Mindstorms Revisited: Making New Construals of Seymour Papert's Legacy

Meurig Beynon

Computer Science
University of Warwick, Coventry, UK

Edurobotics 2016 Athens Nov 25th 2016

The CONSTRUIT! project

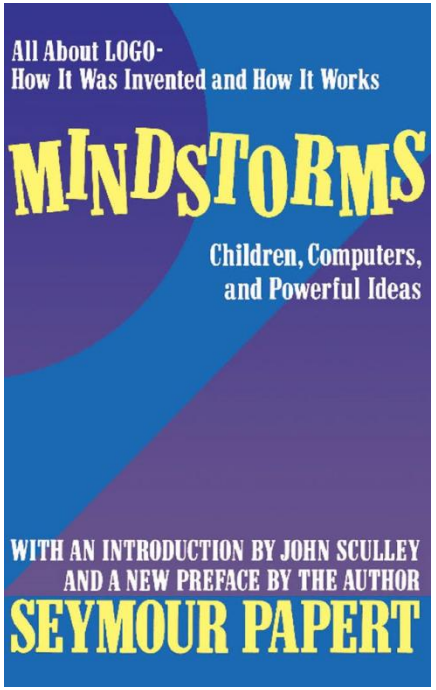
Making construals
as a new digital skill
for creating interactive
open educational resources

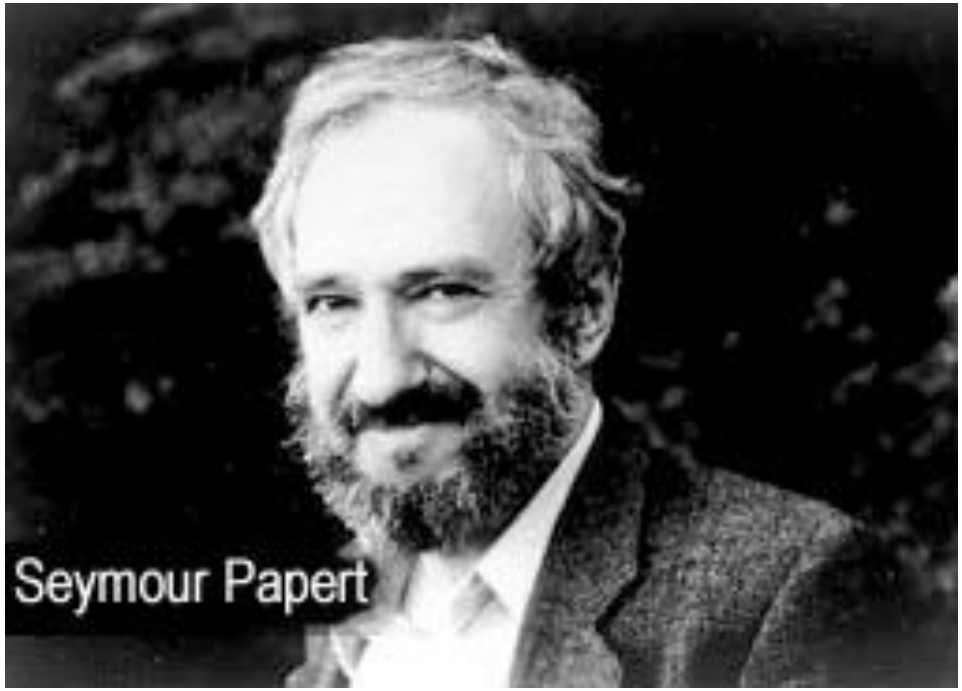
construit.org
jseden.dcs.warwick.ac.uk/construit.c3

"The environment for making construals" – aka as "the MCE"

Erasmus+

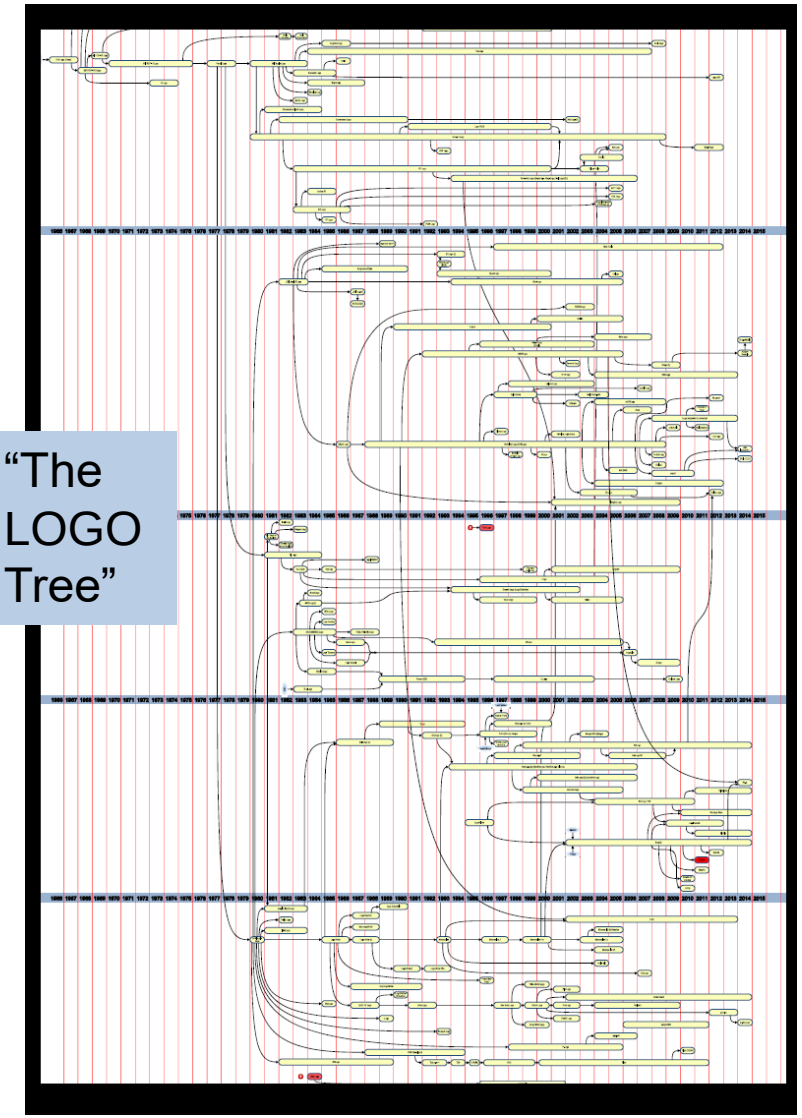
This project has been funded with support from the European Commission under the Erasmus+ programme (2014-1-UK01-KA200-001818). This presentation reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.





Seymour Aubrey **Papert** (February 29, 1928 – July 31, 2016)

"ALL ABOUT LOGO - HOW IT WAS INVENTED AND HOW IT WORKS" !



"The LOGO Tree"

Children, Computers and Powerful Ideas ...

Papert envisages a computer-inspired revolution in learning ...

"I do not present LOGO environments as my proposal for this ... [they are] too primitive ... too limited by the technology of the 1970s ...".

Boytchev, P.: Logo Tree Project, http://elica.net/download/papers/LogoTreeProject.pdf

Objects-to-think-with

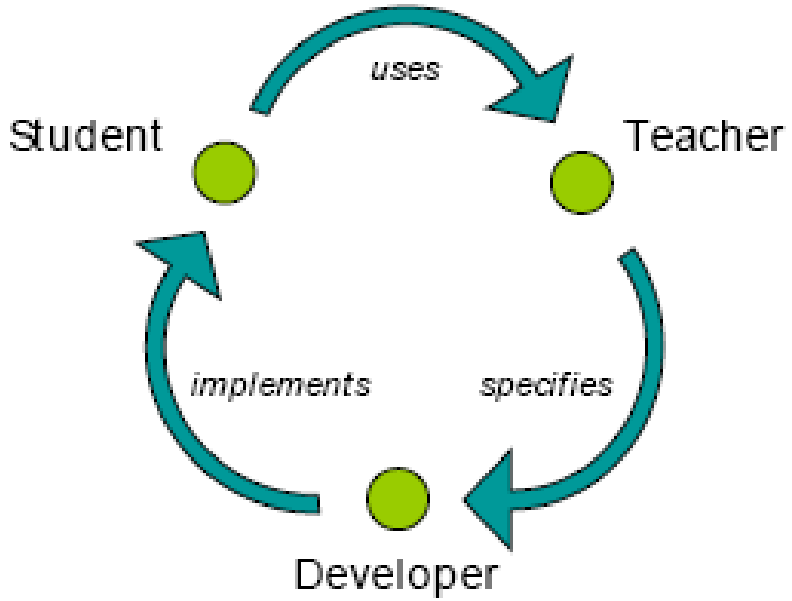
Papert saw programs as *objects-to-think-with*

- The gears of his childhood ...
- Constructionism ...
- Construction as integrating perspectives of designer/teacher, learner, developer

... cf. end-user programming

Constructionism ...

Learning through constructing an *object-to-think-with ...*



The learner plays many roles ... motivates environents in which the learner can be the developer (cf. Scratch)

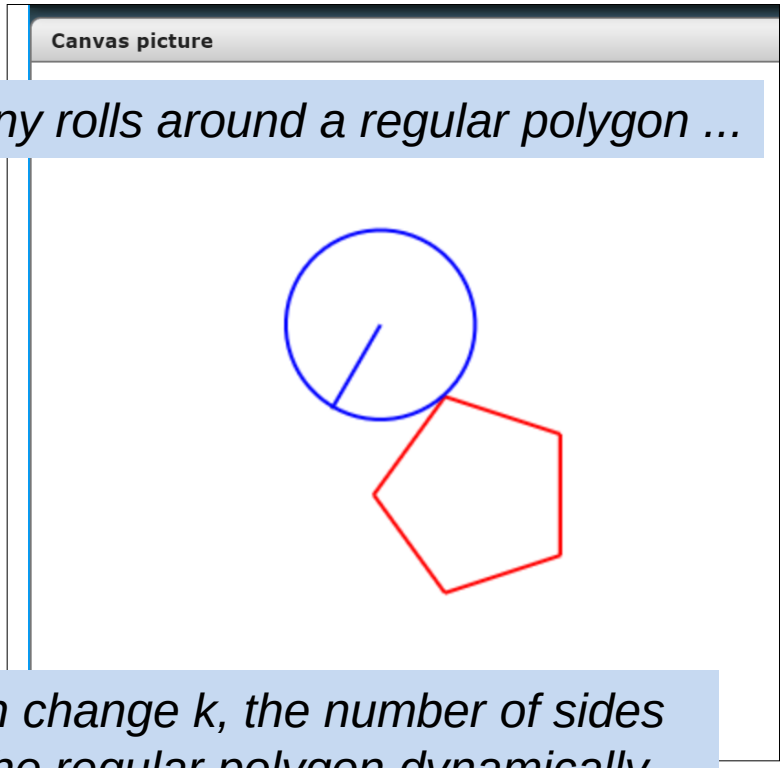
The **Penny Rolling** puzzle (cited in Mindstorms p150)

“If one penny rolls around another penny without slipping how many times will it rotate in making one revolution? ...”

“... One might guess the answer to be one, since the moving penny rolls along an edge equal to its own circumference, but a quick experiment shows that answer is two; apparently the complete revolution of the moving penny adds an extra revolution.”

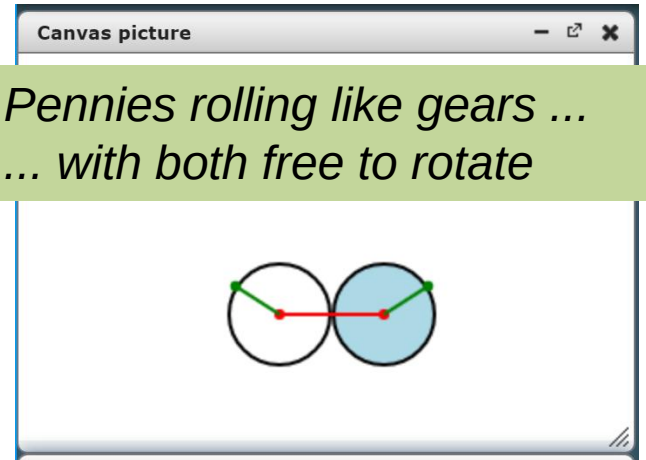
Martin Gardner: *Mathematical Carnival*

http://jseden.dcs.warwick.ac.uk/latest-master/index-dev.html?load=jseden1/public/PennyRollingwithPolygon&tag=3261

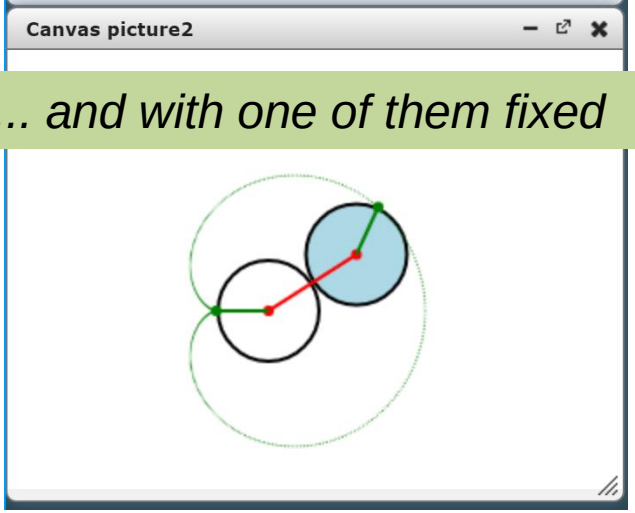


Penny rolls around a regular polygon ...

Can change k, the number of sides of the regular polygon dynamically



Pennies rolling like gears ...
... with both free to rotate

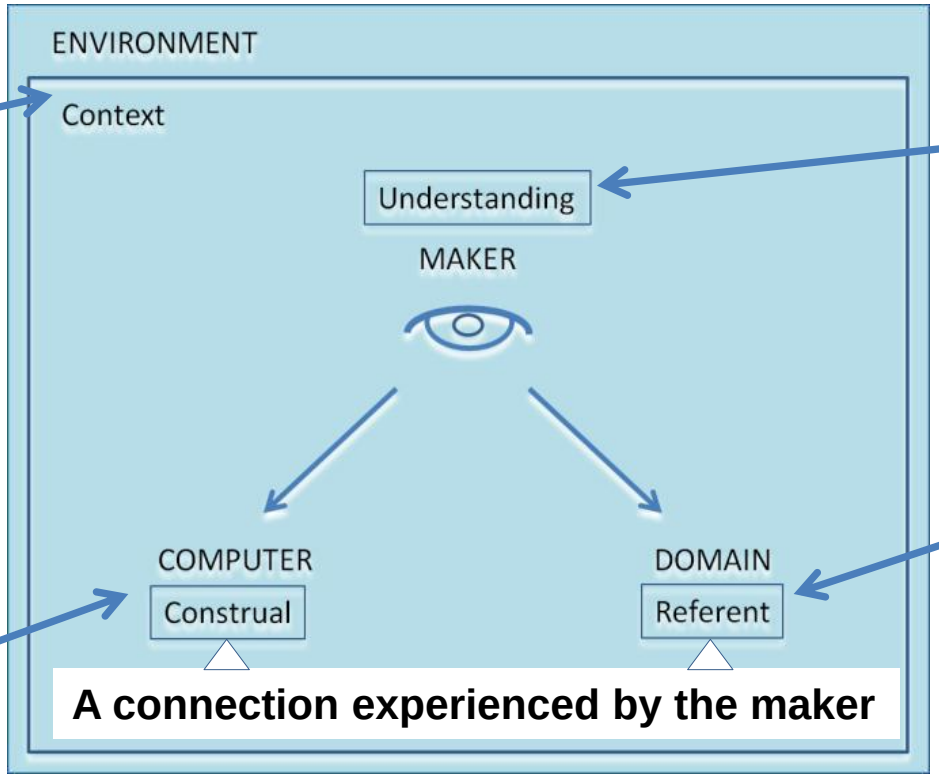


... and with one of them fixed

http://jseden.dcs.warwick.ac.uk/latest-master/index-dev.html?load=jseden1/public/PennyRolling&tag=3303

Making a ("digital") Construal

From which perspective is the maker making the construal e.g. Agents? Constraints?



What interactions and interpretations is the maker familiar with? Convinced of? puzzled about?

Script of definitions of *observables* with associated **network** of *dependencies*

What external subject does the maker have in mind when interacting with the construal?

Papert and Crook recognise ...

- the critical importance of being able to exploit the computer as a means to create common knowledge
- the great yet-to-be-realised potential of the computer in this respect
- that thinking of 'programming the computer' is not an appropriate way to conceive this role
- the vital need to develop a richer conceptual framework in which to address such concerns

Objects-to-converse-with

A common aspiration: *objects-to-converse-with*

- promoting an epistemological stance
- supporting intersubjectivity
- enabling bricolage

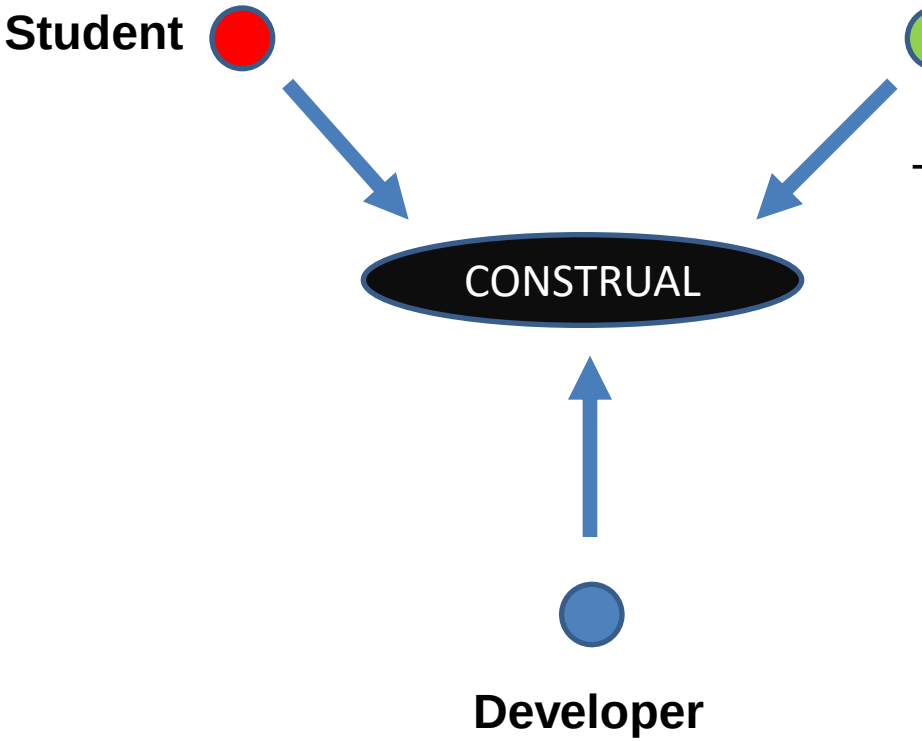
Conversation epitomising the character of making construals / making connections

Bridging private and public in constructionism

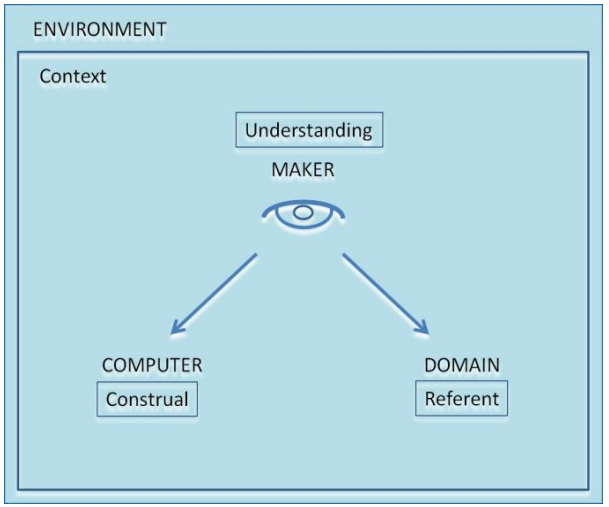
cf. **Microworlds** and **Educational Robotics**

Alternative view of constructionism ...

Learning through constructing an *object-to-converse-with ...*

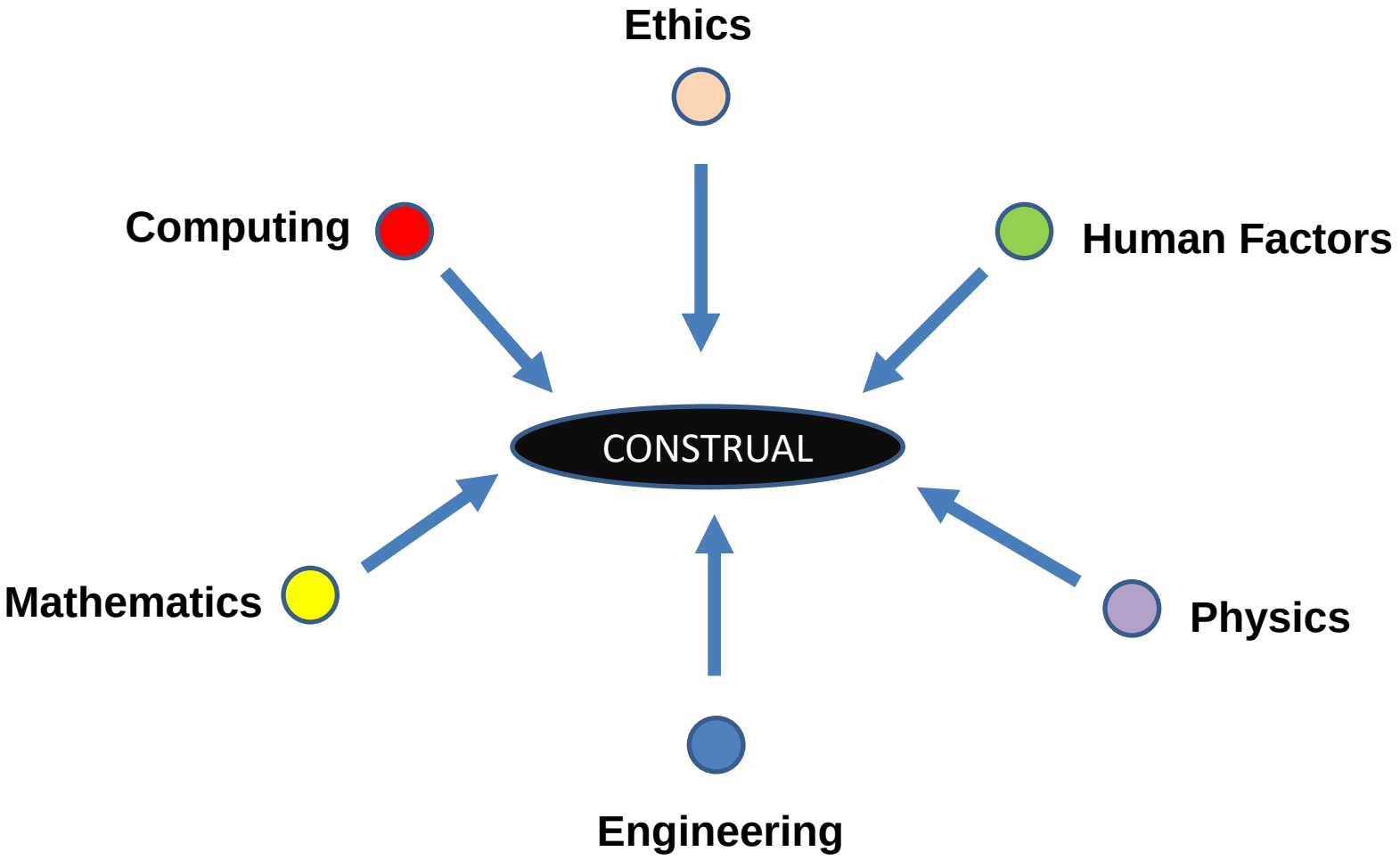


Teacher/Student/Developer as MAKER



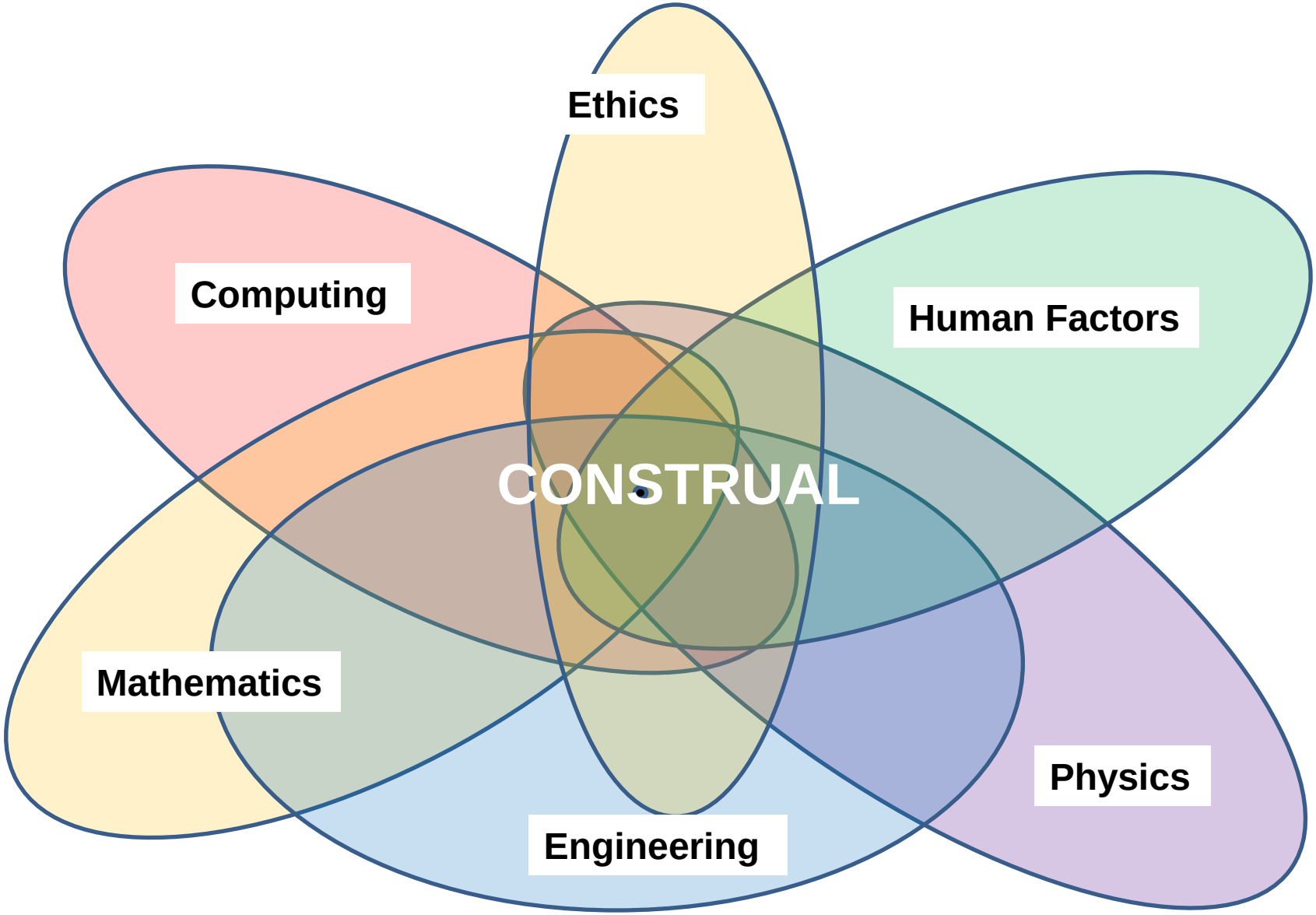
Diverse agents sharing observables and dependencies ...

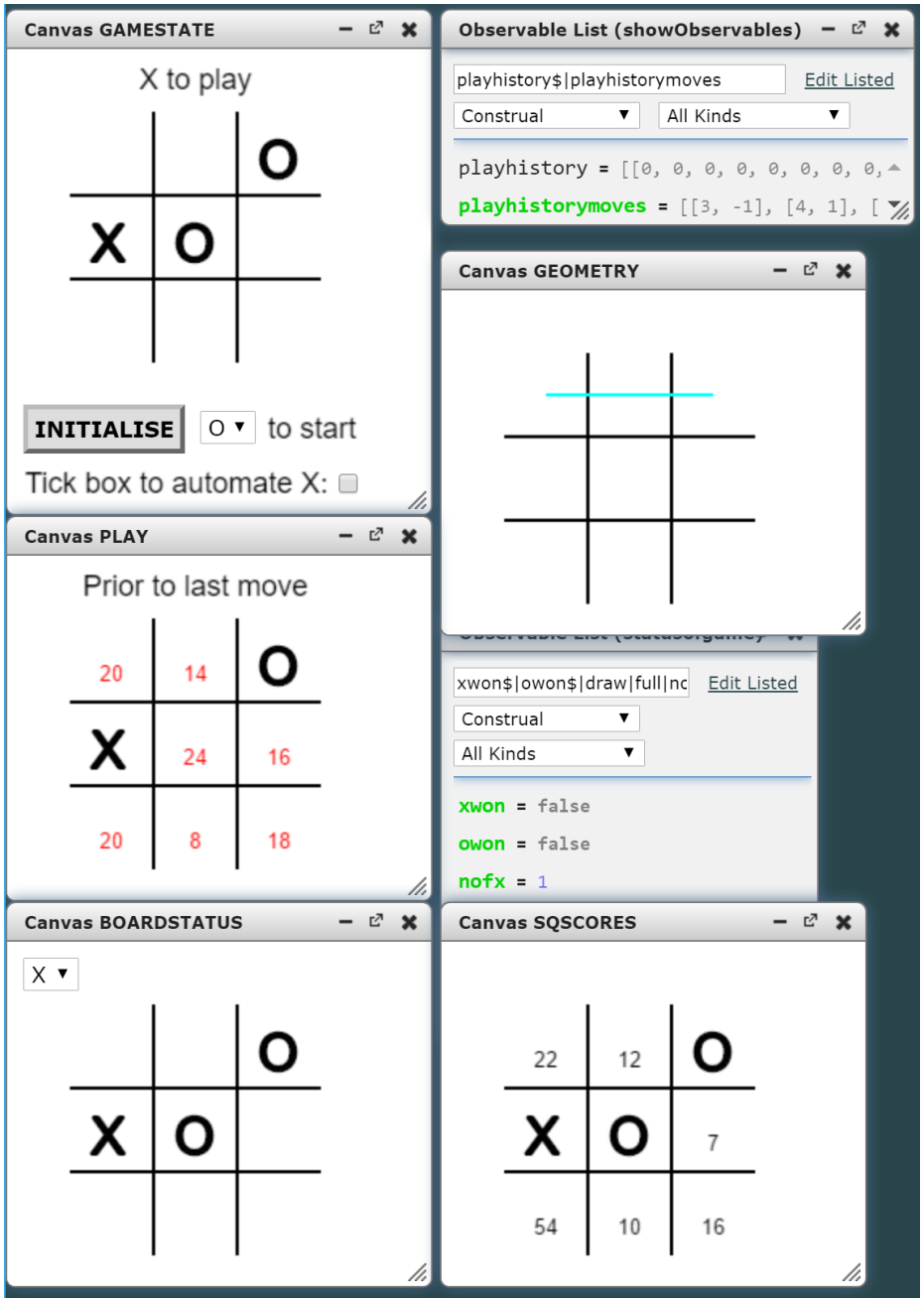
Educational Robotics ...



A construal as an *object-to-converse-with ...*

Construal as ‘construction’





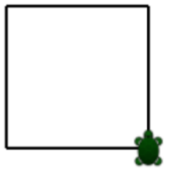
Making construals supports conversation in collaborative participatory design ...

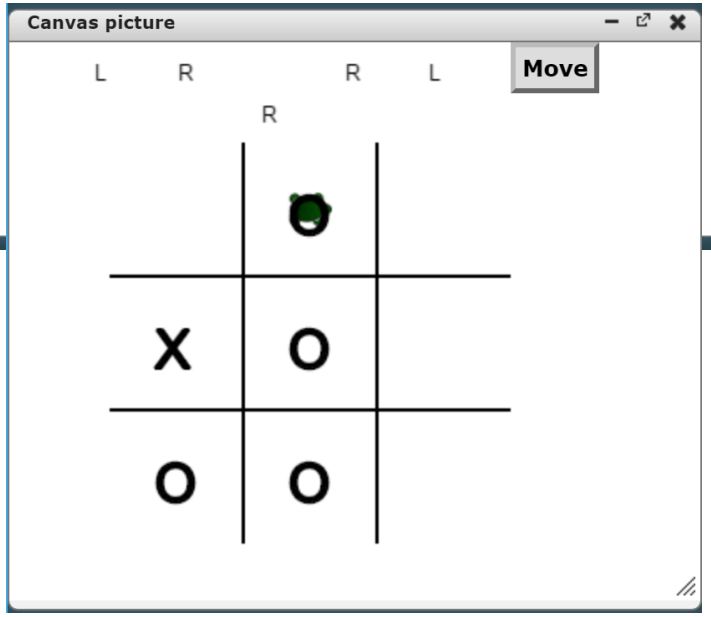
The OXO Laboratory is a construal of the game of Noughts-and-Crosses that can be adapted to develop an open-ended family of 'OXO-like' games.

Each window reflects an agent viewpoint on a game of noughts-and-crosses: manual and automated

Turtle OXO – blend OXO with LOGO

```
 * @title Logo Example 1
 * @author Nicolas Pope
 */

import logo/basic;
_view_input_agent = "logo/example1";

## Square
{
do forward 100;
do left 90;
}

## Fan
{
do forward 100;
do left 112;
}

do reset;
```





Can blend observables in Turtle OXO with physical observables associated with a robot Turtle by specifying suitable dependencies

Conclusions

Papert's legacy is much more than LOGO:

- Important to look beyond *programs* as objects-to-think-with
- Constructing objects-to-think-with is not to be confused with end-user programming
- Focus should be on how computers support conversation across disciplines and viewpoints
- Making construals has promise and potential

Acknowledgements

Dimitris Alimisis for inviting me to Edurobotics

Nick Pope
Ilkka Jormanainen, Tapani Toivonen
Elizabeth Hudnott, Jonathan Foss
Joe Butler, Tim Monks

for their work on the JS-Eden environment and the Arduino extensions

The **CONSTRUIT! project team**

Thank you

Any questions?