



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

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*New ways of using computers ...*

*... New ways of learning*

Before writing a program we have to imagine the subject – for example, what it's about, the context of its use, how it will change.

Imagine managing your house heating ‘intelligently’, or managing a local sports event. We call such imaginings ‘construals’. Usually our construals are ‘in our heads’ and maybe partly in documents.

The innovation in CONSTRUCT! is making construals on computers – *before* we make programs, and as an *approach to programs*.

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*New ways of using computers ...  
... New ways of learning*

CONSTRUCT! builds on previous research and development in Empirical Modelling and in educational technology over many years at Warwick. Team leaders at Warwick are:

Mike Joy (Co-ordinator)      Meurig Beynon      Steve Russ

<http://www2.warwick.ac.uk/fac/sci/dcs/research/em/>

<http://www2.warwick.ac.uk/fac/sci/dcs/research/edtech/>

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*New ways of using computers ...*

*... New ways of learning*

The CONSTRUCT! Project is part of an EU-funded Programme to share innovation and good practice in computing and ICT at all levels. It has a special focus on work in schools.

It is for 3 years with 6 partners. Warwick Computer Science is the ‘lead’, others in Edinburgh, Finland, Netherlands, Slovakia, Greece.

*Started: .... last September ... Initial meetings of partners were held at Warwick in October, December. Meetings in Finland and Greece (April/May) to trial material for students and teachers.*

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*New ways of using computers ...*  
*... New ways of learning*

The main objectives of CONSTRUCT! are:

- to use the computer to help us in 'making construals';
- to make this widely available to students and teachers;
- to make this facility useful for learning;
- to evaluate the effectiveness of our approach and methods.

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*New ways of using computers ...*  
*... New ways of learning*

For all those objectives we are calling for collaboration with students and teachers who are willing to try out our materials.

Anyone can experiment with current environments already, you may find they are not easy to use ... . We hope that will change!

Later this term we shall call for 'evaluators' (teachers and students) to register with us for specific and on-going feedback on the environments and their illustrative applications.

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*New ways of using computers ...*  
*... New ways of learning*

Places to find out more:

<http://www2.warwick.ac.uk/fac/sci/dcs/research/em/construit/>  
 (Local site with links to resources for an open online course)

<http://www.construit.org/>  
 (The official site under development)

For enquiries: (Meurig) [wmb@dcs.warwick.ac.uk](mailto:wmb@dcs.warwick.ac.uk)  
 (Steve) [steve.russ@warwick.ac.uk](mailto:steve.russ@warwick.ac.uk)

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**Prototype construals / virtual workshops at the url:**

[jseden.dcs.warwick.ac.uk/scifest](http://jseden.dcs.warwick.ac.uk/scifest)

The Light Box, Hexagon Colouring, Nim – see the **Project List**

**The CONSTRUCT! project: introducing construals to school education**

*... prepared in connection with*

The 8th Panhellenic Conference on ICT, 26-28th of June, 2015, Syros Island

<http://www2.warwick.ac.uk/fac/sci/dcs/research/em/construit/introconstrualsschooleducation/>

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## The Light Box ...

Each square can contain a mirror that faces forwards (/) or backwards (\)

We arrange the mirrors and cover the Light Box  
Can you find the hidden mirrors?

You arrange the mirrors and see if you can make:

- the longest ray
- the shortest ray
- the longest ray short!

What is the total length of the rays?

Can you arrange 4 mirrors so that the status of a mirror doesn't matter?

## Grid Colouring ...

Colour the map: you now have 2 red, 3 green, 3 blue, 2 yellow cells left

Can you colour the hexagon grid in red, blue, green, and yellow using each colour at most 4 times so that touching hexagons are different colours?

Now change the rules and try again

How many of the cells can you colour green?

Can you colour the grid without using yellow?

## The Game of NIM ...

Take turns to take stones from ONE of the 3 piles.  
The winner is the one to take the LAST stone.

The first player can be a winner almost all the time, but HOW?

Who wins when there are just TWO piles of stones?

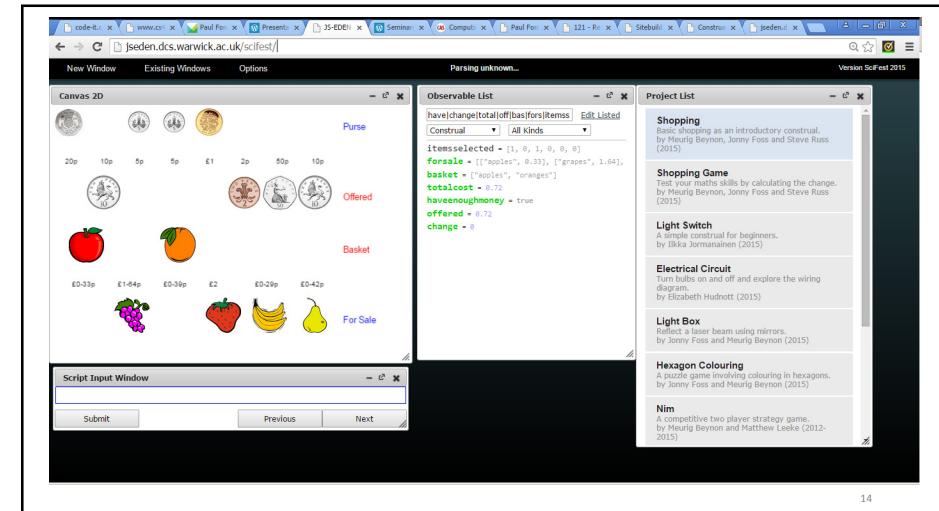
Play against an expert, and find out how they use math to win!

Play Nimmoni: a new kind of NIM – with coins, invented for SciFest!

Qualities of / aspirations for making construals

## Characteristics

- Capturing understanding of state and potential for state change in a domain
- Provoking reflection on the basis for understanding and misunderstanding
- Potentially personal and subjective
- Principles to support “a person making sense of a situation”  
cf. computational thinking associated with “a mind following rules”

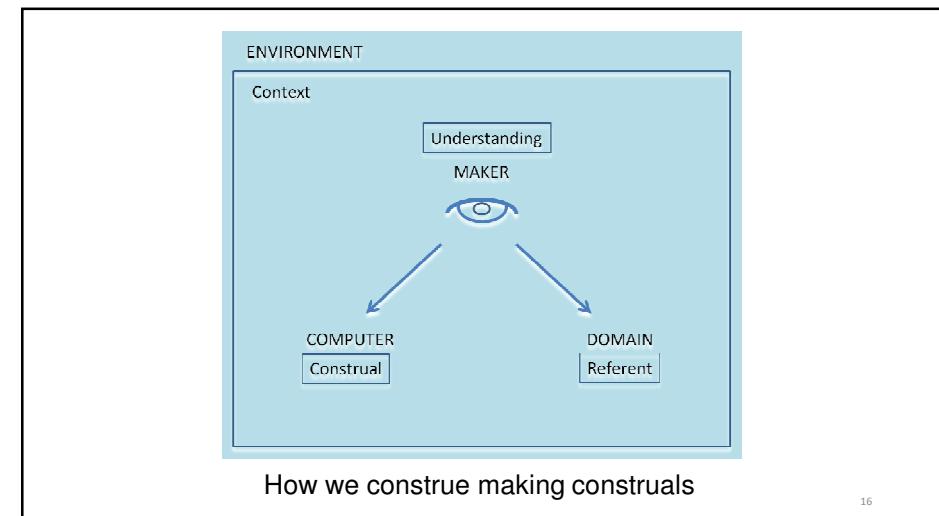


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## Basic concepts

### Scripts of definitions capturing

- Observables
- Dependencies
- Agents / agency
- a playground for exploring agent interaction
- “Metaphorical” representations of situation
- Understanding expressed in terms of implicit knowledge of interactions and interpretations



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## To explore the demo for yourself ...

1. Launch the JS-EDEN environment. The current version is at:  
<http://jseden.dcs.warwick.ac.uk/scifest/>
2. Select 'Shopping' from the Project List.
3. To set up the environment as pictured in the previous slide, use the **New Window** drop-down menu to obtain an **Observable List** then type in the expression you see in the previous display into its search box.

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## Shopping: movement of coins/fruit

`picture` is [coin1pic, ... item3pic, .... coin1text, ...item3text, ... MyCoinsText,...];

`itemsselected = [0, 0, 1, 0, 0, 0];`

`item3pic` is `HTMLImage("item3pic", scaleWidth*3.1, 5.5*scaleWidth-2*scaleWidth*itemsselected[3], scaleWidth,scaleWidth, imagelocation // itemdisplay(3));`

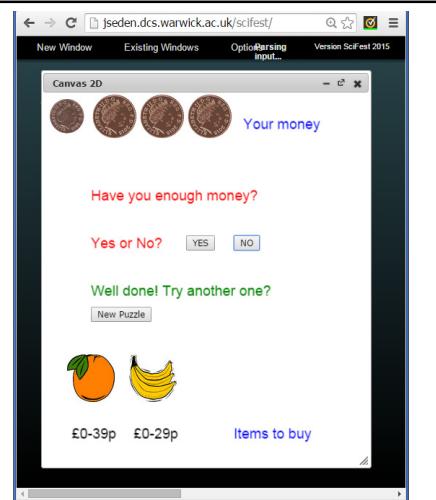
```
proc item3picMove : item3pic_click {
    if(item3pic_click)
        itemsselected[3] = 1 - itemsselected[3];
}
```

### A game derived from the Shopping construal

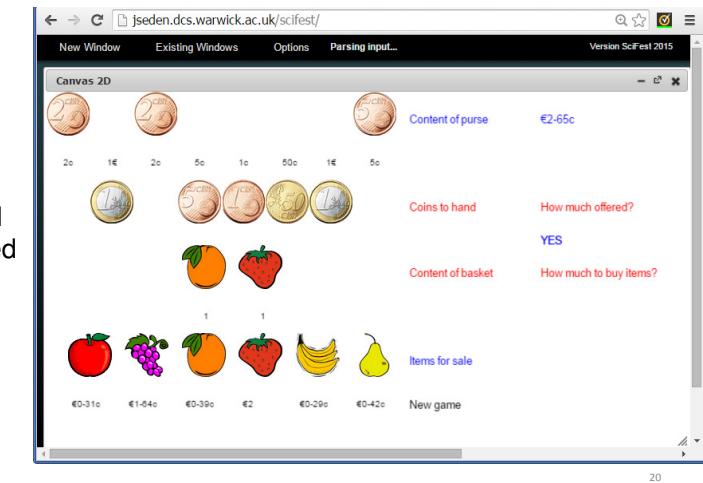
... based on a typical OER:

<http://www.sheppardsoftware.com/mathgames/earlymath/BPEnoughCoins.htm>

- programmed for an explicit teaching purpose
- has a specific intended use – may not suit
- teacher is not intended to adapt or extend



A Euro version with scaffolded learning derived from Shopping



## Issues to consider

- Enough / exact change for bus-fare home
- Exact payment for item / simplifying change
- Cooperative purchase
- Quantity of items at a certain cost per item
- Different currency / exchange rate
- Saving up pocket money
- Representation of cash  $103p = £1\text{-}03p = £1.03$

## Target themes

- Collaborative development and interaction
  - concurrent environment for making construals
  - integrating contributions from participants with diverse levels of expertise
- Integration with other resources e.g. combining the demo with the construal of giving change by a former MEng student – cf. the paper: <http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/web-em/01/greedy.pdf>
- Scope for empirical study with teachers and pupils in local schools

## Topical ideas

- Establishing communities of CONSTRUITers – the Greek experience
- Making connections with ‘unplugged’ computing resources
  - human actors as computers, Barefoot computing
- Visual interfaces for specifying scripts – “script maps”
- Establishing activities with IGGY

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## Questions?

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