

# 23rd Jyväskylä Summer School



## Using Language to Teach Science: Researching Classroom communication and Developing Dialogical Approaches

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# Assignment

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Working in groups of 4 you will analyse a classroom episode.  
Submit by 18 August 2013 (?) by sending short essay (less than 3000 words) to [jaume.ametller@udg.edu](mailto:jaume.ametller@udg.edu)

# Outline of the course

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**Science as  
Language**

**Learning the  
language of  
Science**

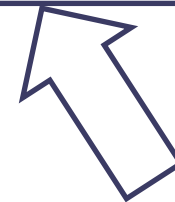
**Language  
and thinking**

**Language and  
learning Science**

**Dialogic  
approach**

**Analysing**

**Planning**



# The roles of language in teaching and learning Science

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Language is a fundamental part of the activity of teaching and learning (to many the most important element).

Language plays four main roles in this activity:

- a) It provides a lexico-grammatical realisation of the meaning being constructed
- b) It provides a series of scientific genres
- c) It shapes the interactions among participants (general)
- d) It shapes the process of learning science

- **a and b** refer to **what** is being taught-learnt
- **c and d** refer to **how** it is being taught-learnt

# **Vygotsky Biography**

# Language and Thinking - Vygotsky

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Frontispiece of Lev Vygotsky and facing title page from the original Russian edition (1934) of *Thought and Language*

## Language and Thinking - Vygotsky

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Born in 1896, in Orsha, close to Minsk, Bielorrusia.

Student days at the University of Moscow: linguistics, sociology, psychology, philosophy and the arts.

## Language and Thinking - Vygotsky

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- systematic work in psychology did not begin until 1924. Ten years later he died of tuberculosis at the age of only 38.
- with the collaboration of Luria and Leontiev, he launched a series of investigations in developmental psychology, pedagogy and psychopathology.
- Vygotsky actively participated in the development of the Revolution (1917) under atrocious conditions and almost total isolation from the West.
- His works were published after his death in 1934 and were not known in the West until 1958.



According to Luria, his student and key member of his academic group:

**‘The entire group gave almost all of its waking hours to our grand plan for the reconstruction of psychology. When Vygotsky went on a trip, the students wrote poems in honour of his journey. When he gave a lecture in Moscow, everyone came to hear him’**

(Wertsch, 1985, p.10).

# **Vygotsky**

## **Culture and mental functions**

# Language and Thinking

## Culture and mental functions

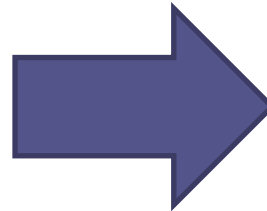
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### Elemental mental functions

Innatas (determinadas genéticamente)

Ej: memoria, percepción,...



### Higher mental functions

Developed from the interaction (talking, counting...)



### Tools of mental adaptation

Culturally determined

**Our cognitive functions are related to the values, beliefs and tools of the culture in which we have developed (Socio-cultural Context)**

# **Vygotsky**

## **Development of speech**

# Language and Thinking

## Development of speech... development of thought

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- **Social speech:** communication with others



- **Egocentric speech:** thinking aloud, seeking and planning the solutions of problems.



- **Inner speech:** internal thinking

According to Piaget, 44-47% of the talk of children in their seventh year is egocentric.

# Language and Thinking

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**Social speech:**  
communication  
with others

**Egocentric speech:**  
thinking aloud, seeking  
and planning the  
solutions of problems.



## Language and Thinking

### Egocentric speech

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A 4 year old child was posed the practical problem of getting candy from a cupboard with a stool and stick as possible tools.

*Child stands on the stool, quietly looking, feeling along a high shelf with the stick:*

*'On the stool'.*

*Glances at researcher. Puts stick in other hand.*

*'Is that really the candy?'*

*Hesitates*

*'I can get it from that other stool, stand and get it'*

## Language and Thinking Egocentric speech

*Gets second stool.*

*'Not that doesn't get it. I could use the stick'.*

*Takes stick, knocks at the candy.*

*'It will move now'.*

*Knocks candy.*

*'It moved. I couldn't get it with the stool, but the, but the stick worked'.*

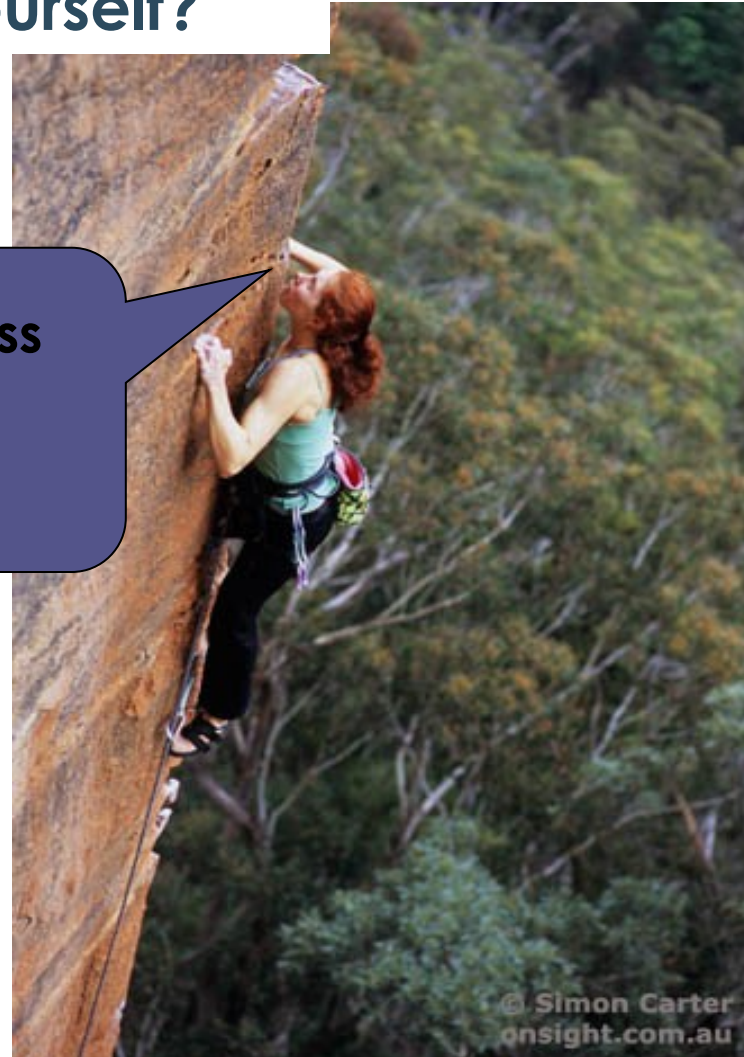
Vygotsky 1978: *Mind in Society*, P.27

**Children solve practical tasks with the help of their speech as well as their eyes and hands.**



## Do you ever talk to yourself?

Thank goodness  
for egocentric  
talk!!



1. Talking through problems *with others* helps us order our thoughts: 'can I just try this out with you?'
2. Sometimes we talk aloud *to ourselves* ...as we think aloud
3. Talk provides the tools for thinking.

**So: We need to get children talking and thinking in school...if meaningful learning is the target!!**

## Mark, his teacher and the plunger explanation

How does the teacher *assist* Mark in explaining why the plunger sticks to the table?

- Read through the whole intervention (which only lasted 2-3 minutes)
- Examine carefully what the **teacher** says at each point.
- How does the teacher help the student towards the scientific explanation? How does the teacher provide assistance?

## Mark: section 1

**T:** Can we just talk through why it is that you think the plunger sticks when you press it down on the table?

**M:** Well, when you push it down you push all the air out...

**T:** When you pressed down, the air is pushed from under the plunger bit...

**M:** Yeah, yeah...and er...well, there's not really anything there so....and...err...I've forgotten!

**T:** Well let's talk it through. You take the plunger, you press it down. When you press it down, it pushes some of the air out....

**M:** Yeah

**T:** So there's less air under the plunger.....Now somewhere...I remembered we talked about low pressure and high pressure. Can you remember that at all?

**M:** Err.....Oh!.....was that with the bottles?

**T:** It came into that

**M:** So....err....I've forgotten. I can't remember.

## Mark: section 2

**T:** What was the bottle one you were thinking of?

**M:** Well...the one where you take the air out, it goes in because there's less air inside the bottle than there is outside, so it all shrivels in.

**T:** Yeah..

**M:** and when you add it, the air pressure gets greater inside the bottle than outside.

**T:** Oh, right! So, the bottle shrivels up as we take the air out of the bottle. I remember it doing that, connected up to that pump, removed all the air and the bottle kind of crushes in.

**M:** Yeah.

**T:** and it crushed in...why? Say it again.

**M:** It crushed in because the air pressure outside is greater than the air pressure inside..

**T:** Right.

**M:** So it all goes in and when you add air to it the air pressure gets greater inside than the outside

**T:** OK

**M:** and it goes out.

## Mark: section 3

**T:** Well, we'll see if we can use that idea on the plunger. You press the plunger down, some air comes out....where will the low pressure be?

**M:** The low pressure will be.... inside.

**T:** So there is a low pressure on the inside...

**M:** Yeah, and there is a high pressure on the outside.

**T:** High pressure on the outside. So with the bottle, when the bottle collapsed, when there was high pressure on the outside and low pressure on the inside....with this

**M:** Err...well....it sticks....because its low pressure on the inside....like the bottle went in...it's the same wi' that.

**T:** So it's sort of the high pressure on the outside which is holding it...

**M:** Pushing in down on it, holding it.

# **Vygotsky**

## **Social interaction**

## **Vygotsky's general genetic law of cultural development**

- Any function in the child's cultural development appears twice, or on two planes.  
(...any learning of: *history, geography, art, poetry, science, football, music....*)
- First it appears on the social plane and then on the psychological plane.

...social relations or relations among people...underlie all higher (cognitive) functions.

**Vygotsky, 1978, *Mind in Society*, p.57**



## **Internalisation: transfer of concepts?**

‘The process of internalisation is *not* the transferral of an external activity to a pre-existing, internal plane of consciousness: it is the process in which this plane is formed’.

Leontiev, 1981, p.57

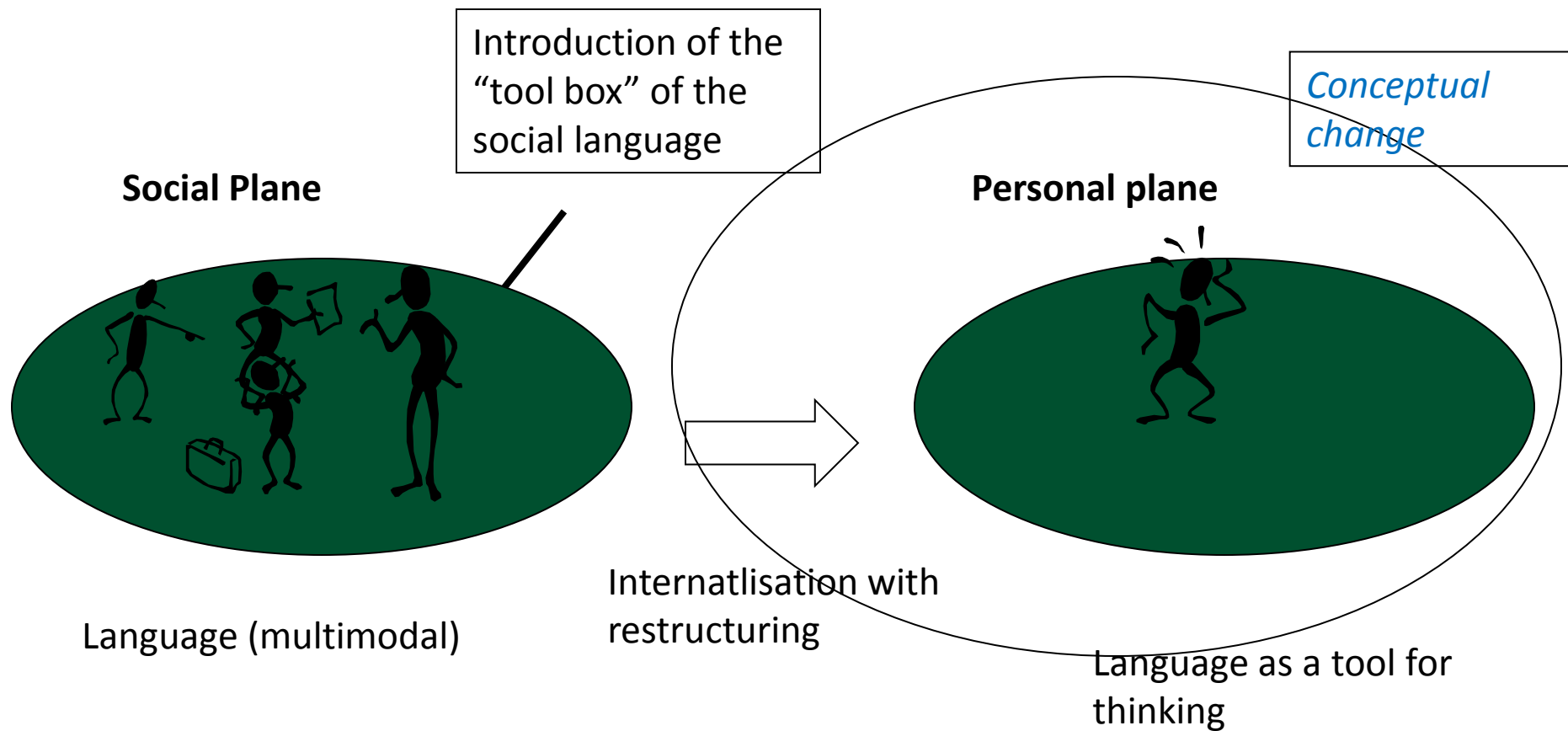
The process of internalisation does not imply a mere copy of the language of the social plane. There is a step of restructuring as the individual makes sense of the talk.

...same as the constructivist ideas of assimilation and accommodation

# Language and Thinking

## Social Interaction

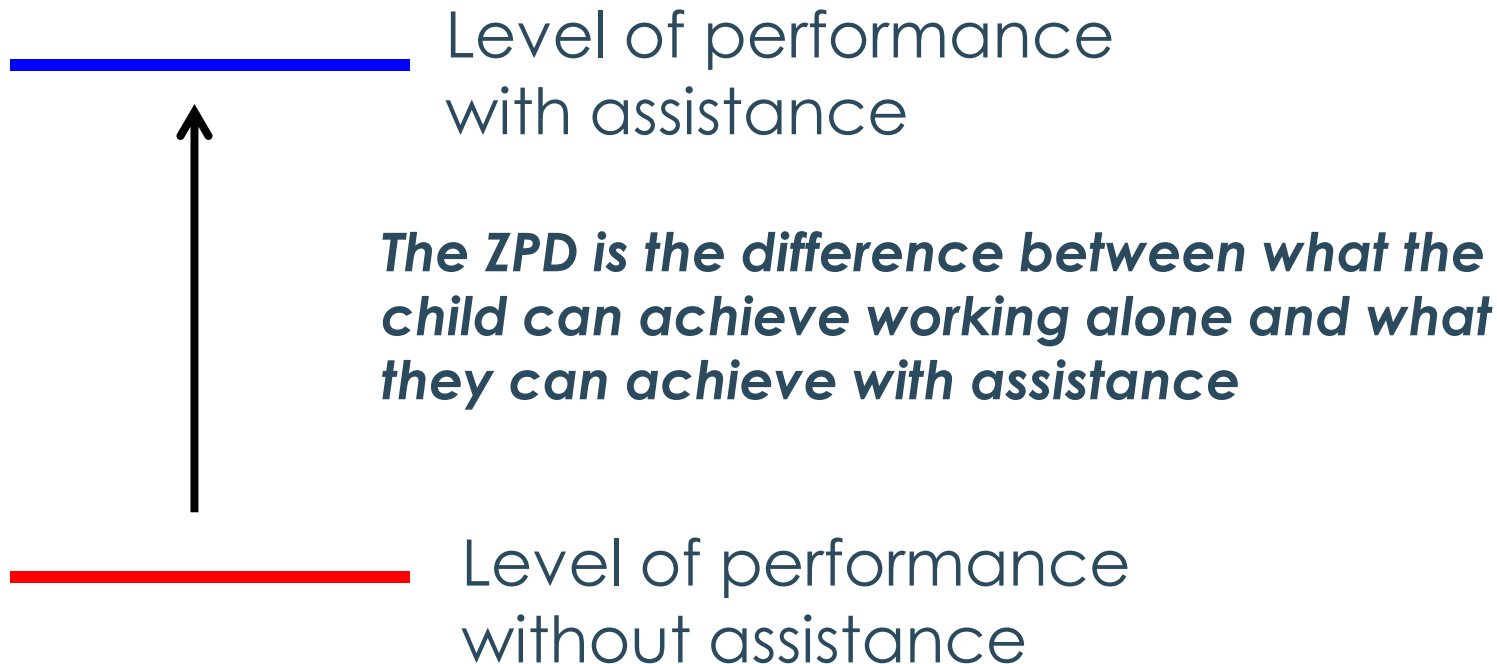
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# Language and Thinking

## Zone of Proximal(Potential) Development ZPD

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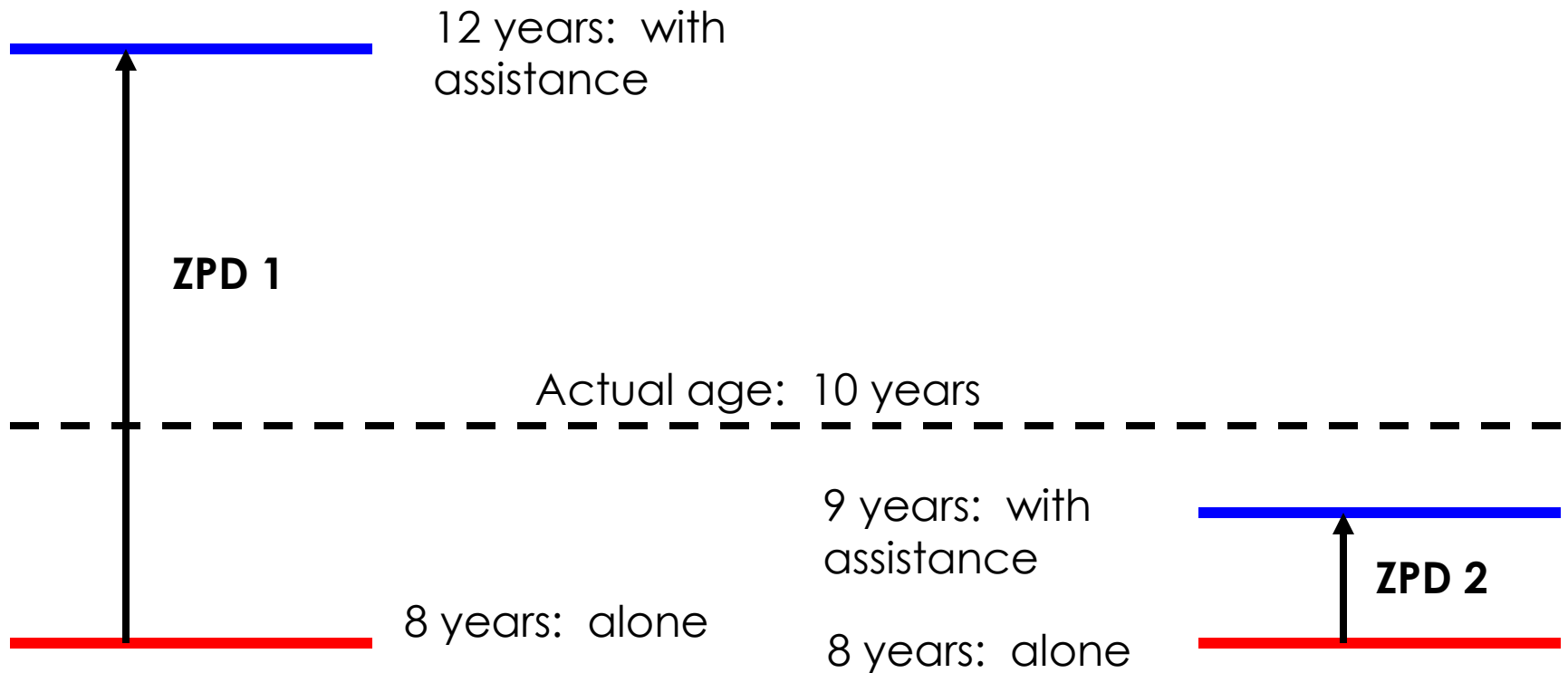
# Language and Thinking

## Zone of Proximal(Potential) Development ZPD

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### ZPD for two different students (Vygotsky 1978 Mind in Society, p.85)



## **Scaffolding learning in the ZPD**

- Initially the pupil may have a very limited understanding of the problem at hand
- The teacher offers direct support or assistance to the child as they engage with the task.
- The teacher scaffolds the child, one-to-one, to support its learning.

Wood, D.J., Bruner J.S., and Ross, G. (1976) The role of tutoring in problem solving. *Journal of of Child Psychology and Psychiatry*, 17(2), 89-100.

## Teaching-learning to count

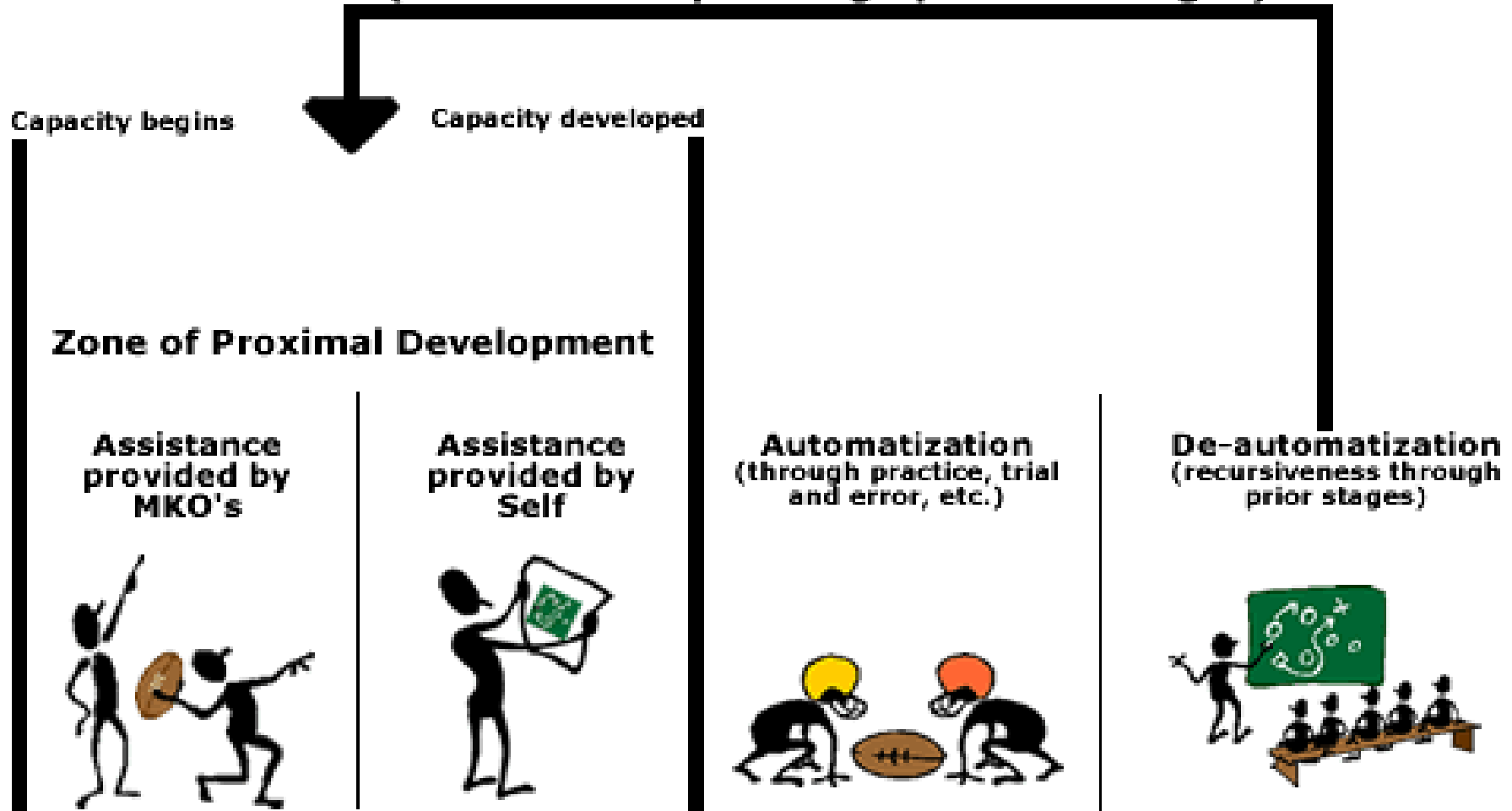
Watch the video and discuss which elements of Vygotsky's theories can be identified.

<http://www.youtube.com/watch?v=ibEP4xBdJco&feature=related>

# Language and Thinking

## Zone of Proximal(Potential) Development ZPD

(Recursive loop through previous stages)



It's a....





## How do we develop a concept of 'dog'?

Characteristic criteria of doginess?:



**No**

## How do we develop a concept of 'dog'?

The concept of 'dog'

- develops informally through experience and language
- we are socialised into ideas of doginess
- children develop 'prototypical examples of dogs and make comparisons...

## Vygotsky: spontaneous and scientific concepts

**Spontaneous (everyday) concepts:** are developed through everyday experience and communication and are formed aside from any process specially aimed at mastering them...link to '*alternative conceptions*'.

**Scientific concepts:** can only be developed through science instruction. This is a conscious process.  
(scientific concepts provide the alternative way of talking and thinking)

## Everyday and scientific knowledge

### Everyday knowledge

- Everyday ways of talking and knowing
- Moulded by experiences of the natural world and daily talk
- Learned and reinforced in daily communication
- Often non-conscious learning

### Scientific knowledge

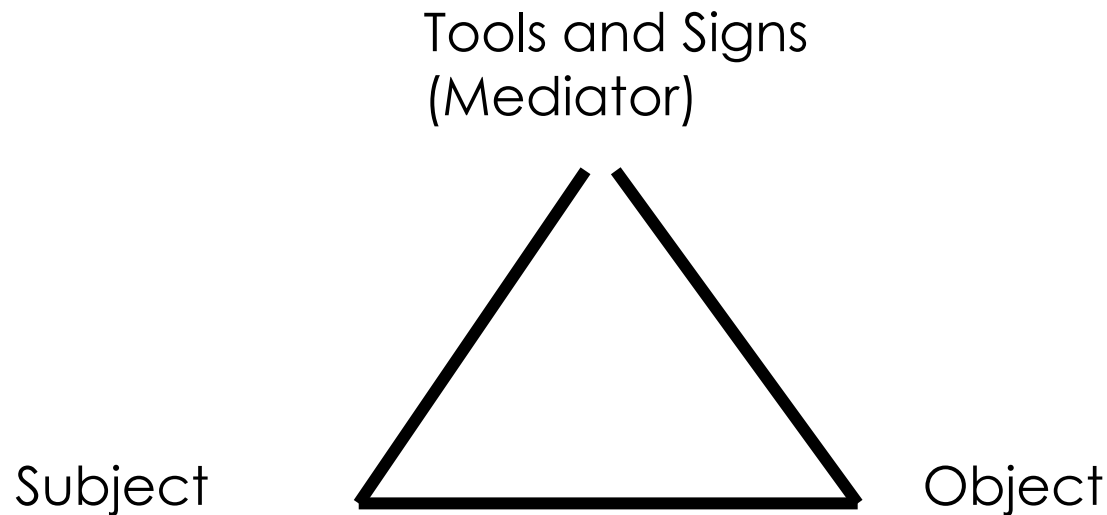
- A form of disciplinary knowledge
- Developed and validated by the scientific community
- Learned through teaching
- Conscious learning

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**To Vygotsky our relation with the world is mediated**



The subject transforms reality and itself through the mediators.

## Three types of mediators:

- Material tools (to transform material objects)
- Psychological-sings tools ( to direct the mind and the behaviour)
- Other people

*As we have already seen Vygotsky sees language as the the essential tool in the cognitive development*

# **Vygotsky In the School**

# Language and Thinking

## Vygotsky in the School

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1. The role of the teacher
2. The role of the peers (group work)
3. Planning the ZPD
4. Allowing for internalisation
5. Reflection on the tools



## Language and Thinking

### The role of the teacher

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'Vygotsky's project [is] to find the manner in which aspiring members of a culture learn from their tutors, the vicars of their culture, how to understand the world.

That world is a symbolic world in the sense that it consists of conceptually organised, rule-bound belief systems about what exists, about how to get to goals, about what is to be valued.

There is no way, none, in which a human being could master that world without the aid and assistance of others for, in fact, that world is others'

(Bruner, 1985, p.32).

## **Scaffolding: it's everywhere!**

- 'the students worked individually on a reading exercise which scaffolded their learning'
- 'the teacher scaffolded the class's learning with a series of carefully selected experiments'
- 'the CD ROM was chosen to scaffold each pupil's learning'

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### Vygotsky in the School - Scaffolding

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## Scaffolding: there's not much of it about!

**John:** Sir, I don't understand it!

**Teacher:** What's making that plunger stick to the table?

**John:** Air pressure

**Teacher:** Where's the air pressure that makes it happen?

**John:** Is it inside this here? [*pointing inside the plunger*] And it's sucking the plunger down so that it sticks?

## Language and Thinking

### Vygotsky in the School - Scaffolding

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**Teacher:** Watch what happens! There's air in here, alright? There's still air in there and it's not sticking. Now when you push it down that's the air pushing out and when you let go, the air's been pushed out, there's less air inside, there's less pressure inside, there's more pressure on the outside, so it sticks to the table. Now let's have a margin and a title and get that written down.