Personal Protective Behaviour During an Epidemic

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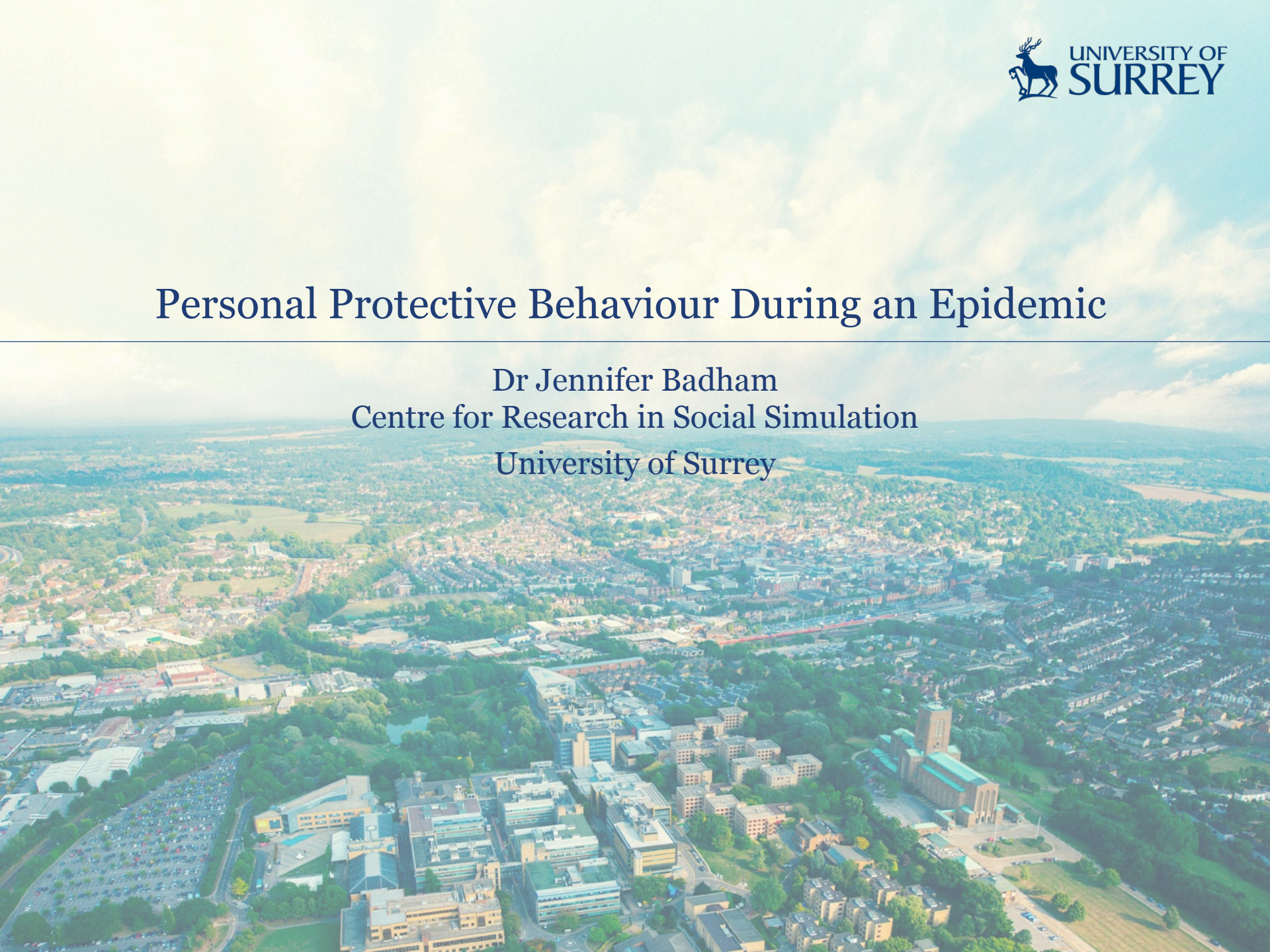

Anticipating the panel discussion

How is cognition represented in your model?

- behaviour decision based on weighted average of three inputs
  - attitude
  - norms
  - threat

Why is it important for your work to have cognitive models?

- model concerns behaviour change
- communication intended to act on cognitive decisions

What would you like to incorporate (cognition-wise) in your model ? And why haven't you?

- parameters that are less arbitrary
- minimal data for calibration

How would you define cognition?

- deliberate behaviour (contrasts with habit)
- at least some ‘decision’ and potential for independence (contrasts with norms)

What is the model for?

TELL ME: European funded project about communication during an epidemic

- Simulation is one of the outputs
- Other partners developing communication kit

Help health agencies plan communication

- enter details of epidemic scenario
  - severity, vaccine delay, hand washing efficacy etc
- try out communication strategy options
  - packages of messages

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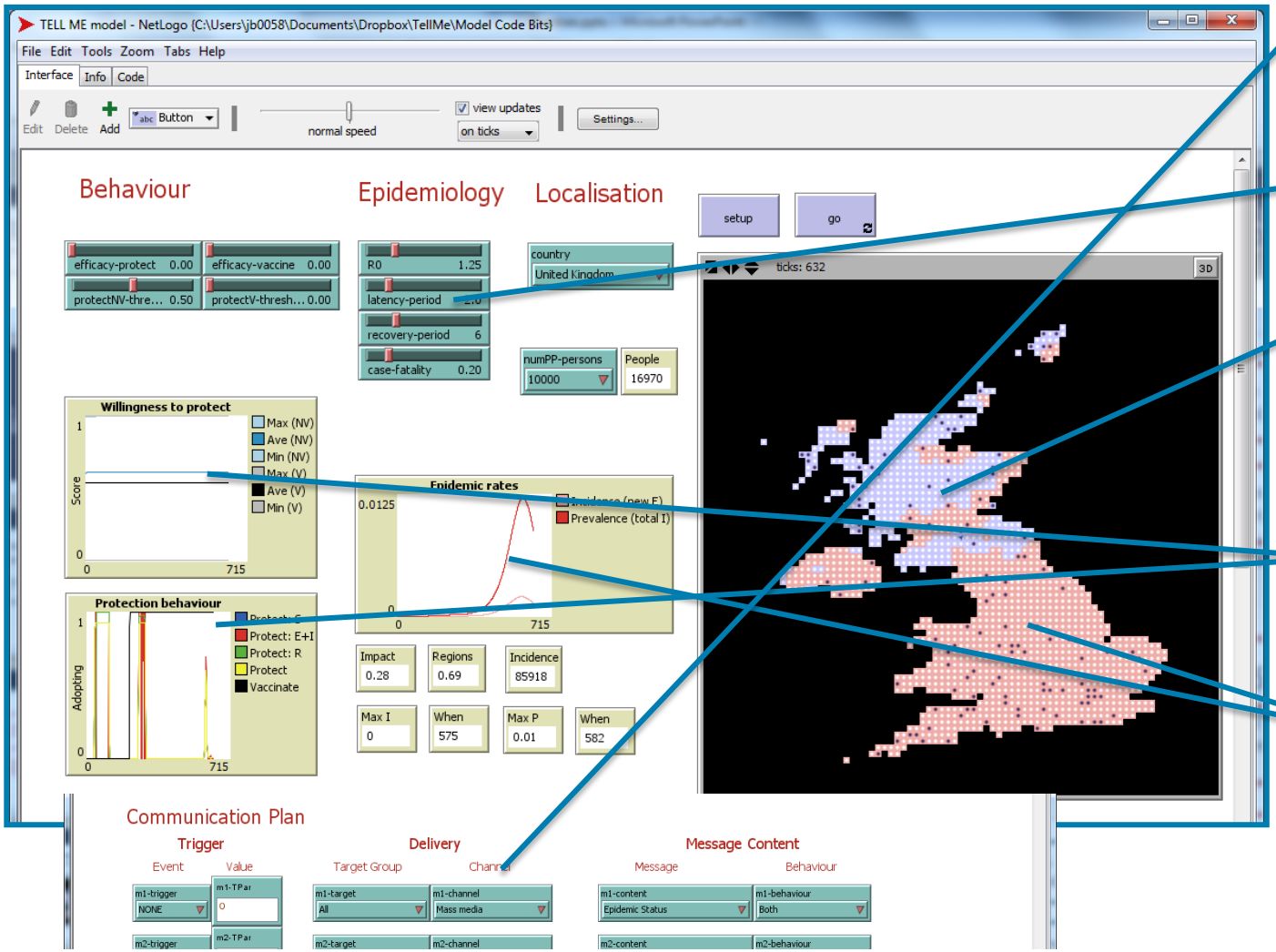
Demonstration model



Inputs

- Communication strategies (media)
- Epidemic features
- Population density

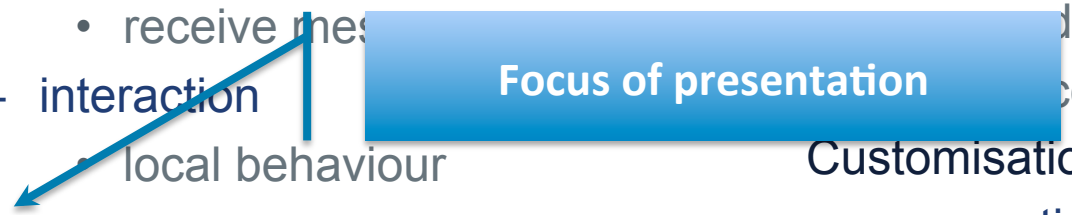
Outputs

- Communication effect: attitude and behaviour
- Epidemic progress

Two connected models

ABM for protective decisions
- heterogeneity
  - location specific risk
  - receive mes
- interaction
  - local behaviour

Decision based on psychological models
- includes risk (from SD)



SD (difference equations) for epidemic
- Standard SEIR model
  - difference equations
  - compartment transition

Customisation
- spatially explicit
  - some travel
- Infectivity modified by personal behaviour (from ABM)

Behaviour models

Well established models from psychology about the influences on behaviour

Three most relevant:

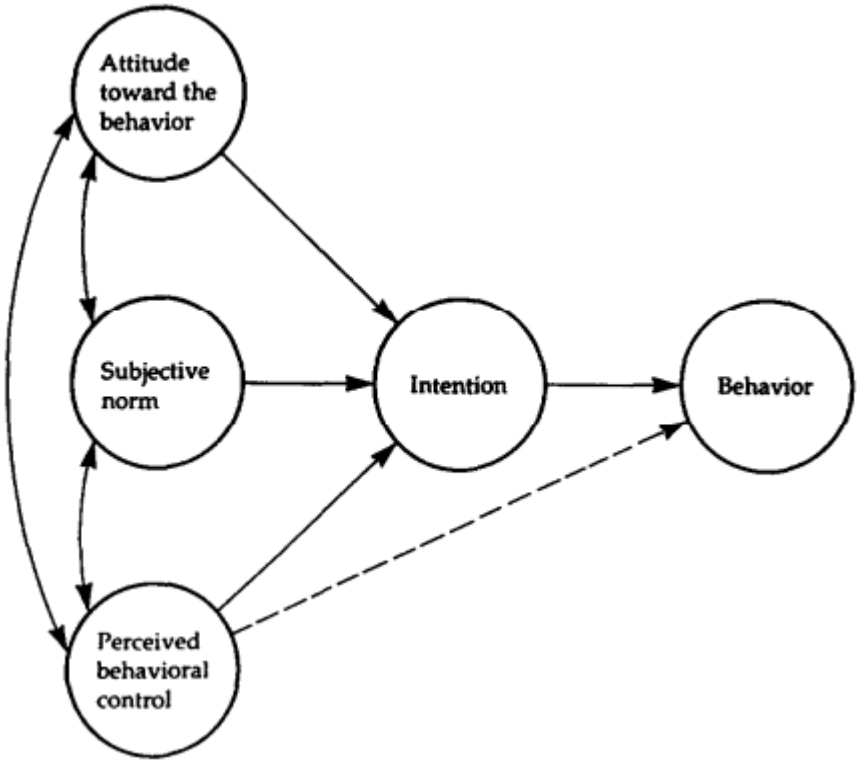
- Theory of Planned Behaviour
- Health Belief Model
- Protection Motivation Theory

Theory of Planned Behaviour

Dominant general behaviour model

Linear regression

- Coefficients are specific to the behaviour



I. Ajzen, "The theory of planned behavior," *Organizational Behavior and Human Decision Processes*, vol. 50, no. 2, pp. 179 – 211, 1991.

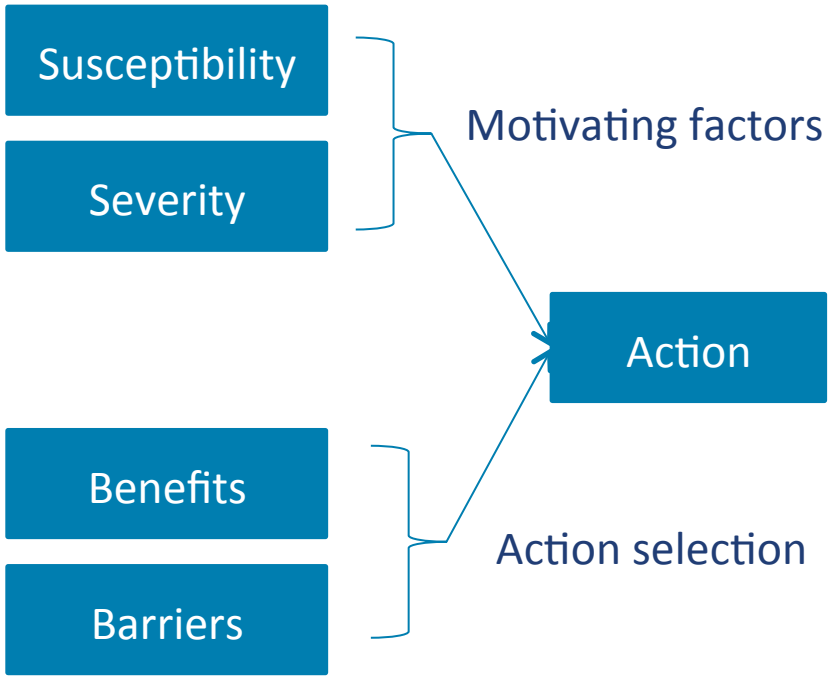
Health Belief Model

Popular for health behaviour

No model structure

- identifies factors

Undefined ‘cue to action’



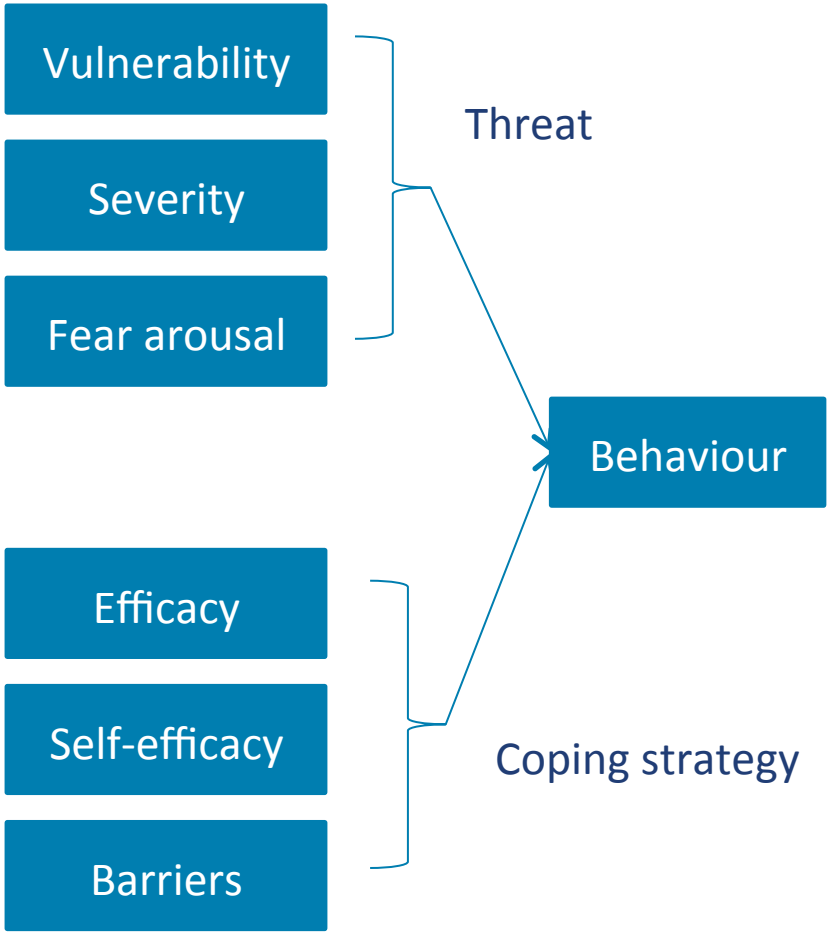
I. M. Rosenstock, “The health belief model and preventive health behavior,” *Health Education & Behavior*, vol. 2, no. 4, pp. 354–386, 1974.

Protection Motivation Theory

Fear motivates intent

But action only if belief in efficacy

- Else maladaptive behaviour (eg denial)



J. E. Maddux and R. W. Rogers, "Protection motivation and self-efficacy: A revised theory of fear appeals and attitude change," *Journal of Experimental Social Psychology*, vol. 19, no. 5, pp. 469 – 479, 1983.

Adopting behaviour

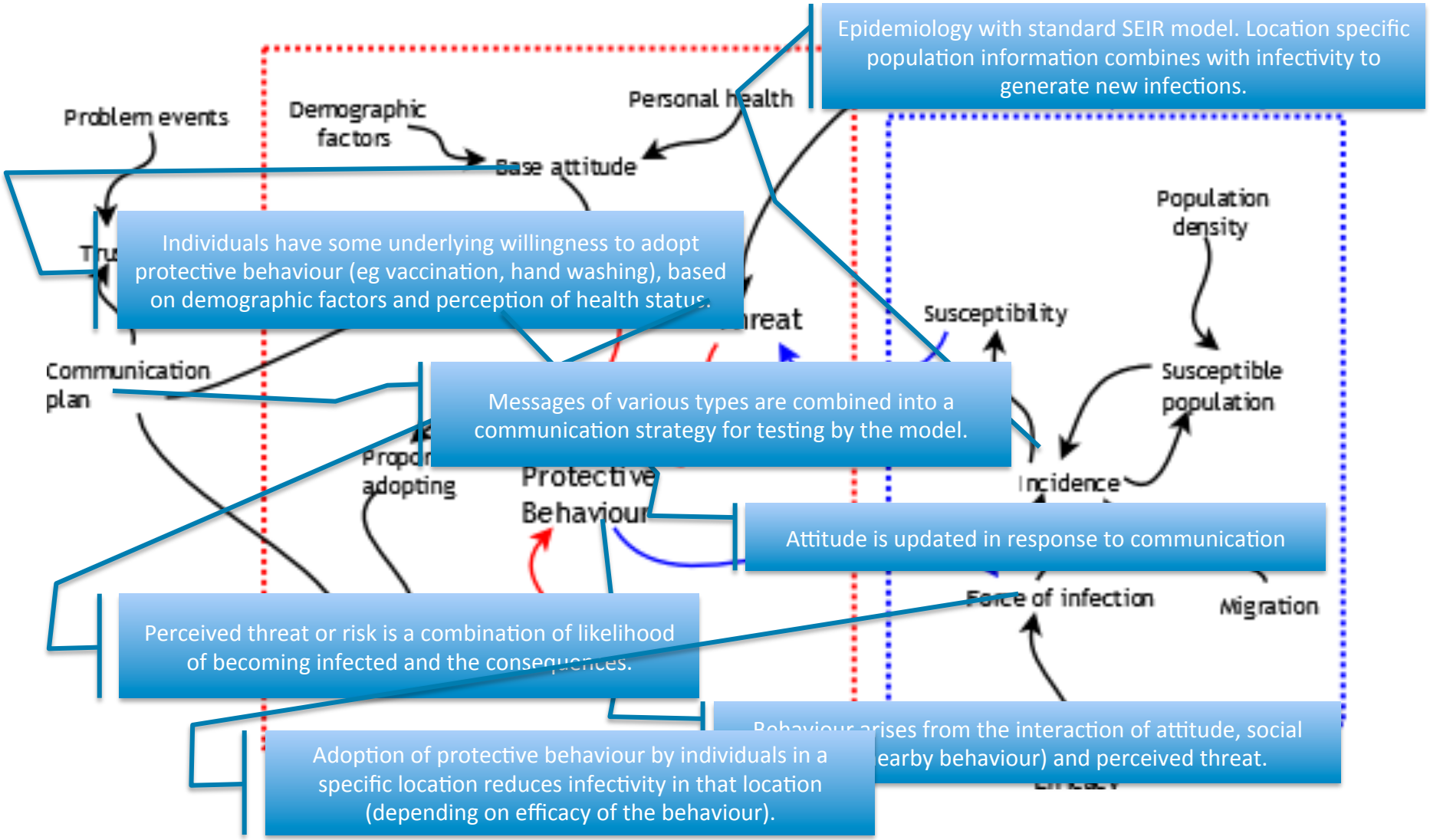
Hybrid of TPB and HBM / PMT

- factors with large effect size, dynamic

Linear combination (weighted average)

- attitude (score 0 to 1)
- perceived norm
  - operationalised as proportion of visible agents who have adopted behaviour
- threat
  - susceptibility as discounted visible cumulative incidence
  - severity modifier (multiplier for weight)

Broad model logic



Calibration approach

Use H1N1 (swine flu 2009) datasets to estimate 4 values for 2xbehaviour

- attitude weight, norms weight, incidence discount, adoption threshold

Why H1N1?

- most substantial data (7 studies, up to 13 data points)
- no quarantine, so ‘natural’ epidemic curve provides context
- most relevant to model purposes, management plans would not rely on communication for more severe epidemics

Dimension reduction

- epidemic parameters from literature
- simple assumptions of attitude distribution, travel rates
- exclude communication

Calibration approach

Parameter sweeping with some optimisation elements

- working with Sandtable (UK private company) who have a specialised calibration platform

1. Generate epidemic from random seed
   - efficacy set to 0 so protective behaviour does not affect epidemic
   - locate time for epidemic peak
2. Centre behaviour data using known date of epidemic peak
3. Run model with same random seed for behaviour calibration with criteria:
   - mean square difference between modelled and actual behaviour
   - maximum proportion of population adopting behaviour
   - difference in dates of modelled and actual behaviour peak
4. Sensitivity analysis

Conclusions

Conflict between psychologists and social researchers about behaviour

- psychologists use formal structures tested by experiment
  - parameter values are specific to the experiment
- social researchers measure willingness of behaviour
  - typically 5 point Likert scale, not numerical
  - measure related factors but without any expectation of influence structure

Consequence is modelling difficulty:

- if designed from theory, no data to calibrate
- if designed from data, no theory to provide model rules

What does this mean for project?

- model is prototype, links communication, behaviour and epidemic outcomes
- model does not predict, represents current understanding of connections
- guide future data collection