

Artificial Cognitive Systems

Module 9: Social Cognition

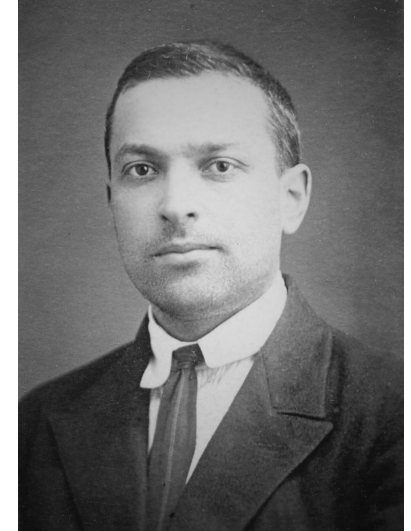
Lecture 3: Development and interaction dynamics; Piaget and Vygotsky; zone of proximal development

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Development and Interaction Dynamics

- Two different views of cognition
 - Individual
 - Social
- Two different theories of cognitive development
 - Jean Piaget (1896–1980)
 - Lev Vygotsky (1896–1934)
Лев Вѳготский or Вѳготский
born Лев Выгодский



Development and Interaction Dynamics

Piaget's theory of developmental psychology

- Focusses on the spontaneous development of the child as he or she interacts with the world
- Child's social context helps promote development, but
- Child's own exploratory activity is primary in developing an understanding of
 - Child's own capabilities
 - Child's relationship to the world around it

Development and Interaction Dynamics

Piaget's theory of developmental psychology

- A child goes through several stages of development
 - Sensorimotor stage up to two years of age
 - Preoperational stage from two to seven years of age
 - Concrete operational state from seven to eleven years of age
 - Formal operational state from eleven years on

Development and Interaction Dynamics

Piaget's theory of developmental psychology

- Each stage build on — **scaffolds** — what the child has learned for itself in the previous phases of development
- The primary building blocks of the child's knowledge are based on his or her own first-hand **experiential interaction** with the object and people around it

Development and Interaction Dynamics

Piaget's theory of developmental psychology

- Piaget's theory is effectively a **constructivist** one
 - the child constructs his or her own understanding of the world through first-hand exploration of that world
 - rather than watching other people do things or being told about things by other people

Development and Interaction Dynamics

Vygotsky's theory of developmental psychology

- The social context is the essential element in development
- Teaching plays a pivotal role
- Child's cognitive development is heavily influenced by the cultural norms
 - Cultural and social patterns determine the way the child will develop and understand the world around it
 - Social dynamics are an important aspect of development

Development and Interaction Dynamics

Vygotsky's theory of developmental psychology

- The coordination of movements between agents as they interact plays a key role in the development of cognitive skills
 - Natural need to synchronize activities during cooperative activities
 - Need to coordinate the agent's goals and intentions with those of the other agent with which it is interacting

Development and Interaction Dynamics

Vygotsky's theory of developmental psychology

- He introduced the concept of the **zone of proximal development**
 - Children develop skills that are just beyond their current capabilities
 - With the help of another agent or in collaboration with another agent

Development and Interaction Dynamics

Vygotsky's theory of developmental psychology

- The zone of proximal development has also been used in artificial cognitive systems
 - to identify the degree of assistance that an it should provide to a disabled user of a wheelchair
 - To balance the current needs of the user with the longer-term rehabilitation potential provided by adaptive assistive technology

Development and Interaction Dynamics

Piagetian position *vs.* Vygotskian position

- **Complementary** rather than incompatible alternatives
- Motivations that drive development in a child:
 - Exploratory
 - Social
- Cognition: sense-making
- Meaning of knowledge emerges through interaction

Development and Interaction Dynamics

Cognitive development is a journey of discovery

- Determine what matters and what does not matter to an agent
- Discovering what matters allows the agent to act prospectively
- To help itself and to help others

Development and Interaction Dynamics

Cognitive development is a journey of discovery

- To construct an understanding of the world that manages an effective tradeoff between
 - Being autonomous
 - Surrendering some of that autonomy to protect the social environment upon which the agent depends

Development and Interaction Dynamics

Cognitive development is a journey of discovery

- Piaget

- The importance of the child's part in the process of discovery through spontaneous exploration

- Vygotsky

- The essential role of the social interaction in guiding that journey and determining what each act of discovery reveals

Development and Interaction Dynamics

Cognitive development gives the agent — biological or artificial — the ability

- to anticipate the need for action and
- the flexibility to adapt as the world throws unexpected events in its path



Recommended Reading

Vernon, D. *Artificial Cognitive Systems – A Primer*, MIT Press, 2014; Chapter 9.