

3 Theories of Learning

3.1 Overview of Learning Theories

3.2 Behaviorism

3.3 Cognitivism

3.4 Constructivism 

3.5 Learning as Social Process

Literature:

<http://www.univie.ac.at/constructivism/>

Paul Watzlawick: How Real is Real? Vintage 1977

H. Maturana: The Tree of Knowledge. Shambhala 1992

Who Is Right?

A shoe factory sends two marketing scouts to a region of Africa to study the prospects for expanding business.

One sends back a telegram saying,

SITUATION HOPELESS STOP

NO ONE WEARS SHOES

The other writes back triumphantly,

GLORIOUS BUSINESS OPPORTUNITY STOP

THEY HAVE NO SHOES

from:

Roz & Ben Zander:
The Art of Possibility,
Penguin 2000

Motto

It's All Invented!

from:
Roz & Ben Zander:
The Art of Possibility,
Penguin 2000

How Real Is Real?

A man claps his hands every ten seconds.

Asked about the reason for this strange behavior, he explains: 'in order to scare away the elephants.'

When told there are no elephants present, the man responds: 'Well, there you go. See?'

From Paul Watzlawick: "The Situation is Hopeless, But Not Serious: The Pursuit of Unhappiness"

Selective Attention (Daniel Simons 1999)

Selective Attention Test
from Simons & Chabris (1999)

Definition of Constructivism

What is meant by constructivism?

The term refers to the idea that learners construct knowledge for themselves – each learner individually (and socially) constructs meaning – as he or she learns.

Constructing meaning is learning; there is no other kind.

The dramatic consequences of this view are twofold;

1) we have to ***focus on the learner*** in thinking about learning (not on the subject/lesson to be taught):

2) There is ***no knowledge independent of the meaning*** attributed to experience (constructed) by the learner, or community of learners.

George A. Hein, Constructivist Learning Theory.

<http://www.exploratorium.edu/ifi/resources/constructivistlearning.html>

History of Constructivism

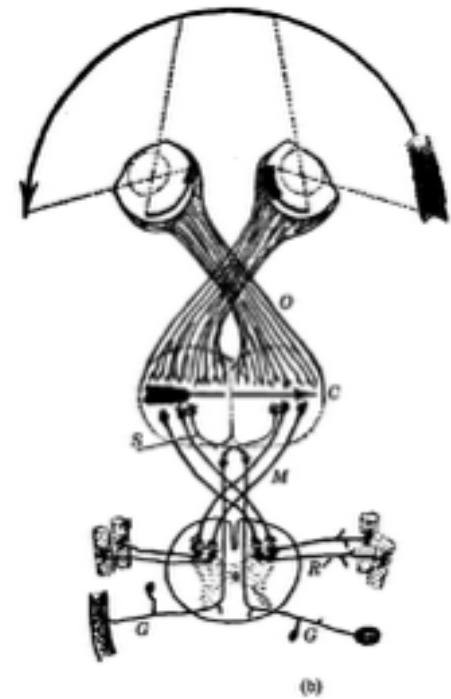
- Roots:
 - Giambattista Vico (1686 – 1744)
 - Immanuel Kant (1724 – 1804)
- Influence: Reform pedagogy
 - Maria Montessori (1870 – 1952) ("prepared environment")
 - John Dewey (1859 – 1952) ("Democracy and Education")
- Cognitive Constructivism
 - Jean Piaget (1896 – 1980)
- Radicaler Constructivism
 - Humberto Maturana (1928 –) & Francisco Varela (1946 – 2001) (Human being as *autopoietic organisation*) Biology
 - Paul Watzlawick (1921 – 2007) Communication
 - Heinz von Förster (1911 – 2002) Cybernetics
 - Ernst von Glasersfeld (1917 –) Psychology, pedagogy

Man, having within himself an imagined World of lines and numbers, operates in it with abstractions, just as God, in the universe, did with reality.

G. Vico

Undifferentiated Coding

- Frogs use "differentiated coding" (proven in experiments):
 - Meaning (e.g. movement detection) is already encoded by *peripheral* nervous system
- Humans use "undifferentiated coding" (Heinz von Förster):
 - Brain receives only the intensity of a stimulus, *not* the cause or nature of the stimulus
- Examples:
 - "Seeing stars" after a blow to the eye
 - ***others...?***



The human brain invents / constructs the world.

Based partially upon:

L. Segal, The Dream of Reality: Heinz von Foerster's Constructivism, Springer 201

More about frog eyes:

<http://neuromajor.ucr.edu/courses/WhatTheFrogsEyeTellsTheFrogsBrain.pdf>

Language: The Act of Indication

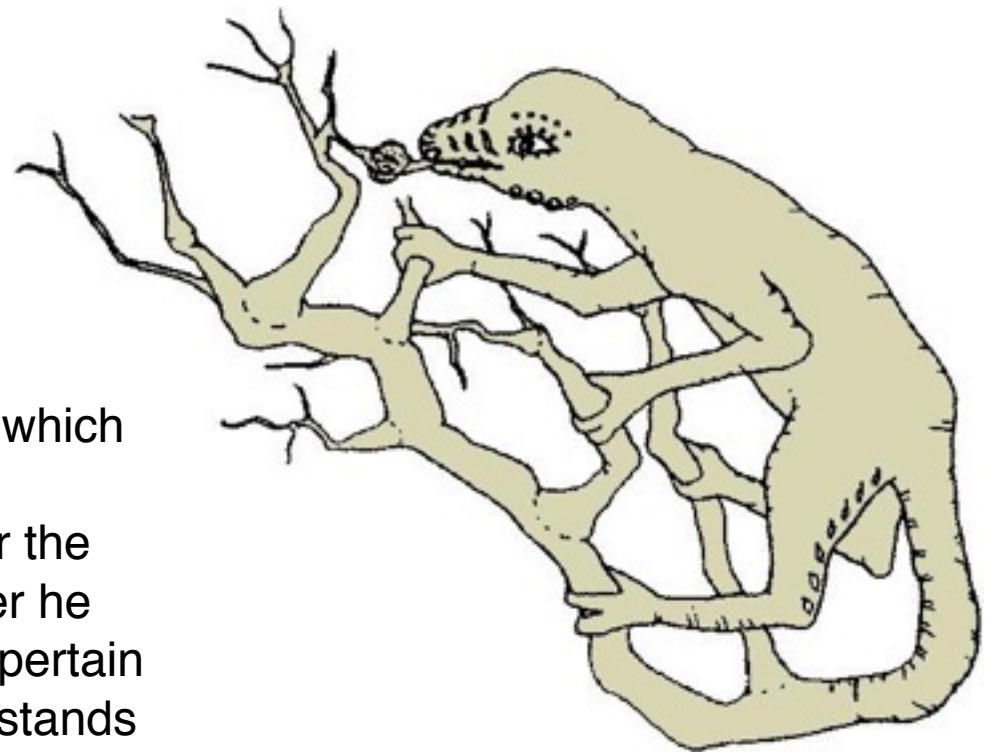
Francisco Varela:

"In this primordial act we separate forms which appear to us as the world itself. [...]

We thus assert the primacy of the role for the observer who draws distinctions wherever he pleases. Thus the distinctions made [...] pertain more to a revelation where the observer stands than to an intrinsic constitution of the world, which appears, by this very mechanism of separation between observer and observed, always elusive.

In finding the world [...] we find little more than a mirror-to-mirror image of ourselves and the world. [...]

A description, when carefully inspected, reveals the properties of the observer."



Drawing by Humberto Maturana
(The Tree of Knowledge)

Francisco J. Varela G.:
A Calculus for Self-Reference.
Int. J. General Systems 1975

<http://homepages.math.uic.edu/~kauffman/VarelaCSR.pdf>

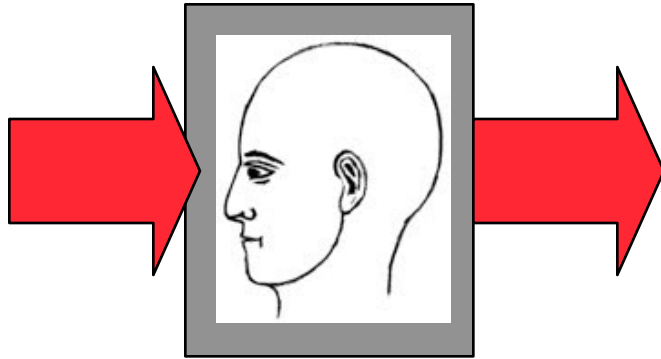
A Zen Koan

The *roshi* (master) seizes a short bamboo stick and asks the young monk:

"If you call this a stick, you affirm; if you call it not a stick, you negate. Beyond affirmation and negation, what would you call it?"

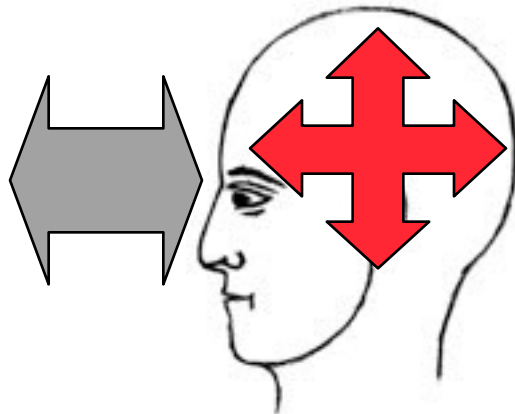
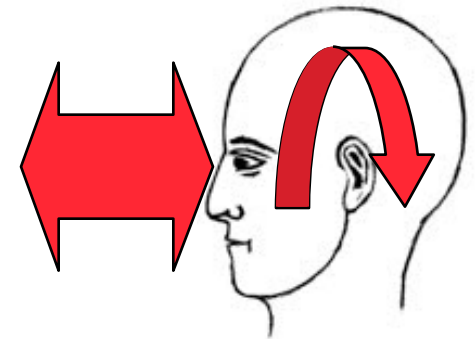


Behaviorism – Cognitivism – Constructivism



Behaviorism:
Input/output observation only,
Internal processing is irrelevant

Cognitivism:
External information is
processed into knowledge



Constructivism:
All knowledge is *constructed* internally,
The assimilation of external information is
dominated by internal constructions.

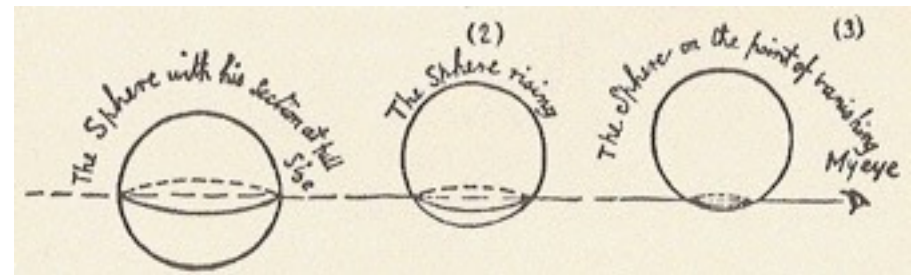
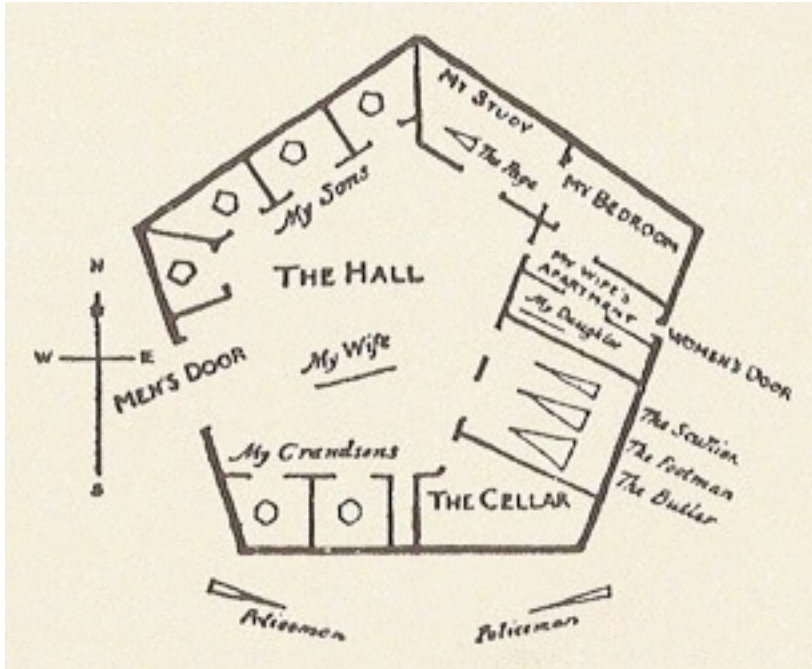
Paradigm of Constructivist Learning

- There is **no way to transfer knowledge** into a learner.
- Learning is
 - **active construction of knowledge** by the learner
 - which is done **in a different way by each individual** learner.
- Teachers can only assist the learner.

Question: Shall we then stop giving lectures?...

What Can a Learning Person Understand?

- Abbott: Flatland (1884) (see <http://en.wikisource.org/wiki/Flatland>)



Question: What does this tell us about learning?

Flatland and Picasso?

Recognizing Pablo Picasso in a train compartment, a man inquired of the artist why he did not paint people "the way they really are".

Picasso asked what he meant by that expression.

The man opened his wallet and took out a snapshot of his wife, saying, "That's my wife."

Picasso responded, "Isn't she rather small and flat?"



Picasso, Seated Woman,
Red and Yellow Background,
1952

Text from:
Roz & Ben Zander:
The Art of Possibility,
Penguin 2000

Three (Out of Five) Axioms of Communication (Watzlawick)

- First Axiom:

"You cannot not communicate."

- Second Axiom:

"Every incident of communication has a content aspect and a relationship aspect, with the latter determining the former."

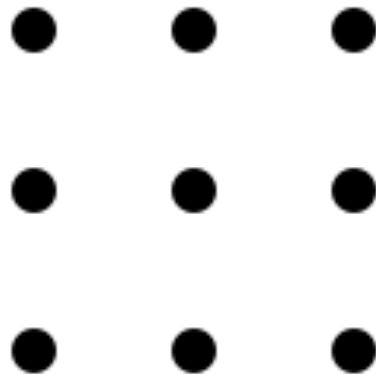
- Third Axiom:

"The nature of a relationship is contingent upon the punctuation of the communication processes on the part of the partners."

Watzlawick, P., Beavin-Bavelas, J., Jackson, D. 1967.
Some Tentative Axioms of Communication.
Formulations from <http://www.stiehlover.com>

QUIZ

- Do you know the solution to this popular puzzle?
- If not, try to find out.
- How is this example related to the theory of constructivism?



*Connect the 9 points
with a pen by four
straight lines without
putting down the pen!*

[http://www.stiehlover.com/en/blog-en/
if-the-solution-is-the-problem-the-pope-of-communication-paul-watzlawick/](http://www.stiehlover.com/en/blog-en/if-the-solution-is-the-problem-the-pope-of-communication-paul-watzlawick/)

Constructive Learning Processes

- Learning is an **active process** in which the learner uses sensory input and constructs meaning out of it.
- People **learn to learn** as they learn.
- Constructing meaning happens **in the mind**. Physical activity is not sufficient (but may be helpful).
- Learning involves **language**: the language we use influences learning.
- Learning is a **social** activity.
- Learning is **contextual**: we learn in relationship to what else we know.
- One needs **knowledge** to learn.
- It takes **time** to learn.
- **Motivation** is a key component in learning.

Question: How to apply this to design of learning material?

George A. Hein, Constructivist Learning Theory.

<http://www.exploratorium.edu/ifi/resources/constructivistlearning.html>

Anchored Instruction

- Cognition and Technology Group at Vanderbilt (CTGV)
- *Anchor*
 - Specific task or problem (case study)
 - Short, motivating, engaging
 - Contains a general goal reachable via subgoals
- Multimedia presentation of anchor
 - Rich information source
 - Interactivity (stepwise presentation with intervening discussion/problem solving phases)
- Famous example
 - „The Adventures of Jasper Woodbury“
 - Video Disc series



John Bransford

	Complex Trip Planning Journey to Cedar Creek Rescue at Boone's Meadow Get Out the Vote
	Statistics and Business Plans The Big Splash Bridging the Gap A Capital Idea
	Geometry Blueprint for Success The Right Angle The Great Circle Race
	Algebra Working Smart Kim's Komet The General is Missing

Rescue at Boone's Meadow



Emily learns to fly an ultralight plane



Much information about various weights, speeds, money, prices and technical data

An eagle is shot and wounded



What is the quickest way to bring the eagle to Dr. Ramirez, the veterinarian?



Cognitive Apprenticeship

- Apprenticeship = *dt. Lehre* (im Sinne von *Berufsausbildung*)
 - Real-life situations
- Teacher explains expert-like strategies involved in a task
- Teacher designs *scaffolds* that encourage students to apply the strategies
- Students articulate their reasoning or methods to solve a problem
- Students are encouraged to reflect on and learn from others' approaches
- Teacher *fades* support as students apply their learning to personally relevant problems

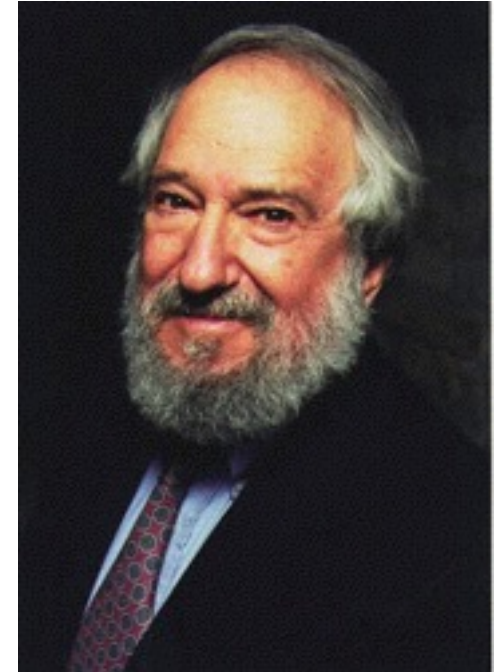


Only in the last century, and only in industrialized nations, has formal schooling emerged as a widespread method of educating the young. Before schools appeared, **apprenticeship** was the most common means of learning and was used to transmit the knowledge required for expert practice in fields from painting and sculpting to medicine and law.”

Collins/Brown/Newman 1990

Seymour Papert & Logo

- Mathematician, scholar of Piaget
- Influenced Alan Kay
- Co-Founder of MIT AI Lab, member of Media Lab
- Most famous book: „Mindstorms“
- „Given my background as a mathematician and Piagetian psychologist, I naturally become most interested in the kinds of computational models that might lead me to better thinking about powerful development processes. [...] The kind of developmental questions I was interested in needed a dynamic model for how intellectual structures themselves could become into being and change.“
- Programming language „Logo“ targeted at children



Seymour Papert
(1928 –)

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Literature:

D. Jonassen/ S. Land (eds.): Theoretical Foundations of Learning Environments, 2nd ed., Erlbaum 2012

C. Kimble et al. (eds): Communities of Practice: Creating Learning Environments for Educators, Information age Publishing 2008
<http://www.chris-kimble.com/CLEE/>

G. Siemens: Connectivism: A Learning Theory for the Digital Age, Dec. 2004.
<http://www.elearnspace.org/Articles/connectivism.htm>

Lev Vygotsky

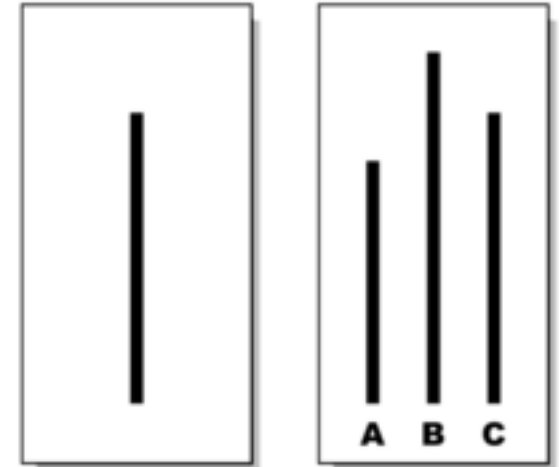
- "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals."
- Potential for cognitive development depends upon the "**zone of proximal development**" (**ZPD**).
 - ZPD is “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers”
- Full development of the ZPD depends upon full social interaction.



Lev Semyonovich
Vygotsky
(1896 – 1934)

Asch's Social Conformity Experiment

- Solomon Asch (1947 – 1996)
- Experiments in the 1950s
- Asch conformity experiment
 - Subjects believe to participate in a “vision test”
 - Task: which bar has the same size as a given bar?
 - Confederate participants have been instructed to give *incorrect* answers
- Results:
 - Subjects are discomforted
 - 33% conformed to the obviously wrong majority opinion!
- Related: Milgram experiment (1961)
 - Subjects believing to study “punishment effects” apply 450 V electric shocks to other subjects



http://en.wikipedia.org/wiki/Asch_conformity_experiments

Albert Bandura

- Learning from models
 - By observing others
- Necessary conditions:
 - Attention
 - Retention (remembering)
 - Reproduction (ability to replicate)
 - Motivation
- Modeling
 - Teaches new behaviors
 - Modifies the frequency of behaviors
 - May encourage previously forbidden behaviors
- Important issue:
 - Can violence be learned from the models on TV?



Albert Bandura
(1925 –)

See e.g. <http://www.simplypsychology.org/bobo-doll.html>

Limitations of Traditional Learning Theories

- Learning seen as an individual process
 - Even in social constructivist views
 - In life, often teams are more important than individuals
- Learning seen as a construction of internal representations
 - Skills and knowledge within the learner
 - In life, external representations are important (knowing how to find and access knowledge)
- Learning seen as independent from technology
 - Technology changes the way how we work with knowledge!
 - Many cognitively demanding tasks are replaced by technology!
 - » Old example: electronic calculators in school

Situativity, Situated Cognition

- Lauren Resnick 1987 ("Learning in school and out"):
 - Incongruence between formal school education and practical skills
 - Shows that teaching is more successful if "organized around joint accomplishment of tasks"
- Jean Lave (1988), Lucy Suchman (1993), Etienne Wenger (1998), from an anthropologist background:
 - Learning as a process of social participation
 - *Negotiation of meaning* in a social group
 - "Learning does not belong to individual persons, but to the various conversations of which they are a part." (McDermott)

We have come to the conclusion [...] that there is no such thing as “learning” sui generis, but only changing participation in the culturally designed settings of everyday life.

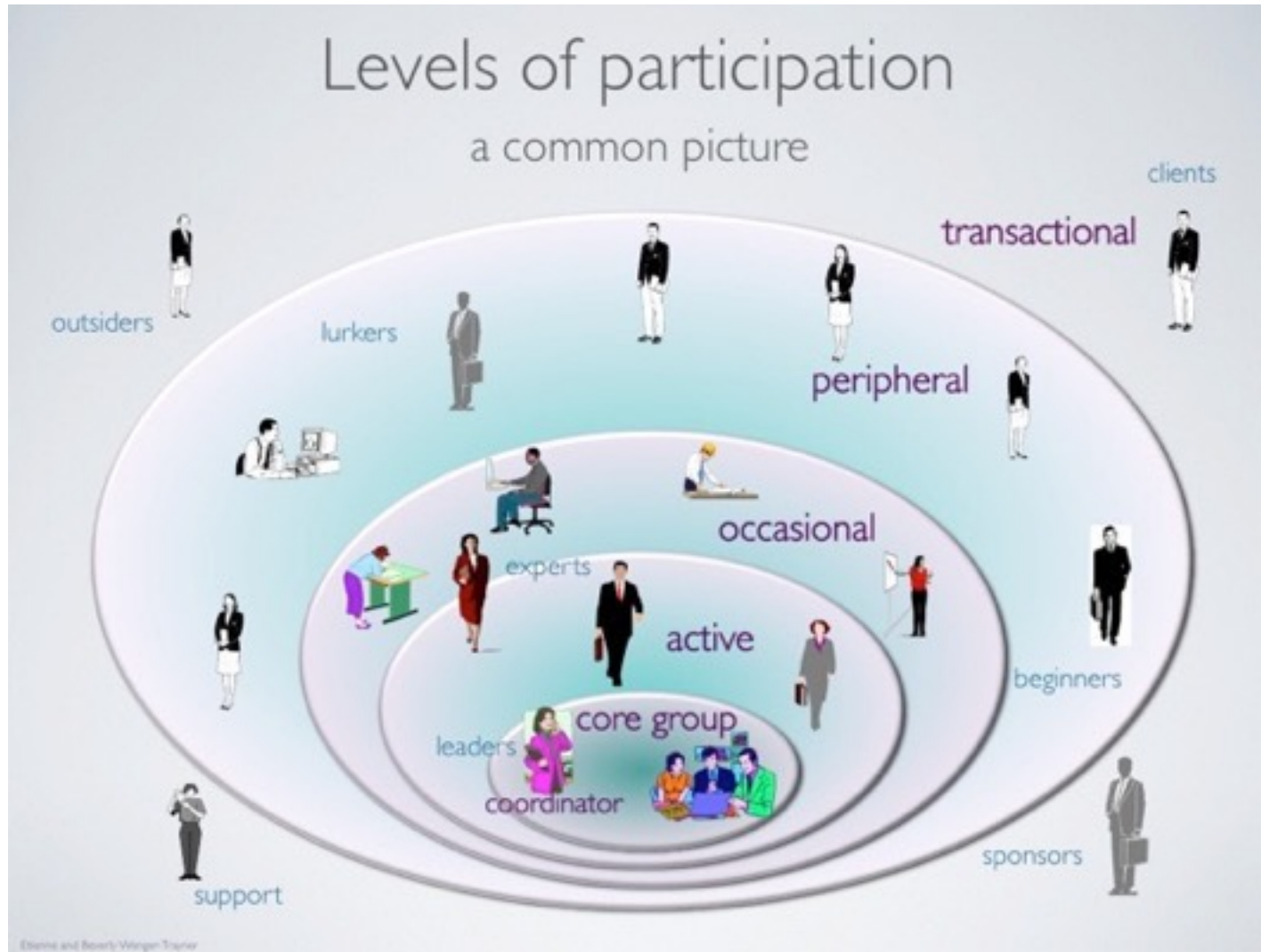
Chaiklin/Lave 1996

<http://infed.org/mobi/jean-lave-etienne-wenger-and-communities-of-practice/>

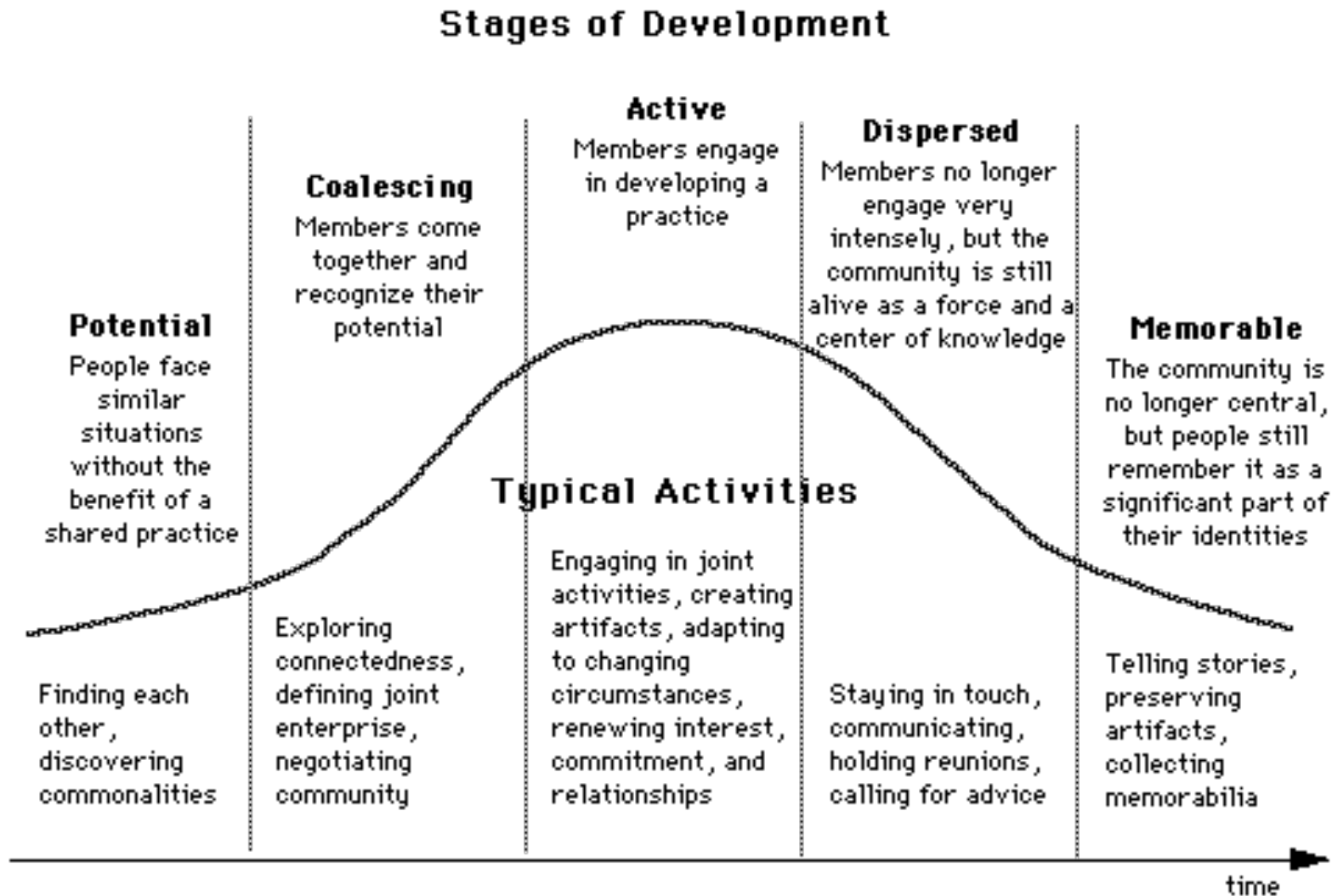
Communities of Practice (CoP)

- *Community*: Persistent, sustained social network of individuals who share and develop an overlapping knowledge base, set of beliefs, values, and experiences focused on a common practice and/or mutual enterprise. (Barab/Duffy 2002)
- Characteristics:
 - Common purpose or overlapping enterprise
 - Common cultural and historical heritage
 - Interdependent system – joint identity
 - Reproduction cycle (*enculturation* of new members)
- ***Give examples of CoPs in your/our daily life!***

Structure of a CoP



Development Stages of a CoP



E. Wenger, 1998, <http://www.co-i-l.com/coil/knowledge-garden/cop/lss.shtml>

Questions About Communities of Practice

- *Where and how does learning take place in a CoP?*
- *What is the difference between a CoP and*
 - *team learning?*
 - *"learning by doing"?*
 - *social-constructivist learning (e.g. with Anchored Instruction)?*

Communities of Learners (CoL)

- Ann L. Brown et al., 1994:
 - "Engineering" communities of learners
 - Learning by participation
 - Realizing multiple zones of proximal development (ZPD)
- Method: Reciprocal Teaching (e.g. for text comprehension)
 - Small group of about 6 students
 - Several rounds of discussion, each led by one of the participants (first teacher, then students in teacher role)
 - Strategies for group discussion:
Questioning, summarizing, clarification, prediction
- Method: Jigsaw
 - Theme divided in subtopics studied by small subgroups of class
 - Each subgroup researches its subtopic and teaches the results to the others
- ***(Meta-)Question: What is the variety of research methods applied in learning theory research?***

Connectivism: A Learning Theory for the Digital Age

George Siemens, 2004 (Author of the first MOOC)

- Amount of knowledge is exploding, half-life of knowledge is shrinking
- Nowadays, everybody has to learn for all of his lifetime
- Informal learning becomes more important (than schooling)

An alternative theory is needed which

- Embraces networks of connected people
 - "I store my knowledge in my friends."
 - "For me it is enough to own somebody to ask if needed."
- Embraces chaos and self-organization of social groups
- Accepts the fact technology is used for storage and application of knowledge

<http://www.elearnspace.org/Articles/connectivism.htm>

Principles of Connectivism

- Learning and knowledge rests in diversity of opinions.
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in non-human appliances.
- Capacity to know more is more critical than what is currently known
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Ability to see connections between fields, ideas, and concepts is a core skill.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
- Decision-making is itself a learning process, taking into account an always shifting reality.

<http://www.elearnspace.org/Articles/connectivism.htm>