

Message-Passing Thought Exercise

Traffic Modelling



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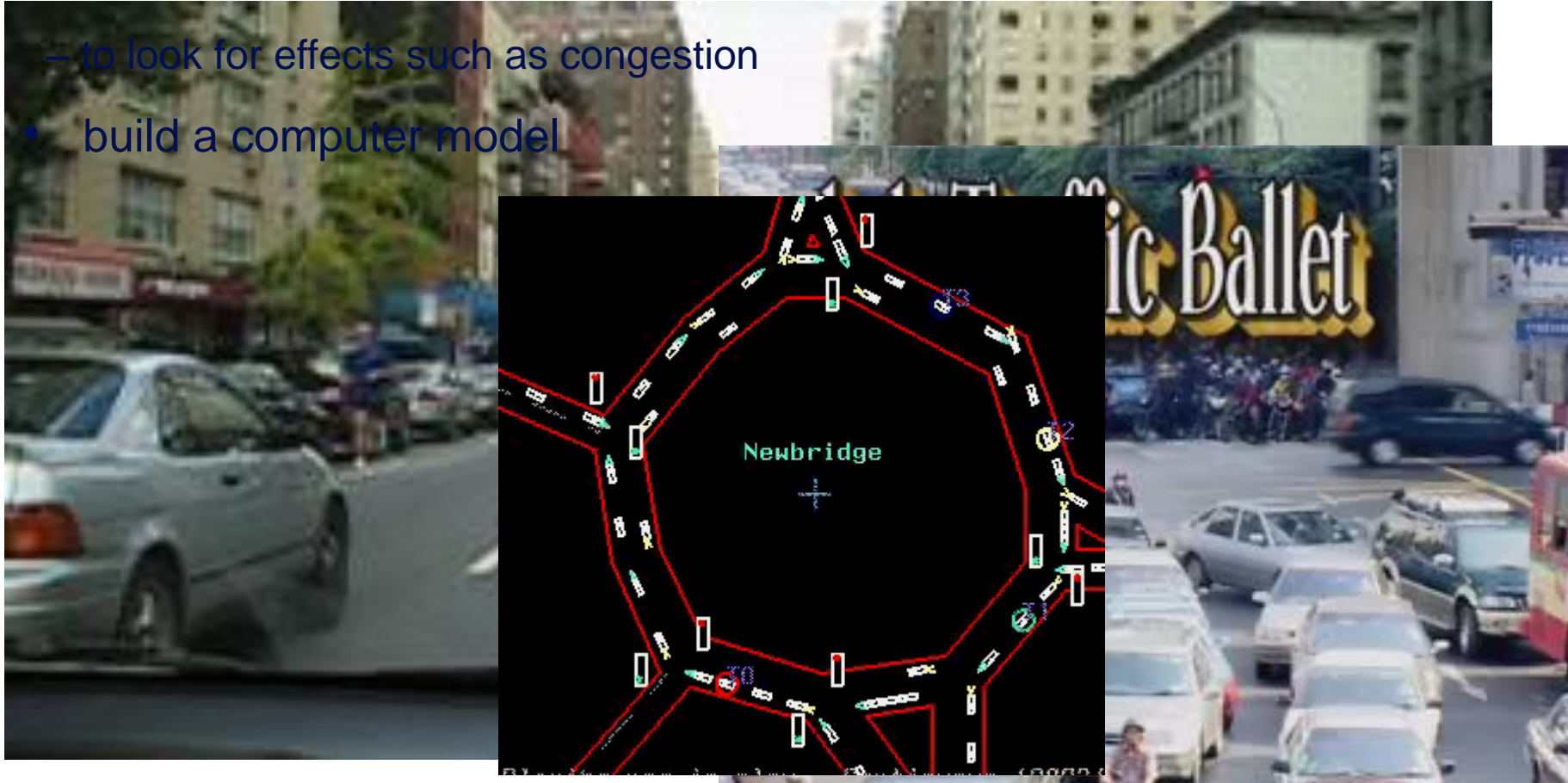
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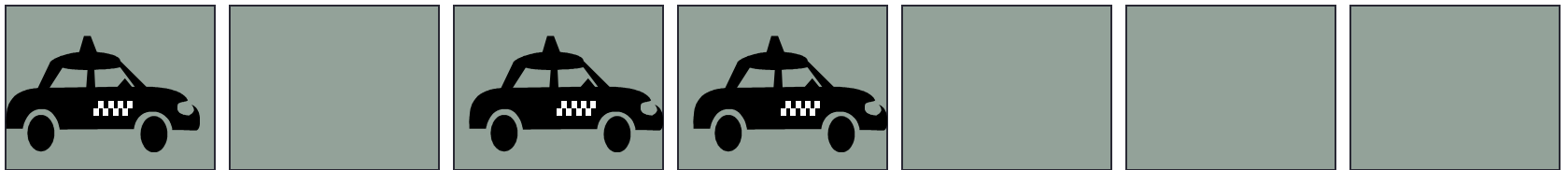
Traffic flow

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



Simple traffic model

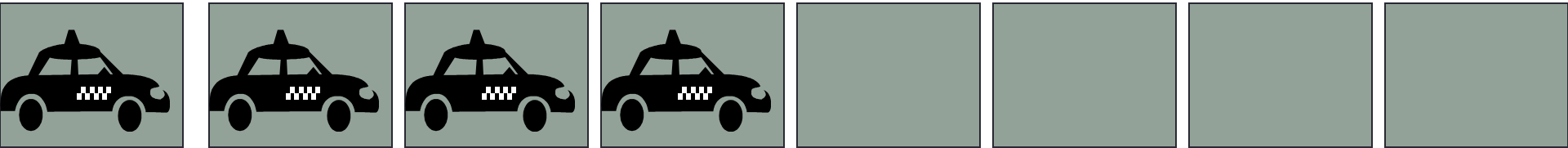
- divide road into a series of cells
 - either occupied or unoccupied
- perform a number of steps
 - each step, cars move forward if space ahead is empty



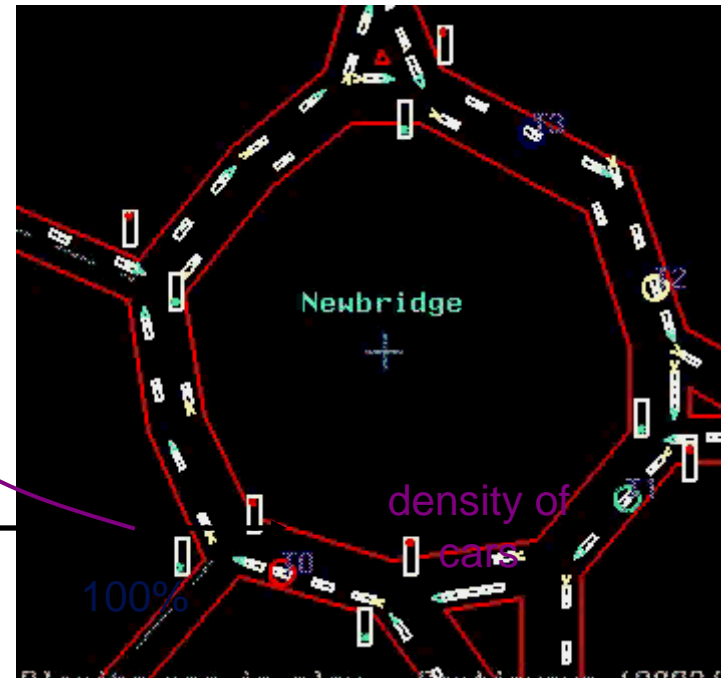
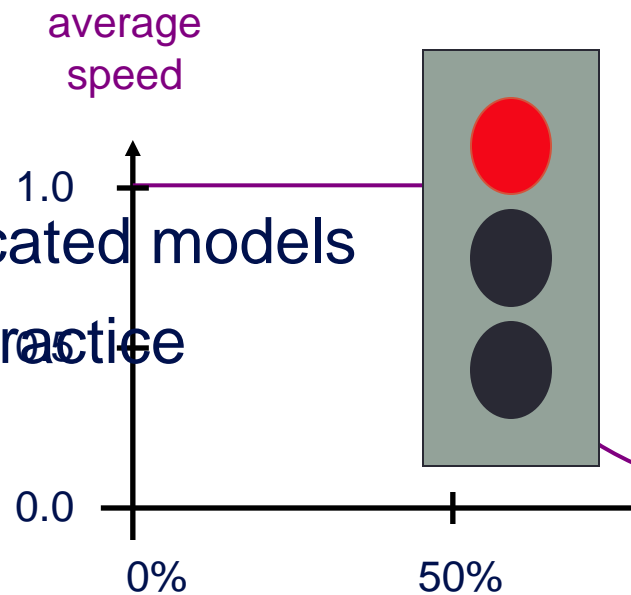
**could do this by moving
pawns on a chess board**

Traffic behaviour

- model predicts a number of interesting features
- traffic lights

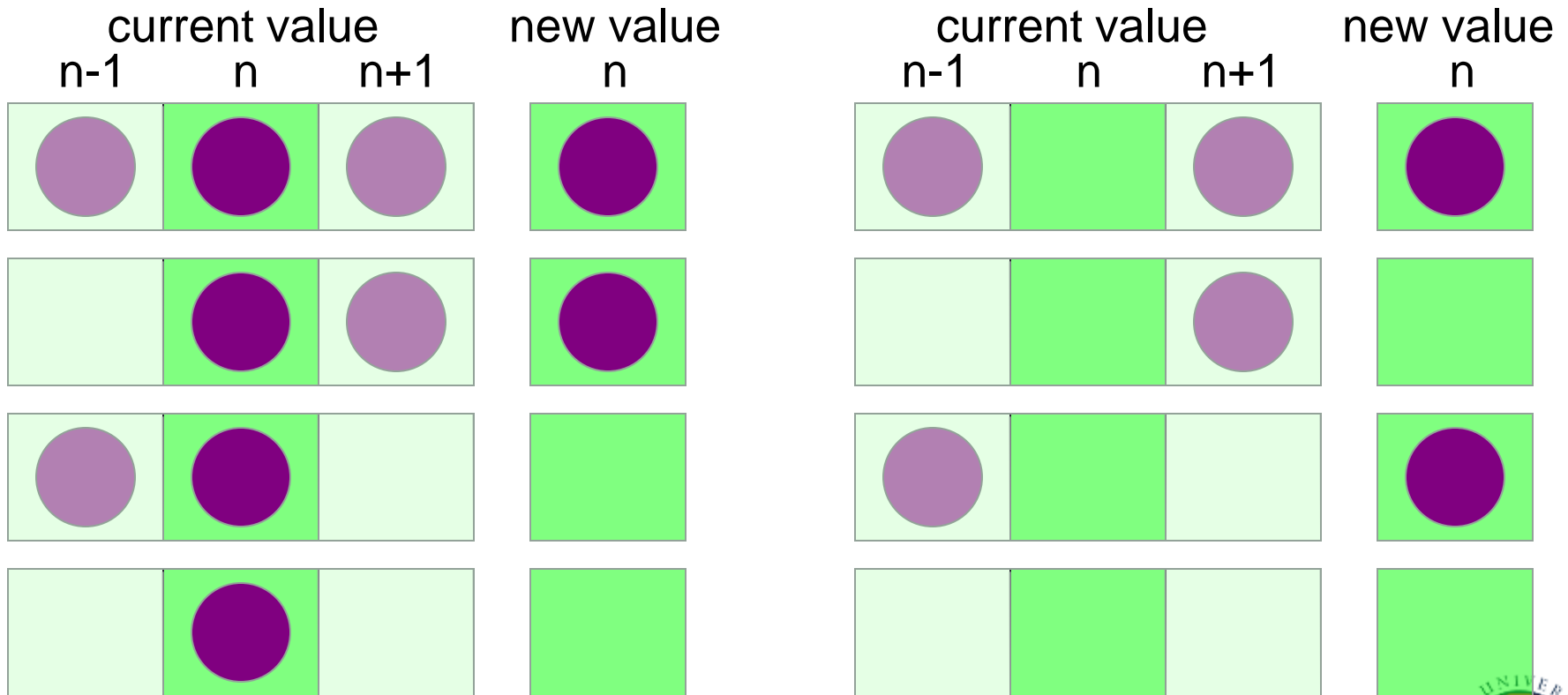


- congestion
- more complicated models are used in practice



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:

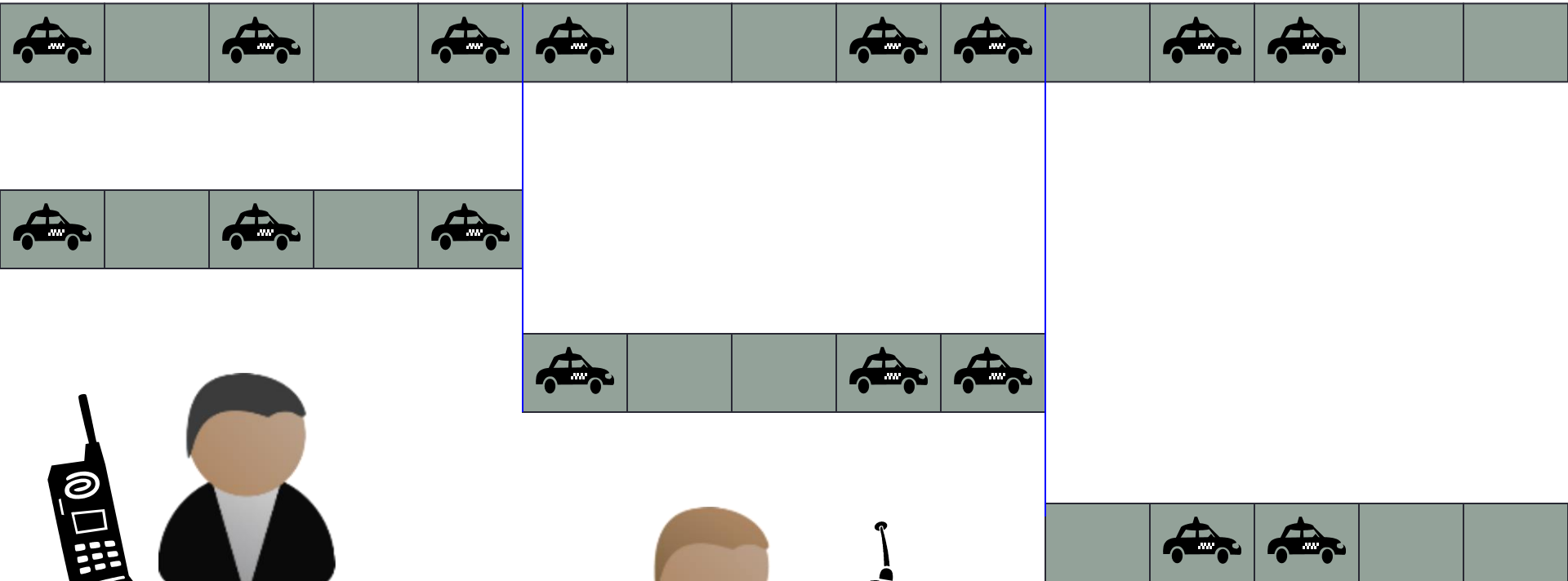
	$R^t(i-1) = 0$	$R^t(i-1) = 1$
$R^t(i+1) = 0$?	?
$R^t(i+1) = 1$?	?

How fast can we run the model?

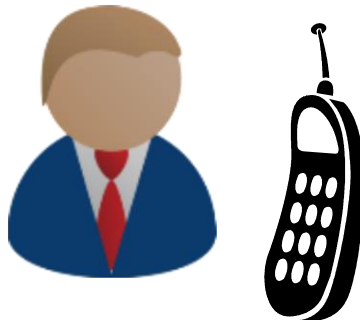
- measure speed in Car Operations Per second
 - how many COPs?
- around 2 COPs
- but what about three people?
 - can they do six COPs?



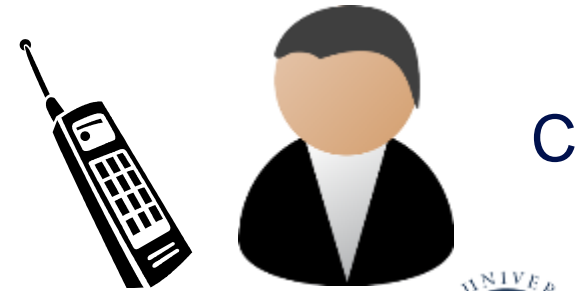
Parallel Traffic Modelling



A



B



C

Pseudo Code: traffic on a roundabout

```
declare arrays old(i) and new(i), i = 0,1,...,N,N+1
initialise old(i) for i = 1,2,...,N-1,N (eg randomly)
loop over iterations
  set old(0) = old(N) and set old(N+1) = old(1)
  loop over i = 1,...,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,...,N-1,N
end loop over iterations
```