

Chapter 7 Cognitive Development

Part 1

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I think, therefore I am...

- **What are thinking & thought?**
- **How should we treat them from a natural science viewpoint?**
- **How do they develop?**
- **How are language & thought related?**

Thinking (Cognition)

- **Cognition = the act or process of knowing**
- **Knowing = thinking**
- **What is thinking?**
 - **An action, a behavior**
 - **What makes thinking different from other operant behaviors?**

It's all about LOCATION

- **Cognitive behavior thoughts**
 - Private events
 - “inside the skin” (i.e., covert)
 - Still related to the environment

Examples of Thinking

- Birth- 24 mo.?
- 2-7 years?
- 7-11 years?
- 12+ years?

3 Aspects of Cognition

- **Cognitive development involves changes in our skills and abilities over one's life span**
 1. **Knowledge (About)**
 2. **Ability (How)**
 3. **Problem Solving**
- **These are operant behaviors**
 - **Some covert (private), some overt (public)**

Cognitive Development

- **Involves changes in our knowledge and abilities over our life span**
 - Behavioral systems viewpoint provides the processes
 - BUT, we need to talk about structural knowledge as well
 - Jean Piaget

Piaget

- **1896 – 1980**
- **Published at 10! Structural changes in mollusks**
- **Scientist – did work in backdrop of Darwin’s increasingly popular theory of evolution**
- **Helped develop the first standardized intelligence tests**
 - **Noticed particular errors children made**
 - **Tried to identify the logic used in producing these errors**
- **Used clinical method**
 - **Small number of subjects studied extensively**

Piaget's Theory of Cognitive Development

- **What Changes?**

- **Structure: Interested in biological structure of phylogenic development**
- **Originally looked at shell development of mollusks and created a parallel metaphor for the development of knowledge**
 - **Mental structures were what changed**

Piaget's Theory of Cognitive Development

- **Schemes are these changed mental structures – mental representations**
 - **Actions, images, or symbols used to “interpret” interactions with the world; miniature models that are stored**
 - **Environment → schemes → cognitive behavior patterns**
 - **Schema as middle man**

Types of Schemes

Complexity, Amount



- **Infants:**
 - Behavioral schemes
 - Innate, deal with reflexes (suckling)
- **1 year:**
 - Circular reactions
 - More complex; acting a slinky or drinking
- **2 years:**
 - Symbolic schemes
 - Deal with language, allow person to verbally represent the world (dog = “dog” no sim. properties)
- **Operational scheme**
 - “actions of the head” logic, mathematics, word manipulation

How Do The Structures (Schemes) Change?

- **“Adaptation” of mental structures**
 - Assimilation and accommodation are reciprocal and complementary processes
- **Assimilation**
 - Taking environmental information into a scheme
- **Accommodation**
 - Occurs when environmental information doesn't fit with current schemes
 - Child knows “cat” and sees a lion and calls it “cat” it doesn't fit in scheme, so schemes are reorganized or new schemes are created to accommodate new info

How Do The Structures (Schemes) Change?

- **What “motivates” development?**
- **Mismatch between what a child knows and what they need to know**
 - **Problem with intentionality**
 - **Equilibrium**
 - **Achieved only temporarily when there is a match between what the child knows and the environment**
 - **Disequilibrium**
 - **Normal state; discrepancy between what a child knows and what they should know**
 - **Implies universality of learning; not because a child wants to**

Piaget's Stages of Cognitive Development

- **Sensorimotor Stage:**
(Birth-24 months)
- **Preoperational Stage:**
(2-7 years)
- **Concrete Operational Stage:**
(7-11 years)
- **Formal Operations Stage:**
(12 years and up)



Sensorimotor Stage (Birth – 24 Mo)

- **Reflexes (B - 1 mo.)**
- **Primary Circular Reactions (1-4 mo)**
 - Repetitious reflexes (kicking, s. thumb)
- **Secondary Circular Reactions (4-7 mo)**
 - Repetitious bxs that produce consequences (rattle, kicking)
- **Coordination of Secondary Schemes (8-12 mo)**
 - Patterns more organized, learning is “intentioned”
 - Behave for certain consequences, not because they have shaped bx
- **Tertiary Circular Reactions (12-18 mo)**
 - Curiosity and symbolic schemes
- **Symbolic Problem Solving (18-24 mo)**
 - Mental representations (object permanence); imitation

- <http://www.youtube.com/watch?v=ue8y-JVhjS0>

Preoperational Stage (2-7 years)



- **Preconceptual Period: (2-4)**
 - Thinking naïve; no cause to effect logic
 - Animism (wind = trees moving arms)
 - Egocentrism (lack of perspective taking)
- **Intuitive Period (4-7)**
 - Begins to reason, but still egocentric
 - No conservation; tall = more,
<http://www.youtube.com/watch?v=gnArvcWaH6I>

Concrete Operations Stage (7-11 years)



- **Operational Schemes**

- Many complex schemes combine and child has rules about the relationships between more abstract properties of objects

- Conservation, hierarchical relations, adult-like logic
<http://www.youtube.com/watch?v=gA04ew6Oi9M>

- **Inductive Reasoning**

- Specific to general; beginning logic
- Concrete Reasoning only

Formal Operations Stage (12+)

- **Most highly and developed schemes**
 - **Abstract Thinking, most flexible stage**
 - **Ability to follow arguments and logical arguments**



Problems with Piaget's Theory

- **Schemes have been presented as if they are real things - - they are not; they do not have a physical existence**
 1. Piaget inferred schemes from the behaviors children gave in responses to their environments
 2. No one has ever seen a scheme
 3. Schemes are really descriptions of behavior and of categories of behavior, not explanations
- **Age as a causal variable**

Vygotsky's Theory of Cognitive Development

- **The Zone of Proximal Development (ZPD)**
 - What the child can do alone vs. what the child can do with the help of others
- **Scaffolding**
 - Assistance which can lead to cognitive, social and behavioral development (shaping)
 - Think of a scaffold of a building that supports walls as builders build
- **Cultural Tools**
 - The physical things and intellectual tools that are part of the child's cultural experience (LANGUAGE)
 - Cognition is learned through social interactions (process)
 - <https://www.youtube.com/watch?v=Du6vqSOj7UU>

Behavioral Approaches to Cognitive Development

- **Behavior analysts often accused of not handling cognition**
 - Untrue, although they do not include hypothetical structures and instead deal with the functions of cognitive behaviors
 - “Cognition” vs. cognitive behavior
- **What develops?**
 - Behavior, not hypothetical constructs

Behavioral Approaches to Cognitive Development

- **Same operant principles from yesterday are responsible for cognitive behavior:**
 - Knowledge and Ability
 - Natural and Contrived Consequences
 - Problem Solving
 - Exploratory Behavior
 - Creative Behavior

Knowledge and Ability

- **Knowledge: knowing about things**
 - First president? 2+2? Positive reinforcement?
- **Ability: knowing how to do things**
 - How to use an ATM? How to change a tire?
- **Cognition not a thing, not a scheme**
 - Something a person does in relation to environmental stimulation
 - Ever increasing knowledge and abilities shaped and maintained by consequences
 - Use it or lose it

What reinforces cognitive behavior?

- **Natural Reinforcers**

- Reinforcing stimuli that are inherent in the response itself (perfume bottle, banging a drum, thinking and producing functional answers, reading and information)

- **Extrinsic Reinforcers**

- Environmental
- Reinforcing stimuli that must be presented by oneself or by another (teaching, parent and language, self-management)

Problem Solving

- **Problem is not having behavior in your repertoire to produce reinforcement**
- **Problem solving: emitting behaviors that change the situation in such a way that behaviors produce reinforcement**
 - **Extinction induced variability!**
 - **Old pattern not effective, variability occurs. These new behaviors are likely to “solve” problem (holding a plate of food+baby gate; remote breaks; child opening a container; cooking)**

Problem Solving

- **Two parts:**
 1. Behavior changes the situation such that reinforcement can be obtained
 2. Emit problem solving behavior
- **Precurrent behavior**
 - Simple responses that make problem solving behavior more likely
 - Alphabetizing, examining the object, looking in the dictionary
 - 1973 * 3982 = ??? Preactant behavior = going through the steps of long multiplication

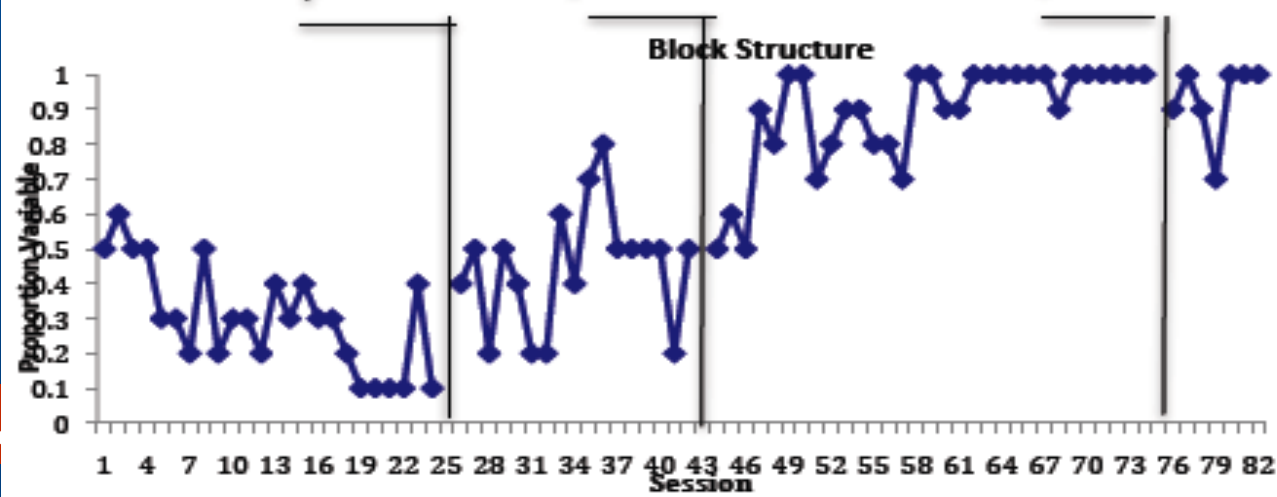
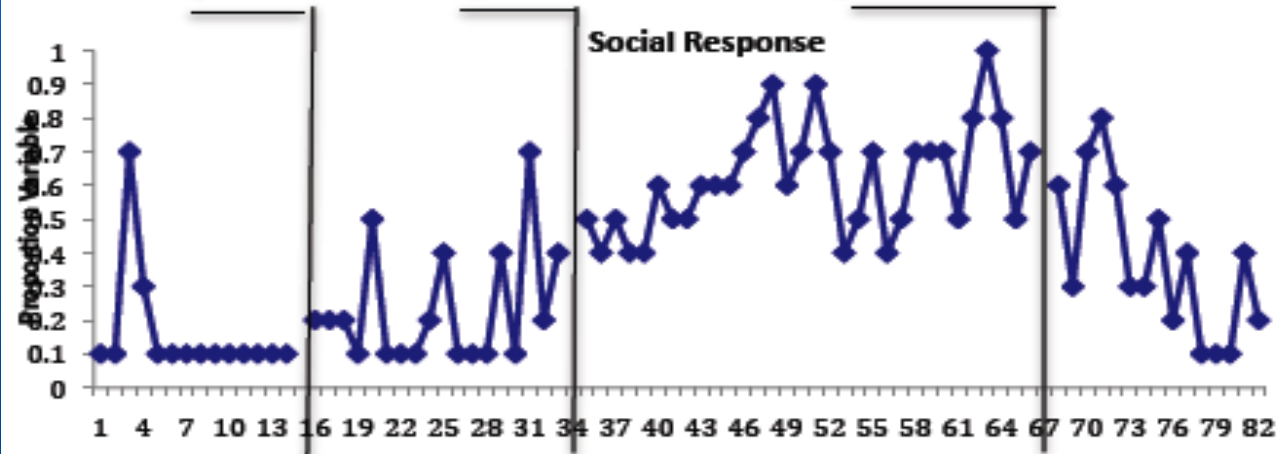
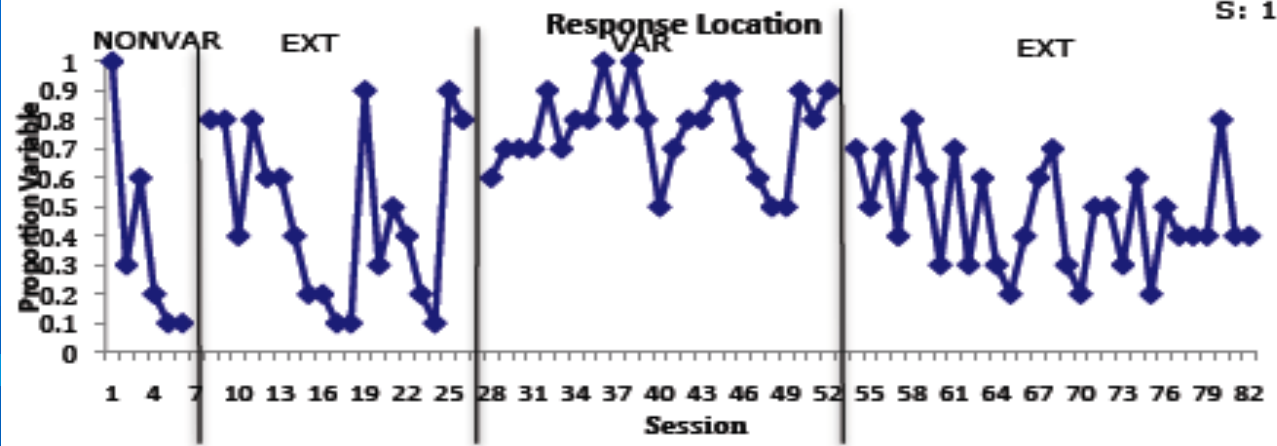
Exploratory Behavior

- **Exploratory Behavior**

- **Ecological Stimuli: intrinsic reinforcers of exploratory behavior involving the physical properties of various objects, social stimuli, or biological stimuli (colors, smells, sound, shapes)**
- **Intrinsically and automatically reinforce**
 - **Shaking a rattle produces sound, kicking legs produces visual and tactile stimulation, mouthing objects produces smells, visual, and tactile stimulation)**
- **Puts baby in contact with environment so other extrinsic reinforcers can occur**

Creative Behavior

- **Not totally new, but but involves unique combinations of responses**
- **Behavior develops under two conditions**
 - There is a development of a large repertoire of knowledge and ability responses
 - A history of reinforcement for making new combinations of knowledge and abilities (artist, singer)
- ***Creative Behavior* = history of knowledge and ability + history of being reinforced for unique combinations**
- **Variability**



Part 2

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Fischer's Skill Learning Approach to Cognitive Learning

Fischer's Skill Theory: What develops? Operant Response Classes

- Instead of Piaget's *schemes*
- **operant response classes**
(or "sets") in relation to the environment.
- Thought & language = behaviors.



Dr. Kurt W. Fischer

The Harvard Graduate School
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Cognitive Behavior

- Often misconceptualized as “memory storage”
 - Mini picture of a dog? That would be the same as “schema”
- Instead, it is remembering
 - An operant
 - Something you do
 - Responding to discriminative stimuli

Cognitive Behavior

- Common discriminative stimuli for remembering:
- Events: Planner, calendar, clock
- Names: people's faces
- Making a meal: ingredients
- What you need: walking through isles of grocery store
- Tattoo: special moment
- Jewelry: engagement, wedding, anniversary
- Photographs

How do skills develop?

- **Fischer (1980)**

- “The child masters specific skills, builds other specific skills upon them, and transfers skills from one domain to another. This mastery process involves qualitative changes in skills, but the specific changes occur gradually, not abruptly” (p. 483).

Cognitive Behavior as Organized Response Classes

- **Level 1:**
 - Contingencies produce individual behavior-environment relationships
- **Level 2:**
 - Contingencies act to organize systems of behavior-environment relationships (patterns of behavior)
 - i.e., response classes
 - Build on each other, later skills emerge from earlier ones, become highly organized and complex. No need for structures to explain this. Just interaction.

Comparing Fischer's Level with Piaget's Stages

- Fischer's Theory

- Operant Behavior Classes
- Org-Env Interaction
- Decalage in domains
- Individual Differences

- Piaget's Theory

- Schemes
- Org-Env Interaction
- Synchrony in all domains
- Universal Stages

Skill theory and Behavior Analysis

The Four-Term Contingency

S^D ----->R----->S +r (-r)

SE

Response classes are controlled by their consequences; complex classes and systems emerge because they have more access to reinforcing consequences

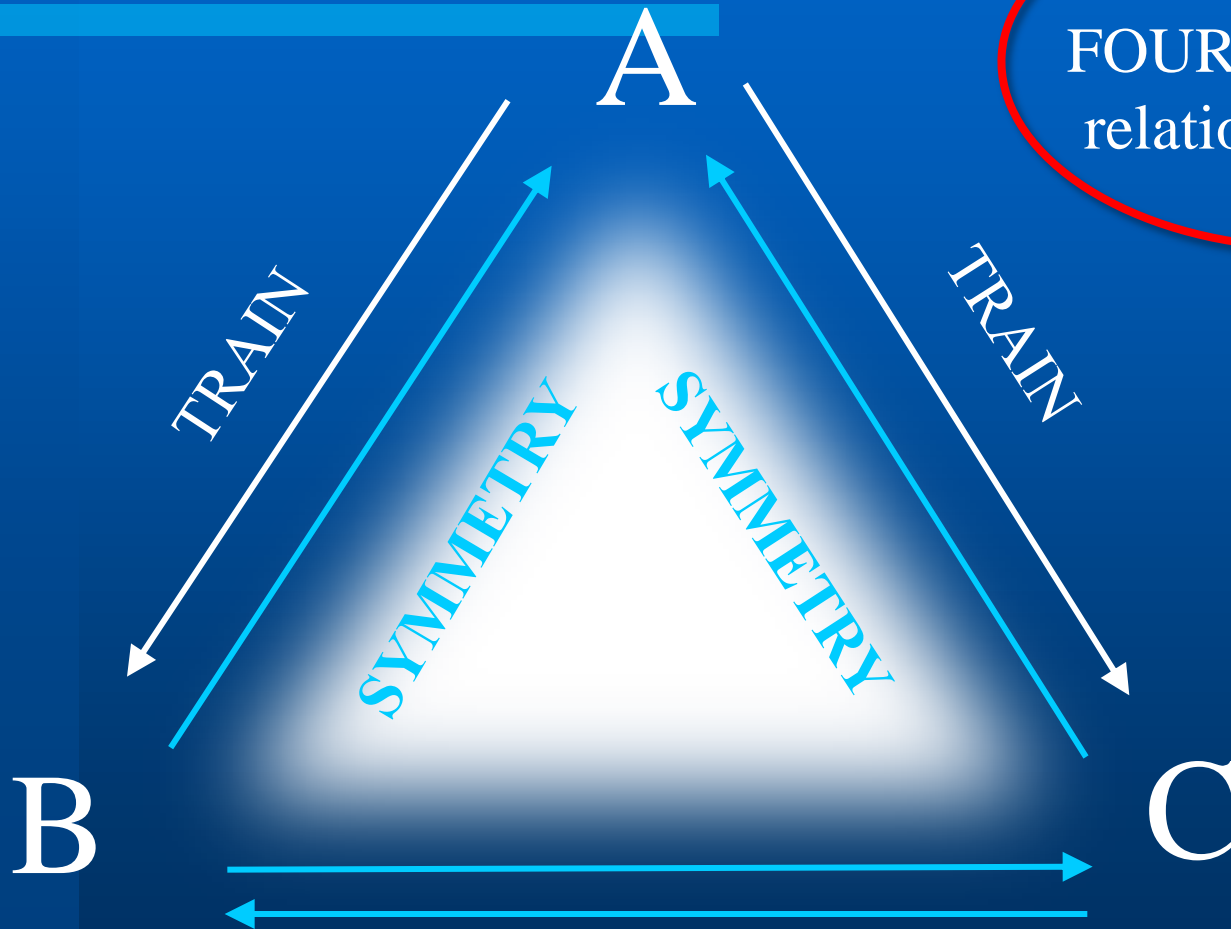
Stimulus Equivalence and Cognitive Development

- **Stimulus Equivalence Classes**
- **Relational Frame Theory and Stimulus Equivalence**

Stimulus Equivalence

- **Consists of stimulus equivalence classes**
 - A group of discriminative stimuli that have the same functional properties
 - One can be substituted for another and same response occurs
- **Few relationships are learned**
- **Many relationships emerge**
 - “More bang for your buck”

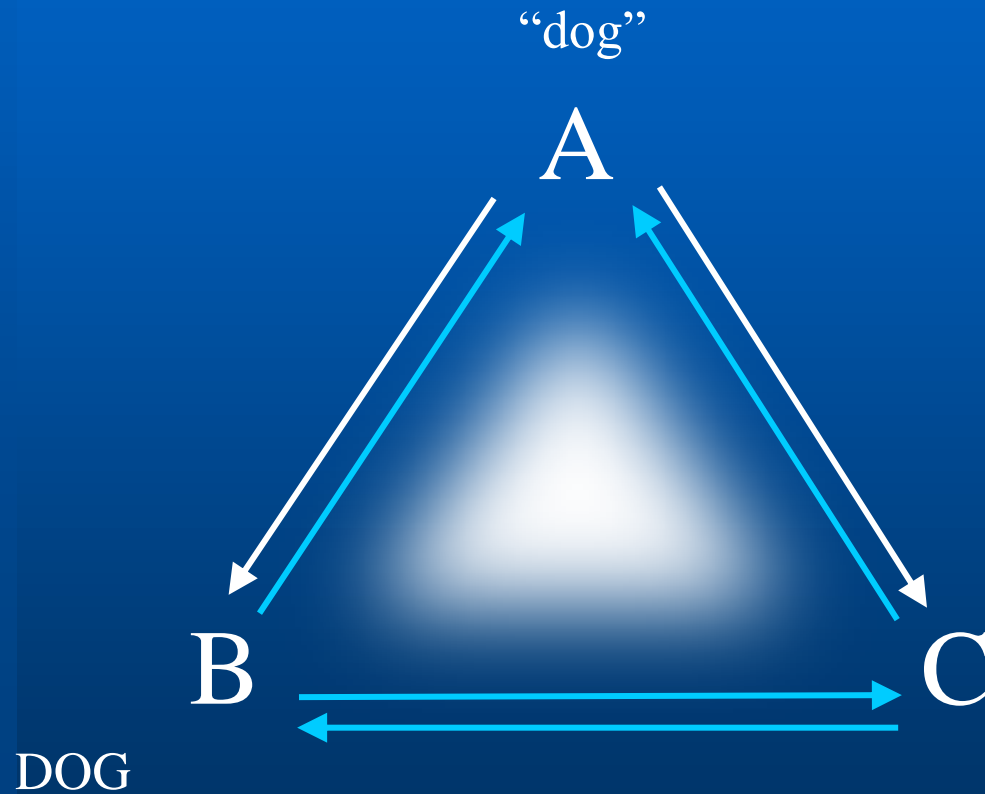
Equivalence



Stimulus Equivalence Classes

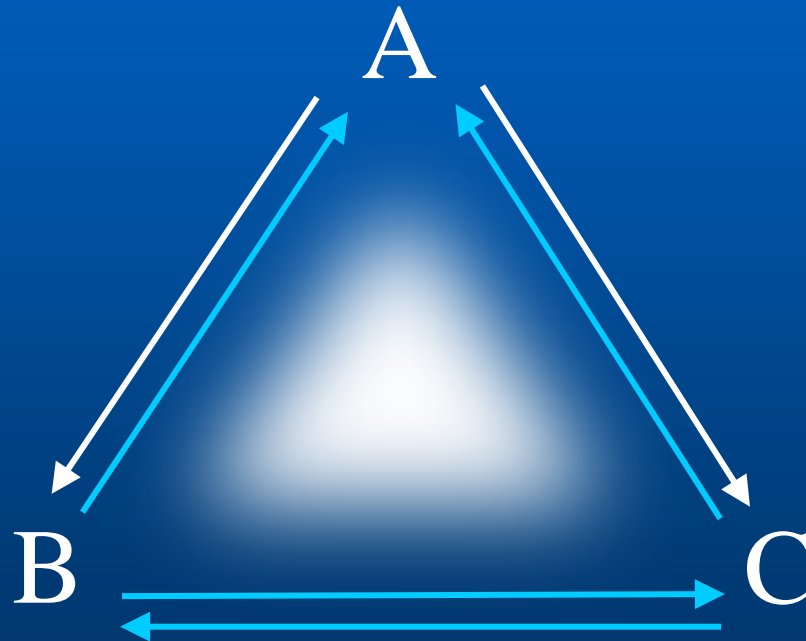
- **Equivalence Class: three relationships must be present**
 - **Identity**
 - $A = A$
 - **Symmetry**
 - $A = B$ then $B = A$
 - **Transitivity**
 - $A = B$ & $B = C$ then $A = C$

Examples



Examples

[https://youtu.be/7ViXj2XEY28?t=11m30s:](https://youtu.be/7ViXj2XEY28?t=11m30s)



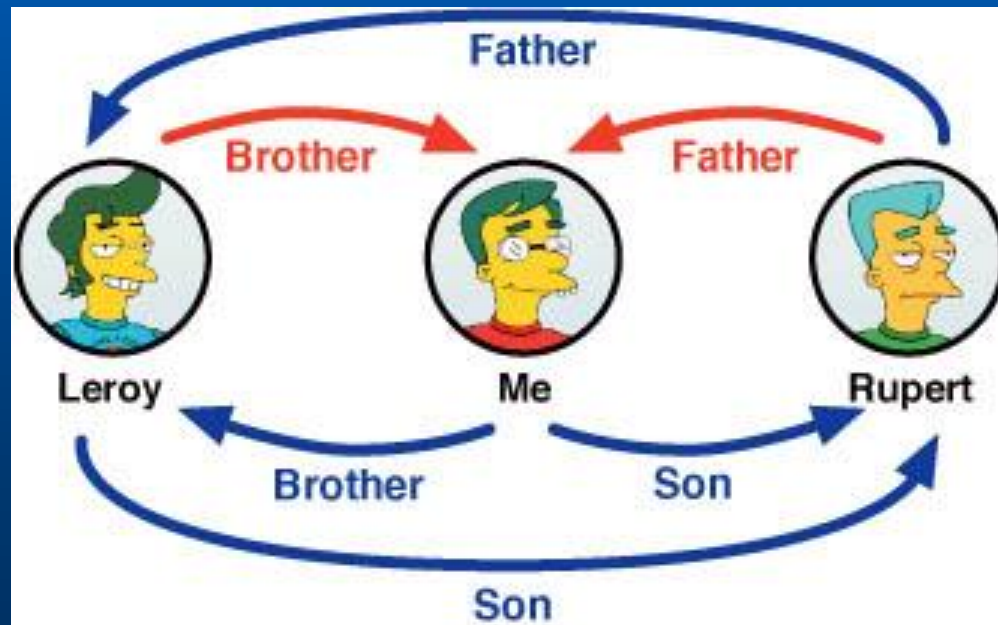
Relational Frame Theory (RFT)

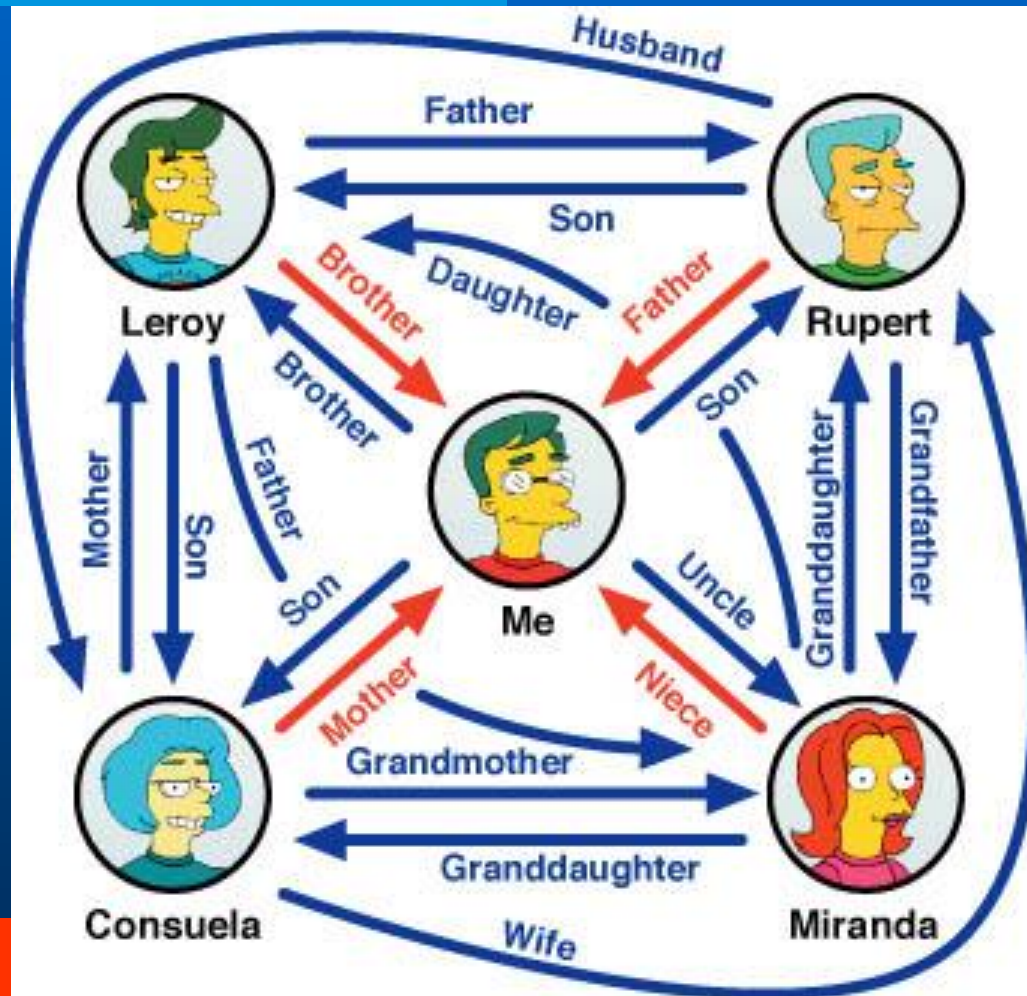
- explains emergence of classes
 - Which define the core of human language and cognition
- relationships between stimuli
- “picture frame”
- Need language to frame

- Transfer of stimulus function
 - <https://youtu.be/BMVx4C5ay0A?t=16m40s>



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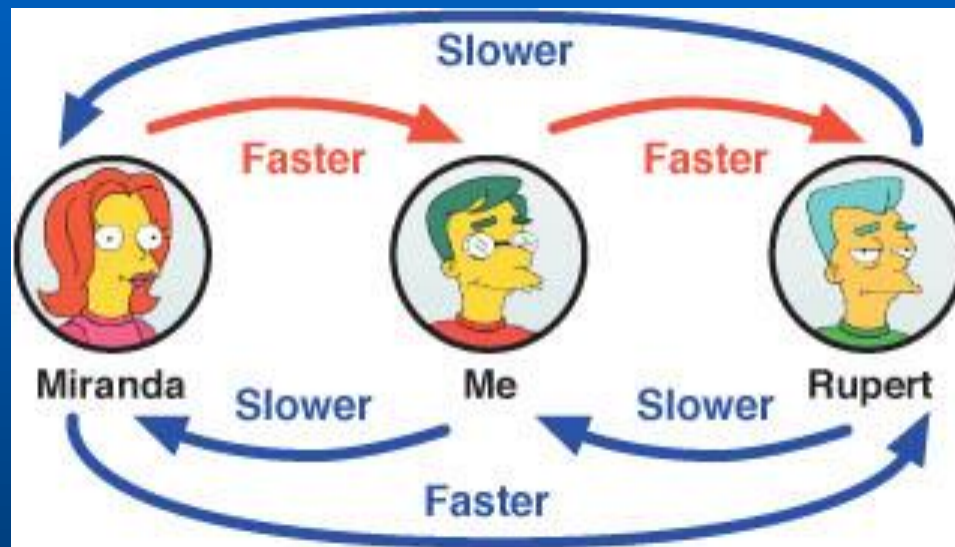




Other ways of framing:

- Same and different
- Earlier and later
- Faster and slower
- Closer and further
- Bigger and smaller
- Mine and yours
- Worse and better
- Here and there
- Causality

...and so on.



Example: 24:28

Novak & Pelaez

RFT

- **Frames are learned, equivalence “happens”**
 - Some data to suggest that these are trained by parents and caregivers early on, then generalize
 - Charlie Experiments
- **Equivalence relations in intact humans are a fundamental part of all verbal behavior**

Why are Equivalence Relationships Important to the Study of Development?

- **Consistent with a dynamical systems view**
- **It helps us understand that complex relationships can emerge from the basic processes for development, particularly from a history of development**
- **Skill that underlies the development of all cognitive skills**
- **Important to our understanding of language development and communication**
 - **Many relationships in language emerge, rather than resulting from direct training**