



# Computer Support for Computing Unplugged?

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## Questions

Why does *computing unplugged* help us to understand computational concepts?

... because real objects have more subtle interactive qualities than abstract computers

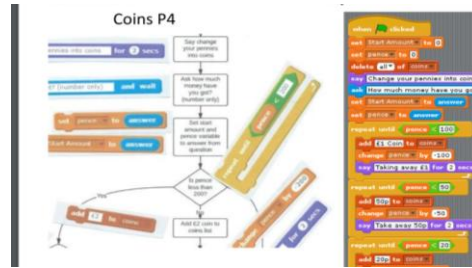
... this has to do with how they embody state that is meaningful (cf. clock, sundial)

## How can the computer help?!

We can devise better ways to express states and interactions as we *experience* them

Beyond procedural and declarative perspectives on state in programming ...

... **observational**, something different in nature



Coins from Phil Bagge's *How to teach Primary Programming using Scratch*

```
add £1 coin to coins
change pence by -100
say Taking away £1 for 2 secs
```

Two independent steps for a single action:  
**adding a pound coin to the list**  
 is also **taking away 100 pennies from the amount to be converted**

## Issues for capturing state



Two independent steps for a single action:  
**adding a pound coin to the list**  
 is also **taking away 100 pennies from the amount to be converted**

[Procedural] spell out computational steps – ‘too much state’

[Declarative] abstract away computational steps - too little state

Whether state is live to interaction cf. state in

- video
- computer game
- real-life game

DENOMINATIONS	1	2	5	10	20	50	100	200
389 pennies	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
189	1	1	1	1	1	1	1	1
89	1	2	5	10	20	50	100	0
39	1	1	1	1	1	0	0	0
19	1	2	5	10	20	0	0	0
9	1	1	1	1	0	0	0	0
4	1	2	5	0	0	0	0	0
2	1	1	0	0	0	0	0	0
0	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE

coins  
 200  
 100  
 50  
 20  
 10  
 5  
 2  
 2

Denominations of coins available

	1	2	5	10	20	50	100	200		
39	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE		
	1	1	1	1	1	0	0	0		
	1	2	5	10	20	0	0	0		20
19										

Quantity of change yet to be given

Largest appropriate denomination

amount = 389; coinlist is [200,100,50];  
 amountleft is amount - sum(coinlist);  
 denoms = [1,2,5,10,20,50,100,200];

	1	2	5	10	20	50	100	200		
39	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE		
	1	1	1	1	1	0	0	0		
	1	2	5	10	20	0	0	0		20
19										

gtdenomix is 1 if amountleft >= denoms[ix] else 0;  
 gtnumlist is gtdenomix with \_ix is 1..denoms#;  
 maxdenom is denoms[sum[gtnumlist]];

### Observation in giving change ...

```

amount = 8;
coinlist = [];
denoms is [1,2,5,10,20,50,100,200];
amountleft is amount - sum(coinlist);
gtdenomix is 1 if amountleft >= denoms[_ix] else 0;
gtnumlist is gtdenomix with _ix is 1..denoms#;
maxdenom is denoms[sum(gtnumlist)];
    
```

### Agency in giving change

## initialisation	## action
{	click is mousePressed;
amount = 195;	<b>when</b> (amountleft > 0 && click) {
coinlist = [];	<b>wait</b> 100;
}	coinlist = coinlist // [maxdenom];
	}

### Giving change in the environment for making construals

```

//**
* @title Giving Change Model
* @author Hourig Beynon
*/
denoms is [1,2,5,10,20,50,100,200];
amountleft is amount - sum(coinlist);
gtdenomix is 1 if amountleft >= denoms[_ix] else 0;
gtnumlist is gtdenomix with _ix is 1..denoms#;
maxdenom is denoms[sum(gtnumlist)];
    
```

### Summary and references

**Computer Support for Computing Unplugged?**

Unplugged computing considers activities from ordinary life that help us to understand what is involved in developing software. These activities illustrate concepts and approaches to computational thinking in ways that avoid some of the complications of computing as it is really practised. This is because they are expressed in terms of interactions with objects that of their nature record and change state in more subtle ways than a raw computational device. This talk introduces and illustrates practical principles and an environment we can use to model such objects using the computer.

**Work with us and other teachers with a view to supporting teaching and learning about computing potentially contributing to a session for teachers at the final conference for CONSTRUCT! to be held at Warwick University in July 2017. If interested, please contact [steve.russ@warwick.ac.uk](mailto:steve.russ@warwick.ac.uk)**

Getting Started with JS-Eden and other resources about making construals  
[go.warwick.ac.uk/em/construit/year2/c15/forteachers/](http://go.warwick.ac.uk/em/construit/year2/c15/forteachers/)

Script for giving change construal: wmb/casws in project repository of  
[jseden.dcs.warwick.ac.uk/scifest16](http://jseden.dcs.warwick.ac.uk/scifest16)

Online links to CAS2016 session slides etc  
[go.warwick.ac.uk/em/construit/year2/CAS2016](http://go.warwick.ac.uk/em/construit/year2/CAS2016)