

Conducting experiments with agent-based modelling for social scientists

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Troubleshooting audio problems

- Check your speaker/headset is plugged in / volume is on.
- Click on audio to change to listening via phone
- We are recording this webinar and will post it on YouTube (<https://www.youtube.com/user/UKDATASERVICE>)

Interaction in this workshop

- Use the Zoom chat for technical questions or comments for the workshop facilitator.
- Ask or upvote questions for workshop host in the Zoom Q&A.
- You can also ask the facilitator to unmute you if you are happy to ask your question out loud.

You might be interested in other UKDS events

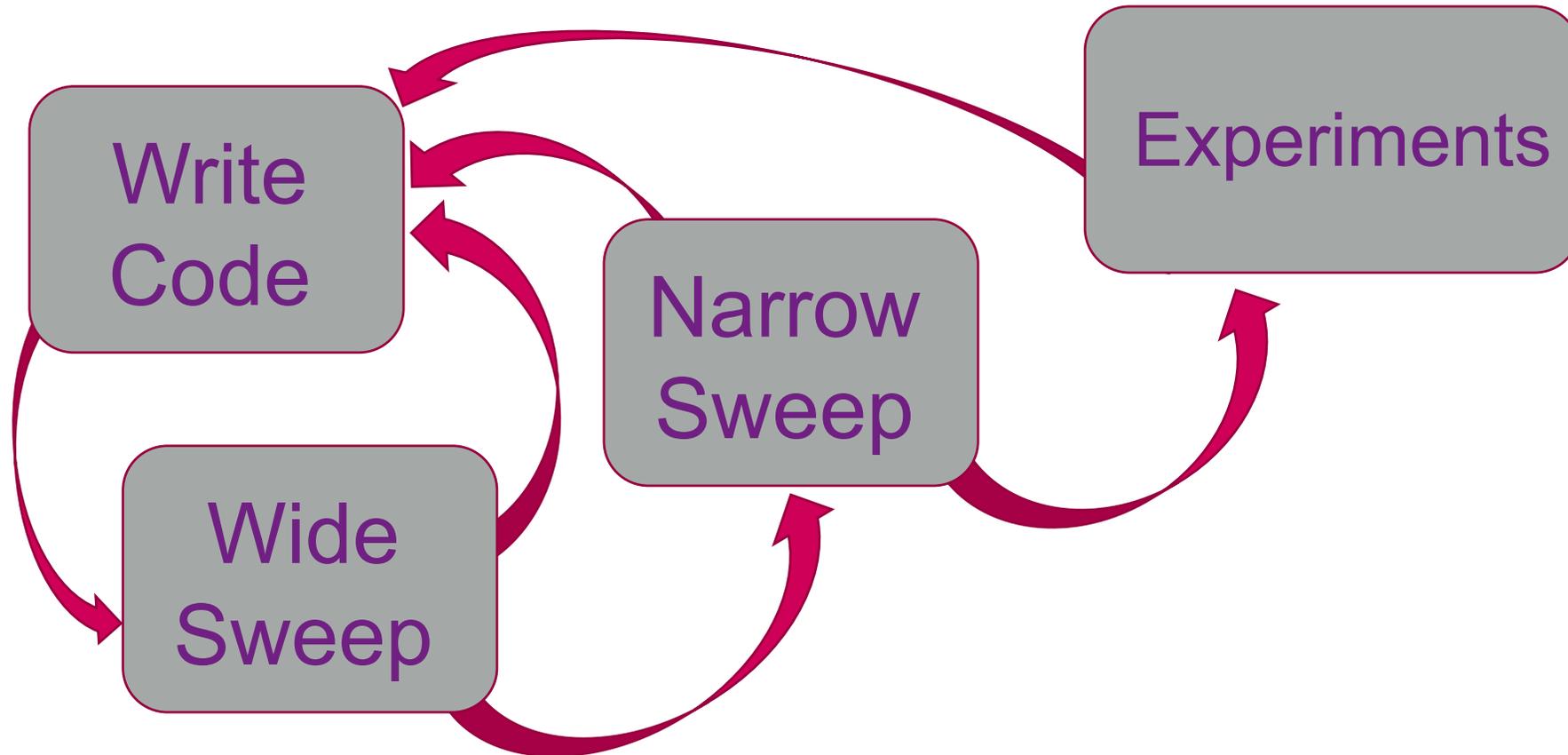
- Reproducibility: Collaborative working Feb 15 (past event)
- ABM guest seminar Mar 9
- CSS Drop-ins – Every second Tuesday of the month at 13:00
- Geographical data visualisation of UK Census data March 17
- <https://ukdataservice.ac.uk/news-and-events/events.aspx>
- <https://www.ukdataservice.ac.uk/news-and-events/events/past-events.aspx>

Table of contents

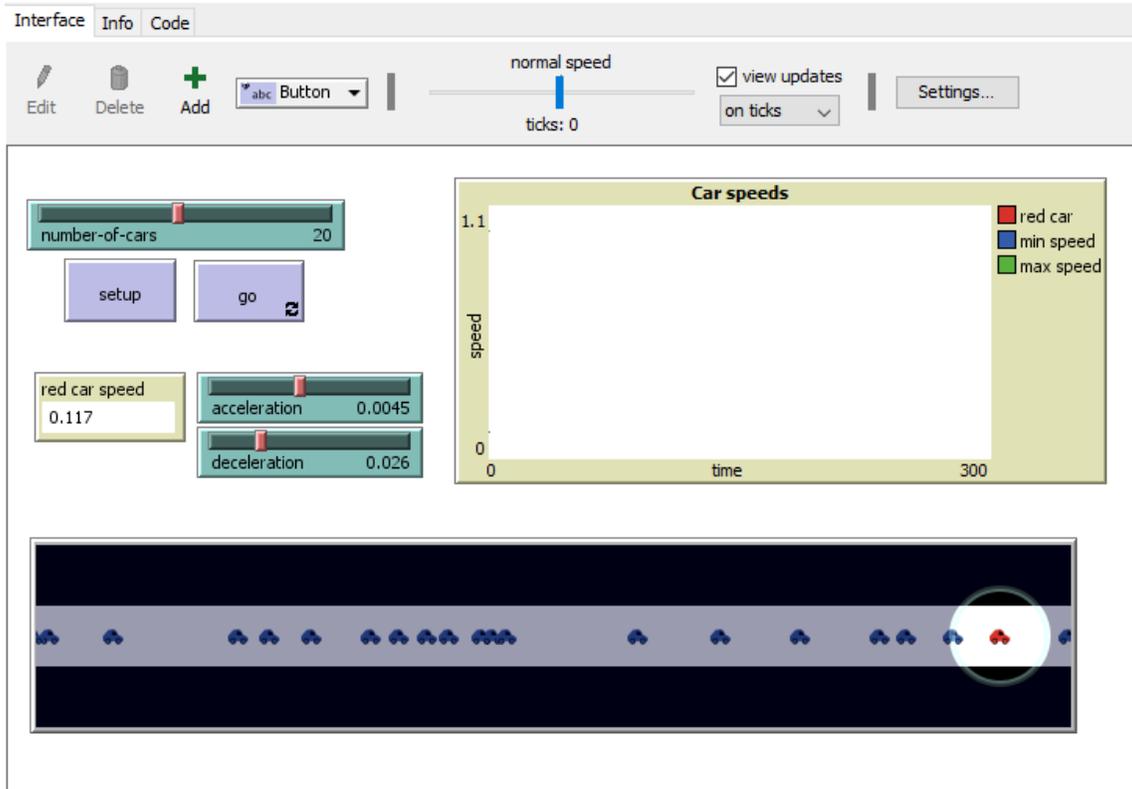
- Concepts and planning of experiments
- Behaviour space – automatically run experiments in NetLogo
- Output
- Q&A

Development is iterative

Writing code and running the model go together in phases
Initially focused on identifying errors



Let's look at the basic traffic model



Three parameters that can vary

The red car can travel at max speed easily on its own, but has to brake and speed up when there is lots of traffic.

We want to find the breakpoint – the combination(s) of parameters where the red car's behaviour changes.



Wide parameter sweeps

Experiment

Experiment name

Vary variables as follows (note brackets and quotation marks):

```
["acceleration" 0.001 0.003 0.005 0.007 0.009]
["number-of-cars" [1 10 41]]
["deceleration" 0.001 0.003 0.005 0.007 0.009]
```

Either list values to use, for example:
["my-slider" 1 2 7 8]
or specify start, increment, and end, for example:
["my-slider" [0 1 10]] (note additional brackets)
to go from 0, 1 at a time, to 10.
You may also vary max-pxcor, min-pxcor, max-pyccor, min-pyccor, random-seed.

Repetitions
run each combination this many times

Run combinations in sequential order

For example, having ["var" 1 2 3] with 2 repetitions, the experiments' "var" values will be:
sequential order: 1, 1, 2, 2, 3, 3
alternating order: 1, 2, 3, 1, 2, 3

Measure runs using these reporters:

```
[speed] of sample-car
```

one reporter per line: you may not split a reporter across multiple lines

Measure runs at every step
if unchecked, runs are measured only when they are over

Setup commands:

Go commands:

Stop condition:
the run stops if this reporter becomes true

Final commands:
run at the end of each run

Time limit
stop after this many steps (0 = no limit)

Start wide

- All parameters vary
- Full/wide range
- Big increments
- Few repetitions

Goal is to find:

- Errors not found in basic testing
- Broad areas of interesting behaviour
- Conceptual problems

Likely to motivate some (major?) code rewrites.



Narrow parameter sweeps

Experiment

Experiment name:

Vary variables as follows (note brackets and quotation marks):

```
[ "acceleration" 0.005 0.006 0.007 0.008 ]  
[ "number-of-cars" [15 5 30] ]  
[ "deceleration" 0.005 0.006 0.007 0.008 ]
```

Either list values to use, for example:
["my-slider" 1 2 7 8]
or specify start, increment, and end, for example:
["my-slider" [0 1 10]] (note additional brackets)
to go from 0, 1 at a time, to 10.
You may also vary max-pxcor, min-pxcor, max-pycor, min-pycor, random-seed.

Repetitions:
run each combination this many times

Run combinations in sequential order
For example, having ["var" 1 2 3] with 2 repetitions, the experiments' "var" values will be:
sequential order: 1, 1, 2, 2, 3, 3
alternating order: 1, 2, 3, 1, 2, 3

Measure runs using these reporters:

```
[speed] of sample-car
```

one reporter per line; you may not split a reporter across multiple lines

Measure runs at every step
if unchecked, runs are measured only when they are over

Setup commands:

Go commands:

Stop condition: the run stops if this reporter becomes true

Final commands: run at the end of each run

Time limit:
stop after this many steps (0 = no limit)

Narrowing in:

- Maybe not all parameters
- Narrower ranges and/or smaller increments
- More repetitions

Goal is to find:

- Hopefully no errors
- Break points
- Delineated critical areas

Code rewrites may be needed.



Experiments!

Experiment

Experiment name

Vary variables as follows (note brackets and quotation marks):

```
["acceleration" 0.006 0.0065 0.007]
["number-of-cars" [18 3 30]]
["deceleration" 0.006 0.0065 0.007]
```

Either list values to use, for example:
["my-slider" 1 2 7 8]
or specify start, increment, and end, for example:
["my-slider" [0 1 10]] (note additional brackets)
to go from 0, 1 at a time, to 10.
You may also vary max-pxcor, min-pxcor, max-pycor, min-pycor, random-seed.

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Essentially

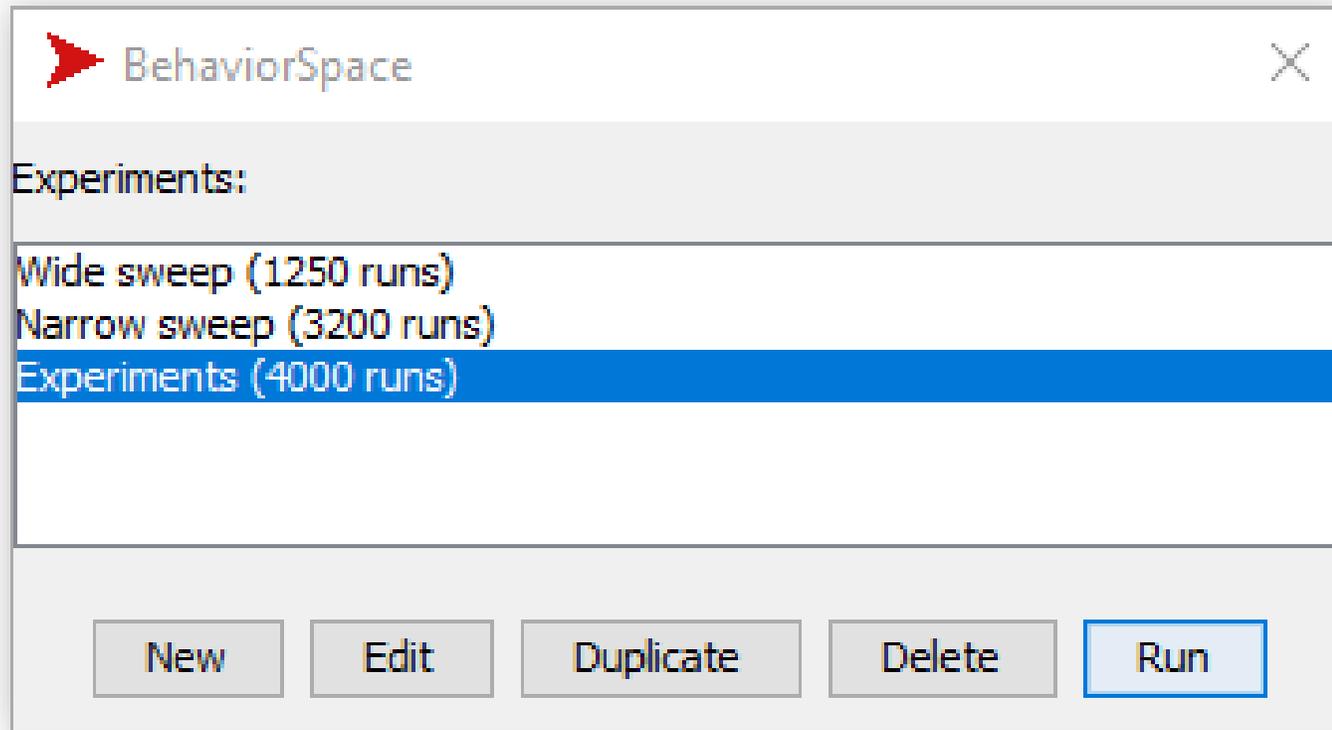
- MANY repetitions on single/few settings

Goal is to find:

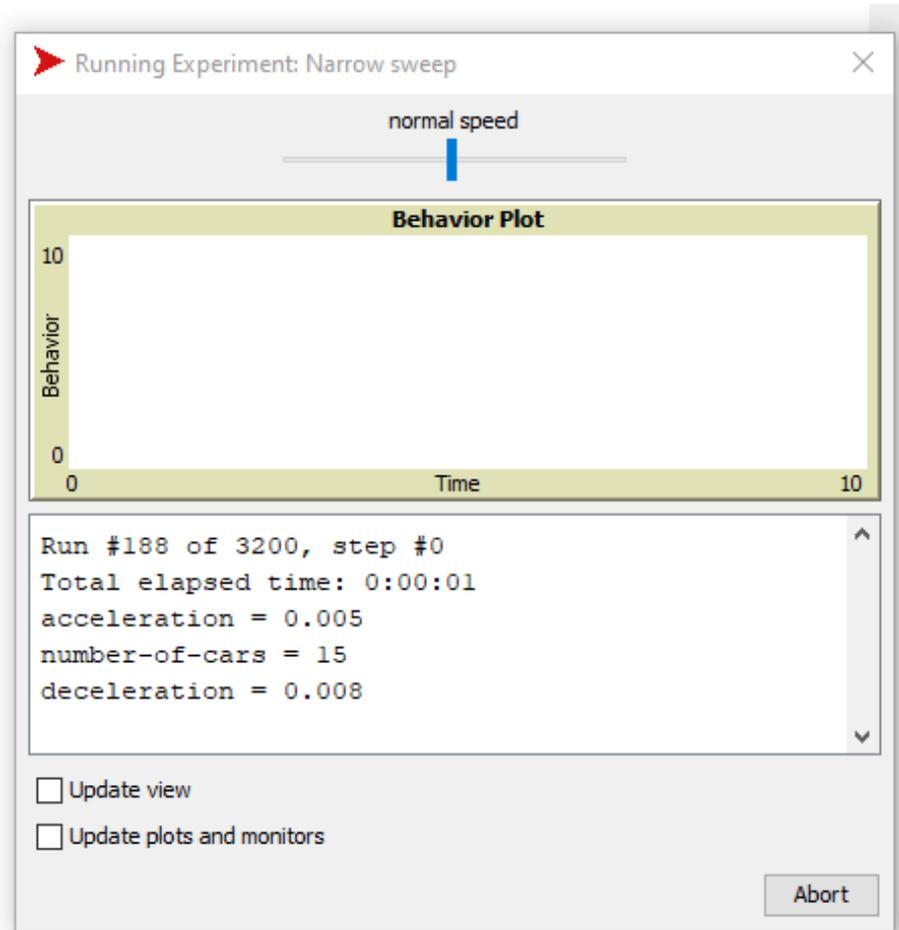
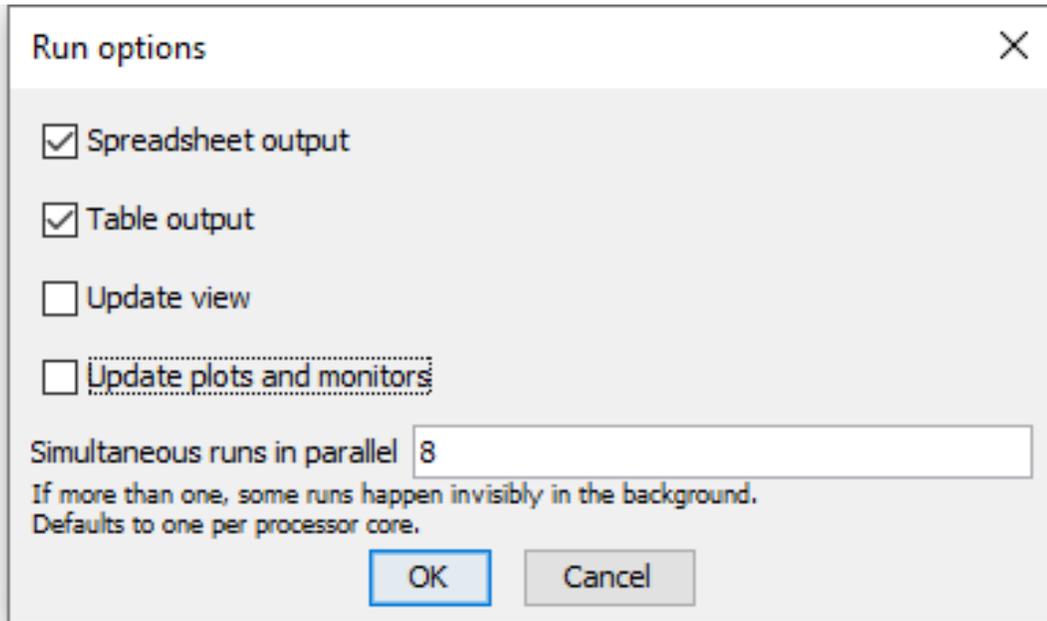
- Statistically useful volumes of data on areas that sweeps suggested were important



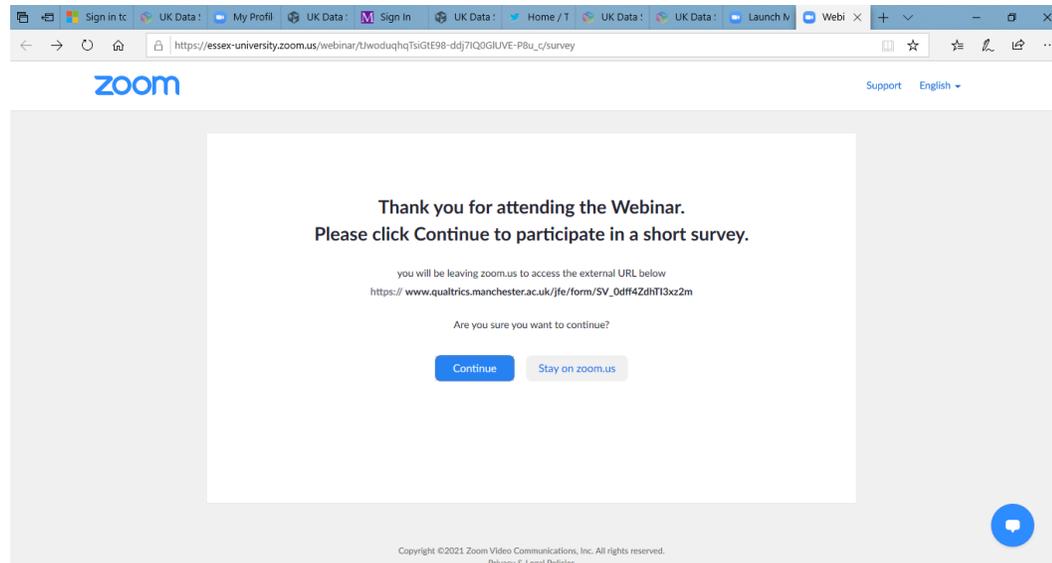
Behaviour Space



Choose a basic output option if needed



Evaluation



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Thank you.

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