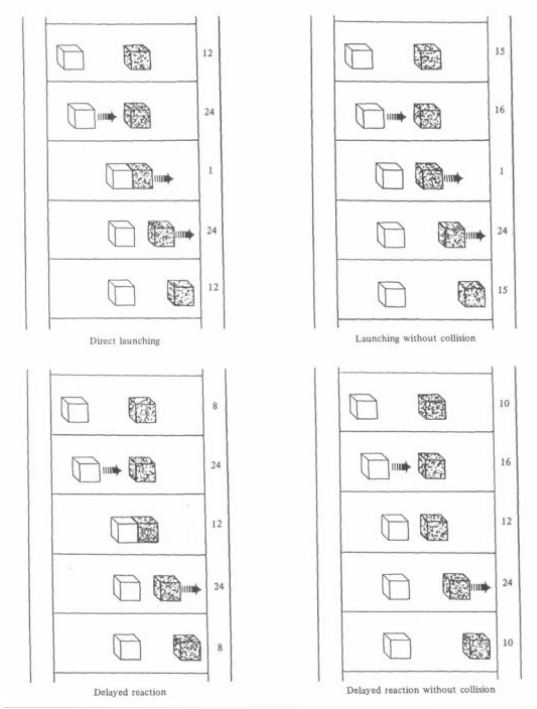
- From 3 months of age, infants, under the right conditions, can abstract same/different relations and generalize across objects
- They can get overloaded!
- For 3-9 months olds, making objects salient, and not part of abstraction learning, interferes with generalization
- Too many pairs for 3-month olds during learning also overwhelms

The perception of causality in events



Causal Perception

- We “see” causality given certain spatial and temporal relationships
- Leslie (1984)
- As common moving surfaces are inputs to core object knowledge, certain spatial-temporal motion relationships are input to core causal knowledge
- Will 6 month-old infants see events as collections of spatial & temporal features, or will they use those features to see them as causal or non-causal?



Causal Perception

Leslie (1984)

6 month-olds

Table 1. Experiment 2: design.

	Group 1	Group 2
Film pairs	DL/DRWC[a]	DR/LWC[a]
Two-feature hypothesis	[+ successive + contact] *versus* [−successive −contact] (both features change)	[−successive +contact] *versus* [+ successive −contact] (both features change)
Causal hypothesis	[+ causal] *versus* [-causal] (causal contrast)	[-causal] *versus* [-causal] (no causal contrast)

[a]DL, direct launching; DR, delayed reaction; DRWC, delayed reaction without collision; LWC, launching without collision.

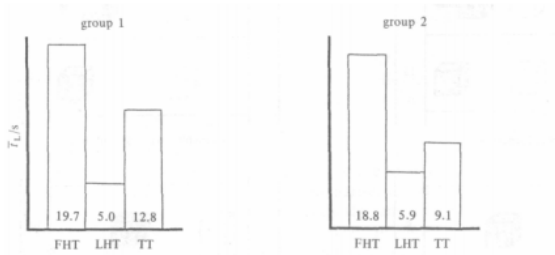


Figure 4. Experiment 2: mean looking time by groups on first habituation trial (FHT), last habituation trial (LHT) and test trial (TT). See table 1 for design.

Causal Perception

Leslie (1984)

6 month-olds

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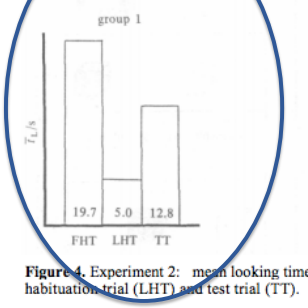

group 1
group 2
$\bar{T}_L$/s
19.7
5.0
12.8
18.8
5.9
9.1
FHT
LHT
TT

Figure 4. Experiment 2: mean looking time by groups on first habituation trial (FHT), last habituation trial (LHT) and test trial (TT). See table 1 for design.

Group 1: Habituates to causal event, tested with non-causal event with both temporal delay and spatial gaps

Table 1. Experiment 2: design.

	Group 1	Group 2
Film pairs	DL/DRWC[a]	DR/LWC[a]
Two-feature hypothesis	[+ successive + contact] *versus* [−successive −contact] (both features change)	[−successive +contact] *versus* [+ successive −contact] (both features change)
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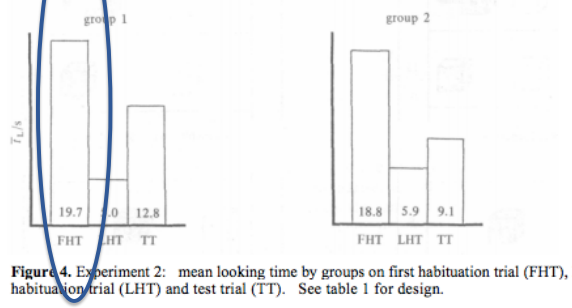

group 1
group 2
$\bar{T}_L$/s
19.7
5.0
12.8
18.8
5.9
9.1
FHT
LHT
TT

Figure 4. Experiment 2: mean looking time by groups on first habituation trial (FHT), last habituation trial (LHT) and test trial (TT). See table 1 for design.

Group 1: First trial of habituation, long looking times

Table 1. Experiment 2: design.

	Group 1	Group 2
Film pairs	DL/DRWC[a]	DR/LWC[a]
Two-feature hypothesis	[+ successive + contact] *versus* [−successive −contact] (both features change)	[−successive +contact] *versus* [+ successive −contact] (both features change)
Causal hypothesis	[+ causal] *versus* [-causal] (causal contrast)	[-causal] *versus* [-causal] (no causal contrast)

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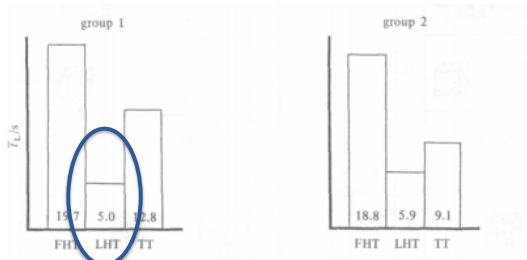

Figure 4. Experiment 2: mean looking time by groups on first habituation trial (FHT), last habituation trial (LHT) and test trial (TT). See table 1 for design.

Group 1: Last habituation trial, short looking times

Table 1. Experiment 2: design.

	Group 1	Group 2
Film pairs	DL/DRWC[a]	DR/LWC[a]
Two-feature hypothesis	[+ successive + contact] *versus* [−successive −contact] (both features change)	[−successive +contact] *versus* [+ successive −contact] (both features change)
Causal hypothesis	[+ causal] *versus* [-causal] (causal contrast)	[-causal] *versus* [-causal] (no causal contrast)

[a]DL, direct launching; DR, delayed reaction; DRWC, delayed reaction without collision; LWC, launching without collision.

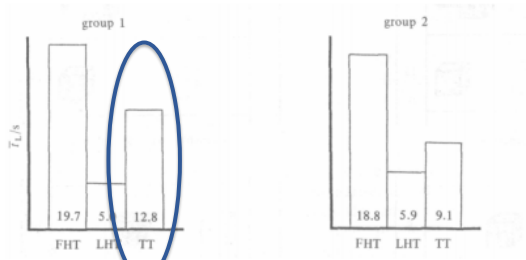

Figure 4. Experiment 2: mean looking time by groups on first habituation trial (FHT), last habituation trial (LHT) and test trial (TT). See table 1 for design.

Group 1: Test trial has long looking times. They discriminate between the causal and non-causal event.

Table 1. Experiment 2: design.

	Group 1	Group 2
Film pairs	DL/DRWC[a]	DR/LWC[a]
Two-feature hypothesis	[+ successive + contact] *versus* [−successive −contact] (both features change)	[−successive +contact] *versus* [+ successive −contact] (both features change)
Causal hypothesis	[+ causal] *versus* [-causal] (causal contrast)	[-causal] *versus* [-causal] (no causal contrast)

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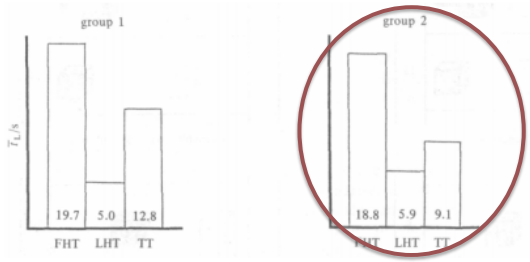

Figure 4. Experiment 2: mean looking time by groups on first habituation trial (FHT), last habituation trial (LHT) and test trial (TT). See table 1 for design.

Group 2: Habituate to a non-causal event (with temporal delay) and then at test see a different non-causal event (spatial gap).

Table 1. Experiment 2: design.

	Group 1	Group 2
Film pairs	DL/DRWC[a]	DR/LWC[a]
Two-feature hypothesis	[+ successive + contact] *versus* [−successive −contact] (both features change)	[−successive +contact] *versus* [+ successive −contact] (both features change)
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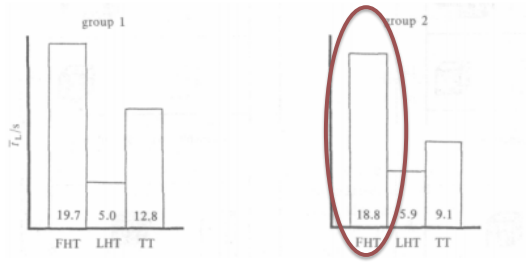

Figure 4. Experiment 2: mean looking time by groups on first habituation trial (FHT), last habituation trial (LHT) and test trial (TT). See table 1 for design.

Group 2: First habituation trial, long looking times

Table 1. Experiment 2: design.

	Group 1	Group 2
Film pairs	DL/DRWC[a]	DR/LWC[a]
Two-feature hypothesis	[+ successive + contact] *versus* [−successive −contact] (both features change)	[−successive +contact] *versus* [+ successive −contact] (both features change)
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[a]DL, direct launching; DR, delayed reaction; DRWC, delayed reaction without collision; LWC, launching without collision.

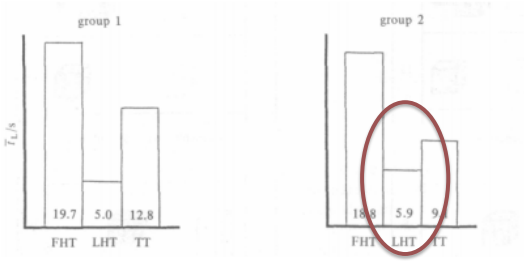

Figure 4. Experiment 2: mean looking time by groups on first habituation trial (FHT), last habituation trial (LHT) and test trial (TT). See table 1 for design.

Group 2: Last habituation trial, short looking times.

Table 1. Experiment 2: design.

	Group 1	Group 2
Film pairs	DL/DRWC[a]	DR/LWC[a]
Two-feature hypothesis	[+ successive + contact] *versus* [−successive −contact] (both features change)	[−successive +contact] *versus* [+ successive −contact] (both features change)
Causal hypothesis	[+ causal] *versus* [-causal] (causal contrast)	[-causal] *versus* [-causal] (no causal contrast)

[a]DL, direct launching; DR, delayed reaction; DRWC, delayed reaction without collision; LWC, launching without collision.

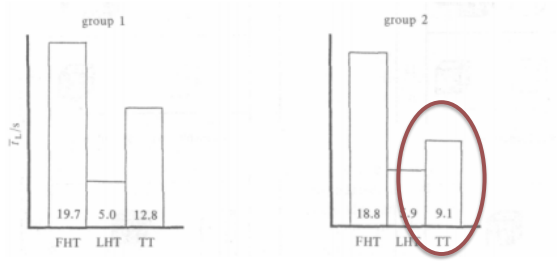

Figure 4. Experiment 2: mean looking time by groups on first habituation trial (FHT), last habituation trial (LHT) and test trial (TT). See table 1 for design.

Group 2: Test trial is not significantly longer than the last habituation trial. They generalized their habituation across non-causal events. They do not appear to discriminate between them, despite their differing spatial and temporal features.

Table 1. Experiment 2: design.

	Group 1	Group 2
Film pairs	DL/DRWC[a]	DR/LWC[a]
Two-feature hypothesis	[+ successive + contact] *versus* [−successive −contact] (both features change)	[−successive +contact] *versus* [+ successive −contact] (both features change)
Causal hypothesis	[+ causal] *versus* [-causal] (causal contrast)	[-causal] *versus* [-causal] (no causal contrast)

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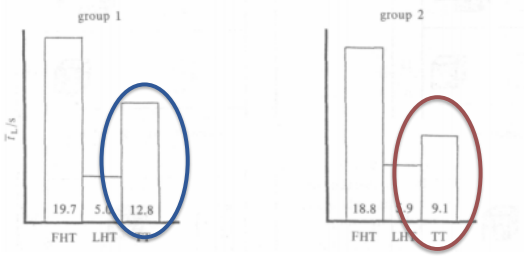


Figure 4. Experiment 2: mean looking time by groups on first habituation trial (FHT), last habituation trial (LHT) and test trial (TT). See table 1 for design.

Across the two conditions, it is clear the infants are responding in terms of causal status. Group 1 dishabituates to a non-causal event after habituating to a causal one. Group 2 generalizes their habituation from one non-causal event to another.

Causal Perception

- We “see” causality given certain spatial and temporal relationships
- Leslie (1984)
- As common moving surfaces are inputs to core object knowledge, certain spatial-temporal motion relationships are input to core causal knowledge
- 6 month-olds treat events as causal, not collections of spatial & temporal features
- Leslie interprets results as evidence for innate causal module

Response from Constructivism

(see Cohen & Cashon, 2006)

- Higher-level units formed lower level units. Learning is hierarchical & constructive
- Infants tend to use highest level units to interpret their environment
- If system gets overloaded, revert to lower-level of processing while incorporating new information

Response from Constructivism

(see Cohen & Cashon, 2006)

- Innate causal module: given certain temporal and spatial cues, infants perceive events as causal
- Constructivism: Causal perception emerges from lower-level features. Infants may be able to perceive causality under some conditions, but may become overloaded in others, and perceive events only in terms of spatial and temporal features.

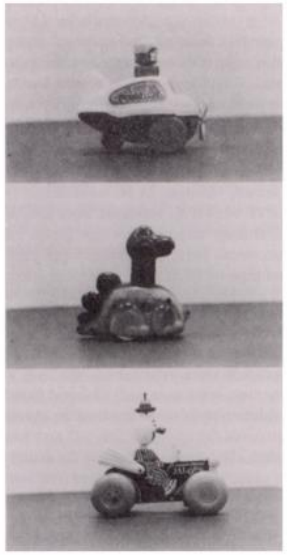


Figure 1. Pictures of the toys used in the events. The airplane and dinosaur were used for the causal and noncausal events. The jalopy was used for the novel event.

Causal Perception

Oakes & Cohen (1990)

6 & 10 month-olds

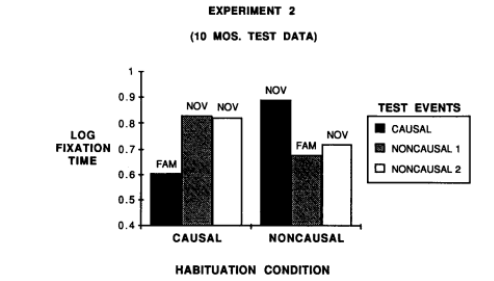
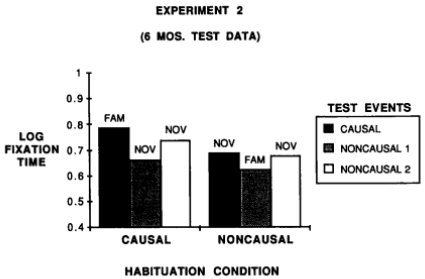


Figure 3. Log 10 fixation times of 10-month-old infants to familiar and novel launching events in Experiment 2.



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Causal Perception

Oakes & Cohen (1990)

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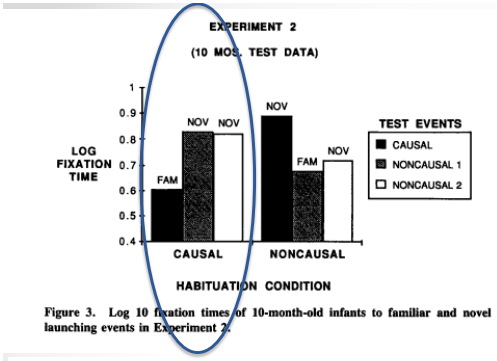

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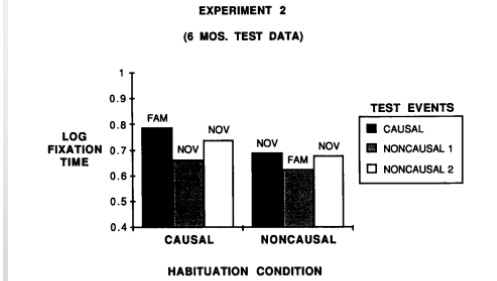
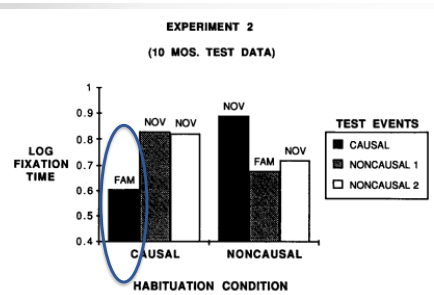


Figure 4. Log 10 fixation times of 6-month-old infants to familiar and novel launching events in Experiment 2.

Test trial data in log (base 10) looking time for 10 month olds habituating to the direct launching causal event.



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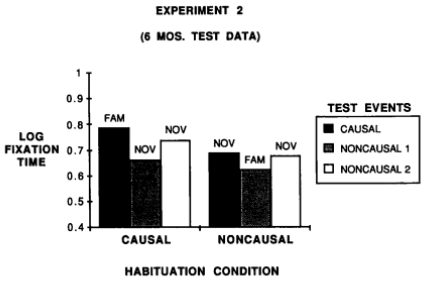


Figure 4. Log 10 fixation times of 6-month-old infants to familiar and novel launching events in Experiment 2.

The familiar causal event shows a low looking time.

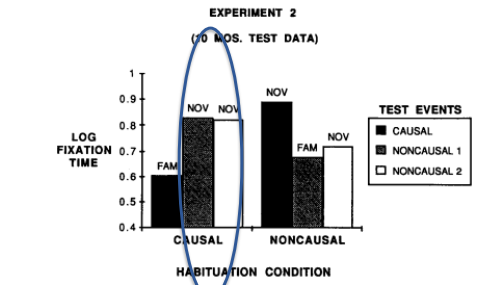


Figure 3. Log 10 fixation times of 10-month-old infants to familiar and novel launching events in Experiment 2.

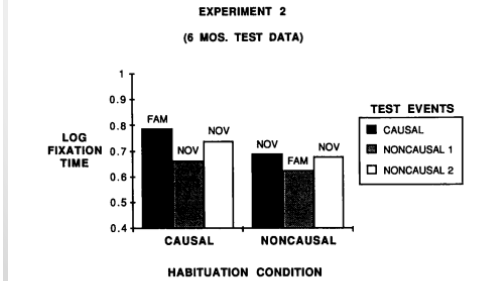
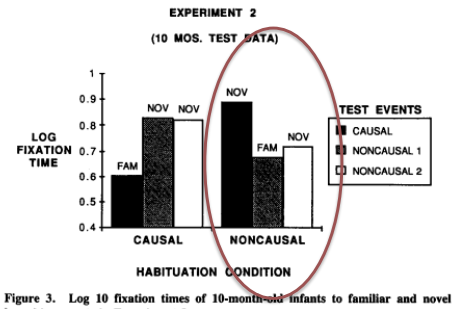


Figure 4. Log 10 fixation times of 6-month-old infants to familiar and novel launching events in Experiment 2.

Both novel non-causal events (temporal delay & spatial gap) show long looking times.
They discriminate between causal and non-causal events.



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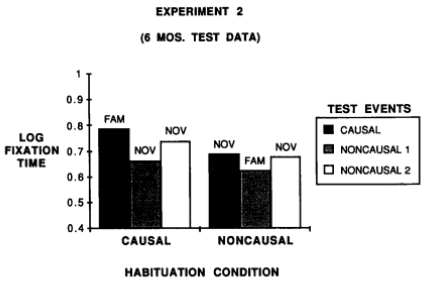
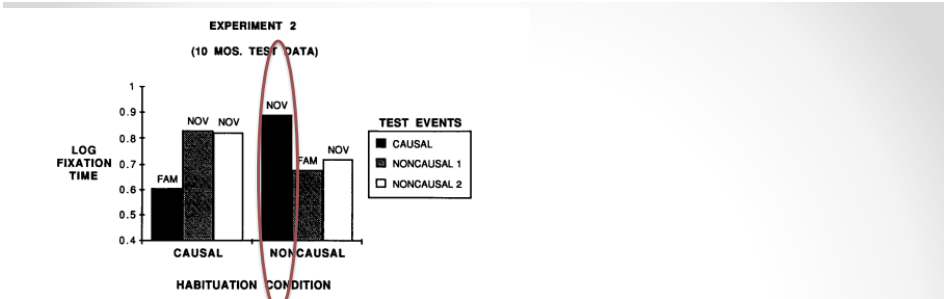


Figure 4. Log 10 fixation times of 6-month-old infants to familiar and novel launching events in Experiment 2.

Test trial data for 10 month olds habituating to one of the non-causal events



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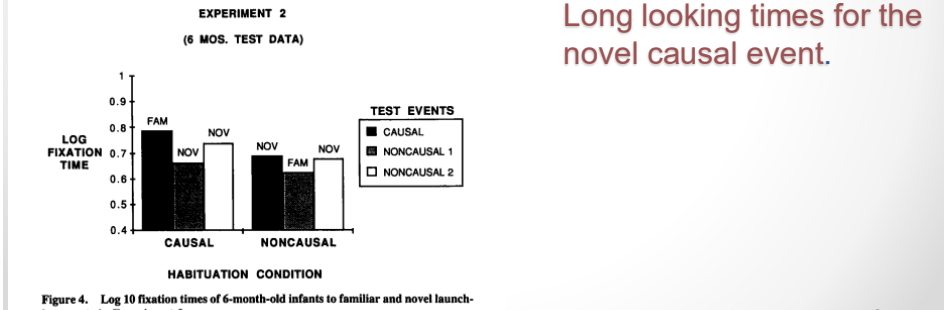


Figure 4. Log 10 fixation times of 6-month-old infants to familiar and novel launching events in Experiment 2.

Long looking times for the novel causal event.

Figure 3. Log 10 fixation times of 10-month-old infants to familiar and novel launching events in Experiment 2.

Figure 4. Log 10 fixation times of 6-month-old infants to familiar and novel launching events in Experiment 2.

Equally short looking times for the familiar non-causal they habituated to and the novel non-causal. They generalized their habituation across spatial and temporal features because of the shared non-causal classification.

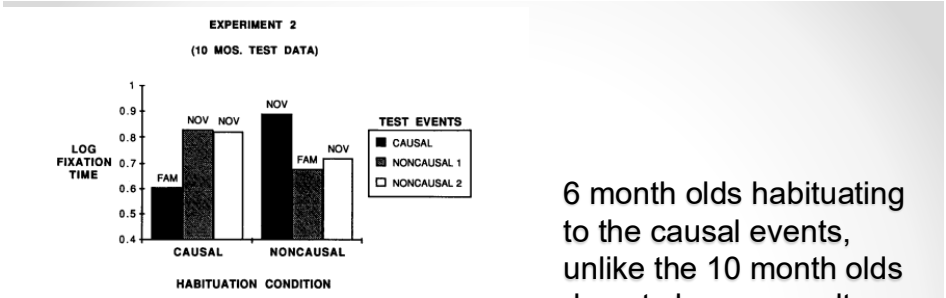


Figure 3. Log 10 fixation times of 10-month-old infants to familiar and novel launching events in Experiment 2.

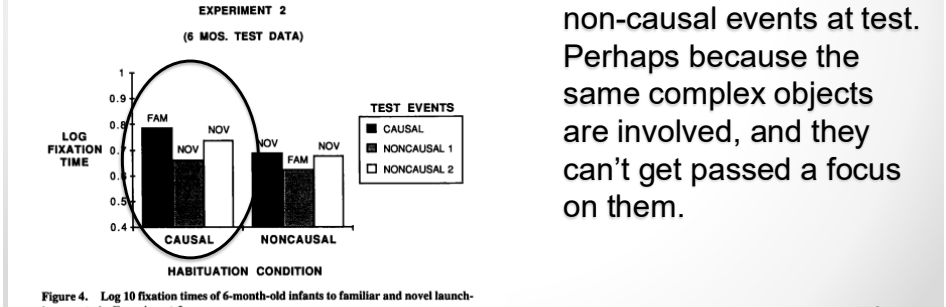


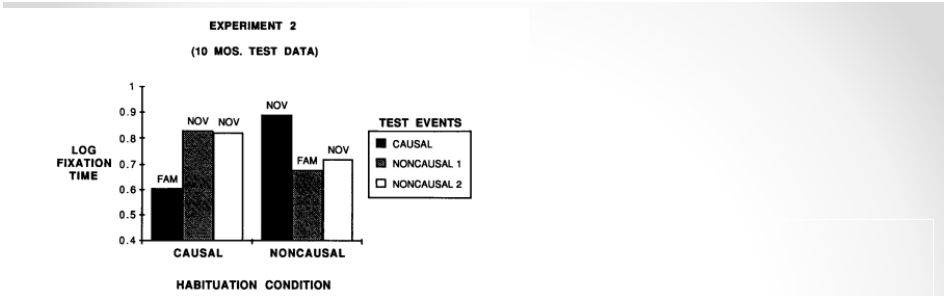
Figure 4. Log 10 fixation times of 6-month-old infants to familiar and novel launching events in Experiment 2.

6 month olds habituating to the causal events, unlike the 10 month olds do not show a novelty preference to the novel non-causal events at test. Perhaps because the same complex objects are involved, and they can't get passed a focus on them.

Figure 3. Log 10 fixation times of 10-month-old infants to familiar and novel launching events in Experiment 2.

Figure 4. Log 10 fixation times of 6-month-old infants to familiar and novel launching events in Experiment 2.

The familiar test trial is actually even longer than the two novel test trials.



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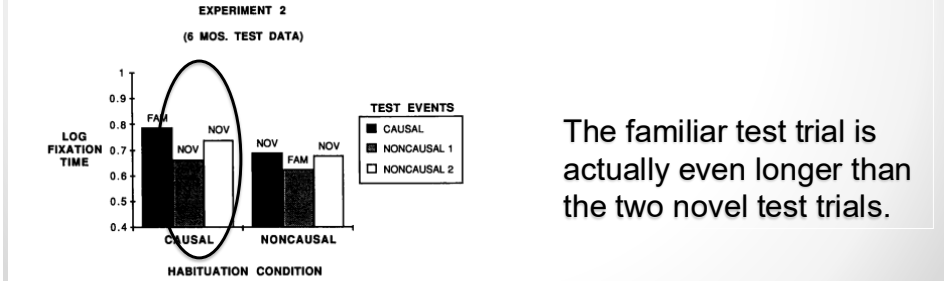


Figure 4. Log 10 fixation times of 6-month-old infants to familiar and novel launching events in Experiment 2.

The familiar test trial is actually even longer than the two novel test trials.

EXPERIMENT 2
(10 MOS. TEST DATA)
LOG FIXATION TIME
1
0.9
0.8
0.7
0.6
0.5
0.4
FAM
NOV
NOV
NOV
FAM
NOV
TEST EVENTS
CAUSAL
NONCAUSAL 1
NONCAUSAL 2
CAUSAL
NONCAUSAL
HABITUATION CONDITION

Figure 3. Log 10 fixation times of 10-month-old infants to familiar and novel launching events in Experiment 2.

EXPERIMENT 2
(6 MOS. TEST DATA)
LOG FIXATION TIME
1
0.9
0.8
0.7
0.6
0.5
0.4
FAM
NOV
NOV
NOV
FAM
NOV
TEST EVENTS
CAUSAL
NONCAUSAL 1
NONCAUSAL 2
CAUSAL
NONCAUSAL
HABITUATION CONDITION

Figure 4. Log 10 fixation times of 6-month-old infants to familiar and novel launching events in Experiment 2.

For the 6 month-olds who habituated to a non-causal event, they looked no longer to the novel causal than the novel non causal, suggesting they are not treating the events in terms of their causal classification.

Response from Constructivism

(see Cohen & Cashon, 2006)

- Leslie (1984) used the same simple objects on every trial

6 months old treated events as causal or non-causal

- Oakes & Cohen (1990) used more complex objects. Same complex objects on every trial

6 month olds responded based on spatial-temporal features

10 month olds treated events as causal or non-causal

- Cohen & Oakes (1993) used complex objects that varied on every trial

Will they be overloaded and revert to spatial-temporal responding?

Cohen & Oakes 1993

- Complex objects that varied on every trial. Same kind of launching events as Oakes & Cohen (1990)

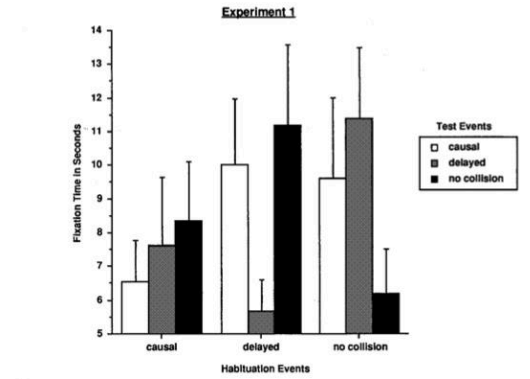
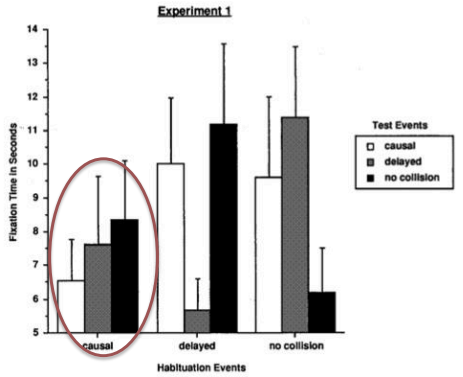


Figure 1. Infant mean fixation times (and standard errors) in Experiment 1 to the causal, delayed, and no-collision test events as a function of type of event received during habituation. (Note that infants habituated to delayed or no-collision events dishabituated as much or more to the novel noncausal event than to the causal event.)

Cohen & Oakes 1993

- Complex objects that varied on every trial. Same kind of launching events as Oakes & Cohen (1990)

- Habituate to causal event
- Do not show much of a novelty preference to either non-causal



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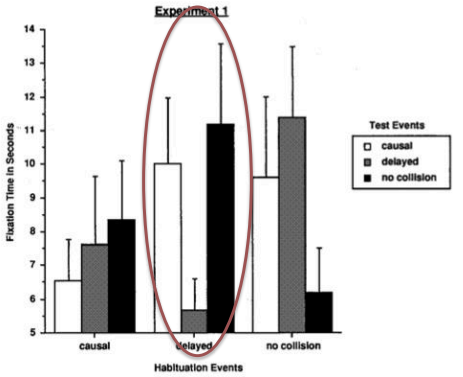
Cohen & Oakes 1993

- Complex objects that varied on every trial. Same kind of launching events as Oakes & Cohen (1990)

- Habituate to temporal delay
- Shows equal novelty preference to causal and spatial gap



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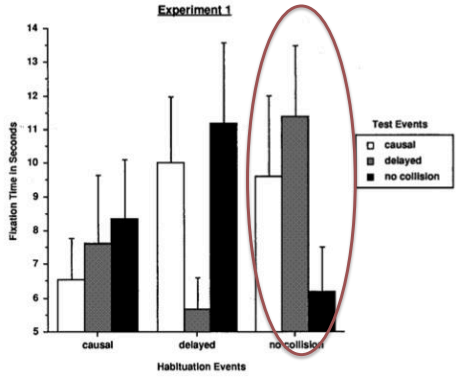

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Response from Constructivism

(see Cohen & Cashon, 2006)

- How does an innate modular account explain the progressions? Why would object complexity affect whether the causal module is employed?

- Oakes & Cohen (1990)

6 month-olds perceive events with simple objects causally, but not events with complex objects

10 month olds perceive events with complex objects causally, when all event exemplars had the same few objects

- Cohen & Oakes (1993)

10 Month-olds fall back to the simpler mode of perceiving events as mere collections of spatial and temporal features. when the complex objects vary across examples of events.

Summary of Infant Relational Learning

- Infants can learn relations from three months of age
- Same/Different learning and causal learning follow constructivist patterns where relational representations are built on top of representations of objects
- In both cases, at young ages, relational representations can be formed, but increased cognitive focus on the objects themselves can disrupt relational processing
- This is the same pattern for learning the statistics among the features in Younger and Cohen research from last lecture.

Abstract Relational Concepts

Relational Learning Beyond Infancy

Micah B. Goldwater, PhD
University of Sydney

The Natural Partitions Hypothesis

Gentner (1982)

- We parse the world into objects and relations among the objects
- Objects are perceptually cohesive: Relations are perhaps harder, dynamic/unstable, indefinite number of options
- Hypothesis: children will form categories of objects before they form categories of relations between objects *universally*
- This means early vocabularies will be filled with simple object nouns, like, *dog* & *chair*, before prepositions *of*, verbs *throw*,and even relational nouns like *guest*.

The Natural Partitions Hypothesis

Gentner (1982)

Early predominance of nouns over verbs found in:

Chintang (Stoll, et al., 2011)
English (e.g., Gentner, 1982; Goldin-Meadow, Seligman, & Gelman, 1976)
Italian (e.g., Caselli, Bates, Casadio, Fenson, Fenson, Sanderl, & Weir, 1995)
Japanese (e.g., Imai, Haryu, & Okada, 2005)
Korean (e.g., Au, Dapretto, & Song, 1994; but see Choi & Gopnik, 1995)
Mandarin (e.g., Liu, Zhau, & Li, 2008; Tardif, Gelman, & Xu, 1999; but see Tardif, 1996)
Navajo (Gentner & Boroditsky, 2009)
Tzeltal (Brown, Gentner, & Braun, 2005)

How are abstract relational concepts learned?

- Last time we talked about identity relations (same/different) and causal perception in infancy

Today, abstracting and generalizing
- Spatial relations
- Causal relations
- Number concepts

- Less time on social relations, but a lot of work on that

Analogical comparison highlights relations

Gentner (1983)

- Rutherford model of the atom
- The atom is like the solar system

Sun is more massive than the planets which causes the planets to revolve around the sun.

Nucleus is more massive than electrons which causes the electrons to revolve around the nucleus.

- aspirin:pain::muffler:noise

Even mundane comparisons highlights relations

- Markman & Gentner (1993)

What goes with this woman from the top picture in the second picture?

Even mundane comparisons highlights relations

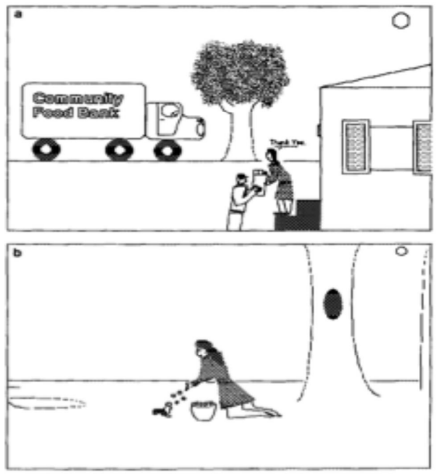
- Markman & Gentner (1993)

What goes with this woman from the top picture in the second picture?

Most people say the other woman

Even mundane comparisons highlights relations

- Markman & Gentner (1993)



What goes with this woman from the top picture in the second picture?

But, if they compare the the two scenes first, they pick the squirrel (each are in the receiving food role).

Even mundane comparisons highlights relations

- Markman & Gentner (1993)

Even simple comparison of simple scenes, shifts focus to relational structure. Similar to more "sophisticated" analogical reasoning

Learning relational concepts

- The relational shift in "the career of similarity"
  - Gentner & Ratterman (1991)
- Consequences for word learning:
- Relational words are learned later
  - e.g., Gentner & Boroditsky (2001)
- Relational words are often assumed to be featural at first
  - Keil & Batterman (1984)
  - *uncle* = beardy guy → uncle = a parents' brother
  - *island* = place with beaches and palm trees → *island* = land surrounded by water

Comparison and the relational shift

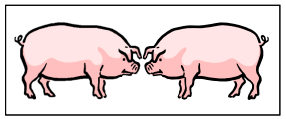
(Christie & Gentner, 2010)

Triad word extension task for a novel relational word

3 year olds
4 year olds

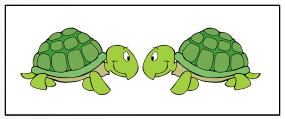
Three conditions: 1 solo example vs. 2 examples presented in sequence vs. Comparison of 2 examples

Solo

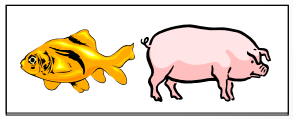


"This is a Toma"

standard 1



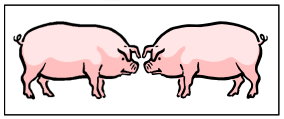
Relational match



Object match

"Which one of these two is also a Toma?"

Comparison

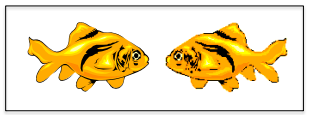


"This is a Toma"

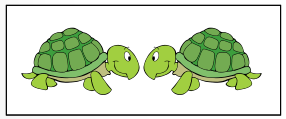
standard 1

"And this is also a Toma"

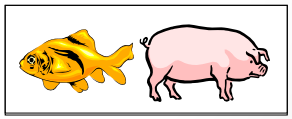
"Can you see why they're both Tomas?"



standard 2



Relational match

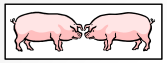


Object match

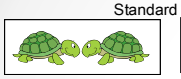
"Which one of these two is also a Toma?"

Solo

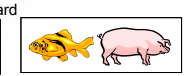
"This is a Toma"



Standard



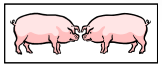
Relational match



Object match

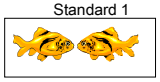
"Which one of these two is also a Toma?"

Comparison



"This is a Toma"

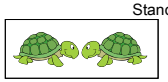
Standard 1



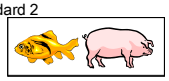
"And this is also a Toma"

"Can you see why they' re both Tomas?"

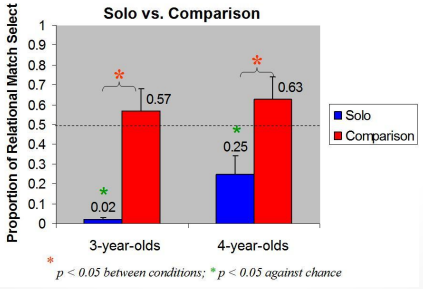
Standard 2



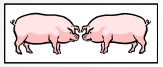
Relational match



Object match



Comparison versus Multiple exemplars

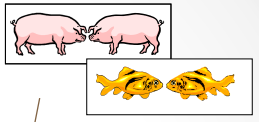


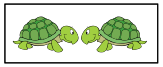
Standard 1

Standard 2

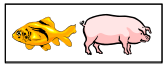
"This is a toma"

"This is a toma"





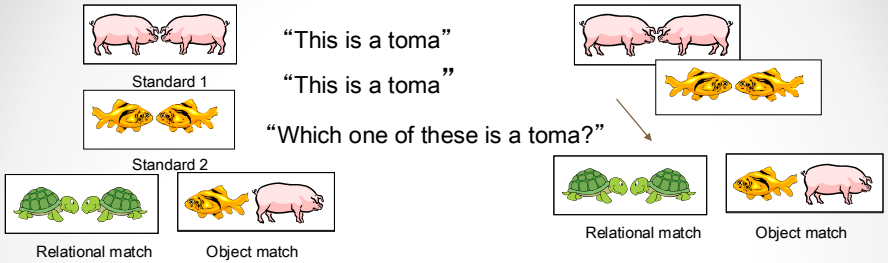
Relational match



Object match

"Which one of these is also a toma"

Comparison vs. Multiple exemplars

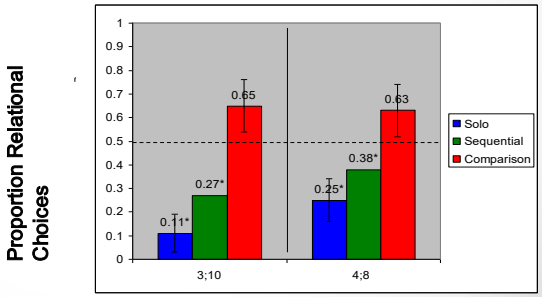


"This is a toma"

"This is a toma"

"Which one of these is a toma?"

This is a similar to pattern to infant relational learning It doesn't matter the age, when learning an entirely novel relation –> comparison helps!



How language fosters relational thinking

- Giving two things a common label is a powerful invitation to compare them, abstract their commonalities
  - Understand their relational structure
- Reify relational systems
- Recall that relations are perceptually ill defined. Systematic relational labeling is critically for having stable relational representations.
  - Homesigners without spatial language have poor spatial skills.
  - Builds on the seedlings of our non-linguistic relational abilities.

Homesign

How language fosters relational thinking

- Gentner, Ozyurek, Gurcanli, Goldin-Meadow (2013)

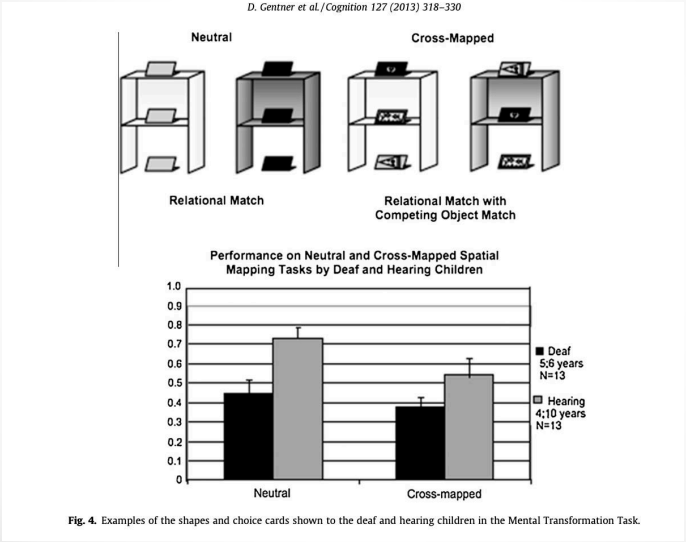


Fig. 4. Examples of the shapes and choice cards shown to the deaf and hearing children in the Mental Transformation Task.

Abstract causal reasoning

- Learning novel spatial relations seem to need a lot of support.
- On the other hand..
- Alison Gopnik (and colleagues) show abstract causal learning during a similar age range
- That is, when children are attempting to figure out what causes what else in the world
  - They are like little scientists who test abstract hypotheses

Abstract causal reasoning

Abstract causal reasoning

- Lucas, Bridgers, Griffiths, & Gopnik (2014)
- 4 year-olds and adults learned about 2 different “blicket” machines
- The first machine would either work with one specific block, or only with a specific combination of blocks
  - Not just any 1 or 2, but specific 1 or 2
- Then the 2nd machine (with a new set of blocks) was presented such that it would be ambiguous between working from 1 specific block, or from 2 specific blocks

Abstract causal reasoning

- Lucas, Bridgers, Griffiths, & Gopnik (2014)
- Adults assumed 1 block for 2nd machine regardless of how the first machine worked
- 4 year-olds interpreted the 2nd in line with the first
- Adults were biased to single-object explanations due to prior experience
- So, kids at least, seem ready to interpret the relations between a new sets of object in terms of just learned causal relations
  - (But next time, we go into some limits on this)

Language and abstract thought: the case of number.

- Carey posits a core knowledge system for number
- However, core knowledge is often qualitatively different than mature conceptual knowledge
- Language plays a key role making this transition

The role of language in Carey's "The Origin of Concepts"

- Core knowledge for number:
- Two systems

1: precise number of small sets

can distinguish 2 dots from 3 dots

2: analog magnitude scale

can distinguish large quantities from others, vaguely

350 dots from 500 dots, not 350 dots from 352 dots

- To learn maths, clearly something needs to change.

The role of language in Carey's "The Origin of Concepts"

- 2 year olds often can count to 10 and beyond, but this doesn't mean they know what those words mean

The role of language in Carey's "The Origin of Concepts"

As suggested by CS2's being qualitatively different from each of the CS1s that contain symbols with numerical content, it is indeed difficult to learn. American middle-class children learn to recite the count list and to carry out the count routine in response to the probe "how many," shortly after their second birthday. They do not learn how counting represents number for another $1\frac{1}{2}$ or 2 years. Young 2-year-olds first assign a cardinal meaning to "one," treating other numerals as equivalent plural markers that contrast in meaning with "one." Some 7 to 9 months later they assign cardinal meaning to "two," but still take all other numerals to mean essential "some," contrasting only with "one" and "two." They then work out the cardinal meaning of "three" and then of "four." This protracted period of development is called the "subset"-knower stage, for children have worked out cardinal meanings for only a subset of the numerals in their count list.

The role of language in Carey's "The Origin of Concepts"

- How does language support the transition from subset knowers to knowing the general principle that the next number in the count list means that previous number + 1?
- For this situation, Gentner's analogical learning view & Carey's core knowledge view give language the same role
- Systematic structure in language can be the basis of an analogy for systematic conceptual structure

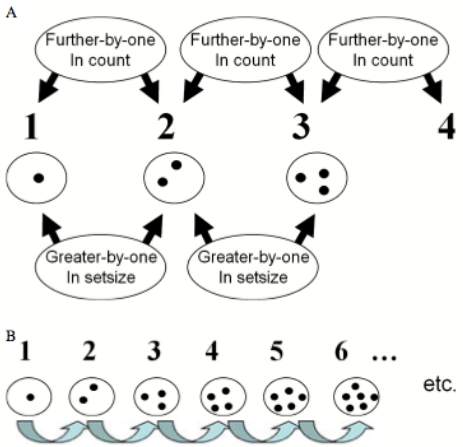


Fig. 4. The analogy linking count sequence and numerical order [based on Carey's (2001, 2004, 2009) proposal]. (A) When the child has "2" connected to set size 2, and "3" to set size 3, this makes two instances of the same relational pattern—permitting an analogy. This analogy invites the inference (not shown here) that the same relational pattern will hold for "4": that is, that its set size will be one greater than the set size of "3." (B) The analogy also invites the abstraction IMPLIES {FURTHER-BY-ONE (count list) → GREATER-BY-ONE (setsize)}, suggesting that the sequence continues indefinitely.

The role of language in Carey's "The Origin of Concepts"

The role of language in Carey's "The Origin of Concepts"

- Evidence that Piraha tribe in Brazil have no numerical language and never leave core knowledge state of numerical cognition
  - See work by Peter Gordon & Mike Frank
  - Sometimes language may support abstract concept learning, but people may still learn these concepts without language. Other abstract concepts seem perhaps unlearnable without language.

Summary of different approaches

Abstract/ Relational Concept

- Infancy: constructivist pattern of building relational representations as a higher-level over object representations
- Gentner's Analogical learner view: the world is naturally partitioned into objects and the relations among them. Our perceptual systems readily process objects, but relations are less perceptually constrained, and so is facilitated with language/comparison. This pattern is common across age groups.
- Carey- Core Knowledge: we are born with core knowledge, but this is inadequate for mature cognition. Language is needed for the conceptual shift to mature cognition (e.g., numbers to do maths).
- Gopnik's hypothesis-testing view: Causal exploration in action reveals abstract thought from early age.

Thinking During Play

Micah B. Goldwater, PhD
University of Sydney

Readings

- Quick commentaries online to see the debate on play-based education

http://www.scholastic.com/teachers/article/early-childhood-today-interviews-dr-herb-ginsburg-math-education-young-children

http://preschoolmatters.org/2014/03/03/play-mathematics-and-false-dichotomies/

http://www.salon.com/2013/08/26/school_is_a_prison_and_damaging_our_kids/

Readings

- Legare (2014) *Child Development Perspectives*
- Siegler, R. S. (2009). *Child Development Perspectives,*

Outline

- General importance of play
- Scientific thinking in play
- Logical thinking in play
- Mathematical thinking in play
- How can we use play to improve early education?

Play is important and is(was) in decline

- Children play, and it is good for them
- Wenner (2009) reviews in Scientific American
- Evidence that play reduces stress and anxiety
  - Anxious kids much less anxious after imaginative play
- Improves social skills
  - After free play, kids given social conflicts to reason about, offer better solutions
- Improves creativity
  - After playing with tools, kids generate more creative uses for them
- Increases self-regulation, lowers impulsivity

Play is important and is(was) in decline

- "According to a paper published in 2005 in the Archives of Pediatrics & Adolescent Medicine, children's free-play time dropped by a quarter between 1981 and 1997. Concerned about getting their kids into the right colleges, parents are sacrificing playtime for more structured activities. As early as preschool, youngsters' after-school hours are now being filled with music lessons and sports—reducing time for the type of imaginative and rambunctious cavorting that fosters creativity and cooperation."

- Peter Gray surveys evidence suggests kids are less creative on the whole than they were
  - See this new paper Gray, P., Lancy, D. F., & Bjorklund, D. F. (2023). Decline in Independent Activity as a Cause of Decline in Children's Mental Well-being: Summary of the Evidence. *The Journal of Pediatrics*, *260*.
  - Already criticisms e.g., comparing mental health across decades is confounded with diagnostic criteria, etc.

What is play like?

- Sensorimotor play
  - learning and repeating action sequences
  - 50% of play up to 2 years of age
- Symbolic/pretend play: multiple kinds
- Constructive play
  - Building/making stuff
  - 50% of play of 4 – 6 year olds
- Dramatic play
  - Imaginary situations and role playing in such situations
  - 2-3 years old often engage in parallel play
  - 3 – 5 more group play
- Games with rules
  - Can be culturally pre-existing games with established rules, or kids can make up their own rules. More structured than dramatic play.
  - Grows dramatically from 4 -7

Thinking in play?

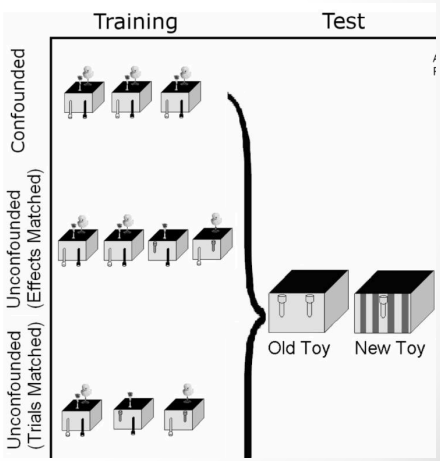
- Often when surveying teachers/parents about how much sophisticated reasoning is in play they say little
- Deny children can think mathematically, logically, and scientifically
  - "preoperational child"
- "it's just child's play"
- Recent research has showed just how sophisticated this thinking is

Scientific thinking in play

- Science is about finding out the causes of natural phenomena
- Children also appear very concerned with what causes things
- They generate causal explanations and explore the world to test their hypotheses

Scientific thinking in play

- Schultz & Bonawitz (2007): Play is about discovering causal structure



Scientific thinking in play

- Schultz & Bonawitz (2007): Play is about discovering causal structure
- Jack-in-the-box type toy with 2 levers, 2 toys pop out (e.g., a donkey and a tiger)
  - One lever causes one toy, the other the other.
- Adult and pre-school child each pull a lever
- Confounded (i.e. ambiguous) condition: adult & child pull both levers at the same time and both toys pop up.
- Unconfounded (i.e. clear) condition condition: adult & child pull levers sequentially and each toy pops up in corresponding sequence
- Then child given option to play with this toy or a new toy
- They choose new toy in unconfounded, old when confounded
- Confounded condition needs more play to figure out how it works.

Causal Reasoning in Play is Abstract: Covered last lecture

- Alison Gopnik has been promoting a position wherein children reason abstractly from quite early on, specifically when engaging in causal reasoning
- Remember: kids are willing to entertain hypotheses that adults may be biased against

Scientific thinking in play

- Despite foundations of scientific thinking, school-aged children and non-scientist adults need instruction to control for variables when testing hypotheses.
  - David Klahr's work.
  - Lennart Schalk and colleagues in Switzerland show that "inquiry-based" primary school physics education improves both COV strategies and physics concepts understanding

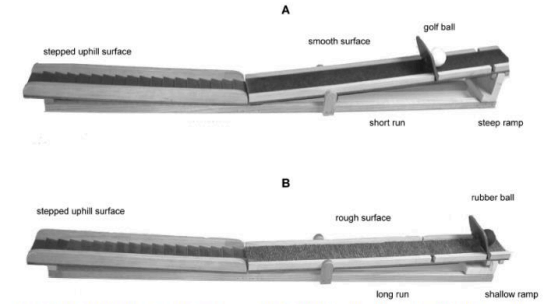


Fig. 1. The ramps used during the exploration and assessment phases. On each of the two ramps, children could vary the steepness, surface, and length of the ramp, as well as the type of ball. The confounded experiment depicted here contrasts (a) a golf ball on a steep, smooth, short ramp with (b) a rubber ball on a shallow, rough, long ramp.

Scientific thinking in play

- Kids will try all sorts of stuff, not systematically control for variables when many are involved.
- Don't have abstract representation for control-for-variables strategy
- In addition
- Domain-knowledge is critical: what are the relevant variables to control for?
  - Think about how different theories tell you which variables are important.
  - When professional scientists don't control for a variable, it's not because they don't have this understanding

- https://twitter.com/C_Hendrick/status/1432405330785443846 discussing

Joseph, G. M., & Patel, V. L. (1990). Domain knowledge and hypothesis generation in diagnostic reasoning. *Medical Decision Making*, *10*(1), 31-44.

Outline

- Logical thinking in play

Logical thinking in play

- Pretend play is often about establishing hypothetical situations and reasoning from the premises of these hypothetical situations
  - Deductive reasoning
- "If we are in a world like X, therefore Y follows, but if it were like A then B follows"
  - Counterfactual reasoning

Logical thinking in play

- Harris (2001): Can children think logically about hypotheticals that contradict their experience?
- "All cats bark. Rex is a cat, does Rex bark?"
- Ask 4 – 6 year olds.
- They say no. Rex is a cat, cats don't bark. Refuse to reason from the false premise. Concrete thinking?
- But simply prompt the question with "Imagine a world where cats bark…"
- Or even "think about how things would be if…"
- Then 4 – 6 year olds could do it no problem.
- Potentially contradicts classic work by collaborators of Vygotsky that abstract logical reasoning was only supported by cultural institutions like schools.

Logical thinking in play

- Buchsbaum et al. (2012). Pretense and counterfactual reasoning
- 3 and 4 year old children are shown a toy that lights up and sings "happy birthday."
- They are shown two objects, a zando and a non-zando. Zandos makes the box play, non-zandos do not. This is demonstrated
- Children are asked "what if the non-zando was a zando, then would the box play?" and vice-versa (counter-factuals)

Logical thinking in play

- Buchsbaum et al. (2012). Pretense and counterfactual reasoning
- Then another experimenter comes in and takes the box and the toys.
- It's a stuffed monkeys birthday, but now they don't have the birthday singing toy. So, the experimenter takes out just some other objects and tells the kid to pretend it's a birthday singing box and that there is a zando and a non-zando.
- Kid is then supposed to reason that the pretend zando can make the pretend toy sing "happy birthday" while the non-zando would not.
- Ability to reason correctly about the pretend zando was correlated with the ability to reason counterfactually earlier.

Logical thinking in play

- Buchsbaum et al. (2012) & Harris (2001) show how children can go beyond their perceptual experience, inhibit the most obvious response about known objects and reason logically

Outline

- Mathematical thinking in play
- How can we use play to improve early education?

Mathematical thinking in play

- Many teachers do not attempt to teach children under 6-7 math beyond simple counting games and using a clock because they don't think kids can think mathematically.
  - And they often hate maths themselves
- Many pre-school teachers (perhaps over-reacting to need for play research) say that teaching is bad for young kids and they just need to play freely to develop properly
- Seo & Ginsburg (2004) catalogue mathematical thinking during play in 4 year-olds to show how much more children are capable of

Mathematical thinking in play

- From Seo & Ginsburg (2004) via Sarama & Clements (2009)
- *Classification*
- This category includes grouping, sorting, or categorizing by attributes. A child cleaned up the blocks on the rug, for example, by taking one block at a time and placing it in a box that contained the same size and shape of blocks. Also a girl took all the plastic bugs out of the container and sorted them by type of bug and then by color. They were classifying.

Mathematical thinking in play

- From Seo & Ginsburg (2004) via Sarama & Clements (2009)
- *Pattern and Shape*
- This category includes identifying or creating patterns or shapes or exploring geometric properties. In one example, a child made a bead necklace, creating a yellow-red color pattern. In another, a boy put a double-unit block on the rug, two unit blocks on the double-unit block, and triangular blocks in the middle, building a symmetrical structure. These children were playing with pattern and shape.

Mathematical thinking in play

- From Seo & Ginsburg (2004) via Sarama & Clements (2009)
- *Magnitude*
- *Enumeration*
- *Dynamics*
- *Spatial relations*

Failures in mathematical thinking

- Why are people so terrible in maths on the whole?
- New York Times magazine recently described a case from the 1980's US where a 1/3 lb burger was marketing to compete with MacDonald's 1/4 lb burger. It failed because people thought 1/4 was bigger than 1/3
- 4 year-olds carefully use symmetry in their block building, but then fail to understand it formally in maths class years later.

Failures in mathematical thinking

- Huge socio-economic class disparities
  - High rates of numerical illiteracy in US lower classes. Can't have a job that requires the use of a cash register
- Already major differences in formal maths reasoning by the start of primary school between SES groups, and numerical competence during childhood predicts longitudinal outcomes.
- Why the early difference?
- No difference between classes in mathematical play
- Large disparities in verbal mathematical reasoning
- But large disparities in quantity and quality of language input/conversation in high vs. low SES groups.
- Low SES kids have less opportunity to reflect on their play and make concepts explicit

Improving mathematical thinking

- Kids show foundations of maths thinking
- This is different than explicit formal reasoning ability
- There needs to be intentional instruction encouraging reflection, explicit thought, and systematic application of mathematical ideas to novel situations

Improving mathematical thinking

- Not recommending to take time away from play to then give 4 year-olds a lecture
- Clements and Sarama say: Educators need to understand what children's thinking is like, and build curricula building on what the children can already do and then formally *mathematicize* their implicit knowledge
- Siegler has a slightly different angle: what is critical to understand what are the key representations, and design games to target those.
  - Rather than gamifying the entire curriculum, you can be more targeted

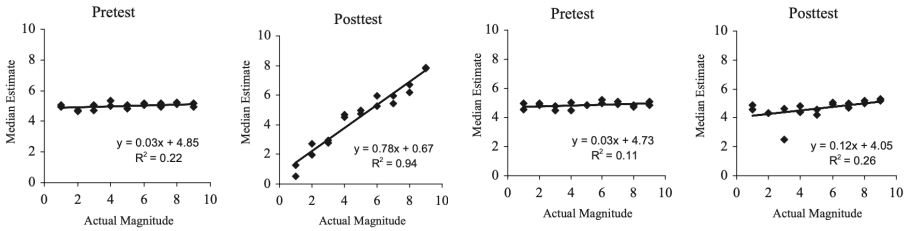
Improving mathematical thinking

- Robert Siegler's "The Great Race" Game
- Number line representations are critical
- Improves numeracy for low SES children, some evidence that complete closes the preschool SES numeracy gap
- Across papers, different control conditions- counting activities, circular version of the game, or a linear game with just the colors, not numbers

Improving mathematical thinking

- Pre-test and post-test measures:
  - number line estimation, 1-10
  - Magnitude comparison "what is more, six cookies or one cookie?"
  - Single digit arithmetic. At post-test, corrective feedback and opportunities to learn more.
- Four 15 minute sessions over two weeks (for linear number game and the controls) and a post-test session later
  - Post-tests: between one week and nine weeks later
- Game play is simply, spin a spinner that lands on a number, move ahead that number of places. First to the end wins

Improving mathematical thinking



Linear board game

Circular game

- Median place on the number line for a condition. At pre-test, median for every number is where 5 should go.
- Only linear number condition significantly improves. Median becomes accurate. Other controls look like circular game.
- Magnitude comparison and arithmetic improves for linear game.
- Little or no improvement on any measure for other conditions.

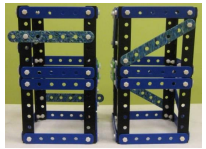
Learning geometric/physical principles in play: Principles of Stable Construction

Dedre Gentner et al., 2016

Collapsed Building

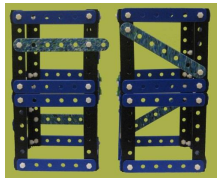
Children often fail in free construction tasks

Goal: teach children a key principle of stable construction: that *diagonal braces* confer stability

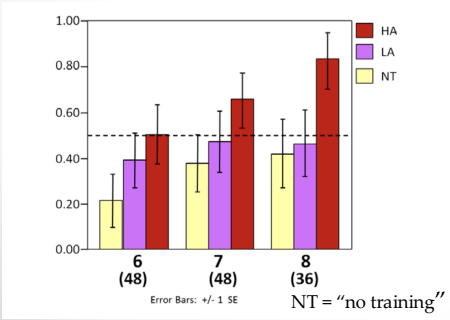


- Basic principle: The triangle is a stable polygon

Low Alignability High Alignability Test



Demonstration part of play session.



NT = "no training"

Follow up work shows that the word "brace" during learning helps even more
Zheng, Goldwater & Gentner (2025)

Improving formal thinking more generally

- If there is no well-designed learning game, you can at least support reflective thinking about their play
- Generally, (outside of maths as well), help children practice reflective reasoning, ask children "why did that happen? Why do you think that? How do you know?"

Thinking in play: Summary

- Free play helps social skills, creativity & reduces stress.
- Before entering primary school, children show sophisticated thinking skills during play
- They test hypotheses to determine cause and effect relationships
- They reason logically (deductively and counter-factually) about imaginary scenarios that conflict with their knowledge and experience
- They show a multitude of mathematical thinking strategies
- Formal scientific and mathematical thinking is still a great challenge
- Early educational curriculum needs to build on their abilities shown in play and make such knowledge the object of explicit reflection and reasoning.

Executive Function

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Readings

- Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science*, *318*(5855), 1387-
- Make sure you check out the supplemental materials to actually see how the study worked
-
- Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4 to 12 years old. *Science*, *333*(6045), 959-964.
  - Read with caution: this describes preliminary findings that some now doubt the conclusions
-
- Hackman, D. A., & Farah, M. J. (2009). Socioeconomic status and the developing brain. *Trends in cognitive sciences*, *13*(2), 65-73.

Outline

- Introduction to Executive Function
- Response Inhibition
- Task Switching
- Working Memory
- SES & Executive Function Interventions

Introduction to Executive Function

Watch later for quick revision

Introduction to Executive Function

- Critical for:
- devising a plan and keeping that plan
- monitoring what you are doing or learning
- metacognitive evaluation
- emotion regulation
- social appropriateness

- The executive of the mind/brain, controls your thoughts, feelings, behaviors.

Development of Executive Function

- Drastic improvements from 3 – 5 years across EF's but keeps on changing/improving through your 20's!
  - Which is why car rentals are much more expensive until you are 25.
- Prefrontal cortex
- Integrates, amplifies, down-regulates information from the rest of the brain
- Major frontal growth in first few years of life
  - Largest time of growth is actually 7-11
- Strengths of connections/myelination continue through adolescence, and recent work documenting the brain changes in prefrontal connectivity through the 20's
  - One important example of prefrontal connectivity: people at risk for depression have less white matter connecting prefrontal cortex and amygdala
  - (work by Chris Beavers, David Schnyer, & Jenni Pacheco)

Response Inhibition

- Most studied EF from developmental perspective
- Inhibit the most immediately alluring or habitual response
- Immediate vs. long term goals
  - It's 5 pm, keep on writing that paper or go have a drink?
- Marshmallow test predictive of lifelong outcomes
  - Worse performance in school, worse liked among peers
  - Likelihood of being a drug addict, not completing high school.
  - Disorders of impulsivity

- More precise measures of behaviours used…

red blue orange purple

orange blue green red

blue purple green red

orange blue red green

purple orange red blue

green red blue purple

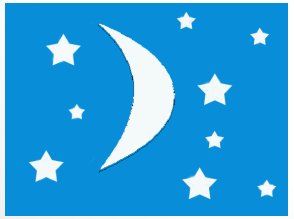
orange blue red green

green purple orange red

Day - night 'Stroop-like' task

When you see:

SAY "NIGHT"



SAY "DAY"

Response Inhibition: Theoretical Implications

- Often claims have been made that children do not possess knowledge of a certain kind, but really they cannot show it because there is a more alluring option
  - Competence V Performance
- Social-cognition
- Analogical reasoning/relational learning
  - Remember the lure of visual features over matching relations? Some say a lot of that is about a lack of response inhibition
  - E.g., Richland, Morrison, & Holyoak (2006)

- Munakata's work argues however that response-inhibition comes from representing goals, and that what changes is the ability for the PFC to represent goals robustly/abstractly enough that immediate stimuli don't drive behaviour

Task Switching/Cognitive Flexibility

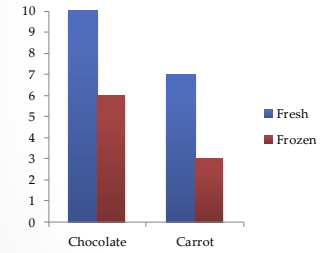
- Dimensional Change Card Sort Task: 3 year-old children possess knowledge of either way to sort categories, but cannot switch from one strategy to the next

Working Memory

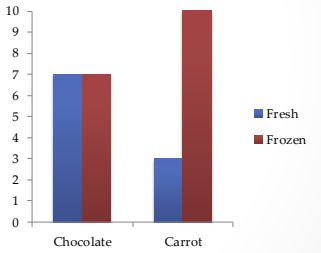
- The amount of stuff you can juggle in your mind at once
- Critical for complex problem solving and learning complex concepts
- Halford's: Relational Complexity Theory → It's not the number of items, but items in relation to one another
  - PFC supports analogical reasoning. Finding commonalities in the relations requires WM, in addition to inhibiting more superficial matches
- If just # of items, they can be processed serially, but the relations among then items force one to process them at once.

Working Memory

- Relational complexity
- Think about 2 main effects vs. an interaction vs. a 3 way interaction.



Fred's Bakery



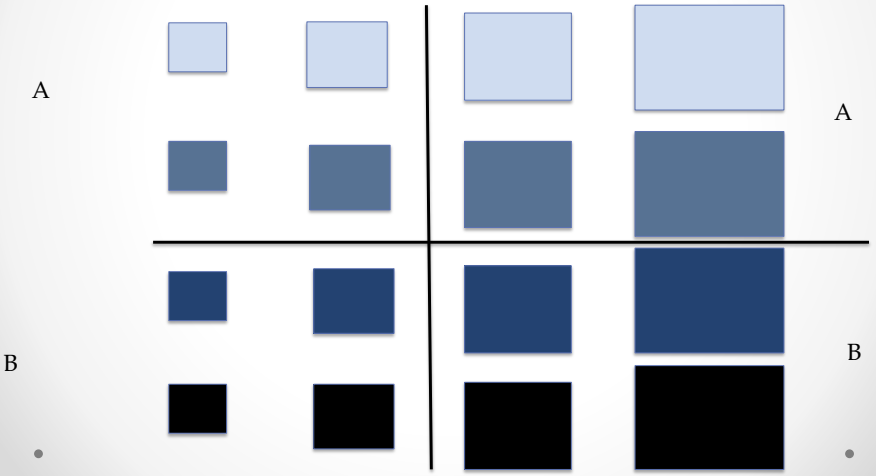
Bob's Bakery

Development of WM

- Andrews & Halford (2002): Children < 5 pretty bad at considering relations between multiple variables at once
  - Across language comprehension, learning, reasoning

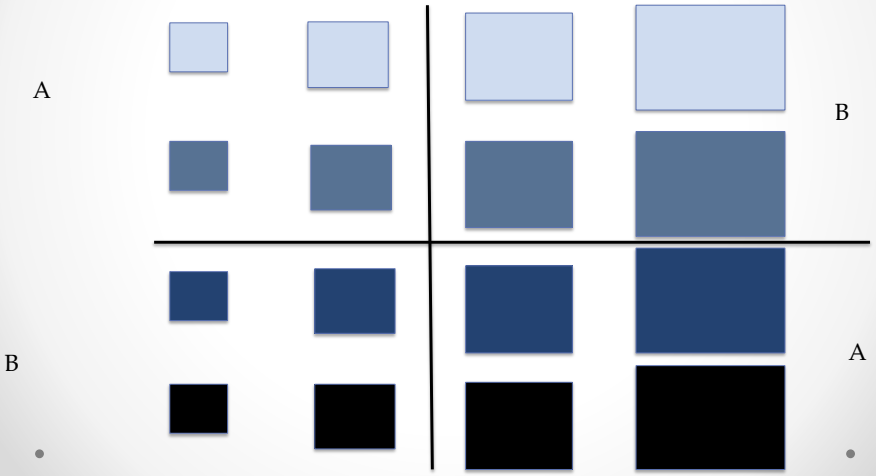
Development of WM

- Example: Categorization
- When adjacent quadrants map to categories -> easy



Development of WM

- Example: Categorization
- When diagonal quadrants map to categories -> hard for pre-schoolers



Interaction of Knowledge & WM

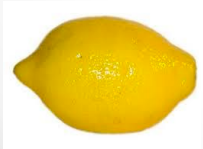
- WM is critical for learning complex concepts
- But high-quality knowledge reduces WM load in problem solving
  - With higher quality stuff in mind, less stuff has to be juggled at once
  - e.g., chess experts
- Why old people can think better than one might predict given decline in PFC function
  - Myelination lessens in old age, reverse of child development
- Also suggests why EF is so critical in childhood: need to acquire the high-quality knowledge in the first place

Interaction of Knowledge & WM

- A:B::C:D analogies: in Piaget's studies Pre-operational children couldn't solve them
- Goswami & Brown (1990): 3 year olds can solve with relations they know


Is to

As


Is to


Interaction of Knowledge & EF

- What is the driver of cognitive development?
- The contemporary update to Piaget focusses on the combination of how increases in knowledge improve how you think and increases in the three EF faculties of "cognitive capacity" improve how you think.
- So, these two factors together, not stage transitions, account for cognitive improvements over development.

Outline

- SES & Executive Function Interventions

SES & Executive Function

- Lower SES children have lower EF's across the board, and this is predictive of educational/longitudinal outcomes
- Stress specifically effects PFC and EF's
- Lack of stimulation & stress hinder PFC growth
- EF and language primary issues that connect SES and achievement
  - Classic language brain areas (Broca's area) is frontal region very involved in verbal working memory
- Hackman & Farah for review

Executive Function Intervention

- Traditional martial arts training, with a focus on discipline and self-control
  - Not just teaching kids how to fight
  - Lakes & Hoyt (2004)
  - This was a single low sample size study.
- "Brain training:" Early computer training games of various kinds showed promise, but have not stood up to scrutiny
- Abcedarian- was not called an EF study, did not directly measure EF, but you can be confident that it improved EF
  - EF and Fluid IQ are very highly correlated.

"Tools of the Mind" curriculum in pre-K Diamond et al. (2007)

- Goal to create a curriculum that any pre-k teacher could implement: no special training or equipment
  - (such as with martials arts training or computer games)
- A Vygotskian, structured play-based curriculum
- Low-income urban public school system agreed to test this curriculum for EF against one it designed to improve early literacy.
- But after some time, all schools starting using Tools because all the kids and teachers were so much happier!
- No behaviour problems in Tools classrooms, so no stressed kids and teachers.
- Evidence that Tools kids go on to have improved literacy and maths skills.

"Tools of the Mind" curriculum in pre-K

- Curriculum/Activities
- Concrete External Aids: for example
- "During the Tools of Mind activity of "Buddy Reading," all children get a picture book, and are told to take turns telling a story that goes with their book to one another in pairs, turning the book's pages and pointing at the pictures as the story progresses. Initially all want to tell their story; none want to listen. The teacher gives one child per pair a drawing of lips and the other a drawing of an ear, explaining that "ears don't talk; ears listen." With the concrete graphic symbol to refer to, preschoolers with the ear inhibit talking, wait their turn, and listen. Children then trade drawings and roles, thus learning to enact the social norms of turn-taking and waiting one's turn. The visual aids remind children who is doing what. After only a few months, the pictures are no longer needed."

"Tools of the Mind" curriculum in pre-K

- Regulate others
- "For example, during a math activity, again done in pairs, one child has a "hand" and counts out objects while the other child checks whether the counting has been correct (the second child serving as a regulator of the first child's performance). The child who is the "checker" waits until the first child finishes counting out the number of objects and then, using a checking sheet, makes sure the answers are correct. This supports self-reflection as well as inhibition. The child who checks inhibits the desire to act until it is his or her turn. The "counter" engages in self-reflection while watching the checking, reflecting on his/her previous answer, thinking about whether it's correct or not. "Reliving" one's actions by watching someone check is practice in self-reflection on action, a metacognitive aspect of EFs."

"Tools of the Mind" curriculum in pre-K

- Private speech to regulate oneself & encourage cognitive flexibility
- Teachers model speaking to oneself during lots of learning activities to be aware of one's thinking
- Pattern Movement Game
- "Children are shown a pattern, such as ABABBA represented by shapes: Triangle, Square, Triangle, Square, Square, Triangle. The teacher assigns specific movements to each shape and the children then enact the pattern as the teacher points to the pattern. Then the shapes are assigned a different set of motor movements and the children have to place a new set of behaviors in working memory and enact them. They have to inhibit the previous set of actions and change to the new actions. Children use private speech to help them remember the changed sets of actions and hold each new set in working memory."

"Tools of the Mind Curriculum" in pre-K

- Dramatic Role Play
- "Children are taught to think about their play scenario ahead of time. Children are taught to plan the play scenario together. They might say, "Let's pretend you're the mommy and I'm the baby. I'll get sick; you'll need to take me to the doctor. She'll be the doctor and give me medicine." The child who'll be Mom might add, "I'll have to drive you there. I'll need a car." After the children agree, they act out the scenario. Then they plan another scenario and play it. "

"Tools of the Mind" curriculum in pre-K

- Dependent measure: Executive function computer-based task no child had any familiarity
  - Attentional control

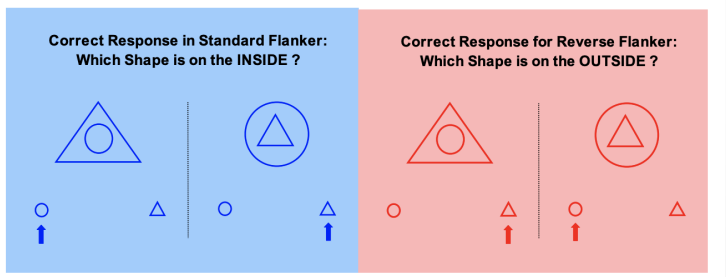
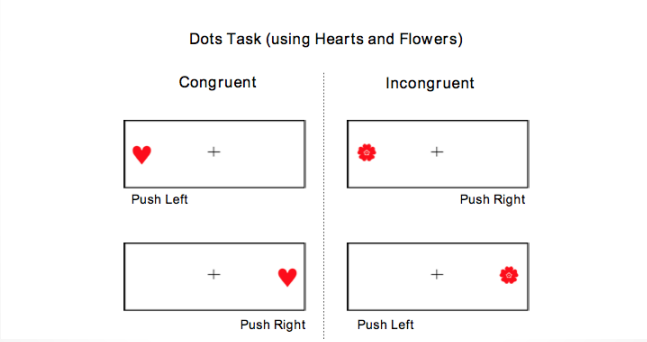


Figure S7. Two trials of the standard flanker and reverse flanker conditions are shown.

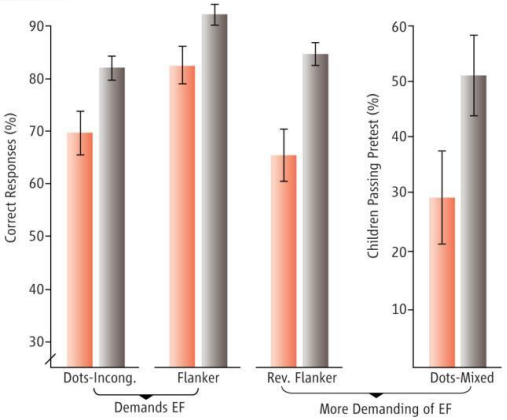
"Tools of the Mind" curriculum in pre-K

- Dependent measure: Executive function computer-based task no child had any familiarity
  - Requires maintaining multiple rules in mind, inhibit responses



"Tools of the Mind" curriculum in pre-K

- Tools > Control especially when EF demands were higher (trials were intermixed on dots, and reverse flanker)



Grey- Tools
Red - Control

"Tools of the Mind" since Diamond et al. (2007)

- Both Pre-K and Kindergarten versions
- Early promising results that started to fizzle a bit
- 2017 systematic review showed that there was some evidence for increased school performance, cognitive, and social benefits, but weak
- Blair et al. (2018): RCT of Kindergarten program- improved socio-emotional outcomes related to aggressive behaviour between children, better teacher-student relationships
- Diamond et al. (2019): RCT of Kindergarten program shows benefits for literacy, and EF-in class gains
  - Sustained task-focus without supervision

Principles of EF Interventions

- Biggest benefits for children with the biggest deficits
  - You can't create super EF children, but you can potentially level the playing field
- Time intensive and adaptive training is critical
  - Limits need to be pushed frequently, and setting higher and higher standards as improvements are seen

Executive Function: Summary

- From 3 – 5 years old there are drastic changes in prefrontal function, but continues into early 20's.
- Inhibitory control, task switching, and working memory
- Critical for emotion regulation, social appropriateness, learning complex concepts
- EF's during early childhood predict longitudinal outcomes in many domains of achievement in life
- Low SES children at risk from stressful environment to have EF deficit
- Interventions show promise to improve at-risk children's EF

Introduction to Language Development

Micah B. Goldwater, PhD
University of Sydney

Readings for all 3 lectures

- Tomasello, M. (2000). The item-based nature of children's early syntactic development. *Trends in cognitive sciences*, *4*(4), 156-163.
- Fisher, C. (2002). The role of abstract syntactic knowledge in language acquisition: a reply to. *Cognition*, *82*(3), 259-278.
- Senghas, A., Kita, S., & Özyürek, A. (2004). Children creating core properties of language: Evidence from an emerging sign language in Nicaragua. *Science*, *305*(5691), 1779-1782.

A nice accessible discussion of Chomskian-linguistics from a historical perspective
http://inference-review.com/article/the-recovery-of-case

General audience writing of anti-Chomskian view
https://www.scientificamerican.com/article/evidence-rebuts-chomsky-s-theory-of-language-learning/

Outline

- Introducing language and the problem of language learning
- Infant speech/perception
- Quick overviews of early word learning, grammatical and pragmatic development
- Humans create language whenever they can

Why Language?

- Why does language get "special attention"?
- Critical for thinking & problem solving, socializing, cultural transmission.
- Some have thought language is the critical difference between humans and other animals.
  - The structural difference between human and animal communication is proposed to either be or reveal the capacities that have enabled civilization, culture, etc.

Aspects of Language

Phonology	Semantics	Syntax	Pragmatic
What sounds (and what combinations) are admissible in a language	Word & Sentence meanings	Grammar: how to put words together	Social conventions about use of language

Side note: Prescriptivism vs. Descriptivism

- Most people's experience with "grammar" is being told they are not using it properly
  - "don't end a sentence with a preposition" or "don't use the passive"
- (Psycho)Linguistics is not concerned with "proper usage" in this sense
- Our concern is how people actually *do* represent, process, and use language, not how they *should*
  - Not that there is anything a priori wrong with improving one's writing to meet professional standard's or greater aesthetic value, it's just not what this field of research is about.

The problem of language learning

- Infants must learn what sounds their language uses
  - R/L are two distinct sounds in English, not in Japanese
- Parse the continuous speech stream into words
  - We think there are gaps between words: there are not
- Learn the meanings of 20,000+ words
- Learn the rules of putting words together
  - In English, verbs tend to be in the middle of sentences, in Korean, at the end
- Learn the social conventions of language
  - Literal vs. figurative, polite vs. rude

The problem of language learning

- Learning a hierarchical system
- Language is componential and compositional
- At each level of description there is a finite set of units that get combined productively with a finite set of rules
- Speech sounds into syllables into words into sentences into discourses
- Not any two sounds can combine to make a syllable
  - St = ok, df = not ok
- Some combinations of words do not go together
  - Words combinations some of go not do
- Not any two sentences can go together to make a coherent discourse
  - Bill says: “Hi, I’m Bill, nice to meet you.” Fred says: “Chomsky’s media criticism, as shown in the documentary “Manufacturing Consent,” and his linguistic theory are united by assuming a deep structure beneath the perceivable surface, that explains what we can perceive .”
- Because of these constraints, language is infinitely productive
  - (will explain how over the next few lectures)

Outline

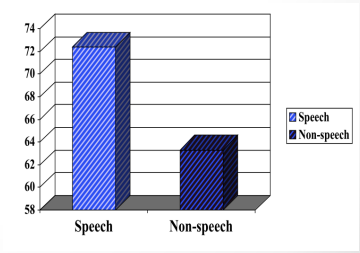
- Infant speech/perception
- Quick overviews of early word learning, grammatical and pragmatic development

Infant Vocalizations

- **2 month-olds coo:**
- Produce simple speech sounds (gooo, aaahh) and vocal gymnastics (smacks, clicks, bubbles)
- Improved motor control of vocalizations
- Imitate sounds of their partners, high pitched for Mom and lower for Dad
- Increase in vocal complexity
- **6 month-olds babble:**
- Repeated consonant vowels patterns that become more varied
- By 10 months: native language specific babbling.
- **12 month-olds: first words**

Newborn Speech Perception

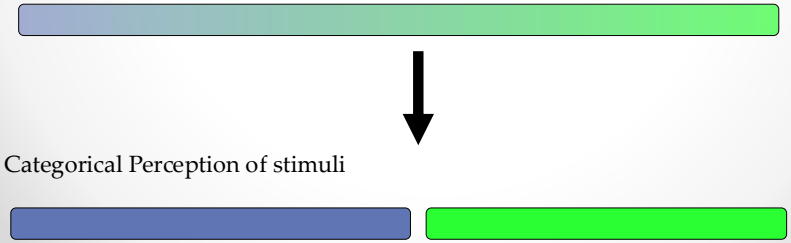
- Recognize the prosody of their native language!
  - Prosody = pitch contours
- Prefer speech to non-speech
  - Vouloumanos & Werker, *Dev Sci*, 2004; 2007
  - High Amplitude Sucking Procedure
  - Alternating minutes, speech & nonspeech
  - More HA sucks to speech



Infant Speech Perception

- Acoustic properties of speech sounds vary
  - Some variance is important, some not
- Not all languages use the same contrastive sounds
- Child's task: Figure out what sounds their native language uses contrastively.
- Categorical perception of phonemes: some variance generalize across, others draw boundaries.

Actual stimuli



Categorical Perception of stimuli

Discrimination Task

"Are these two sounds the same or different?"

Across-Category Discrimination is Easy

Within-Category Discrimination is Hard

Discrimination Task

"Are these two sounds the same or different?"

D 0ms 20ms D

D 20ms 40ms T

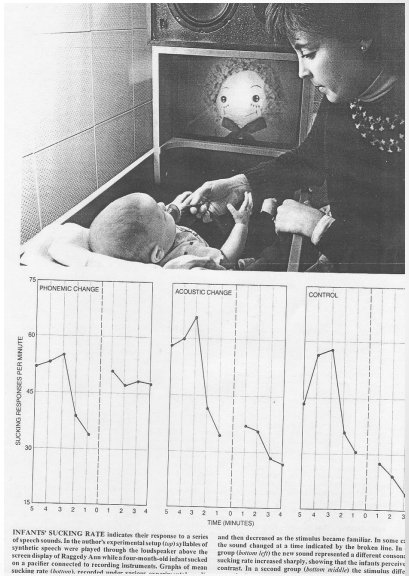
T 40ms 60ms T

Across-Category Discrimination is Easy

Within-Category Discrimination is Hard

Categorical Perception

- Habituation method tests category-discrimination in infants (Eimas, Siqueland, Jusczyk, & Vigorito, 1971)
- Organization from the first days of life



Infant Speech Perception: What Changes?

- Infants show categorical perception across the world's language sounds in first half of 1st year
- By 10 months of age, infants are no longer discriminating phonemic contrasts irrelevant to their language
  - e.g.,Japanese infants no longer discriminate between R and L
- Why is this adaptive?
- Every time you hear a sound, it has slightly different qualities (e.g., across speakers).
- Learners need to learn which contrasts are functionally important, i.e., signify different words

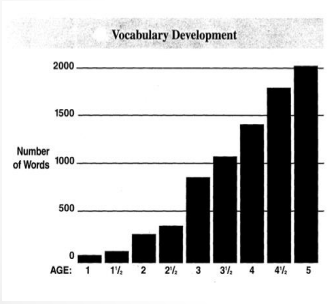
Infant Speech Segmentation

- Will discuss further in oncoming lectures but:
- Host of properties
- e.g., stress patterns
- Any utterance with only one stressed syllable (**Man**; **Du**sty; Spa**ghe**tti) is a single word, no matter how long it is.
- Gambell & Yang (2003; 2005)

Word Learning

- 1st words at 12 months

Vocabulary explosion (approx 2 - 6 years)



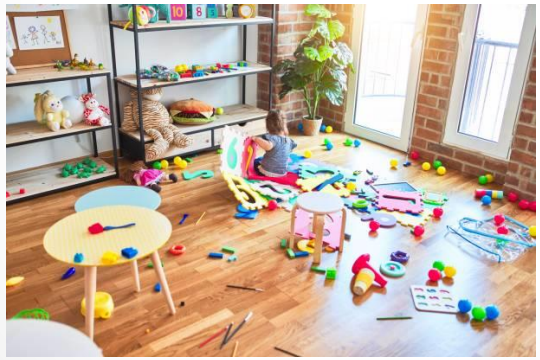
Children's vocabulary grows from
100-2000 words at age 2,
to 5000-20,000 words at age 7

Cognitive Mechanisms of Word Learning

- We already saw the importance of statistical/associative learning in the development of the shape bias
- Other cognitive processes too.

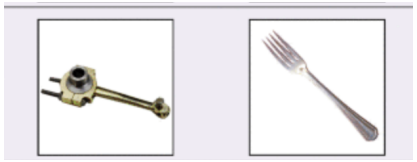
Cognitive Mechanisms of Word Learning: Social Inference

- Children can track the intentions of adults, including "Referential intent" e.g., by following gaze



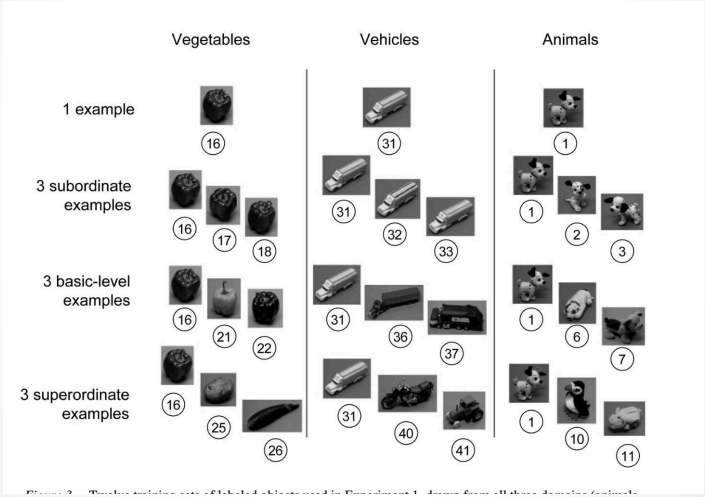
Cognitive Mechanisms of Word Learning: Social Inference

- Mutual exclusivity - see Ellen Markman; Eve Clark
- "Hand me the dax?"

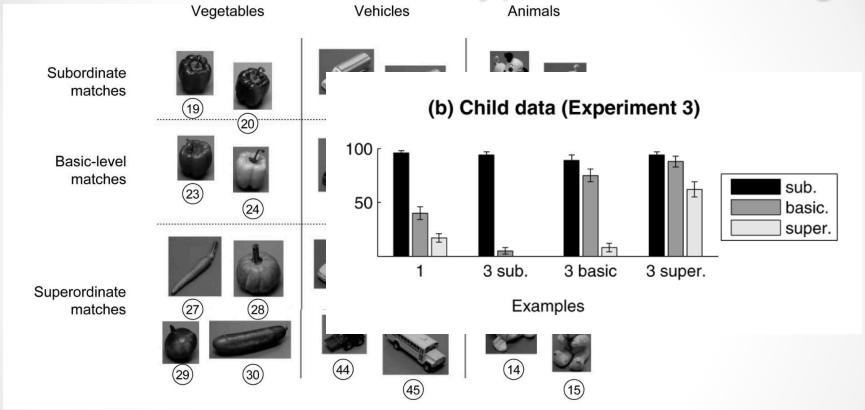


- 95% of 3 year-olds pick the unfamiliar object
  - Wilson & Katsos (2021)

Cognitive Mechanisms of Word Learning: Social Inference + Hypothesis Testing

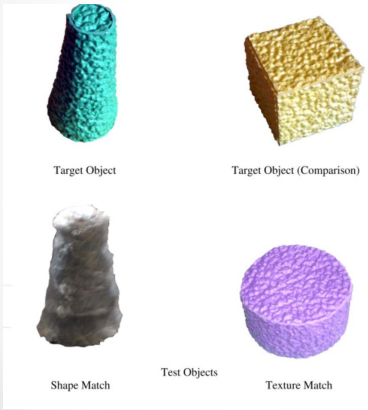


Cognitive Mechanisms of Word Learning: Social Inference + Hypothesis Testing



3 and 4 year-old children

Cognitive Mechanisms of Word Learning: Comparison



3-5 year-olds
When a single object- 7% texture
Shows a default strong shape bias

Two objects compared, 75% texture

Graham, Namy, Gentner & Meagher, 2020

Beginnings of Syntax

- 18 months: 2 word combinations
- The two words chosen are not random (e.g., "Daddy went to work" becomes "Daddy work")
- Child maintains most important content words and word order
- Grammar ability correlates with size of vocabulary

Morpho-Syntax

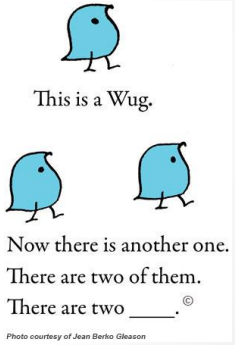
- Morphemes: meaningful units of language
- Some words have just 1: sport, man, bag
- Others are compounds of single morpheme words: tugboat
- Syntactic morphemes have syntactic function and add meaning
- Inflectional morpheme: changes in number and tense, e.g., plural “s”, past tense “ed”
- Derivational morpheme: change grammatical category, e.g., -tion turning verb into a noun “destruction”

Morpho-Syntax

- 2-3 children show productive mastery of basic inflectional morphology as shown by applying them to novel words

- Further, overgeneralization:
- tooths, mouses

- Often kids imitate irregulars
- Then learn the rules and overextend
- Then re-learn irregulars



- We're going to focus on syntax more later, but from 2 – 5 the complexity of syntactic production rapidly increases

Pragmatics

- Sophisticated pragmatics develops through middle childhood along with general social cognitive (e.g., advanced ToM abilities)
- Adjusting kinds of language for different contexts fluidly
- Metaphor, use of idioms irony, sarcasm develop 6-8
  - All non-literal language use require understanding communicative intention
- ASD children with otherwise good language skills are still behind on pragmatics
- Vocabularies and pragmatic skills just keep on growing and developing

Outline

- Humans create language whenever they can

What if you don't have access to language?

- Many deaf children are born to speaking parents: what happens?
- If they do not have interaction with any sign language they invent simple gestural systems to communicate some basic stuff: "home-sign"
- If not exposed to sign language by puberty, they most likely will never get beyond home-sign

What if you don't have access to language?

- If parents learn to sign, then children learn it from them better then the parents know it themselves!
- Singleton & Newport (2004), case study
- Hearing parents would use correct inflectional and derivational morphemes ~70%, the rest a mix of errors
- 7 year-old child of deaf parents used correct morpheme >80%, same as sample of native signers
  - If deaf children have native signing parents, there are no language delays compared to speaking parents.
- Children found the signal in the noise and exploited it

What if you don't have access to language?

- Hudson Kam & Newport (2005) show this pattern with large sample of hearing children learning stochastic artificial grammar
  - Adults reproduce variability of input grammar, 5-7 year-old children more likely to regularize
- 7 sessions of 20 minutes to learn a fake language with 17 words: 4 verbs, 12 nouns, and 1 determiner
  - Simple syntax of "the bear falls" or "the bear eats the fruit"
- Two conditions 100% determiner use, or 60%
- Then task is "In the silly language, say "the bear falls"
- Participants were classified as "systematic determiner users" e.g., always used in one way, such as for subject ("the bear" above) or object nouns ("the fruit" above)

What if you don't have access to language?

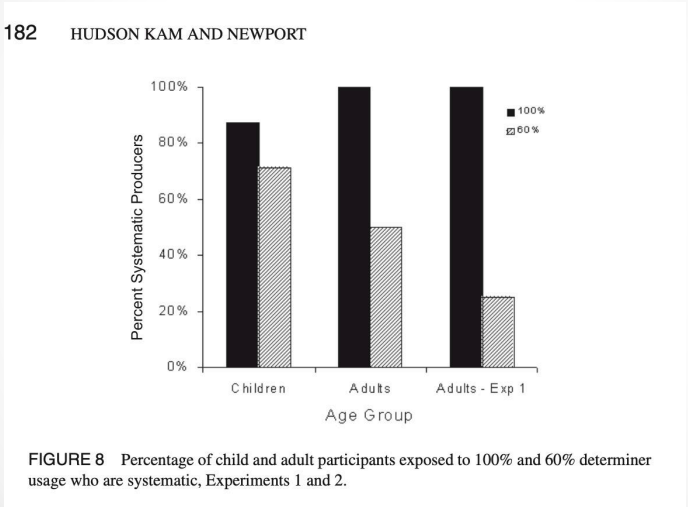


FIGURE 8 Percentage of child and adult participants exposed to 100% and 60% determiner usage who are systematic, Experiments 1 and 2.

What if you don't have access to language?

- (at least from 2 -6 minutes)

Introduction to Language: Summary

- Language is hierarchically structured/composed from the physical structure of the signal to rules for combining words and sentences into discourses
- 1st year of life: children learn to focus only on sound categories of native language, segment words from speech, and produce sounds just from native language
- 2nd year: word learning begins, & accelerates rapidly along with onset of multi-word utterances towards end
- Toddlers learn morpho-syntactic rules and (over)generalize them to new words.
- Pragmatics grow with general social/cognitive skills in middle childhood.
- With no input, deaf children gesture to communicate
- With a community of others, or faulty input from parents, deaf children create systematic language use

Language Development: Nativist approaches

Micah B. Goldwater, PhD
University of Sydney

Outline

- Universal Grammar and nativist arguments from the complexity of syntax
- Evidence in support of UG from child language production
- Nativist arguments from sensitive periods and children generating language (in NSL)
- Simpler nativism: early abstraction accounts

Our knowledge of syntax is subtle and complex

- Some examples from Jackendoff (2002)

For a different sort of phenomenon, consider the examples in (11). The italicized elements are understood as having a role appropriate to the position marked by *t*. For instance, in (11a), *which movie* is understood as the object of the verb *saw*:

(11) a. *Which movie* does Susan imagine that Sarah saw *t* last night? [*wh*-direct question]
b. John was wondering *who* Sarah decided she would go to the movies with *t* on Sunday. [Indirect question]
c. I didn't like the movie *which* you said that, everyone was talking about *t* the other day. [Relative clause]
d. You may take *whichever sandwich* you find *t* on the table over there. [Free relative]
e. *That movie*, I wouldn't recommend that anyone consider taking their kids to *t*. [Topicalization]

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(11) a. *Which movie* does Susan imagine that Sarah saw *t* last night? [*wh*-direct question]
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d. You may take *whichever sandwich* you find *t* on the table over there. [Free relative]
e. *That movie*, I wouldn't recommend that anyone consider taking their kids to *t*. [Topicalization]

(12) a. **What* did Beth eat peanut butter and *t* for dinner?
b. **Who* does Sam know a girl who is in love with *t*?
c. **Who* does Betty know which professor flunked *t*?
d. **What food* were you never aware of the hypothesis that you shouldn't eat *t*?

Where does knowledge of language come from?

Where does knowledge of language come from?

Noam Chomsky: Reinforcement learning (proposed by behaviorists) and sensorimotor learning mechanisms (as proposed by Piaget) cannot explain the acquisition of human language.

Human language is too computationally complex. Language is composed of abstract syntactic rules that can generate an infinite number of novel sentences, that don't even have to make any sense!

"Colorless green ideas sleep furiously"

Where does knowledge of language come from?

Recursion: Sentences can be embedded within sentences

The man is tall.
The man who likes cats is tall.
The man who likes cats that went to the store yesterday is tall.
The man who likes cats that went to the store yesterday to pick up a new tie to match his shirt is tall.

Chomsky argued you can't get that from Skinner's or Piaget's "general learning mechanisms." Thus, language must have special innate properties.

Only human language shows recursion (among primates. Some bird song and dolphin communication shows such structure).

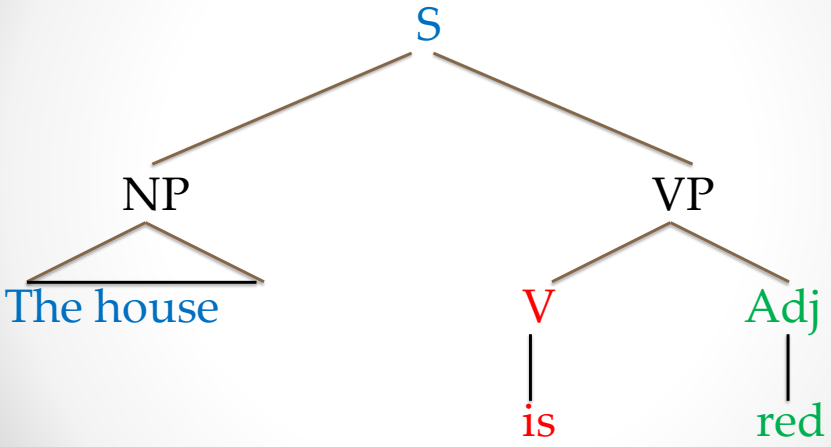
Where does knowledge of language come from?

- At some level, clearly in our genetic endowment is the ability to learn language and all it's complexities
  - Also true of everything we learn/do
- So, what specifically is in UG?
- Structured representations with abstract syntactic categories
- For example, that sentences are composed of noun phrases and verb phrases, and verb phrases are composed of verbs and noun phrases
- Rules operate over phrases.

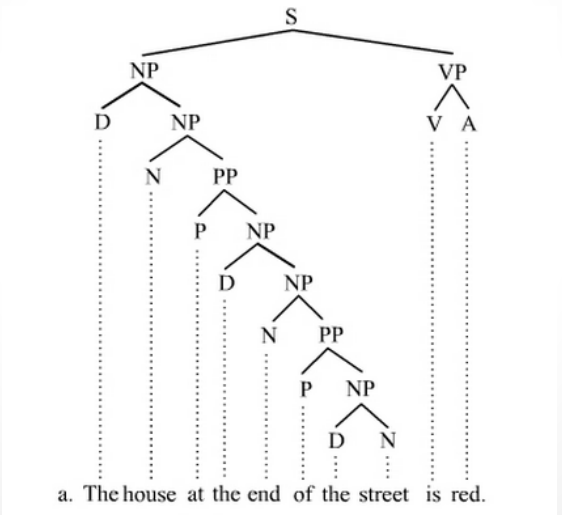
What's a phrase?

- A group of words that form a functional/structural unit.
- For example, a noun phrase can consist of a determiner and a noun, such as "the dog" and one can add modifiers such as "the dog by the house."
- Those modifiers can have phrases within them, e.g., "by the house" is a prepositional phrase that has another noun phrase "the house" within it.
- Phrases are hierarchically organized.

Example hierarchically structured syntax tree



Example hierarchically structured syntax tree



How can you tell what is in a phrase?

1 example way: pronominal reference:

e.g., “it is red.” “it” can take the place of the entire noun phrase regardless of how much stuff is embedded in it, but it can’t take less than all of it, e.g., “the it is red” is bad

“A man with dark glasses is following us” →

OK= “He is following us”

Not OK = “He with dark glasses is following us”

“We watched a documentary about cheese making last week” →

OK = “We did that last week”

Not OK = “We did that about cheese last week”

Where does knowledge of language come from?

- "People attain knowledge of the structure of their language for which no evidence is available in the data to which they are exposed as children." (Hornstein and Lightfoot 1981:9)
- What is innate and what is learned?

Where does knowledge of language come from?

- "People attain knowledge of the structure of their language for which no evidence is available in the data to which they are exposed as children." (Hornstein and Lightfoot 1981:9)
- What is innate and what is learned?
- For example, UG states VP=V+NP but NOT the order
- Children must learn the order of elements in phrases
- This can’t be in UG as it’s different for different languages:

- English: VP = V then NP (kicked the ball)
- Turkish: VP= NP then V (the ball kicked)

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- English: VP = V then NP (kicked the ball)
- Turkish: VP= NP then V (the ball kicked)

- This knowledge/learning is syntax specific, similar to core knowledge modules from before.

UG: a test case in child language

- Structural dependence in question formation, “a parade case of an innate constraint” – Stephen Crain.

“The boy is crazy” – declarative sentence

“Is the boy crazy?” – to form a question *is* goes to the start of the sentence.

What is the rule? Could it be, take the first verb and move it to the front? Perhaps as a leaner tracking statistics of word sequences might think?

UG: a test case in child language

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What is the rule? Could it be, take the first verb and move it to the front?

NO!

“The boy who is smoking is crazy” becomes

“Is the boy who is smoking crazy?” and not

“Is the boy who smoking is crazy?”

UG: a test case in child language

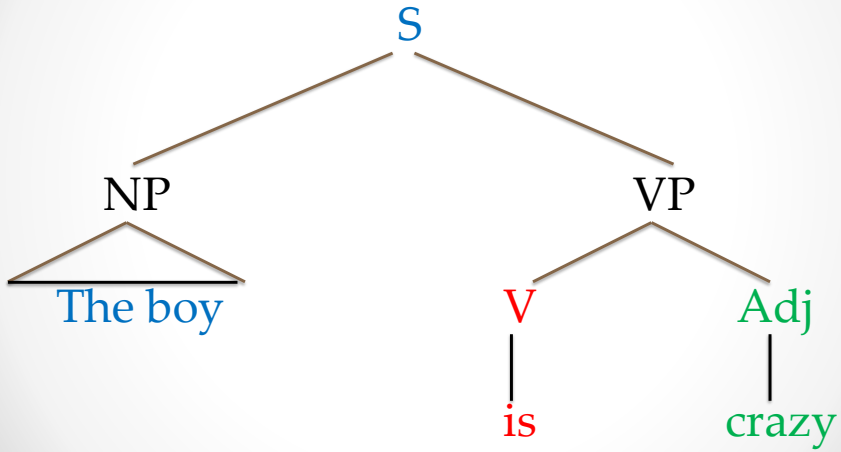
- Structural dependence in question formation, “a parade case of an innate constraint” – Stephen Crain.

“The boy <u>is</u> crazy”

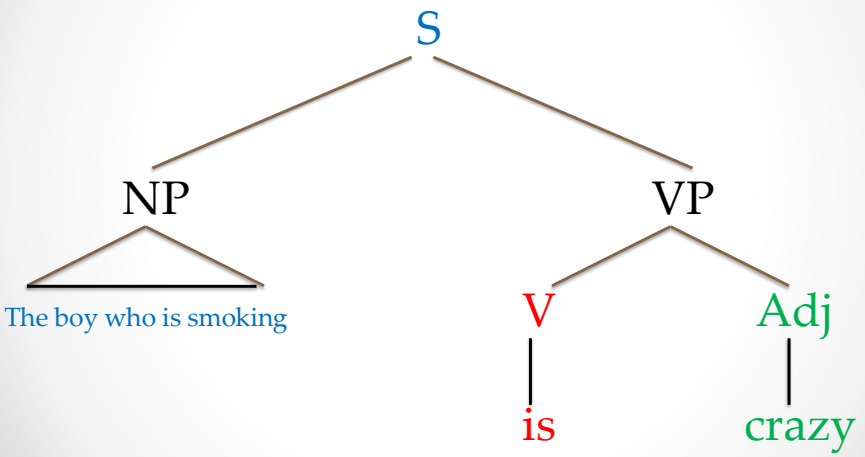
“The boy who is smoking <u>is</u> crazy”

These two <u>is</u>’s have different places in the word order, but the same structural position.

UG: a test case in child language



UG: a test case in child language



UG: a test case

- Structural dependence in question formation, "a parade case of an innate constraint" – Stephen Crain.

"The boy is crazy"
"The boy who is smoking is crazy"

These two is's have different places in the word order, but the same structural position.

Rules of syntax operate over abstract syntactic structure. Children know this innately, and thus **NEVER** make mistakes like "is the boy who smoking is crazy?"
Or so the claim goes…

Is this true?

- YES! No errors of the type

Is the boy who smoking is crazy?

ever recorded in naturalistic data
Or in an elicited production study
(Crain & Nakayama, 1987)

Conclusion: Structure dependence is an "innate schematism" (Chomsky, 1971)

Outline

- Nativist arguments from sensitive periods and children generating language (in NSL)
- Simpler nativism: early abstraction accounts

Nicaraguan Sign Language & Sensitive Periods

- Video discussed how if deaf children are not exposed to language before 7, there will be difficulties learning, and if not before puberty: no chance of true native fluency.
- Suggests genetically driven biological maturation constraints.
- Before sensitive period ends, children generate language beyond what they could have possibly been in the input.
- We discussed how language is componential and compositional.
- How quickly did NSL acquire these properties?

Outline

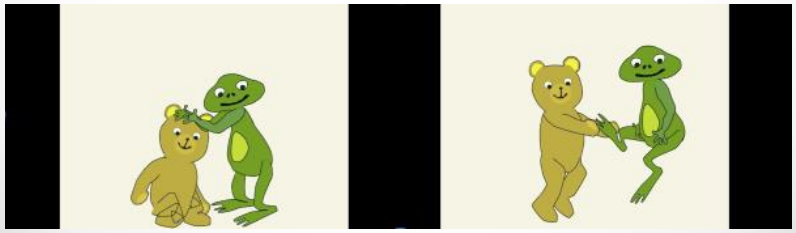
- Simpler nativism: early abstraction accounts

Early abstraction accounts: Evidence from verb learning

- Innate links between roles & nouns → learn word order rules
- Links between roles & nouns combined with word order rule knowledge → use these cues to lean novel verbs
- Will test this account with how children can use word order rules alone to learn verbs

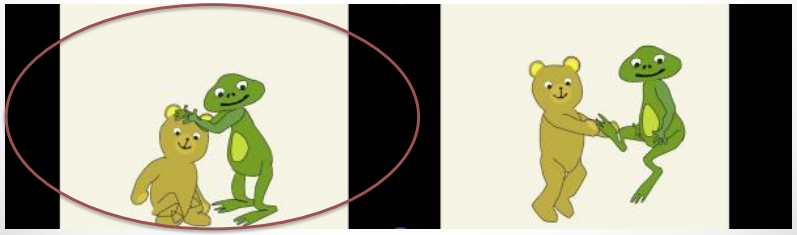
Gertner, Fisher, & Eisengart, 2006: Abstract knowledge in 2 year olds

- "The frog is gorping the bear"
- Gertner et al., both scenes show events with the same two participants, only verb general knowledge can guide children.



Gertner, Fisher, & Eisengart, 2006: Abstract knowledge in 2 year olds

- "The frog is gorping the bear"
- Children look longer to the frog as causal actor
- Must have some sort of links between abstract syntax and semantics to interpret the new verb



Language Development: Constructionist Approaches

Micah B. Goldwater, PhD
University of Sydney

If interested in trying to make connections across concept and language development:

Goldwater, M. B. (2017). Grammatical constructions as relational categories. *Topics in cognitive science*, *9*(3), 776-799.

Ambridge, B. (2020). Against stored abstractions: A radical exemplar model of language acquisition. *First Language*, *40*(5-6), 509-559.

Ambridge, B. (2020). Abstractions made of exemplars or 'You're all right, and I've changed my mind': Response to commentators. *First Language*, *40*(5-6), 640-659.

Constructionist Approaches

- Clearly humans are endowed genetically with the ability to learn and create language.
- But that is also true of baseball. Does anyone think there is innate Universal Baseball?
- Do we have a language/syntax specific endowment? Or does language emerge from the interaction of more domain-general cognitive mechanisms?

Constructionist Approaches

- Operating assumptions:
- We do not start out with any endowment of pre-specified abstract grammatical categories and phrase structure rules
- Input is extremely rich, despite claims of the "poverty of the stimulus,"
  - And thus the inability of the child to learn from it
- More powerful learning mechanisms have been explored since Chomsky refuted Skinner & Piaget such as

1. Statistical driven learning via the structure of neural networks (as in Cohen/Smith)
2. Analogical/relational abstraction (as in Gentner).
3. Also social reasoning, see ToM lectures

Statistical Learning

- Hypothesis: Infants and children will track the transitional probabilities between sounds, words, and phrases, and how they are distributed more globally to learn grammatical categories and phrase structure rules.

- First test case: infant word segmentation and transitional probabilities.

Statistical Learning

- What is a transitional probability? The probability that, after a given syllable, a particular syllable will occur
  - Or whatever relevant unit, not just syllable

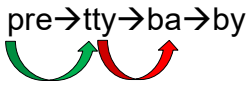
e.g.,

pre→tty	0.5
pre→dict	0.25
pre→cise	0.25

- If, after pre, the next syllable is tty 50% of the time, the TP of pre→tty is 0.5.
- How does this help the learner?

Statistical Learning

- If you hear a string such as prettybaby, you can use TPs to find the words



TP of pre→tty is high, so don't posit a word boundary

TP of ty→ba is very low (almost zero) so DO posit a word boundary

Statistical Learning

So can children actually do this? Test with "artificial grammar" Saffran, Aslin & Newport (1996): 8m olds

bi-da-ku-pa-do-ti-go-la-bu-bi-da-ku

1.0 1.0 0.33 1.0 1.0 0.33 1.0 1.0 0.33 1.0 1.0

Only cue to word boundaries is the transitional probability information: High between syllables within a "word" (e.g., bi→da); low between syllables across a "word" (ku→pa). No gaps in stream!

Statistical Learning

- Infants listened to this continuous stream of speech sounds for 2 minutes. Then their listening time was measured for:

A) Repetitions of words: "bidaku, bidaku, bidaku"
B) Repetitions of non-word "kupado, kupado, kupado"

- As defined by the transitional probabilities with a ½ second gap between each
- They showed a novelty preference for B.

Statistical Learning

- Mintz 2003
- Grammatical categories are revealed through their distributions, analysing corpora of child-directed speech
- e.g., the ___ (is usually a noun), is__ing (usually a verb), and the "the ___" is often followed by "is __ing"
- Showed infants are sensitive to forming categories of words through shared distribution in artificial grammar

Statistical Learning & Structural Dependence

- The constructionist claim is that the learning of grammatical structures can be driven via these sorts of mechanisms, tracking transitional probabilities and the distributions of words and phrases.
- Can this perspective re-explain previous findings interpreted as evidence for UG, such as the Crain's work on children's questions?
- Reminder:
  - given "The man who is smoking is crazy" children always turn it into a question by respecting phrase structure, as in "Is the man who is smoking crazy?" and not "Is the man who smoking is crazy?"

But….

- Whether or not children have innate knowledge of SD, such errors would not be expected to occur given (implicit) knowledge of the transitional probabilities of particular lexical items or categories thereof.

Is the boy who smoking is crazy?

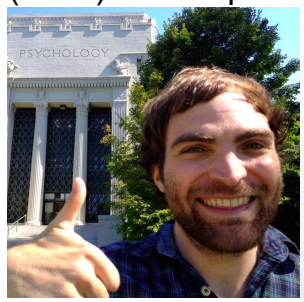
AUX DET NOUN COMP PARTICIPLE AUX ADJ

- That is, no ever says anything like "who smoking" in any context, question or otherwise

(besides auxiliary verb dropping dialects…).

So,

- If children are building up their knowledge of syntax by tracking the statistics/distributions of words and categories of words, they also shouldn't make such errors.
- How can we test the two accounts?
- Ambridge, Rowland, & Pine (2008) came up with a way



Constructionist approach to development of question formation

- Unlike for *is* questions, for *can* questions, a SD error results in a possible word (category) pair

"The boy who can smoke can drive"

"Can the boy who can smoke drive?

SD error "Can the boy who smoke can drive?"

"Who smoke" unlike "who smoking" is a grammatical pair of words in other contexts. e.g., "people who smoke die young"

If children construct rules from complex sentences from simpler smaller units, they might make such errors.

Constructionist approach to development of question formation

- Ambridge et al. (2008) used an elicited production method similar to Crain & Nakayama, 1987
  - gave situations, made 7 year olds ask questions about them
- Unlike with *is* questions, where there are 0 SD errors, with *can* questions, they found 7% SD errors, with children ranging from 0% SD errors up to 43%!
- UG would not predict such word-specific effects. Structural dependence is a universal constraint that applies equally to all words.

Outline

- Gradual abstraction
- Response from nativism: Early abstraction accounts

Gradual Abstraction (Tomasello, 2003)

- Abstract grammatical categories and structures allow for free production of words, independent of how individual words have been used before
- However, children start by only using words in phrases they hear them are used in the input
- Slowly children start noticing commonalities in patterns of words use and generalize individual words to novel contexts
  - Hypothesized mechanism: Gentner's analogical learning
- Children's earliest grammatical structures are based on individual words, and more abstract adult-like grammars are built from there.
- More specifically…

Constructionist approach to development of abstract structure more generally

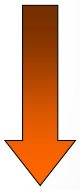
I kick it, I kick ball

I kick [OBJECT], I hit [OBJ]

I [ACTION] [OBJECT],
Mummy [ACTION] [OBJ]

[SUBJ] [VERB] [OBJ]

Wholly concrete (substantive)



Wholly abstract (schematic)

Constructionist approach to development of abstract structure more generally

- Schematization

Break utterances into component parts and generalize across them to form partially-productive, lexically specific schema

Kick it + Kick ball + Kick Mummy = Kick X

- This creates verb specific schemas.
- Then across verb specific schemas, find the commonalities in these schema/utterances to form abstract constructions

(X kick Y, P kiss Q → SUBJ, VERB, OBJ)

What's the evidence for this verb-specific to verb-general pattern?

Schematization Experiments

Novel verb studies: Teach children a novel (made up) verb (e.g.: meeking, tamming) in one construction, and see if they will use it in another

If so, this is evidence that they have a VERB-general rule (e.g., SUBJECT VERB OBJECT)

Schematization Experiments

Tomasello & Brooks (1998)

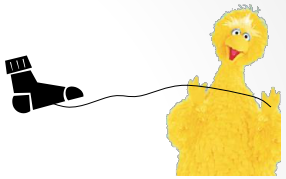
Taught children a novel verb in an intransitive [SUBJECT] [VERB] construction:

The sock is tamming

Then tried to elicit use of this verb in a transitive [SUBJECT] [VERB] [OBJECT] construction

Schematization Experiments

What's Big Bird doing?



Answer He's tamming the sock

Only 3/16 children aged 2;0 (7/16 aged 2;6) would use the verb in the non-attested transitive construction. Doing so is no problem for 4 year-olds.

Suggests children formed [THING TAMMING] TAM **verb island**, so could use TAM only in this construction

Schematization Experiments

But when children are taught a new noun (Tomasello & Olguin, 1993) they readily use it in new constructions (so it's not just "shyness")

Experimenter: This is a toma
Child: I want toma, I see toma

Suggests they have small scale schemas such as I want X, I see X **NOT** abstract constructions
such as SUBJECT VERB OBJECT

Constructionist Approach: Summary

- Claim 1: Children can learn syntactic categories through the distributional/statistical patterns of words in their input.
- Claim 2: Children's initial syntactic knowledge is item-based (based on individual words) and abstract constructions are formed slowly by generalizing across such item-based constructions.

Early abstraction accounts

- Many psychologists have abandoned theorizing that much of the rich specific structure (e.g., that VP = V +NP) is part of a language-specific genetic endowment, but they also reject the constructionist notion that early language knowledge is all item-specific
- Specifically, verb-general notions of *agents* and *patients*, and general notions of how they are linked to nouns constrains language learning from the start
  - That is, each semantic role needs a noun, and each noun needs a semantic role
- From there abstract knowledge of word-order sequences is built
  - While word order needs to be learned, they are utilizing abstract verb-general representations from the beginning.

Early abstraction accounts and verb learning

- English has systematic mappings between syntax and semantics.
- Generally, agents become before the verb, and patients come afterwards.

The boy broke the vase

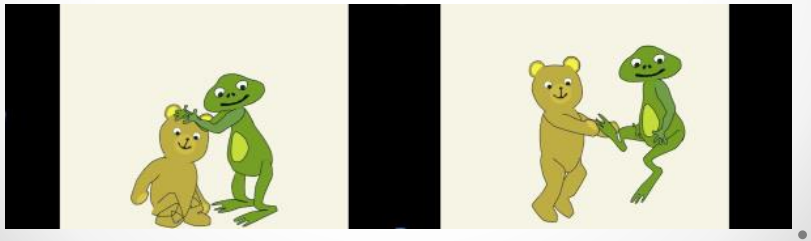
I threw the ball

etc.

If children can use such verb-general cues to assist them in learning verbs, evidence against item-specific syntactic knowledge

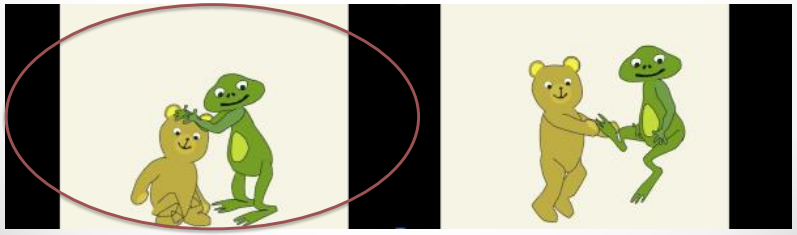
Gertner, Fisher, & Eisengart, 2006: Abstract knowledge in 21 month-olds

- "The frog is gorping the bear"
- Gertner et al., both scenes show events with the same two participants, only verb general knowledge can guide children.



Gertner, Fisher, & Eisengart, 2006: Abstract knowledge in 21 month-olds

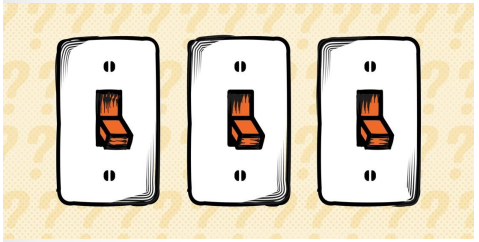
- "The frog is gorping the bear"
- Children look longer to the frog as causal actor
- Must have some sort of verb-general knowledge of syntactic structure



Reply from Constructionism

- Dittmar, Abbot-Smith, Lieven, & Tomasello (2008)
- Noticed that in Gertner et al., children were warmed up to the task with familiar verbs and similar kinds of causal events, using transitive syntax and the exact same nouns used at test (e.g., "frog" and "bear")
  - "The frog is washing the bear"
- Dittmar et al. replicated their procedure and added a condition that simply did not use the nouns or transitive syntax as part of the warm up.
  - "This is called washing"
- Then all children had the same test, as in Gertner et al.
- In the latter condition, children did not succeed at test! They required a relevant prior exposure.
- How abstract are their representations?

Is there a constructivist explanation for Sensitive Periods?



65% 25% 10%

Is there a constructivist explanation for Sensitive Periods?

Ramscar, Michael, and Nicole Gitcho. "Developmental change and the nature of learning in childhood." *Trends in cognitive sciences* 11.7 (2007): 274-279.

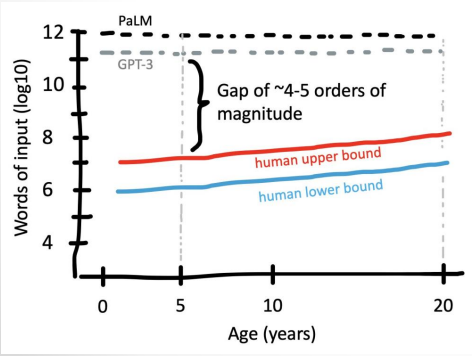
Elman, J. L. (2001). Connectionism and language acquisition. *Language development: The essential readings*, 295-306.

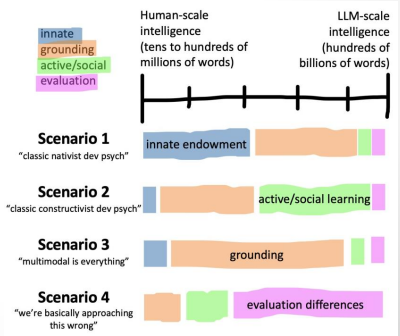
Check out Simon Kirby and who models the evolution of language, e.g.

- Kirby, S., & Hurford, J. (1997). The evolution of incremental learning: language, development and critical periods. *Edinburgh Occasional Papers in Linguistics*, *97*(2), 1-33.
- The Language Game: How Improvisation Created Language and Changed the World
  - by Morten H. Christiansen &Nick Chater

What do large language models (e.g., ChatGPT) mean for theories of language development?

- On the one hand, old nativist arguments said that human syntax can not be learned just from example sentences, without innate constraints
- LLM's seem to show that is wrong, but do they learn like children?- Images via Mike Frank





What do large language models (e.g., ChatGPT) mean for theories of language development?

- If interested in more takes: https://lingbuzz.net/lingbuzz/007180

(argues this shows Chomsky is wrong)

- Chomsky thinks LLM's prove nothing about humans

- A longer discussion with Chomsky and others

Constructionist Approaches: Summary

- Argues that domain-general mechanisms such as statistical learning and analogical abstraction are more powerful than the GDM's Chomsky first argued against, and can in fact account for language learning.
- Infants can segment words and form grammatical categories via statistics/distributions
- Children do make structural dependence errors when the statistics support such errors, despite UG claims
- Children's early syntactic productions are verb-specific
- Early abstraction accounts (trimmed down nativism) rejects item-specific syntax
- However, constructionist have countered this rejection.
- Sensitive periods are related to domain-general brain maturation, not language-module changes

Culture in cognitive development

Micah B. Goldwater, PhD

BM 336

2 parts today

- 1- Experimental research comparing cognitive development in white/western kids to kids from other cultures
- 2- Indigenous Australian child development and education

Interdisciplinary Cognitive Science

Two useful review papers on cross-cultural differences in cognitive development

- Rogoff, B., Paradise, R., Arauz, R. M., Correa-Chávez, M., & Angelillo, C. (2003). Firsthand learning through intent participation. *Annual review of psychology, 54*, 175-203.
  - http://www.annualreviews.org/doi/abs/10.1146/annurev.psych.54.101601.145118
- ojalehto, b. l., & Medin, D. L. (2015). Perspectives on culture and concepts. *Annual review of psychology, 66*, 249-275.
  - http://www.annualreviews.org/doi/10.1146/annurev-psych-010814-015120

Outline

- Caucasian/European Descent compared to East Asian
  - Relational vs. individual object focus
- Caucasian/European Descent compared to Indigenous Central American
  - Mexican/ Guatemalan Mayan
  - "Intent participation" and learning via observation
- Caucasian/European Descent compared to Native American
  - Menominee of Wisconsin, mid-west USA
  - Folkbiology and category-based induction

Roughly….

Oyserman, Coon, Kemmelmeier (2002)

Table 1
Individualism and Collectivism Domains Assessed in Individualism–Collectivism Scales

Domain name	Description	Sample item
	Individualism	
Independent	Freedom, self-sufficiency, and control over one's life	I tend to do my own thing, and others in my family do the same.
Goals	Striving for one's own goals, desires, and achievements	I take great pride in accomplishing what no one else can accomplish.
Compete	Personal competition and winning	It is important to me that I perform better than others on a task.
Unique	Focus on one's unique, idiosyncratic qualities	I am unique—different from others in many respects.
Private	Thoughts and actions private from others	I like my privacy.
Self-know	Knowing oneself; having a strong identity	I know my weaknesses and strengths.
Direct communicate	Clearly articulating one's wants and needs	I always state my opinions very clearly.
	Collectivism	
Related	Considering close others an integral part of the self	To understand who I am, you must see me with members of my group.
Belong	Wanting to belong to and enjoy being part of groups	To me, pleasure is spending time with others.
Duty	The duties and sacrifices being a group member entails	I would help, within my means, if a relative were in financial difficulty.
Harmony	Concern for group harmony and that groups get along	I make an effort to avoid disagreements with my group members.
Advice	Turning to close others for decision help	Before making a decision, I always consult with others.
Context	Self changes according to context or situation	How I behave depends on who I am with, where I am, or both.
Hierarchy	Focus on hierarchy and status issues	I have respect for the authority figures with whom I interact.
Group	A preference for group work	I would rather do a group paper or lab than do one alone.

Individualism vs. Collectivism

- Often Asians are more relational: e.g., when describing/remembering scenes

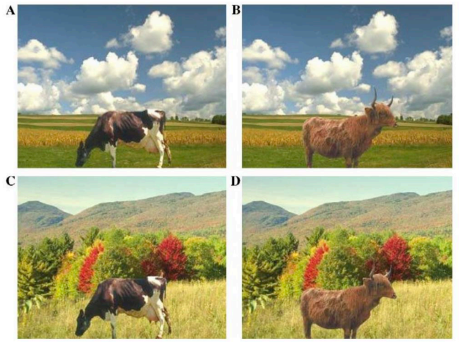


Fig. 5. Sample pictures used in Experiment 3. (A) A study picture. (B) A new animal in the old background. (C) An old animal in a new background. (D) A new animal with a new background.

Individualism vs. Collectivism

- During preschool years, research with European Americans show that both relational abilities improve and the ability to selectively attend to individual objects/one event at a time

Object vs. Relational Focus

- Kuwabara, M. & Smith, L. B.(2012) Cross Cultural Differences in Cognitive Development: Attention to Relations and Objects. *Journal of Experimental Child Psychology, 113*, 20-35.

- http://www.indiana.edu/~cogdev/labwork/Kuwabara_Smith.pdf

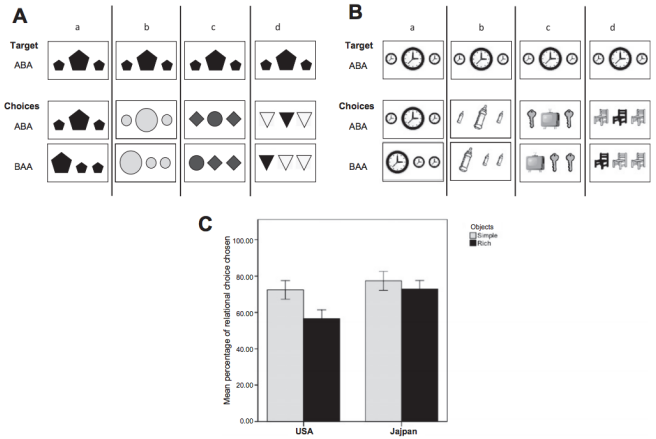


Fig. 1. (A, B) Stimuli examples for Simple (A) and Rich (B) conditions. As seen, different choice cards for the very same target card were constructed to assess just the abstractness of children's relational representations. As seen in column a, the first pair of choice cards uses the very same shapes or objects as in the target card, and thus the relational match is also an identity match that does not require children to ignore individual object properties. The second set of choice cards (size to size) presents a somewhat more abstract relation, namely small–big–small (column b). The third and fourth sets of choice cards require a more abstract representation of the relation that can be realized with many different object properties (shape and color), that is, symmetry around a center object, ABA (see column c for shape example and column d for color example). (C) Mean percentages of correct relational choice chosen by children from the United States and Japan in the Simple and Rich conditions. The error bars show ±1 standard error.

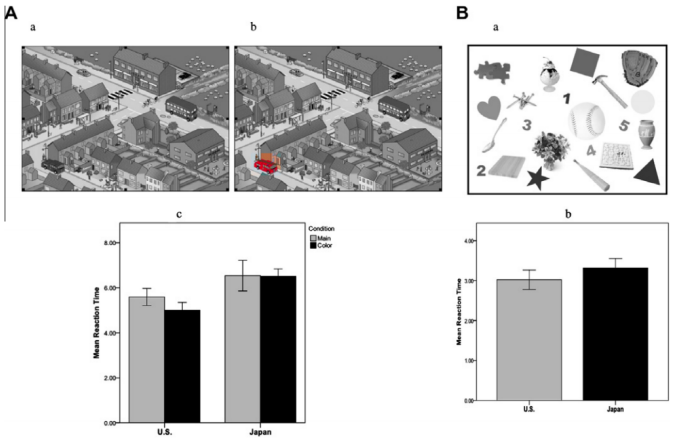


Fig. 2. (A, panels a and b) Examples of the stimuli used in Experiment 2 for the Less Distraction condition (a) and the More Distraction condition (b). For this trial, the target was a bicycle. Trials in the Less Distraction condition were colored black and white, and there was no distracting competitor against the target object. Trials in the More Distraction condition were colored black and white except the distracting competitor against the target object. For this example, the distractor is a red car. (A, panel c) Mean reaction times to find a target object for correct search in Less Distraction and More Distraction conditions for children from the United States and Japan. The error bars show ±1 standard error. (B, panel a) Example of the stimuli used in Experiment 3. The objects are randomly placed in the whole paper with distractors such as numbers and simple shapes. For this example, children looked for a hammer in Order 1 and looked for a flower in Order 2. (B, panel b) Mean reaction times to find a target object for correct search trials in Experiment 2 for children from the United States and Japan. The error bars show ±1 standard error. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Individualism vs. Collectivism

- Cultural values provide strategies of what information to attend to and extract from the environment, detectable as early as 4 years-old
- The interdependent self-conception of collectivist cultures leads to relational focus
- The independent self-conception of individualism leads to object focus

Outline

- Caucasian/European Descent compared to Indigenous Central American
  - Mexican/ Guatemalan Mayan
  - “Intent participation” and learning via observation

Firsthand learning through intent participation

- Rogoff, B., Paradise, R., Arauz, R. M., Correa-Chávez, M., & Angelillo, C. (2003)
- Western schooling fundamentally changed the relationship between children and adults, and how children learn from adults
- Schools isolate children from adult activities
- Pre-industrialization western children learned from adults by directly participating in adult activities, e.g., farming
- Current indigenous communities show these practices

Firsthand learning through intent participation

Intent participation, when even quiet observation is seen as a form of participation. Being a good observer, and strategies for learning via observation are explicitly communicated to children in Asia and central America, among other cultures.

vs.

"assembly-line instruction, which is based on transmission of information from experts, outside the context of productive, purposive activity. This tradition of organizing learning is common in many U.S. schools and middle-class family interactions, perhaps related to historical changes connected with industrialization and child labor laws, which have contributed to compulsory extensive schooling and routine segregation of children from many mature settings."

"In a farming community in East Africa, 3- and 4-year-old children spent 25–35% of their time doing chores, whereas middle-class U.S. children of the same ages spent only 0–1% of their time doing chores and 4–5% of their time accompanying others in chores (Harkness & Super 1992)."

Children in these communities are more likely to be directly involved, and this affects how they observe when they are not

Firsthand learning through intent participation

" In U.S. classrooms children's learning is often assumed to occur primarily by means of the teacher's provision of information, in what has been called a factory model (Callahan 1962). The factory-efficiency approach to learning and teaching is a tradition that became widespread around 1900. It was based on Taylor's time-and-motion studies of steelworkers for industrial efficiency and began to be applied to education to achieve bureaucratic efficiency in the face of enormous growth in student populations. (In 1890 only 4% of U.S. youth graduated from high school. By 1940 half of U.S. youth did.)

Teachers were cast as technical workers who were supposed to insert information to the children, who were seen as receptacles of knowledge or skill. The information itself was broken into bits to be delivered in a specified sequence, like an assembly line. According to the leading educational administration textbook in 1916, written by Stanford's Dean of Education:

Our schools are, in a sense, factories in which the raw products (children) are to be shaped and fashioned into products to meet the various demands of life . . .. It is the business of the school to build its pupils according to the specifications laid down.

(Cubberley 1916, p. 338)

Firsthand learning through intent participation

"In a factory model the teacher strives for efficiency in the delivery of knowledge and applies incentives (or punishments) to induce children to cooperate in the production process. The students cannot speak or help each other without permission from the teacher. The teacher "delivers" the curriculum using specialized forms of discourse, especially quizzing (in which the teacher asks questions to which she knows the answer and evaluates the student's response) to test the receipt of information. Often the teacher directs children's actions without explaining a rationale

(see Mehan 1979, Cuban 1984, Gutierrez 1992, Mercer et al. 1988, Hargreaves 1989, Wells 1992, Minick 1993, Rogoff et al. 1996, Matusov & Rogoff 2002)."

Firsthand learning through intent participation

- Often children of indigenous backgrounds get into trouble in school because they attempt to collaborate with other students and don't seek permission.
- Spontaneous adult problem-solving in Native American cultures is more collective, with an understanding that people have different and complementary skills. Much less of a manager-who-delegates process compared to European Americans
- Western assessment requires distinguishing people as high vs. low performers; not about discovering complementary abilities in collaboration

Firsthand learning through intent participation

- Correa-Chávez, M., Rogoff, B., & Mejía Arauz, R. (2005). Cultural patterns in attending to two events at once. *Child Development, 76*(3), 664-678.

Figure 1. The Origami Lady demonstrates the folding of a figure to three children.

Firsthand learning through intent participation

- Adult comes to primary school to teach origami
- Simultaneous attention:
- Child does their own origami while observing adult model, and activities of other children, and some conversation
- Alternating attention:
- Pausing own activity to watch model or interact with other children

Firsthand learning through intent participation

Table 2
Mean Percentage (and Standard Deviation) of Segments in which Children Used Different Forms of Attention Management

	Primary analysis				Secondary analysis	
Form of attention management	Mexican heritage basic schooling		European heritage high schooling		Mexican heritage high schooling	
Simultaneous	48.3	(7.9)	27.1	(9.7)	34.7	(11.0)
Alternating	37.7	(5.5)	53.3	(9.2)	48.2	(10.0)

Simultaneous attention was negatively correlated with question asking. Authors interpret this as a sign that they are better at learning via observation. Other interpretations possible of that correlation.

Firsthand learning through intent participation

- Correa-Chávez, M., & Rogoff, B. (2009). Children's attention to interactions directed to others: Guatemalan Mayan and European American patterns. *Developmental Psychology, 45*(3), 630.

Figure 1. Scenarios for Sessions 1 and 2. Session 1. Mayan (top left) and European American (top right) children wait their turn and attend (or not) to the Toy Lady and their sibling constructing the mouse toy. Session 2. Mayan (bottom left) and European American (bottom right) children attempt to construct a frog by themselves, while the Toy Lady is busy with her work.

Firsthand learning through intent participation

Children are taught how to build one toy
Observed other children being taught with another toy

Table 2
Mean Percentage and Standard Deviation of Segments in Which Children Attended to Construction

	Mayan traditional		*Kaxlaan* Mayan		European American middle-class	
Form of attention	*M*	*SD*	*M*	*SD*	*M*	*SD*
			All children			
Sustained	62.4[a]	20.4	54.9[a]	19.2	30.6[a]	24.3
Not attending	33.2[b]	19.6	40.2	19.5	46.8[b]	21.5
Brief glances	4.4[c]	5.0	5.0[d]	4.3	22.6[c,d]	15.1

Note. In each row, superscripted letters indicate significant differences across cells with the same letter (according to planned contrasts).

The more western schooling, the less attention paid to other children being taught

Firsthand learning through intent participation

Table 3
Average Amount (and Standard Deviations) of Help Children Needed To Construct Toy, With Respective Correlations

Help score/correlation	Mayan traditional	*Kaxlaan* Mayan	European American middle-class	All children
	Children attempting to construct mouse by themselves			
Percentage (and *SD*) of maximum score of help from Toy Lady	33.5 (14.0)	30.5 (15.1)	31.7 (20.1)	31.7 (16.6)
Correlation (*r*) between help received and attention	−.11	.19	−.07	.01
	Children attempting to construct frog by themselves			
Percentage (and *SD*) of maximum score of help from Toy Lady	43.5 (15.1)[a,b]	52.3 (13.9)[a]	58.8 (11.2)[b]	51.0 (14.8)
Correlation (*r*) between help received and attention	−.38*	−.29	−.44*	−.47*

Note. In each row, superscripted letters indicate significant differences across cells with the same letter (according to planned contrasts).
*$p < .05$.

The more Western schooling, the more help needed for the more difficult toy.
No effect for easy toy.

Firsthand learning through intent participation

- Summary:
- School fundamentally changes the way children and adults interact, where children learn away from the adult activities that the learning is supposed to eventually prepare them for
- There is a focus on transmission of knowledge from expert to novice, and individual assessment
- Children from indigenous communities learn via intent participation and observation of genuine adult activity
- Cognitive consequences: indigenous children can at once attend to models to learn from and perform their own actions
  - White children do not attend to lessons directed to others, and need to alternate attention between model and their own actions when learning from a model

Outline

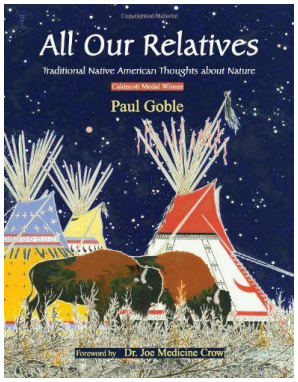
- Caucasian/European Descent compared to Native American
  - Menominee of Wisconsin, mid-west USA
  - Folkbiology and category-based induction

Folk biology: Native and European Americans

- ojalehto & Medin (2015) for review
- What do parents want children to learn about nature?

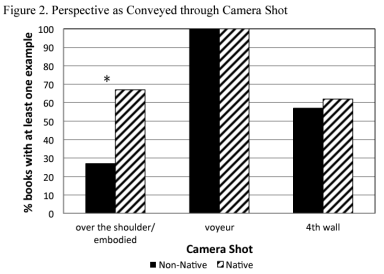
Native: “they are part of nature”

European: “to respect nature”



Building different models of the world

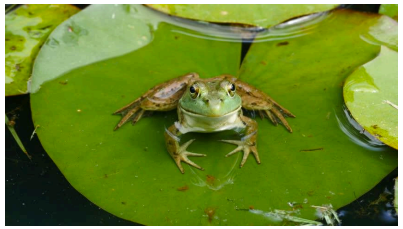
- Megan Bang and colleagues’ analysis of children’s books and 4-year olds playing with ecological dioramas



- 16 of 21 rural Native American children & 14 of 16 urban Native American children displayed perspective taking
- only7 of 17 urban non-Native American children did so
- χ^2 (2) = 9.14 ,p=.01.
- Native American adults when telling a story about animals, sometimes become the animal in gesture, not just depict the animal in a place

Folk biology: Native and European Americans

- Asked 5-7 year old children “Why do these (e.g., frog and lily pad) go together?”



- Compared to rural European Americans, Native American children more likely to mention food chain relations, their utility for people, and mimic sounds of animals

Folk biology: Native and European Americans

- Category-based induction: generalizations based on category knowledge
  - If an emu has omenatum in their bones, how likely is it that all birds do?
  - If a crow has omenatum in their bones, how likely is it that all birds do?
  - (most people would say crow makes it more likely because it’s a more typical bird)
- Carey (1985) showed that 4 year-olds, unlike 10 year-olds and adult do not use these kinds of similarity relations, but instead privilege humans as bases of induction
  - If humans have omenatum, then lots of animals do
  - Generalize to animals from humans more so than from dogs, despite dogs being more similar to other animals according to adults
  - Asymetric generalisation: more so from human to animals than animals to humans

Folk biology: Native and European Americans

- Carey (1985): "folk psychology" precedes "folk biology" where people are the center of reasoning about the natural world
  - Claimed developmental universal
  - Used urban white middle-class children, who may know little about nature

- Medin, Waxman, Unsworth, Bang and colleagues compare urban European American, rural European American, and rural Native American

Folk biology: Native and European Americans

- Children ranged from 4 – 10 years old
- Half told humans had omenatum, half told dogs did
- Then shown pictures of and asked if they had omenatum:
  - human, dog, bear, aardvark, eagle, toucan, trout, angelfish, bee, fly, maple, dandelion, sun, rock, computer, pencil
- Children generalized to non-living things the least, then some to plants, but mostly to animals

Folkbiology: Native and European Americans

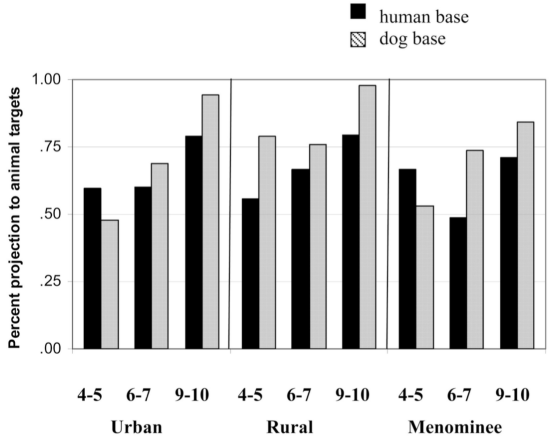


Figure 1.
Projection to animals from human base and from dog base for each population and age group.

All children by age 6 use similarity among animals, draw stronger generalizations from dog

European-descent Rural children with high levels of experience in nature and dogs as pets use dogs earlier on than the other two groups

Folk biology: Native and European Americans

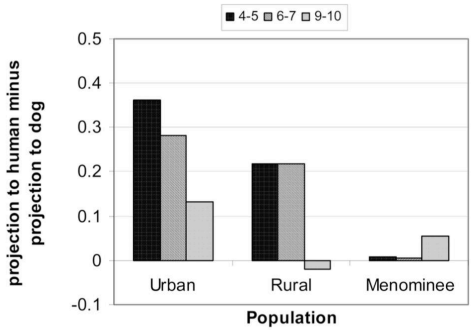


Figure 2.
Asymmetries of projections from human to dog and from dog to human.

Urban white children show the greatest asymmetry early on, generalizing from human to dog stronger than from dog to human.

Rural white children show early asymmetry, but less so

Native American children show no asymmetry from beginning

Fostering a mental model wherein we are a part of nature- and all living things have agency

Led by Megan Bang Northwestern University

Folk biology: Native and European Americans

- Fundamental difference in the mental model of human-nature relations- a part of, or separate from.
- Experience with nature and "psychological distance" to nature critical in developing folkbiology
- Native Americans see more complex ecological relations in nature, and show no inductive asymmetry between humans and animals
- Education attempts to engender a part of nature mental model in all people
- When you are a part of nature, and attribute agency/personhood to non-humans and non-animals, then a different ethics of extraction is created

Related

Some discussion of Native American sustainable forestry practices in this interesting article
https://www.nytimes.com/interactive/2020/12/02/magazine/tree-communication-mycorrhiza.html

Many similar examples in Australia
https://theconversation.com/the-worlds-best-fire-management-system-is-in-northern-australia-and-its-led-by-indigenous-land-managers-133071

Global movement that to fight climate change, we need Indigenous ecological knowledge and practices.

Cross-Cultural Variation in Cognitive Development

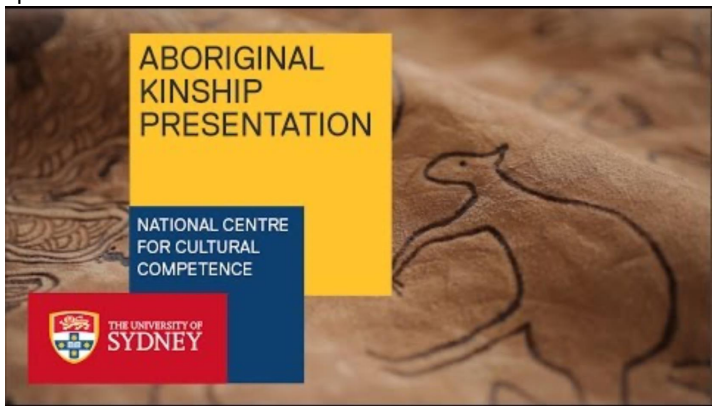
- Cultures provide value systems and these are realized in moment-to-moment interaction with each other and the environment
- Cultures/values provide strategies for attention, learning, memory, reasoning, generalizations, concepts
- Collectivism promotes relational thinking, while individualism promotes an object-focus
- Western schools emphasize individual learning, while Meso-American indigenous cultures promote collaboration and learning via intent participation/observation
- Native American cultures emphasize being part of nature, while European Americans see themselves as separate from nature

2 parts today

- 2- Indigenous Australian child development and education

Indigenous Australian child development and education

A series of short videos made by the university to introduce some basic concepts



Indigenous Australian child development and education

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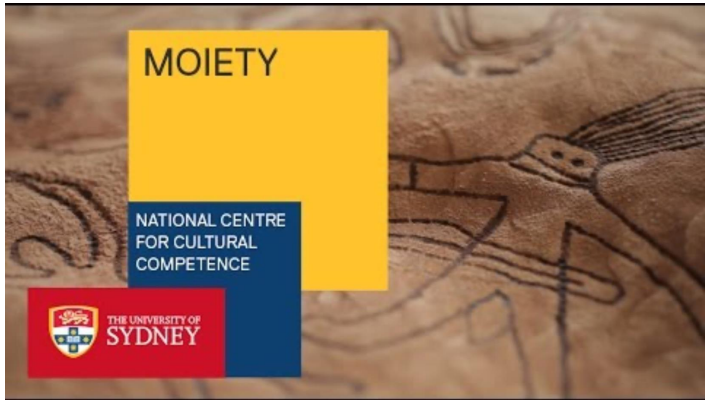

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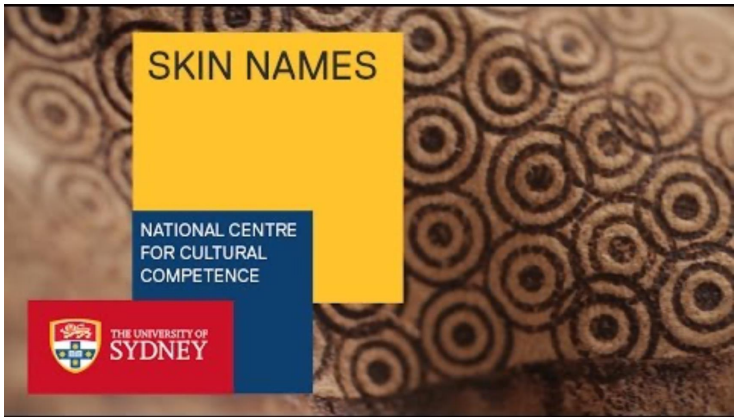

Indigenous Australian child development and education

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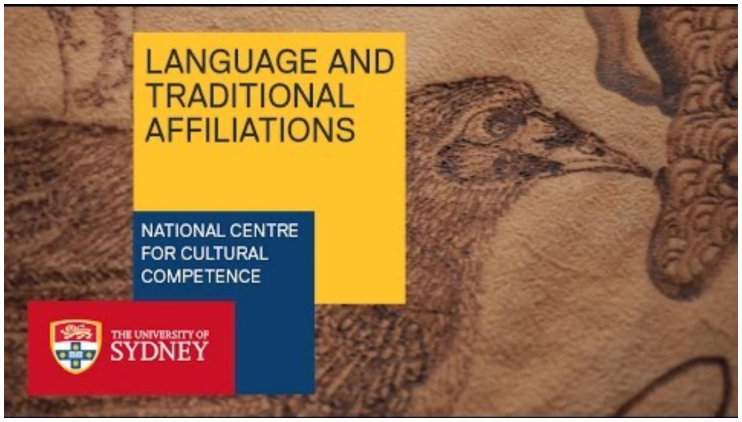


Indigenous Australian child development and education

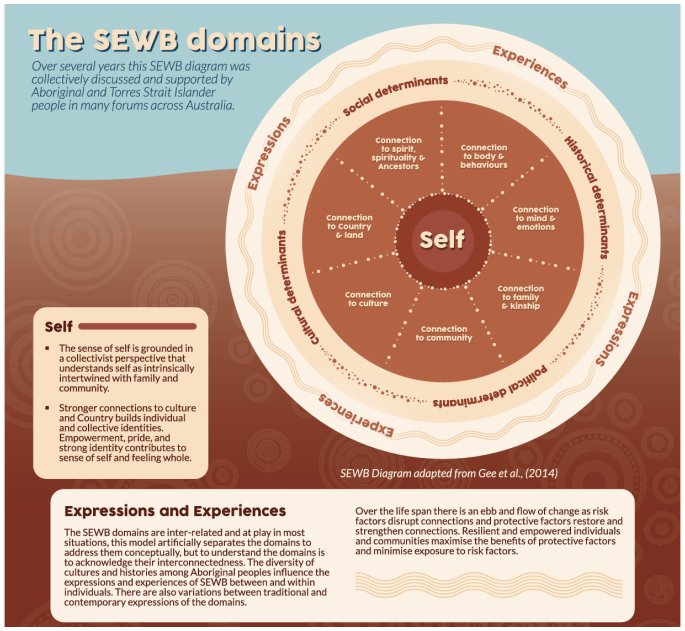
A series of short videos made by the university to introduce some basic concepts

Indigenous Australian child development and education

A series of short videos made by the university to introduce some basic concepts

Self-concepts and self-determination

Social
Emotional
Wellbeing



The importance of self-concepts and self-determination in Indigenous development and education

The nine principles enunciated in the Framework guided the development of *Working Together: Aboriginal and Torres Strait Islander Mental Health and Wellbeing Principles and Practice*. The nine principles are:

1	Aboriginal and Torres Strait Islander health is viewed in a holistic context that encompasses mental health and physical, cultural and spiritual health. Land is central to wellbeing. Crucially, it must be understood that while the harmony of these interrelations is disrupted, Aboriginal and Torres Strait Islander ill health will persist.
2	Self-determination is central to the provision of Aboriginal and Torres Strait Islander health services.

Deficit vs. Strength/Asset Framing

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When we talk about Indigenous education in Australia, it almost always includes three words: “close the gap”. The federal government’s Indigenous education priorities highlight school attendance, literacy and numeracy and year 12 attainment. This frames students and their families as a “problem” to “fix”.

In other areas of education, the word “excellence” is frequently used to frame policy. But a simple Google search of “excellence” and “Indigenous education” comes up with very few meaningful results. Why aren’t starting from the same point in Indigenous education?

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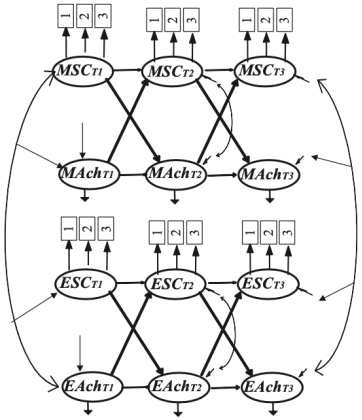
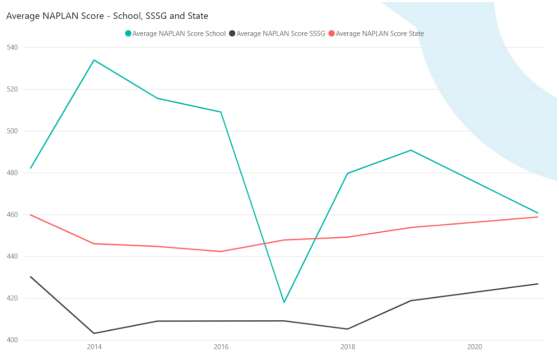
Reciprocal relationships between self-concept and academic achievement

- Marsh et al. (2023)
- High Self-concepts lead to achievement
  - Self-enhancement view
- Achievement leads to high self-concept
  - Skill acquisition view
- Fancy statistical technique needed to test reciprocal relationships
- Here ~500 Indigenous & 500 Non-Indigenous high achieving Australians across many primary and high school over multiple years
- "I learn math/English quickly"
- Relationships equivalent across groups



Self-determination in Education

There are a growing number of Indigenous run schools or schools with-in schools integrating cultural identity and practices with standard Australian curriculum. These are small samples but do not show deficits in numeracy and literacy in NAPLAN tests.



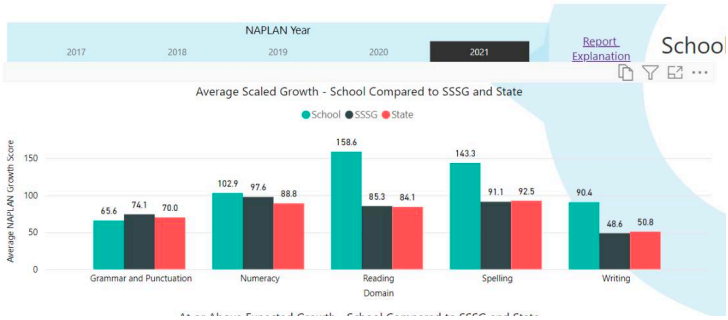
SSSG- other schools with similar Demographics

School = Gawura

Year 5 reading

Self-determination in Education

There are a growing number of Indigenous run schools or schools with-in schools integrating cultural identity and practices with standard Australian curriculum. These are small samples but do not show deficits in numeracy and literacy in NAPLAN tests.



SSSG- other schools with similar Demographics

School = Gawura

Growth from year 3-5

When there is no self-determination: How misapplication of psychological theory can cause severe harm

- Years after the 2008 apology for the stolen generation, Aboriginal children are still separated from their family at higher rates than other groups
- Psychological theory has some blame
- Child services evaluates the quality of parental relationships, in part, related to Attachment Theory
- Attachment Theory was developed in individualistic cultures to predict long term psychological wellbeing based on the quality of relationship between child with their primary caregiver.
- This is misapplied in Aboriginal contexts in multiple ways, for example

1. Communal caregiving, not the responsibility of a single parent

2. From infancy, Aboriginal people view their infant as having more agency & autonomy in their behavior than non-Aboriginal, and this is to be respected and supported. Some behaviors are seen as negligent in Attachment Theory-based assessments are seen as autonomy-respecting in Aboriginal culture. E.g., a child falls down. Do parents help them up? Aboriginal parents may leave the child to help themselves up after assessing the fall did not cause real injury.

Wright, P. Gray, B. Selkirk, C. Hunt & R. Wright (21 Jan 2024): Attachment and the (mis)apprehension of Aboriginal children: epistemic violence in child welfare interventions. *Psychiatry, Psychology and Law*, DOI: 10.1080/13218719.2023.2280537

Also see, papers such as Kruske, S., Belton, S., Wardaguga, M., & Narjic, C. (2012). Growing up our way: the first year of life in remote Aboriginal Australia. *Qualitative Health Research*, *22*(6), 777-787.

Some papers on/inspired by Indigenous Australian Cognition: Space, memory, and narrative

Reser, D., Simmons, M., Johns, E., Ghaly, A., Quayle, M., Dordevic, A. L., ... & Yunkaporta, T. (2021). Australian Aboriginal techniques for memorization: Translation into a medical and allied health education setting. *Plos one*, *16*(5), e0251710.

Levinson, S. C. (1997). Language and cognition: The cognitive consequences of spatial description in Guugu Yimithirr. *Journal of linguistic anthropology*, *7*(1), 98-131.

Heft, H. (2013). Environment, cognition, and culture: Reconsidering the cognitive map. *Journal of environmental psychology*, *33*, 14-25.

Langley, M. C. (2013). Storied landscapes makes us (Modern) Human: Landscape socialisation in the Palaeolithic and consequences for the archaeological record. *Journal of Anthropological Archaeology*, *32*(4), 614-629.

Cultural cognitive strengths: Aboriginal memorization method, with Narratives connected to place

- Reser et al (2021) examined memory in medical students
- Task- memorize word list
- Condition 1- gold standard of Western memorization the "Memory Palace"
- "Participants were instructed to visualize a familiar room and setting, i.e. a childhood bedroom or their current residence, and to try and recall the location and physical appearance of items in the imagined space. A schematic drawing on a whiteboard was used to illustrate this setup. Participants were instructed to associate items to be remembered with specific objects and locations in the imagined space, with as much detail as possible (e.g. a red lamp with an adjustable shade and a power switch in the center of the lamp base sitting on a desk to the left hand side of the entrance to the room. As items were added to the memory list, each new item was associated with an object and position in the imagined room. To recall items, participants were instructed to imagine themselves walking into the room, approaching each object and location which had a list item associated with it, and to attempt to recall the list item in conjunction with the imagined object."

Cultural cognitive strengths: Aboriginal memorization method, with Narratives connected to place

- Reser et al (2021) examined memory in medical students
- Task- memorize word list
- Condition 2- Aboriginal method
- "Group 2 participants were given an overview of the Australian Aboriginal memorization technique by an experienced Australian Aboriginal educator, including a short description of how Elders instruct young people, and the elements of place-based narrative, image, and metaphor. To construct a narrative around the butterfly word list (Fig 1A), the instructor walked students around a rock garden located on campus which contained multiple rocks, plants and concrete slabs arranged in the shape of a large, stylized footprint (Fig 1B & 1C). Each list item was incorporated into a narrative related to elements in the rock garden (Fig 1C). The narrative was practiced as students physically walked through the garden with the instructor, and participants were encouraged to visualize walking through the garden during recall. As the participants mentally "walked" the path in the narrative, they were encouraged to approach each feature in the garden and identify the place and its associated butterfly name."

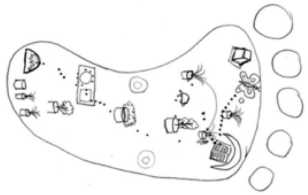
Cultural cognitive strengths: Aboriginal memorization method, with Narratives connected to place

A

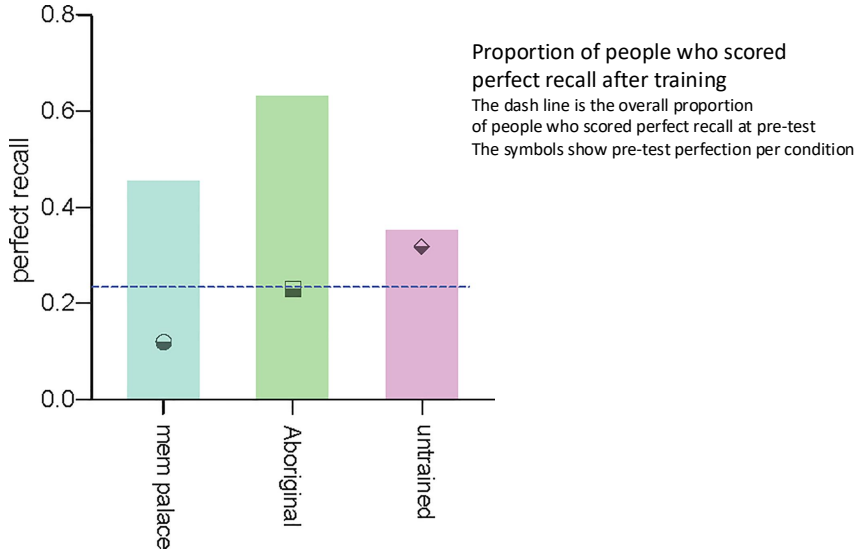
Hairstreak
patch
checkerspot
crescent
nymph
arctic
swallowtail
dogface
tortoiseshell
anglewing
admiral
silverspot
marble
heath
grayling
brushfoot
metalmark
ringlet
sandhill
copper

B

C



Cultural cognitive strengths: Aboriginal memorization method, with Narratives connected to place



Indigenous Australian Child development and Education Summary

- Rather than dividing experimental psychological research into isolated psychological/cognitive processes, the holistic interdependent self should be understood and supported
- Rather than a "deficit model," an "asset" or "strength" based approach focusing on agency and self-determination is needed and is successful
- Self-concept and educational achievement is reciprocal in both Indigenous and non-Indigenous Australians
- With Indigenous self-determination, there is no educational "achievement gap"
- Where there is no self-determination, the misapplication of developmental psychological theory developed in Western contexts can cause severe harm to Aboriginal children and families.
  - To get an introductory sense of the importance of kinship in Aboriginal cultures, watch the 8 videos from the Cultural Competence center.
- All people's cognition can benefit from an understanding of Aboriginal knowledge transmission practices. A strength-based approach highlights two-way cultural influence.

That's the end of The Cognitive Development Section

- How do you argue for different theories?
  - What evidence do you use?
- How do you argue for what interventions to choose?
  - What evidence do you use?

Exam Q&A

- Monday November 17th
- Me: 12:30pm
- Caroline 2:00pm
- Zoom links will be added to Canvas.