

THEORIES OF COGNITIVE DEVELOPMENT

- **Piaget's Cognitive-Developmental Theory**
 - **Vygotsky's Sociocultural Theory**
 - **Bruner's Representation theory**



Piaget's Cognitive-Developmental Theory

- Jean Piaget (1896-1980) – Swiss scholar who began to study intellectual development during the 1920's;
- Profoundly influenced by the work of Binet;
- Employed the clinical method using probing questions to ascertain what children understood;
- Interested in the errors children made and the possibility that these were not random;



Piaget's Cognitive-Developmental Theory

Key Principles

- Children acquire more and more complex “cognitive structures” or schemes as they mature, which help them adapt to their environment;
- An infant's earliest understanding of his/her world is based on a limited number of innate schemes:

Behavioural schemes - organized behaviour patterns elicited by certain stimuli;

Symbolic schemes – mental images or verbal codes that one uses to represent aspects of experience;

Operational schemes - schemes that make use of mental “actions of the head”.



Piaget's Cognitive-Developmental Theory

How is knowledge gained?

- Children are viewed as constructivists who actively create new understandings of the world based on their own experiences;
- Children are able to construct new schemas because they have inherited two intellectual functions: organisation and adaptation



Piaget's Cognitive-Developmental Theory

- According to Piaget, adaptation occurs through two complementary processes: assimilation and accommodation.

Assimilation occurs when new experiences are integrated into existing knowledge.

Accommodation occurs when children modify their knowledge in response to new experiences which cannot be assimilated



Piaget's Cognitive-Developmental Theory

Equilibration reflects a child's attempts to create stable understanding by balancing assimilation and accommodation.

Dis-equilibration refers to imbalances or contradictions between a child's thought processes and environmental events.

Assumptions of Piaget's theory

- 4 stages of cognitive development
- Stages occur in an invariant sequence
- Ages are approximate
- Biologically driven, but development is also potentially influenced by the environment

Piaget's Cognitive-Developmental Theory

Piaget's 4 stages of cognitive development



- The sensorimotor stage (approx 0-2 yrs)- infants co-ordinate sensory input and motor abilities to acquire knowledge of the world.



Piagetian sub-stages of the sensorimotor period

1. Reflex activity (0-1m)
2. Primary circular reactions (1-4m)
3. Secondary circular reactions (4-8m)
4. Co-ordination of secondary schemes (8-12m)
5. Tertiary circular reactions (12-18m)
6. Invention of new means through mental combinations (18-24m)

Important developments of the sensorimotor stage

- *Delayed imitation* – the ability to imitate an action sometime after it has been observed
- *The concept of object permanence* – the understanding that an object continues to exist even when it can't be seen.



Object permanence

- <http://www.youtube.com/watch?v=PuP53BbIY0A>



Development of the concept of object permanence

- *0 – 1 month* – the baby tracks a moving object with its eyes but ignores the object's disappearance;
- *1 – 4 months* – the baby looks intently at the spot where the object disappeared;
- *4 – 8 months* – the baby searches for a partly concealed object;
- *8 – 12 months* – the baby searches for a concealed object but fails to search correctly following a visible displacement;
- *12 – 18 months* – the baby still fails to search correctly following an invisible displacement. After the ages of 18 months, this skill is mastered.

Piaget's Cognitive-Developmental Theory

- The preoperational stage (approx 2-7yrs) – children are thinking at a symbolic level but are not yet using cognitive operations that would enable them to think logically. Important features of this stage are:
 - (1) failure of conservation;
 - (2) egocentrism;
 - (3) class inclusion;
 - (4) animism.

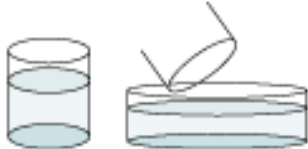
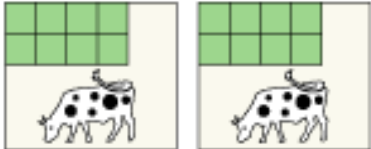
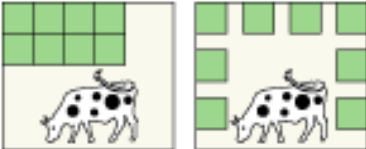




Piaget's Cognitive Developmental Theory

Failure of conservation

- Children fail to realise that the properties of an object or substance do not change when its appearance is altered in some superficial way. Cannot understand 'reversibility'. Piaget looked at 5 different tests - number, length, mass, area, liquid volume.
- Class inclusion – the child can compare parts with parts but not parts with wholes (centration)
- Egocentrism – the inability to take another person's point of view.
- Animism – the tendency to attribute lifelike qualities and intention to non living things

Type of Conservation	Starting Configuration	Transformation	Final Configuration
Liquid quantity	 <i>Is there the same amount of water in each glass?</i>	<i>Pour water from one glass into a shorter, wider glass.</i>	 <i>Now is there the same amount of water in each glass, or does one have more?</i>
Number	 <i>Are there the same number of pennies in each row?</i>	<i>Stretch out the top row of pennies, push together the bottom row.</i>	 <i>Now are there the same number of pennies in each row, or does one row have more?</i>
Length	 <i>Are these sticks the same length?</i>	<i>Move one stick to the left and the other to the right.</i>	 <i>Now are the sticks the same length, or is one longer?</i>
Mass	 <i>Does each ball have the same amount of clay?</i>	<i>Roll one ball so that it looks like a sausage.</i>	 <i>Now does each piece have the same amount of clay, or does one have more?</i>
Area	 <i>Does each cow have the same amount of grass to eat?</i>	<i>Spread out the squares in one field.</i>	 <i>Now does each cow have the same amount to eat, or does one cow have more?</i>

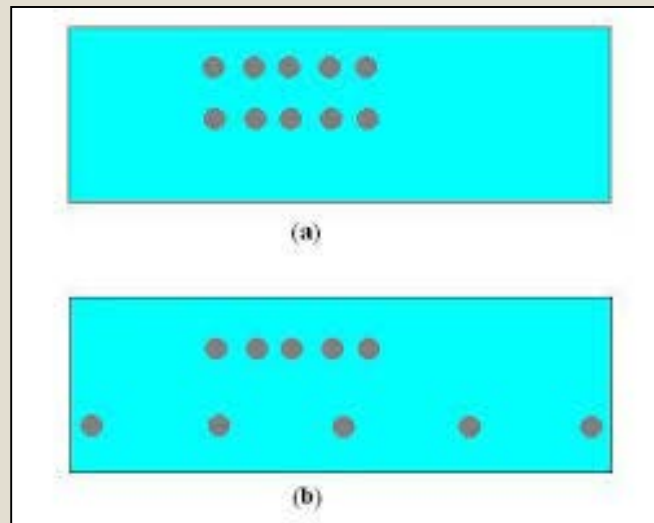
Test of Volume

- http://www.youtube.com/watch?v=R3U_T6C9NtU



Test of number

- <http://www.youtube.com/watch?v=vkQTNeDM-cA>



Test of length

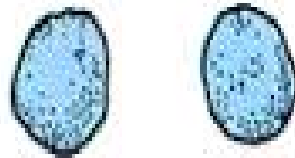
- http://www.youtube.com/watch?v=oc-dZVQ_aCM



Test of mass

- <http://www.youtube.com/watch?v=1zCQL0t5rlo>

1. Conservation of mass



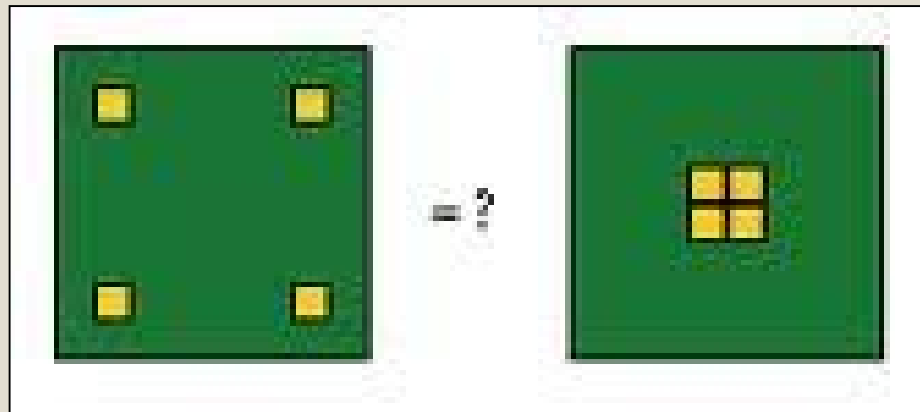
The experimenter presents two balls of clay.



The experimenter rolls one ball into a "sausage" and asks the child whether they still contain the same amount of clay.

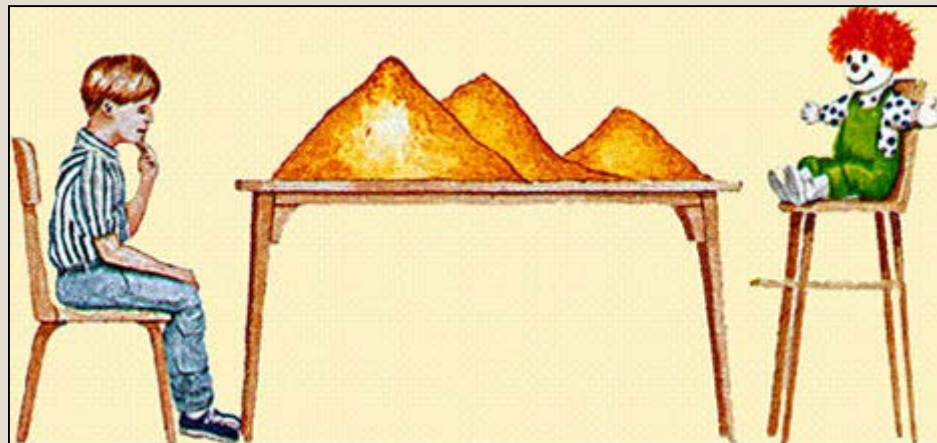
Test of area

- <http://www.youtube.com/watch?v=bpLexv8fsso>



The Swiss mountain experiment (egocentrism)

- <http://www.youtube.com/watch?v=OinqFgslbh0>



Piaget's "3 mountains" egocentrism test:

"Draw how the mountains would look from the doll's point of view."

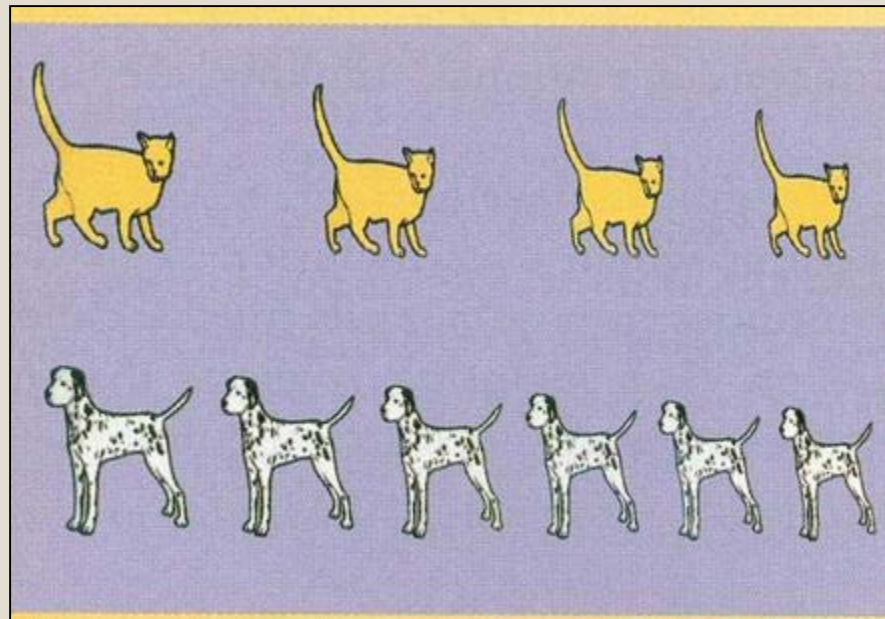
Animism

- <http://www.youtube.com/watch?v=tFVR8gbdqJ8>



Class inclusion (centration)

- <http://www.youtube.com/watch?v=mk7Wp2eNcEA>





Piaget's Cognitive Developmental Theory

- Concrete operational stage (approx 7-12 years) – children are acquiring cognitive operations and thinking more logically about tangible objects and experiences. Thinking is reality bound.

Characteristics

- Children are now successful in solving conservation problems.
- Children are also able for the first time to pass tests requiring seriation i.e. ability to mentally organize items along a quantifiable dimension.
- Transitivity – the ability to mentally infer relations among elements in a serial order (e.g if stick A is longer than stick B and stick B is longer than stick C, which is the longest?).



Piaget's Cognitive Developmental Theory

- Formal-operational stage (approx 11-12 years and beyond) – individuals begin to think more rationally and systematically about abstract concepts and hypothetical events.
- Test of formal operational reasoning

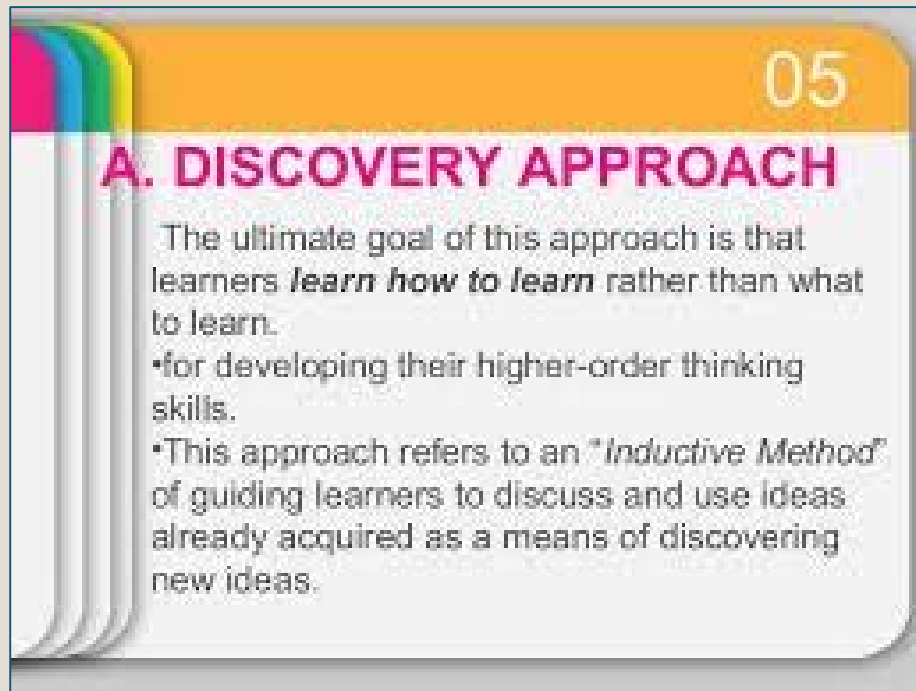


Application: discovery learning

- Piaget's theory offers a description of a child developing a more abstract and general capacity to tackle problems in the world independently;
- The provision of a rich learning environment is necessary (as opposed to direct tuition);
- The child is given opportunities to actively explore and investigate concepts and physical events to build their understanding;
- Discovery learning downplayed the significance of adults as tutors (but Piaget valued peer contact as having the potential to foster cognitive development – socio-cognitive conflict)

Discovery learning in the classroom

- <http://www.youtube.com/watch?v=sgUwHt21yJ0>



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A. DISCOVERY APPROACH

The ultimate goal of this approach is that learners *learn how to learn* rather than what to learn.

- for developing their higher-order thinking skills.
- This approach refers to an "*Inductive Method*" of guiding learners to discuss and use ideas already acquired as a means of discovering new ideas.

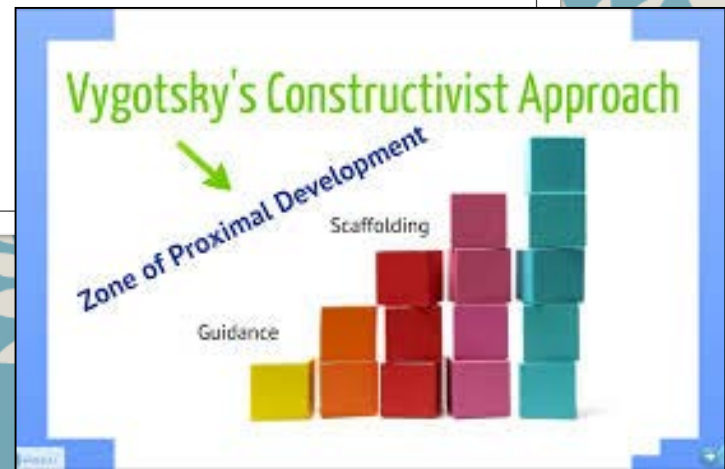


Evaluation of Piaget's Theory

Criticisms

- Underestimated children's cognitive abilities (e.g. Donaldson 1978; Light et al. 1979; Siegler 1997).
- Performances on Piagetian tasks can often be improved through training, challenging Piaget's claim that individualized discovery (not direct tuition) is the best way to promote intellectual growth.
- Failure to take into account educational and cultural factors.
- Cognitive growth much less "stage-like" than Piaget assumed.
- Vagueness regarding cognitive mechanisms.

VYGOTSKY'S SOCIOCULTURAL THEORY





Vygotsky's Sociocultural Theory

Lev Vygotsky's (1896-1934) legacy

- Human development is viewed as a socially mediated process that may vary from culture to culture;
- Children's personal characteristics and cognitive skills evolve largely from social interactions with more competent others;
- Social interactions produce continuous growth.



Vygotsky's Sociocultural Theory

The Role of Culture in Intellectual Development

- Infants are born with a few *elementary mental functions* that are eventually transformed by the culture into *higher mental functions*;
- Each culture provides its children with *tools of intellectual adaptation*

Theories of Knowledge Acquisition

- Vygotsky developed his socio-cultural (involves both societal and cultural influences on learning) theory of Zone of Proximal Development at around the same time as Piaget was developing his ideas
- Vygotsky was influenced by Marxism and the importance of the role of the individual within a group.

Stalin suppressed Vygotsky's work as it was considered anti-Soviet (it highlighted individual differences) thus preventing the West from seeing it until the 1960's when "Thought and Language (1962)" was finally published.

Bruner (see later) even wrote the forward in it.

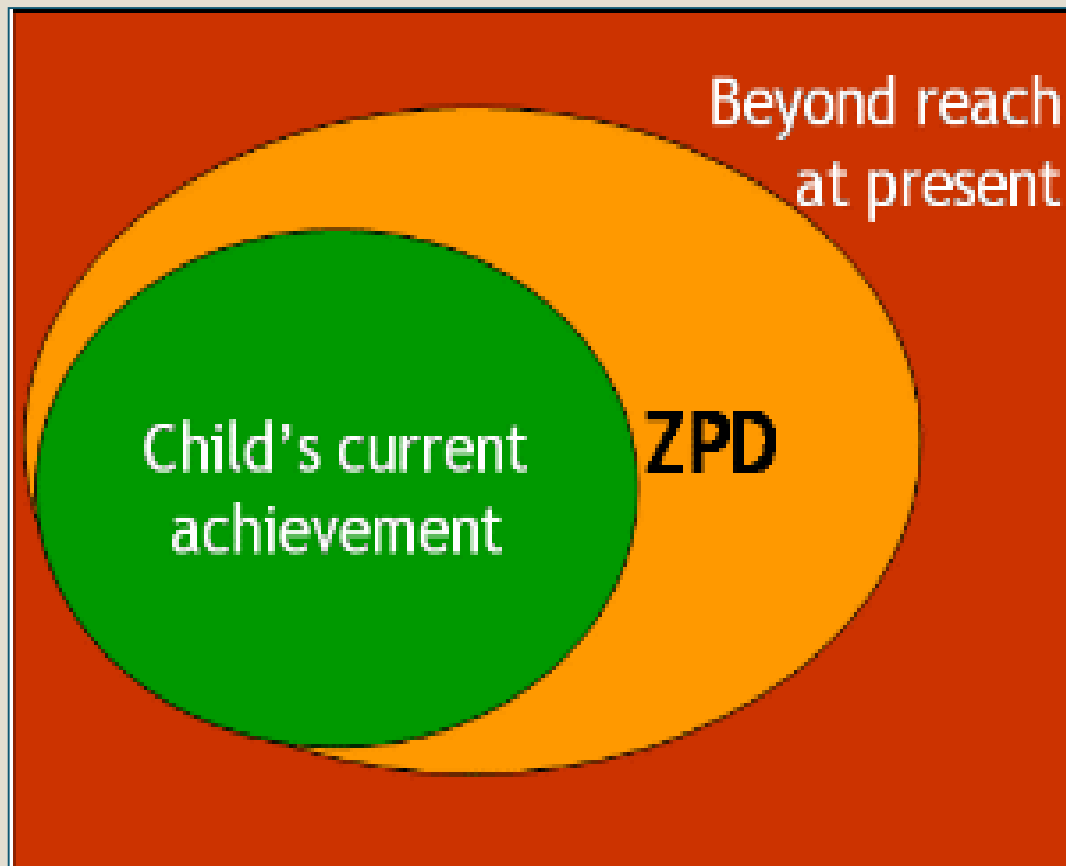


Vygotsky's Sociocultural Theory

The Social Origins of Early Competencies

- Emphasis is on the importance of *social* contributions to personal growth;
- Children's discoveries occur within the context of collaborative dialogues with a more skilful tutor;
- Collaborative learning occurs most readily within the child's *zone of proximal development*;
- *Scaffolding* is a feature of social collaboration which fosters cognitive growth and the acquisition of other skills.

Theories of Knowledge Acquisition



Theories of Knowledge Acquisition

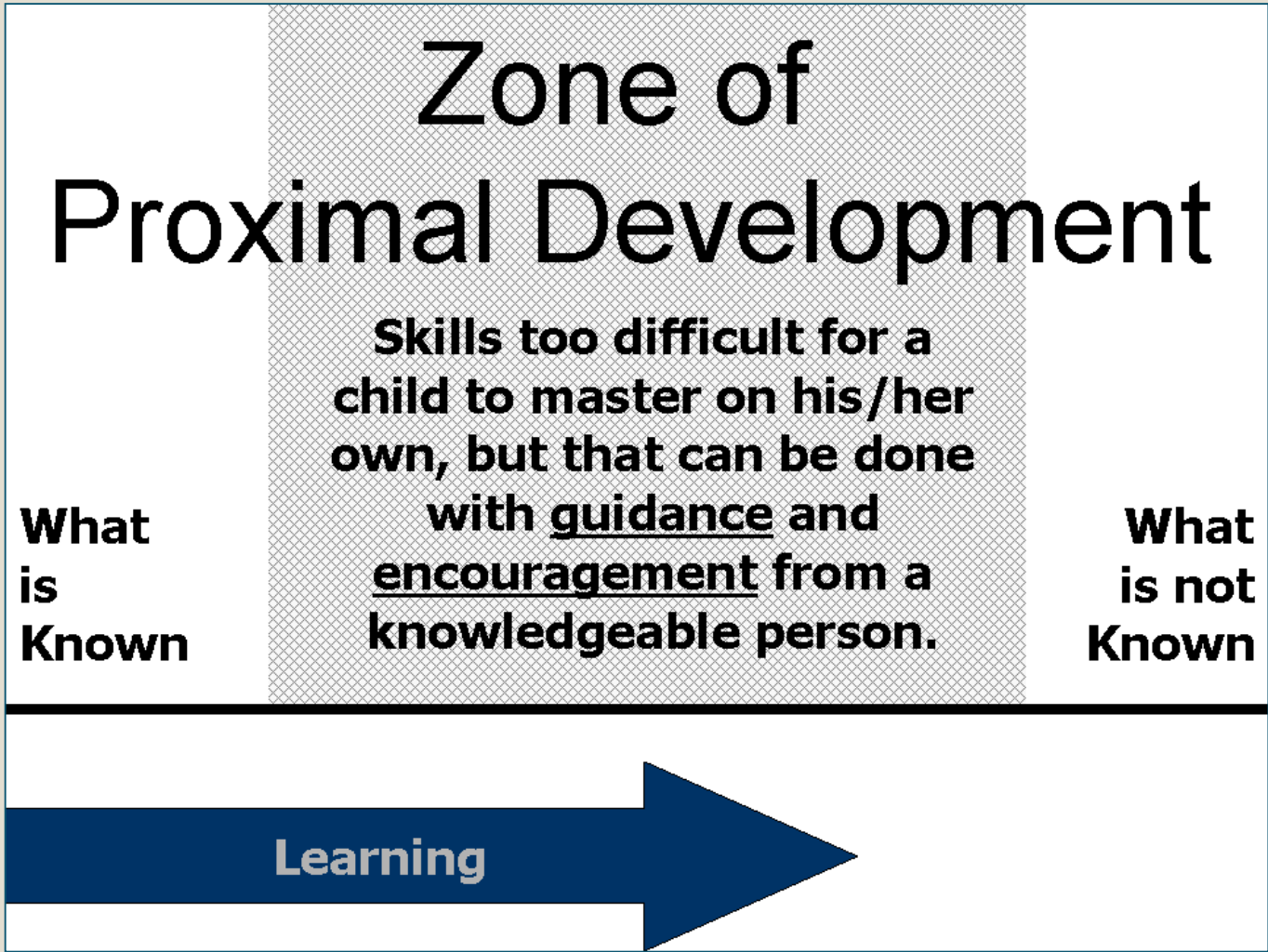
Zone of Proximal Development

Skills too difficult for a child to master on his/her own, but that can be done with guidance and encouragement from a knowledgeable person.

**What
is
Known**

**What
is not
Known**

Learning



Theories of Knowledge Acquisition

- Vygotsky found that children who were given advice and suggestions when they got stuck achieved much more than expected compared to children not given any assistance.
- “Without verbal assistance, the children could only show what they *could* do, but with assistance, they could show what they were *capable* of,” (Bainbridge et al., 2008).
- This difference is the Zone of Proximal Development. If a child has a bigger ZPD they easier they will find learning; the smaller the ZPD, the harder they will find learning.

Levels of Parental Support (Wood & Middleton, 1975)

- 4 yr olds given wooden blocks to fit together
- Building task too difficult for child to complete alone
- Interactions between children and parents observed in different levels of support:
 - Parent demonstrates
 - Parent prepares
 - Parent indicates
 - Parent gives specific instructions
 - Parent gives verbal prompt

Hatano & Inigaki (1992)

- Suggested a distinction between:
 - routine knowledge
 - learning of a context-specific skill
 - conceptual knowledge
 - acquisition of general cognitive principles which are transferable to a range of different contexts



Vygotsky's Sociocultural Theory

Language and Thought

- Vygotsky suggested that it was through speech, formed through the process of social interaction, that the child developed as a thinker and a learner.

Stages of Language-Thought Development

1. External speech – thinking comes from a source outside the child;
2. Private speech - children talk to themselves as a way of directing their own thinking and guiding their activities;
3. Internal speech – children have internalized their thought processes.



Vygotsky's Sociocultural Theory

Contributions

- Stresses the importance of specific social processes hitherto not emphasised by other theorists
- Expectations that wide variations across cultures will exist
- Contribution to education



Vygotsky's Sociocultural Theory

Challenges

- “recent” theory which has not been subject to such intense scrutiny as Piaget’s;
- The biological side of development is neglected
- Guided participations that rely heavily on verbal instruction less useful for learning in some cultures (Rogoff, 1990,1998; et al.,1993)

Bruner`s Theory of Knowledge Acquisition

- Bruner (1966) presented three stages or modes of representation necessary for knowledge acquisition.
- These differ from Piaget's stages in that they are not defined by precise age ranges.
- Bruner highlights that children's intellectual development is dependant on progressing through the three stages; and that the three stages exist throughout an individual's life.
- The three stages are called *representations* because they represent the rules that enable the individual to understand the world.

Theories of Knowledge Acquisition

Enactive Stage

"Knowing by doing"

Actions involved in making the lights work on a toy

Iconic Stage

(up to 6 years)

Mental imagery that represents larger chunks of knowledge.

Mental image of toy can be changed in the mid or represented in drawing

Symbolic Stage

(Approaching adolescence)

Experience of the world can now be represented by symbols i.e. language - toys can now be described in words.

Modes of Representation

- Bruner suggested that different ways of thinking (or representation) were important at different ages.
- In contrast, Piaget emphasised that children developed sequentially through different stages of development.
- The enactive mode (used in 1st 18 months)
- The iconic mode (develops from 18 months)
- The symbolic mode (6-7 years onwards)

Enactive Representation

- The first kind of memory. This mode is used within the first 18 months of life (corresponding with Piaget's sensorimotor stage).
- The infant stores information in the form of muscle memories: remembering the feel of actions.
- Thinking is based entirely on physical actions.
- Infants learn by doing, rather than by internal representation (or thinking).
- This mode continues later in many physical activities, such as learning to ride a bike.

Iconic Representation.

- Information is stored as sensory images: usually visual ones, like pictures in the mind.
- Mode begins to develop from 18 months.
- Some children develop an extreme form of this known as eidetic imagery (photographic memory), but they usually lose it as they grow older.
- Thinking is based on the use of mental images (icons), which may be based on sight, hearing, smell or touch.
- <http://www.youtube.com/watch?v=cByXyaRLAAw>

Symbolic Representation

- The ability to store things in the form of symbols. Words are powerful symbols and we can store a lot of information as verbal memory.
- This mode is acquired around six to seven years-old (corresponding to Piaget's operation stage).
- Representation of the world is principally through language, but also other symbolic systems such as number and music.
- <http://www.youtube.com/watch?v=yDnR9NdyN3c>

Theories of Knowledge Acquisition

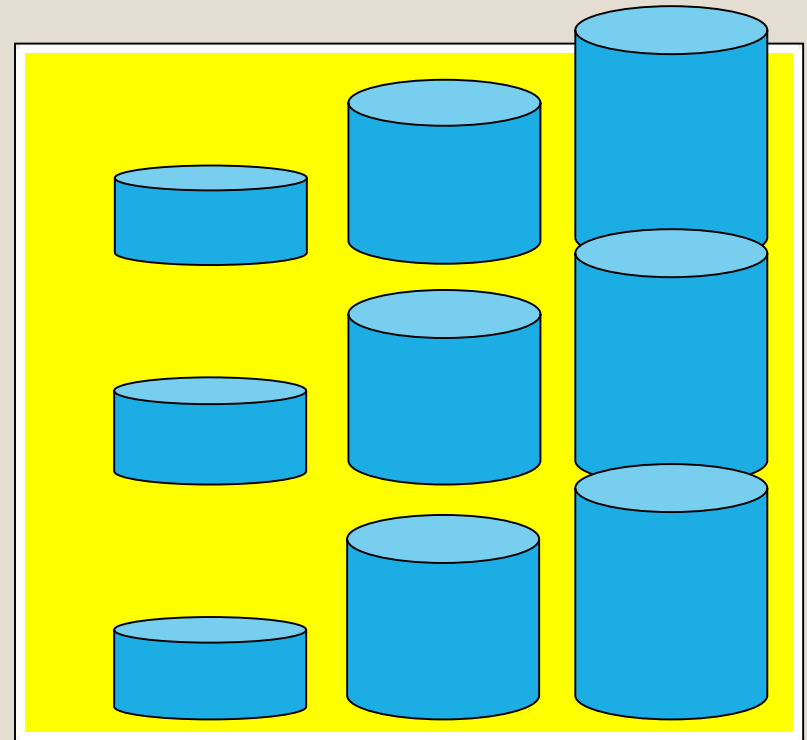
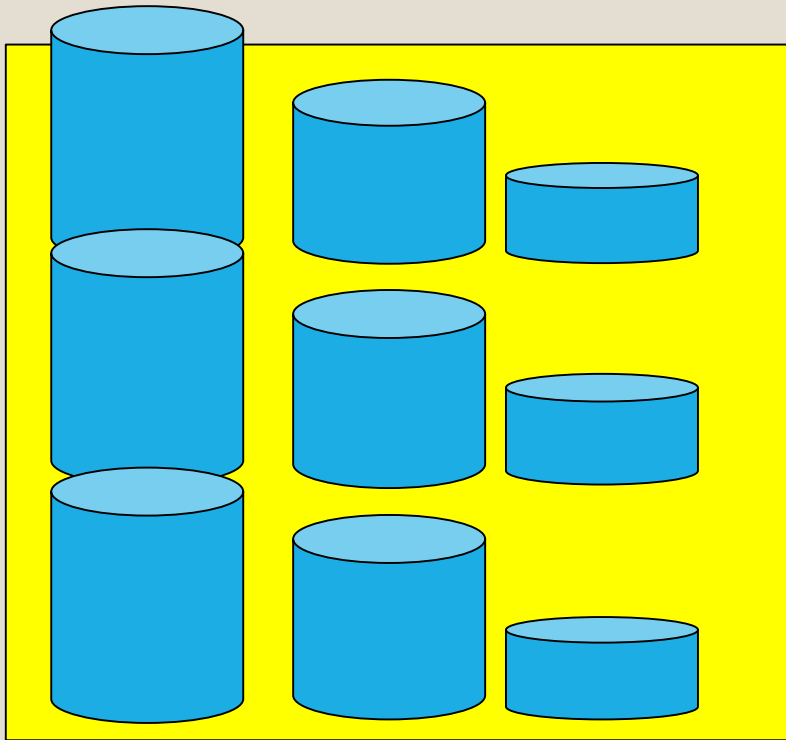
Three further differences to the work of Piaget are;

1. Bruner considers the social world of the child and how this causes different life experiences and therefore, the development of a unique set of rule for each child.
2. Bruner recognises that intellectual development is a result of interacting with the external environment and is not limited to biologically determined age stages.
3. Bruner recognises that language assists in intellectual development, as opposed to being a result of development.

Supporting evidence

- Bruner & Kenney (1966) wanted to find out at what age children move from using the iconic to the symbolic mode of representation.
- They gave children aged between three and seven years old the task of rearranging glasses on a board:
 - 1. as a reproduction
 - 2. as a transposition (mirror-image)

The reproduction-transposition task



Scaffolding

- Wood, Bruner and Ross (1976) – adults particularly parents, support children's cognitive development through everyday play interactions.
- Scaffolding is a temporary support structure around that child's attempts to understand new ideas and complete new tasks.
- <http://www.youtube.com/watch?v=pXI7PP3bBKE>

Scaffolding Purposes

- The purpose of the support is to allow the child to achieve higher levels of development by:
 - 1. simplifying the task or idea
 - 2. motivating and encouraging the child
- Highlighting important task elements or errors
- Giving models that can be imitated.

Dealing with Abstraction

- The first two modes of representation are restricted to dealing with concrete experiences and tangible objects.
- It is only when children start to use the symbolic mode that they begin to deal with abstract concepts.
- Abstract concepts do not exist physically but only exist as ideas.
- Abstract concepts are expressed symbolically through language.

Example of an abstract concept

- An example of an abstract concept, relevant to psychology, is ethics.
- These are a set of guidelines that we follow to ensure our participants well-being is protected in a study.
- However we would find it extremely difficult to communicate the idea of ethics via gestures (e.g. enactively) or images (e.g. iconically).

Application of Bruner's Approach

- Bruner introduced researchers outside of the former USSR to Vygotsky's ideas.
- Bruner's work on language and cognitive development has been very influential.
- Bruner stressed the importance of the role of social exchanges between the child and adult.

Continued...

- Although Bruner's theory is much narrower in scope than Piaget's, Bruner's ideas have been applied more directly to education.
- This is notably through his notion of 'spiral curriculum', which basically argues that ideas can be presented to children at almost any age, provided they are coached in an appropriate mode of representation.