

Cognitive and Language Development

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http://www.psyc.bbk.ac.uk/people/academic/thomas_m/

http://www.psyc.bbk.ac.uk/people/academic/thomas_m/thomas_cogdev_lecture_files/frame.htm

Outline

- Theories of Cognitive Development
 - Piaget vs. Vygotsky
 - Piaget's stages of cognitive development
 - Can development be accelerated?
 - Educational implications
- Language development
 - The information to be learned
 - Main stages
 - Two current theories

Cognitive Development

"Above: Despite their relatively large cranial capacities, babies such as this one are so unintelligent that they are unable to distinguish colourful squeaky toys from food sources"

(SATIRE)



Cognitive Development

- Some central questions in cognitive development
 - Are changes in cognitive ability domain-general or domain-specific?
 - Are there qualitatively different stages or is change gradual and smooth?
 - Is development just learning or does something change in the brain to make children cleverer?
 - Is development "genetically controlled"?

Piaget and Vygotsky



Piaget

- Relied upon clinical method, using probing questions to uncover what children understood
- Was interested in **errors** children make and the possibility that these were not random
- Searched for a systematic pattern in the production of children's errors
- Worked towards logically, internally consistent explanation of children's errors
- Studied how knowledge is acquired and developed theory of **genetic epistemology**
- Studied thought and language in pre-schoolers and early school-age children
- Believed that intelligence arises progressively in the baby's repetitive activities
- Described how concepts of space, time, causes, and physical objects arise in development
- Investigated the beginnings of fantasy and symbolism in infancy
- Outlined a theory that states that the precursors of thinking and language lie in the elementary actions, perceptions, and imitations of babies
- Influenced by evolutionary theory: child has to 'adapt' to environment by altering cognitive structures

Vygotsky

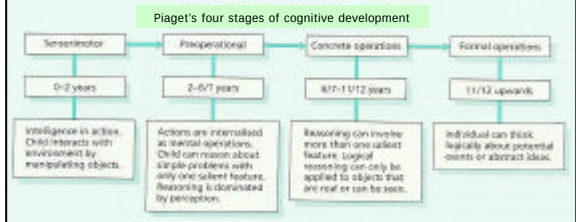
- Concerned with historical and social aspects of human behaviour that make human nature unique
- Social and cultural factors are important in the development of intelligence
- Speech carries culture in that it stores the **history of social experience** and is a "tool" for thought
- People are different from animals because they use tools to create artefacts that change the conditions of life
- There is a close link between the **acquisition of language and development of thinking**
- Gave prominence to the importance of social interaction in development as it influences language and thought
- Does not deal with fixed stages of development but describes "leading activities" typical of certain age periods around which intellectual development is organised

"Stages" in theories of development

COMPARISON OF MAJOR STAGES OF DIFFERENT THEORISTS

Period of development	Piaget	Vygotsky	Freud
Infancy 0-2 years	Sensorimotor	Affiliation	Oral: Anal: Phallic
Early childhood 2-7 years	Preoperational	Play	Oedipal
Middle childhood 7-12 years	Concrete operational	Learning	Latency
Adolescence 12-19 years	Formal operational	Peer	Genital activity
Adulthood	Formal operational	Work	

Piaget's stages of development



Mechanism of change: adaptation (**Assimilation** + **Accommodation**)

Stage 1: Sensori-motor development

- Stage I: Reflexes** (birth to 6 weeks)
 - e.g. sucking
- Stage II: Primary circular reactions** (6 wks to 4 months)
 - First acquired habits, e.g. thumb sucking
- Stage III: Secondary circular reactions** (4 to 8 months)
 - Goal-directed behaviour, e.g. visually guided reaching to objects
- Stage IV: Co-ordinated secondary circular reactions** (9 to 12 months)
 - Differentiation of means and ends in intentional acts, e.g. search for a hidden object
- Stage V: Tertiary circular reactions** (12 to 18 months)
 - Application of established means to new ends, e.g. in the bath, baby squeezes water from a sponge, pours water from a can, holds water carefully in a basin, and studies the water falling under different conditions
- Stage VI: Symbolic representation** (From 18 months)
 - Mental combinations of means and ends
 - Insightful discovery of new means through active experiment, e.g. toddler pulls an object through playpen bars using a stick. Toddler has concepts of object, space, time, and causes

Failure of object permanence before 9 months



Object permanence passed by Stage IV (9-12mo) infant but infant makes strange perseverative errors



Stage 2: Pre-operational (2-7 years, pre-school)

- Mental operations are internalised forms of actions that are mastered during infancy
 - ordering
 - combining
 - separating
 } things in the physical world
- Pre-operational child can reason about simple problems but system lacks critical linkages and is not internally consistent
 - child only able to focus on one salient feature of task at a time [**conservation**]
 - child characterised by egocentrism - can look on world only from own position [**perspective taking task**]

Conservation task

Some operations change the abstract property, some just change perceptual attributes

If you spot that the abstract property has not changed (has been **conserved**) and are not distracted by the perceptual change, then you must have acquired the abstract knowledge!

Property	Stage 1 The child agrees that the two objects are the same with respect to the property	Stage 2 The objects are rearranged and the child is then asked whether they are still the same with respect to the property
VOLUME (of liquid in each beaker)		
NUMBER (of counters in each row)		
LENGTH (of each row)		

Stage 3: Concrete-operational (age 7-11)

- Child becomes able to perform operations that are directly related to objects
- Egocentrism reduces - greater ability with language leads to greater socialisation
- More objective view of world and causes of physical events and their relationships

Development in reasoning across Stage 3



RULES FOR SOLVING BALANCE BEAM PROBLEMS

- Rule 1:** If the weights are the same on both sides, predict that the scales will balance. If the weights differ, predict that the side with more weight will go down.
 - Rule 2:** If one side has more weight, predict that it will go down. If the weights of the two sides are equal, choose the side with the greater distance (i.e. the side with the weight furthest from the fulcrum).
 - Rule 3:** If both weight and distance are equal, predict that the scale will balance. If one side has more weight or distance, and the two sides are equal on the other dimension, predict that the side with the greater value on the unequal dimension will go down. If one side has more weight and the other side more distance, it will be through or a guess.
 - Rule 4:** Proceed as in rule 3, unless one side has more weight and the other side more distance. If so, calculate torque by multiplying weight x distance on each side. Then predict that the side with the greater torque will go down.
- Table from "Three Aspects of Cognitive Development" by P.S. Singer, in *Cognitive Psychology*, Volume 8, 451-525, copyright © 1976 by Academic Press, reproduced by permission of the publisher.

Stage 4: Formal operational (age 11-15)

- Reasoning no longer limited by what can be directly seen or heard (abstraction, symbolic thought)
- Can develop logical propositions and test hypotheses (even hypothetical scenarios)
- "Pure" thought independent of action.
- All types of thought now available (although content perhaps limited)
- Adolescents show lingering egocentrism, and naivety about applicability of logical thought (idealism)

Destination: The thinker as Scientist?

Is there any further development?

- Some argue for later advances in cognition towards the end of adolescence and into adulthood

What is the purpose of laws?

- "If we had no laws, people could go around killing people" (12-13 year olds)
- "To ensure safety and enforce the government", "To limit what people can do" (15-16 year olds)
- "To provide publicly agreed norms for social cohesion given the historical context in which a particular culture exists" (25 year old)

- Ultimate 'stages' are very dependent on education and culture

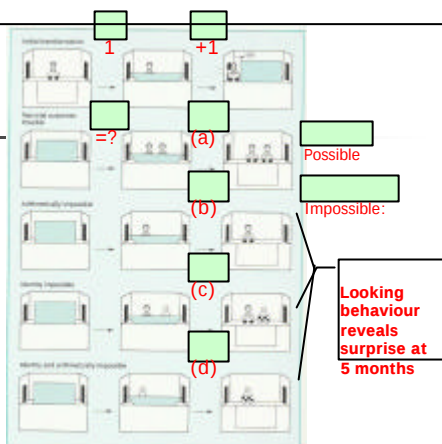
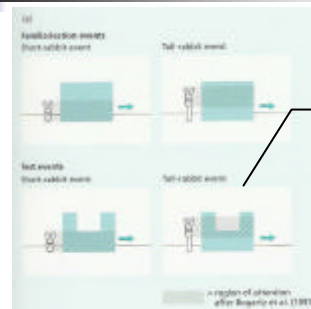
Comparison: formal vs. concrete reasoning

- Transitive inference: If $A=B$ and $B=C$ then $A=C$
- If related to physical objects, solvable by child at concrete stage
 - Use wooden ruler to show that two rods are the same length
- Only at formal stage can the problem be solved when posed on a purely verbal and hypothetical plane
 - "Say that John is taller than Mary and Mary is taller than Jane. Who is the tallest?"

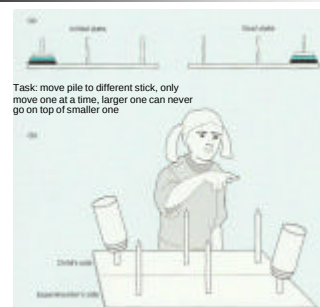
Evaluation of Piagetian theory

- General framework influential
- Much of it wrong in detail
- Notion of domain-general stages dubious, notion of general purpose cognitive processes also challenged
- Under-estimated abilities of infants
- Theory too impoverished to explain language development
- No obvious explanation for increase in "power" of cognitive system with age (e.g., how can child learn to be cleverer?)
- Little emphasis on social or emotion factors, or on abnormal development / developmental disorders

Sensitive experiments reveal earlier understanding of physical world in infants



Less abstract versions of tasks improve performance – context helps



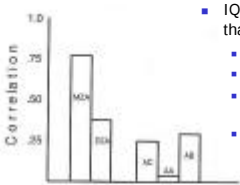
Education

- Later cognitive development influenced by schooling (literacy, numeracy)
- Must build on existing skills
 - literacy: visual object recognition, speech sound knowledge
 - numeracy: quantity estimation, object individuation, learning number words
- Educational implications of stage theory:
 - Stages suggest order of educational goals
 - "It's not what you do, it's the way that you do it"
 - Teacher creates situations to challenge child, doesn't impart knowledge

Flexibility of cognitive development

- Cognitive development cannot be accelerated much by hot-housing (intensive tuition) but it can be delayed by a poor physical and social environment
- Young babies can learn rote associations (picture = "Mozart") - this is not advanced cognitive development
- Performance of young children can be improved by setting tasks in familiar physical and social contexts
- Genes play a role in at least the variability of cognitive development

Twin studies of cognitive development



- IQ more similar in identical twins than in
 - Fraternal twins
 - Adopted children and siblings
 - Adopted children and siblings when both are adults
 - Children and their parents

Figure 12.1 IQ test correlations for monozygotic twins reared apart (MZA), dizygotic twins reared apart (DZA), between adopted children and their adopting siblings, as children (AC), between adopted children and their adopting siblings, as adults (AA), and between adopted children as adults and their biological parents (AB). Based on data presented in T. Bouchard, *Human Biology* 70:257-259 (1998).

Language Development

What has to be learned?

- Sources of knowledge required to use language:
 - **phonology** (the sounds words are made up from)
 - **semantics** (individual words and their meanings)
 - **syntax** (combinations of words)
 - **pragmatics** (how to use language in a social setting)

Nuts and bolts of language

- Language is about learning the words and rules (the recipe) - it is essentially creative.
- Sentences have underlying structure - grammatical rules apply to underlying structure (nouns, verbs, etc.) not surface form
- These rules include semantic and grammatical rules, but also complex rules of social usage
 - greetings to be used in each language
 - "taboo" words
 - polite forms of address
 - styles appropriate to different situations

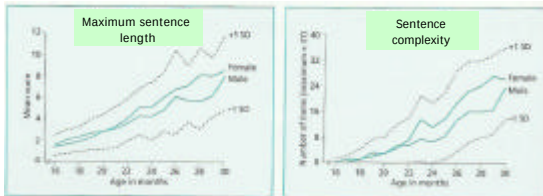
Stages of language acquisition

- Stages are variable and not correlated with IQ (domain specific development?)
 - First sounds (pre-linguistic) - reflexes
 - Babbling (around 6th month) - not a prerequisite for learning to speak
 - First words (around first year) - holophrastic sentences
 - e.g. "up" = "pick me up"
 - Two word stage (around second birthday) - holophrastic words combined into sentences with clear syntactic and semantic relations, and single intonation contour
 - "allgone sock"
 - "byebye boat"
 - "more wet"
 - "it ball"
 - "dirty sock"

Stages (cont.)

- No 3 word stage
- Move straight to telegraphic speech
- Then progressively longer and more complex sentences
- Initial utterances omit function words (to, the, can, is) and include only content words
 - "Cat stand up table"
 - "What that?"
 - "He play little tune"
 - "Andrew want that"
 - "Cathy build house"
 - "No sit there"
- These sentences still have grammatical structure

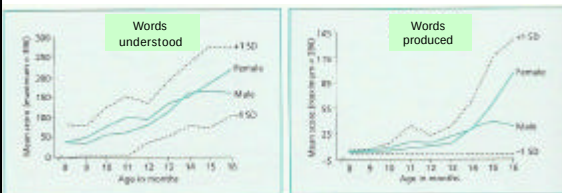
Sentence length vs complexity



Stages (cont.)

- With development, sentences more closely approximate adult grammar
 - addition of function words
 - inflectional and derivational rules
 - Grammar complete by age 5!
- Acquisition of syntactic rules is impressive given input
- Vocabulary explosion: production lags behind comprehension, learning word meanings is initially hit and miss
- Pragmatics
 - What does the speaker know? What does she know about what you know?
 - Changing literal meaning via social context - metaphor, irony, sarcasm. Implied messages ("it's sunny outside" = let's go for a walk)

Comprehension vs. production (parental ratings)



Theories of language acquisition

- Do children learn by imitation? - **No**
- Do they learn by reinforcement or explicit tuition? - **No**
- Language isn't just about producing and comprehending speech - cf. sign language
- Apes can't learn or use **grammar** - this is a uniquely human ability
- Acquisition explained by a special human ability for learning language - details remain controversial

Inside-out vs. Outside-in theories

A COMPARISON OF INSIDE-OUT AND OUTSIDE-IN THEORIES OF LANGUAGE DEVELOPMENT

	Inside-out theories	Outside-in theories
Initial structure	Linguistic	Social or cognitive
Mechanism of language development	Domain-specific	Domain-general
Source of structure	Innate	Learning procedure
Key theories	Chomsky (1981, 1986) Hyams (1986) Lendau & Gleitman (1985) Anker (1989)	Bates & MacWhinney (1989) Bruner (1975, 1983) Nelson (1977) Snow (1983)

Adapted from Hirsch-Pasek and Gorkoff (1996).

+ Connectionism /
neural networks

Reading

■ Cognitive development

- Butterworth, G. & Harris, M. (2002). Developmental psychology. Psychology Press
- Boden, M. A. (1994). Piaget, (2nd Ed.). Fontana Press

■ Language development

- Barrett, M. (1999). The development of language. Psychology Press
- Pinker, S. (1994). The Language instinct: The new science of language and mind. Penguin



MRCPsych Part I Course

Lecture topic: Cognitive and Language Development

Core Knowledge required for MRCPsych examination:

1. Piaget's stages and levels of development; Piaget's clinical method.
2. Use of e.g. conservation task to reveal level of abstractness of reasoning.
3. Educational applications of theory; limitations of theory.
4. Types of knowledge to be acquired during language development - stages of language development.
5. Theories of language development - Chomsky, connectionism.

Re commended reading:

- Butterworth and Harris (2002), introduction to cognitive development
- Boden (1994), overview and evaluation of Piagetian theory.
- Barrett (1999), most recent textbook giving overview of the psychology of language development.
- Pinker (1994), introduction to language development, esp. chapters 1& 2 - Chomskian (innate) view.

Name of Lecturer:

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Indicative Statements

1. Piaget's theory of cognitive development is domain-general and based on stages.
2. Pre-schoolers usually fail conservation tasks
3. More sensitive experimental measures have revealed greater sensori-motor abilities in infants than Piaget first supposed.
4. Cognitive ability is in part genetically constrained, and its development cannot be markedly accelerated.
5. Language development is about learning the 'recipe' for language rather than its surface forms. Syntax may be a unique human attribute.