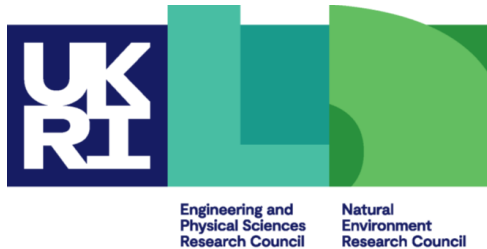


Message-Passing Thought Exercise

Traffic Modelling



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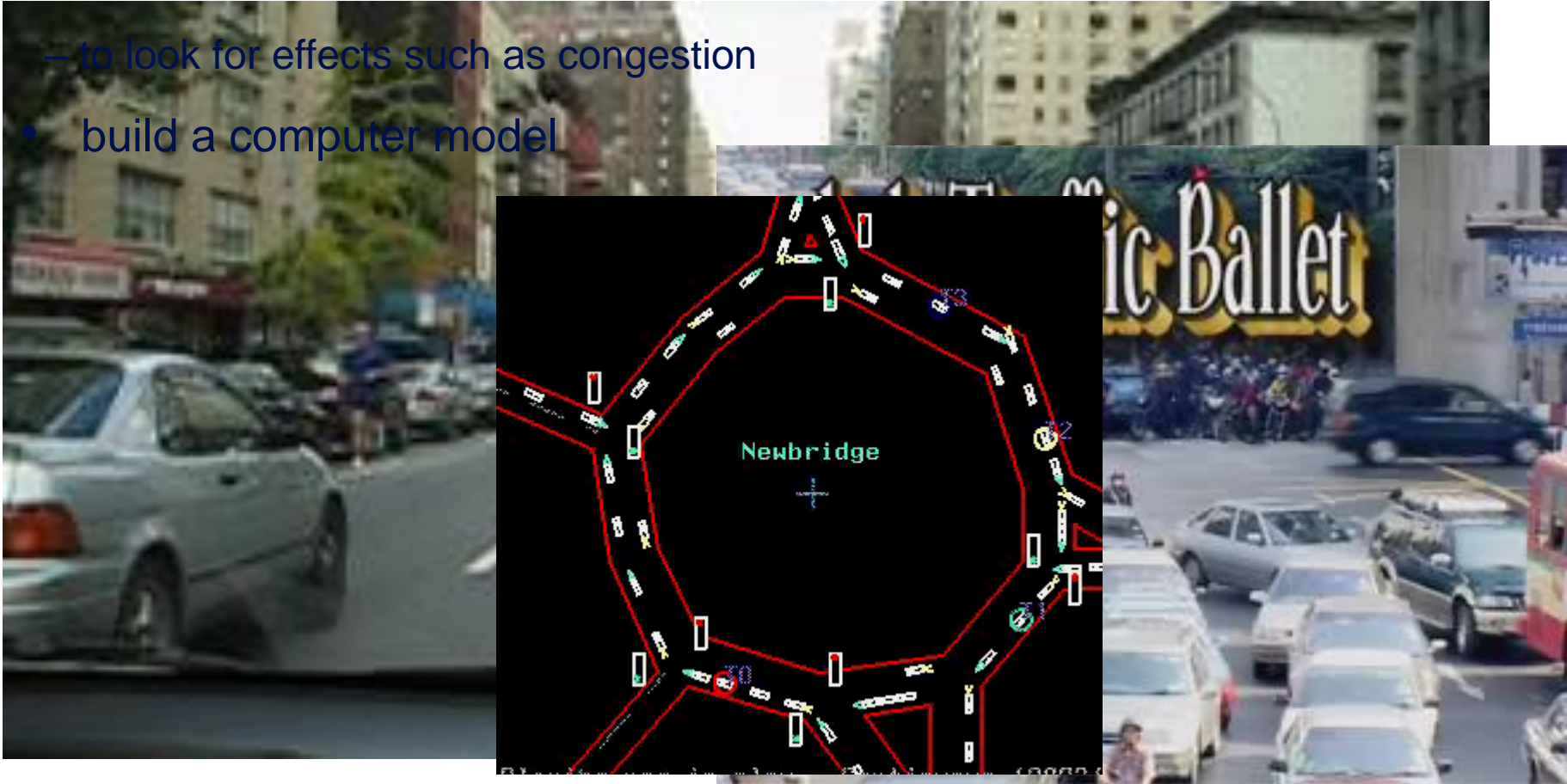
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Traffic flow

- we want to predict traffic flow
 - to look for effects such as congestion
- build a computer model



Simple traffic model

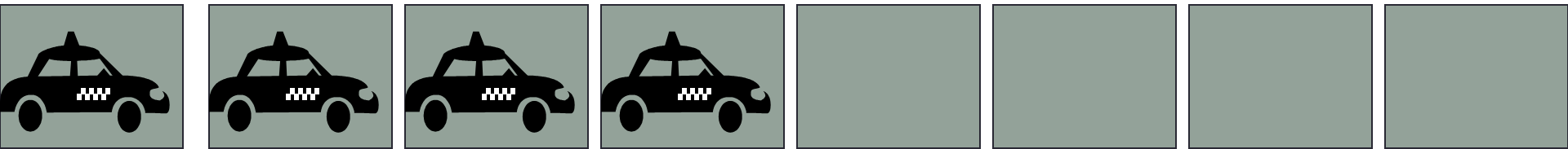
- divide road into a series of cells
 - either occupied or unoccupied
- perform a number of steps
 - each step, cars move forward if space ahead is empty



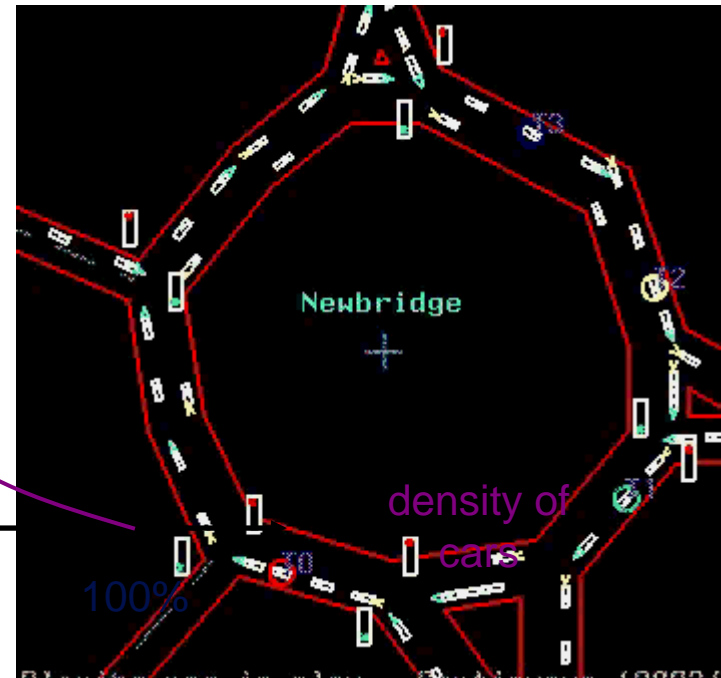
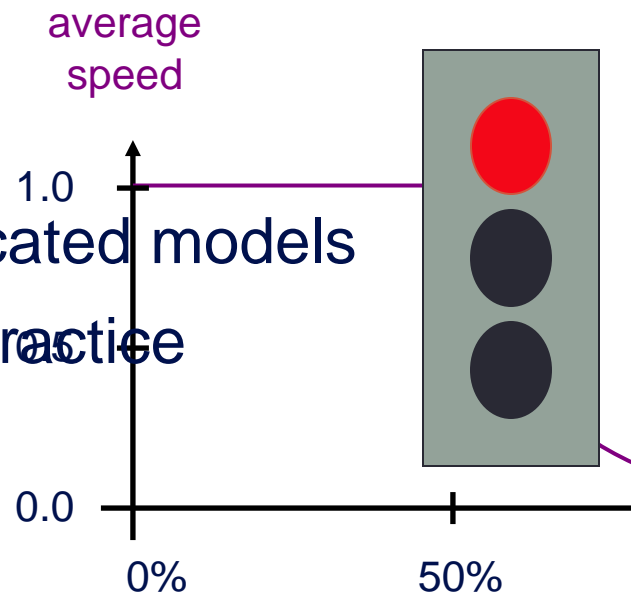
**could do this by moving
pawns on a chess board**

Traffic behaviour

- model predicts a number of interesting features
- traffic lights

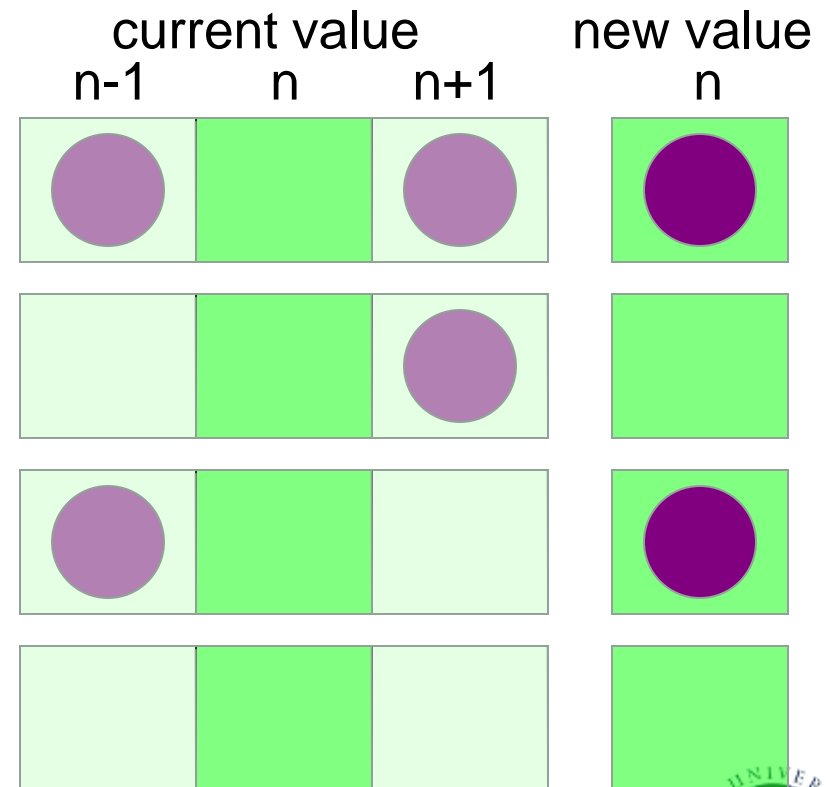
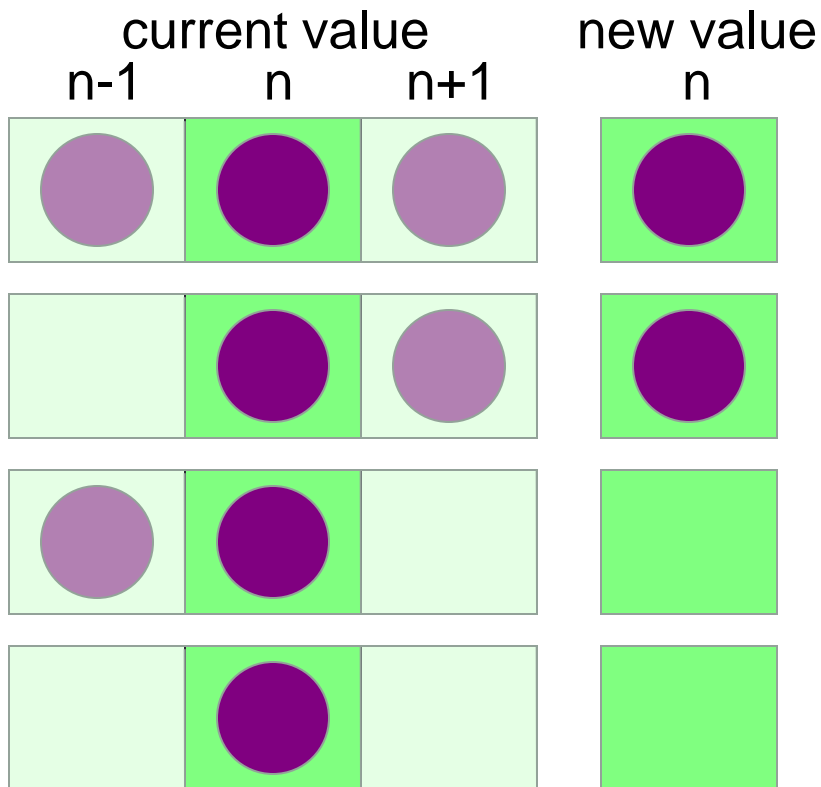


- congestion
- more complicated models are used in practice



Traffic simulation

- Update rules depend on:
 - state of cell
 - state of nearest neighbours in both directions



State Table

- If $R^t(i) = 0$, then $R^{t+1}(i)$ is given by:

	$R^t(i-1) = 0$	$R^t(i-1) = 1$
$R^t(i+1) = 0$	0	1
$R^t(i+1) = 1$?	?

- If $R^t(i) = 1$, then $R^{t+1}(i)$ is given by:

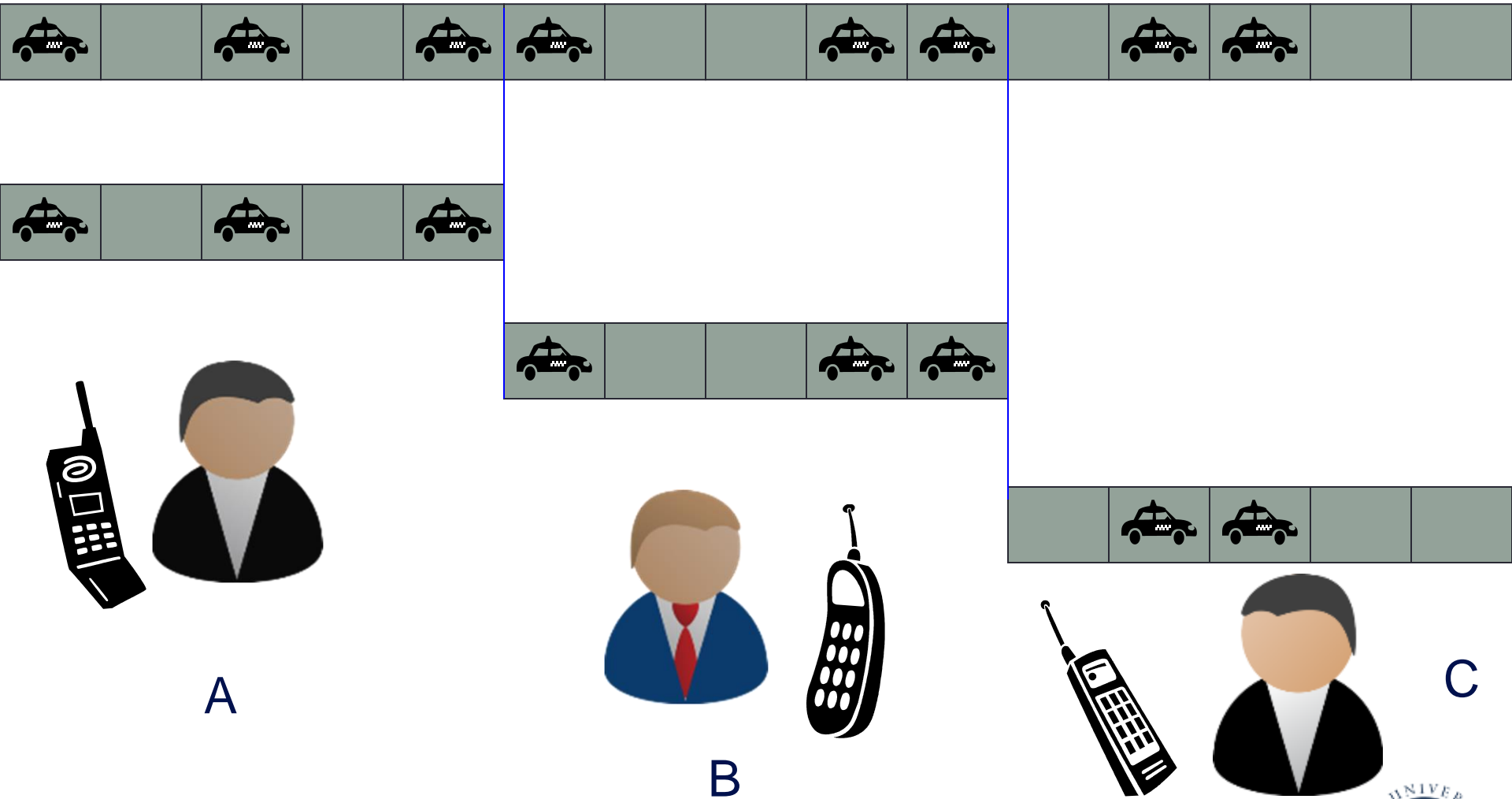
	$R^t(i-1) = 0$	$R^t(i-1) = 1$
$R^t(i+1) = 0$?	?
$R^t(i+1) = 1$?	?

How fast can we run the model?

- measure speed in Car Operations Per second
 - how many COPs?
- around 2 COPs
- but what about three people?
 - can they do six COPs?



Parallel Traffic Modelling



Pseudo Code: traffic on a roundabout

```
declare arrays old(i) and new(i),  $i = 0, 1, \dots, N, N+1$ 
initialise old(i) for  $i = 1, 2, \dots, N-1, N$  (eg randomly)
loop over iterations
    set old(0) = old(N) and set old(N+1) = old(1)
    loop over  $i = 1, \dots, N$ 
        if old(i) = 1
            if old(i+1) = 1 then new(i) = 1 else new(i) = 0
        if old(i) = 0
            if old(i-1) = 1 then new(i) = 1 else new(i) = 0
    end loop over i
    set old(i) = new(i) for  $i = 1, 2, \dots, N-1, N$ 
end loop over iterations
```