

# Message-Passing Thought Exercise

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Traffic Modelling



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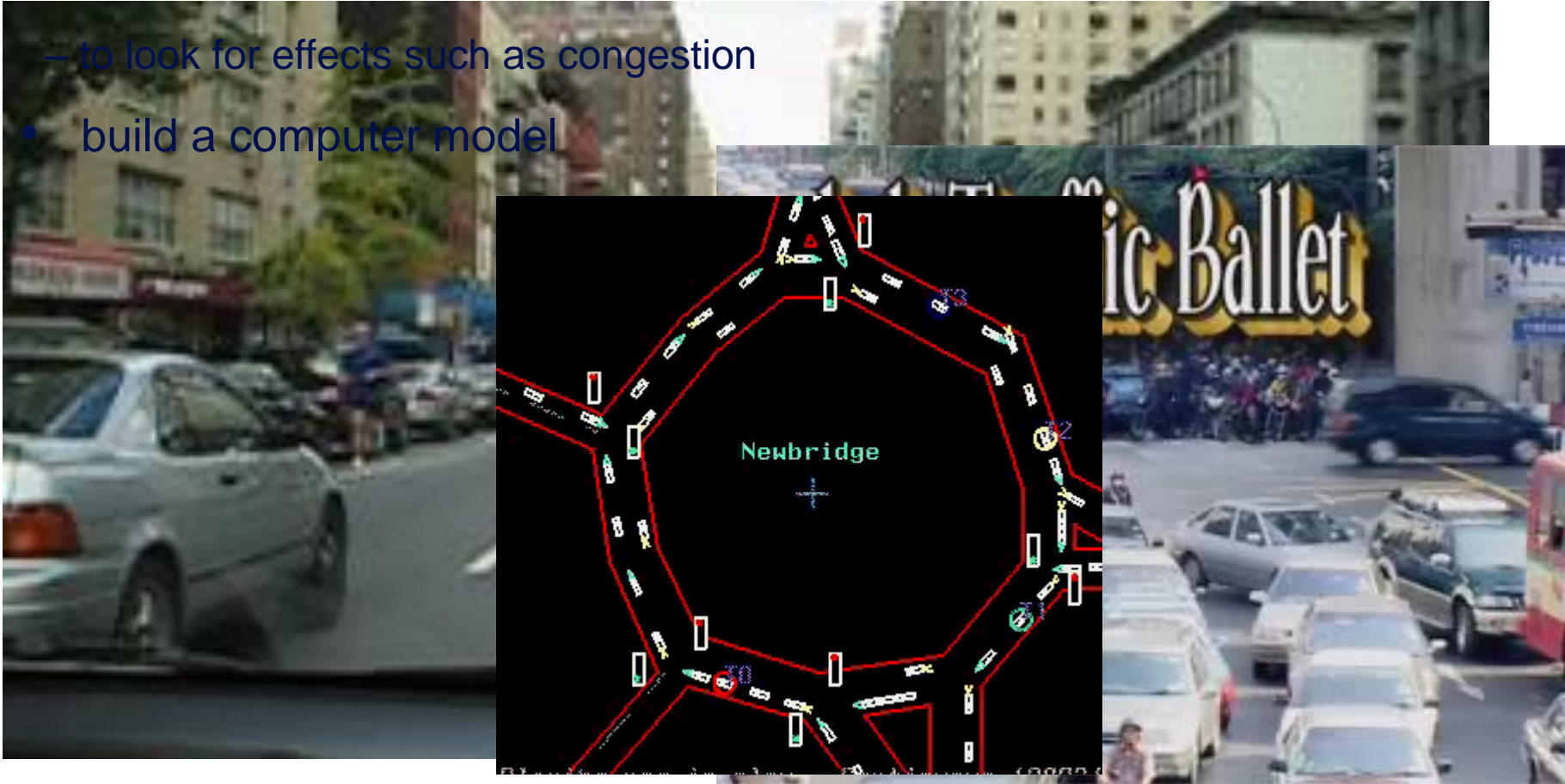
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# Traffic flow

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



# Simple traffic model

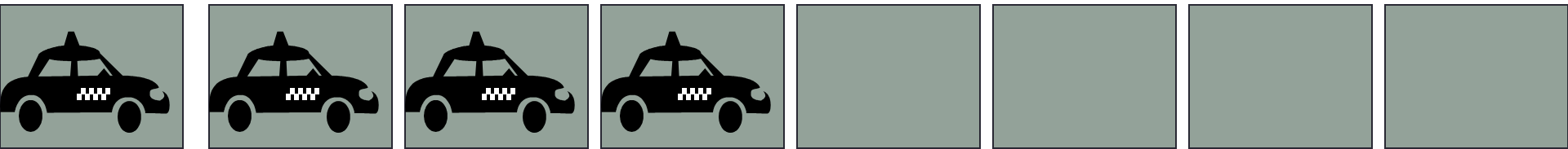
- divide road into a series of cells
  - either occupied or unoccupied
- perform a number of steps
  - each step, cars move forward if space ahead is empty



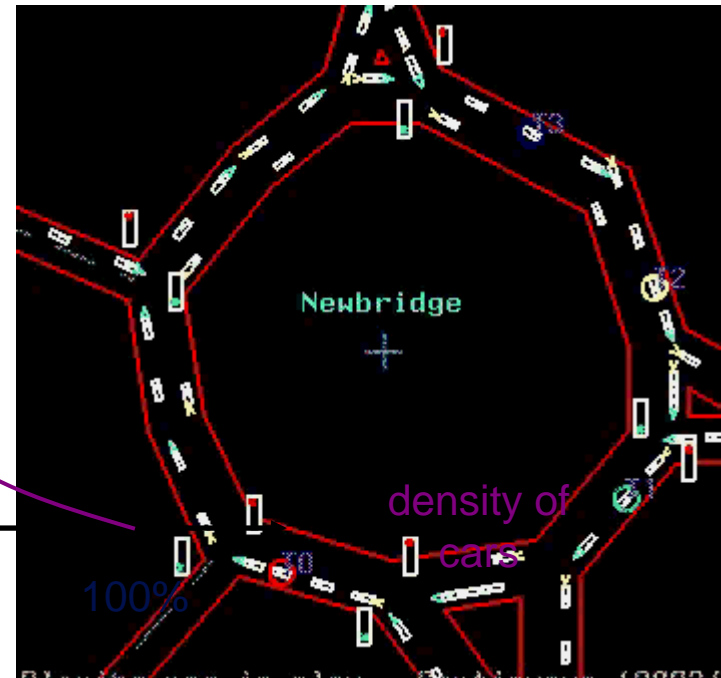
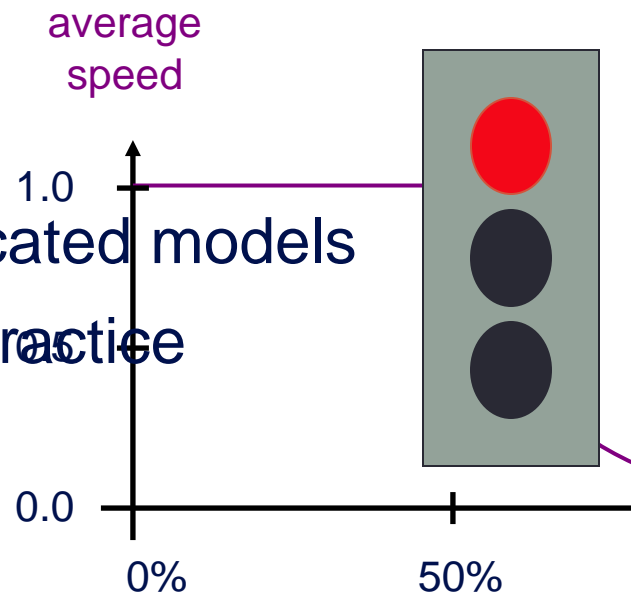
**could do this by moving  
pawns on a chess board**

# Traffic behaviour

- model predicts a number of interesting features
- traffic lights

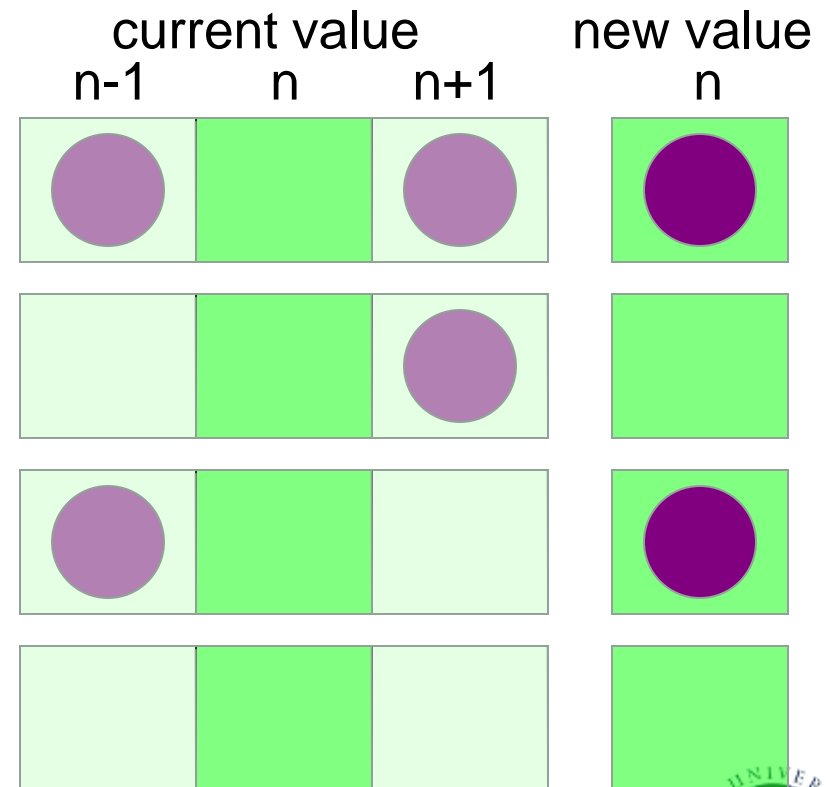
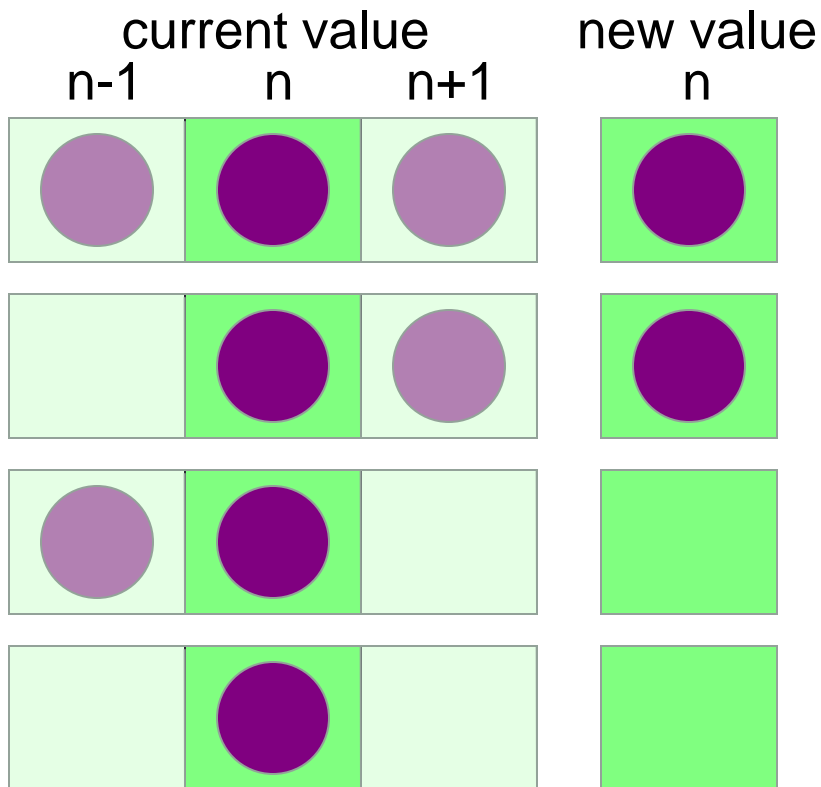


- congestion
- more complicated models are used in practice



# 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:

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

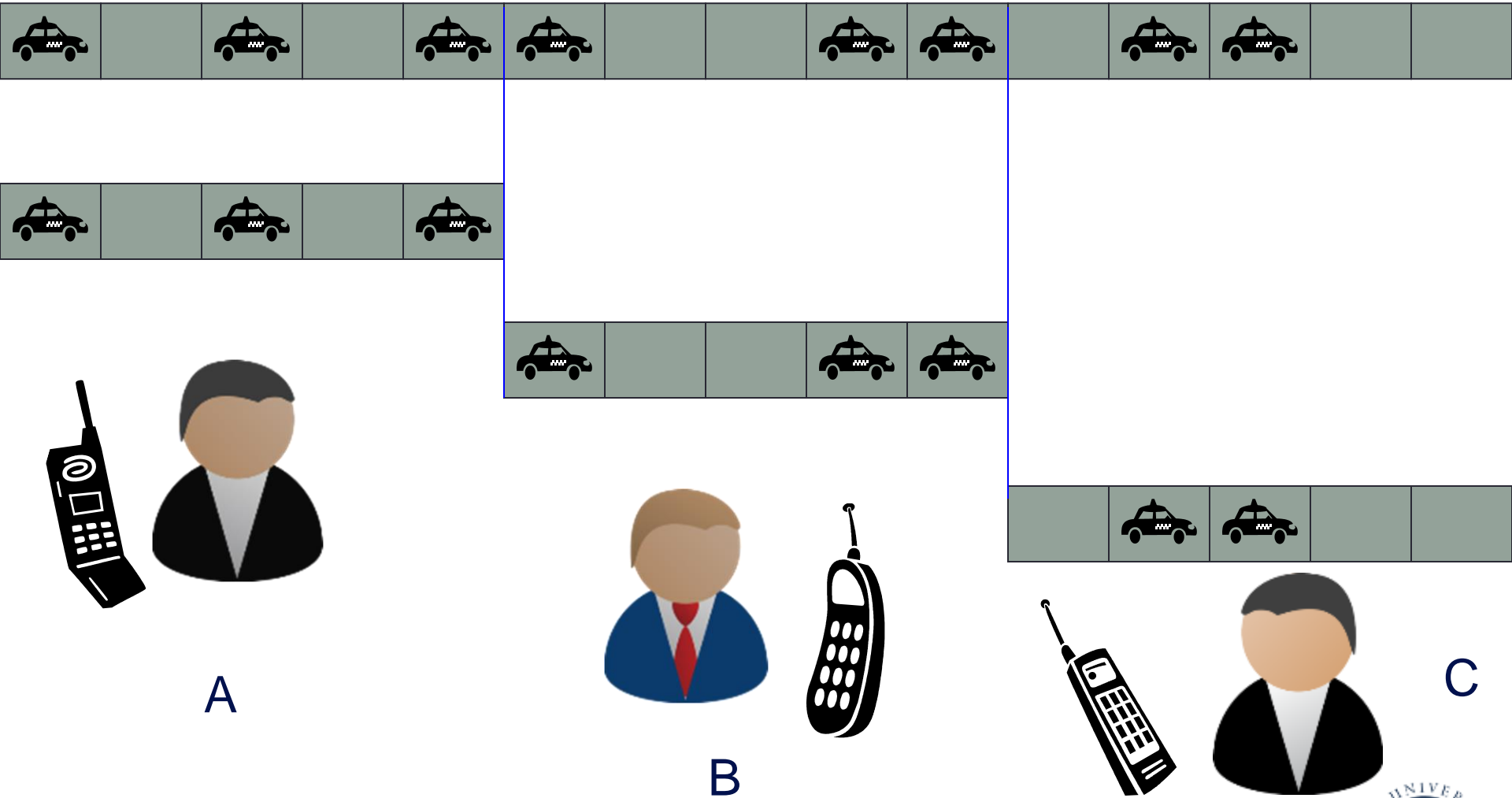
# How fast can we run the model?

- 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
```