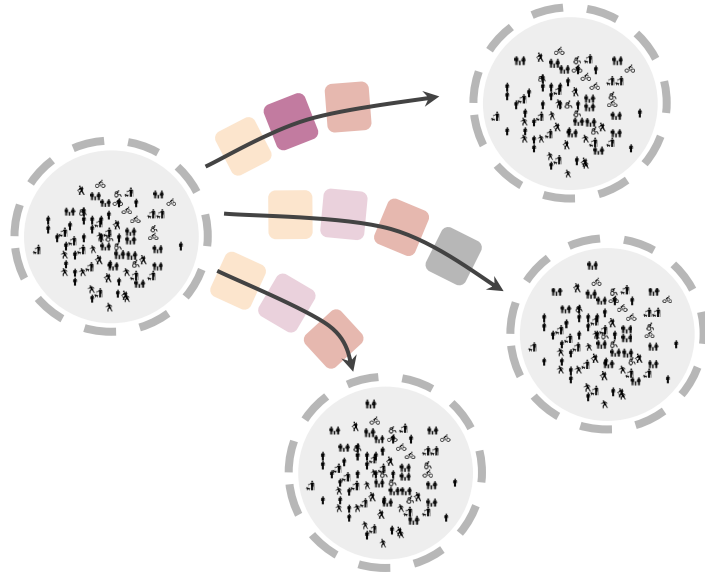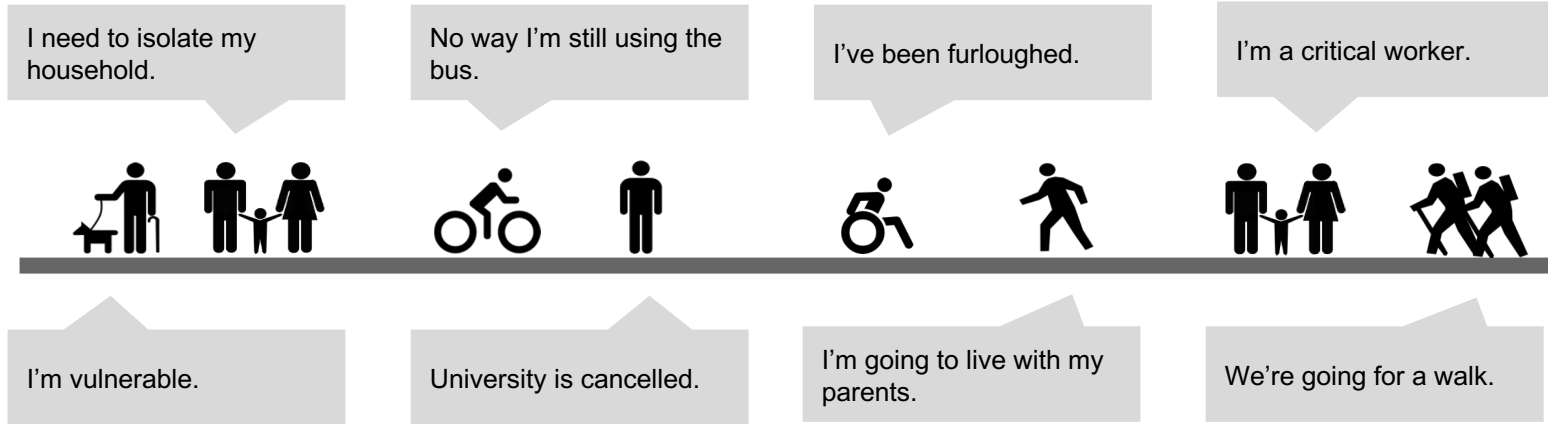# Pandemic Activity Modeller/Modifier (PAM)
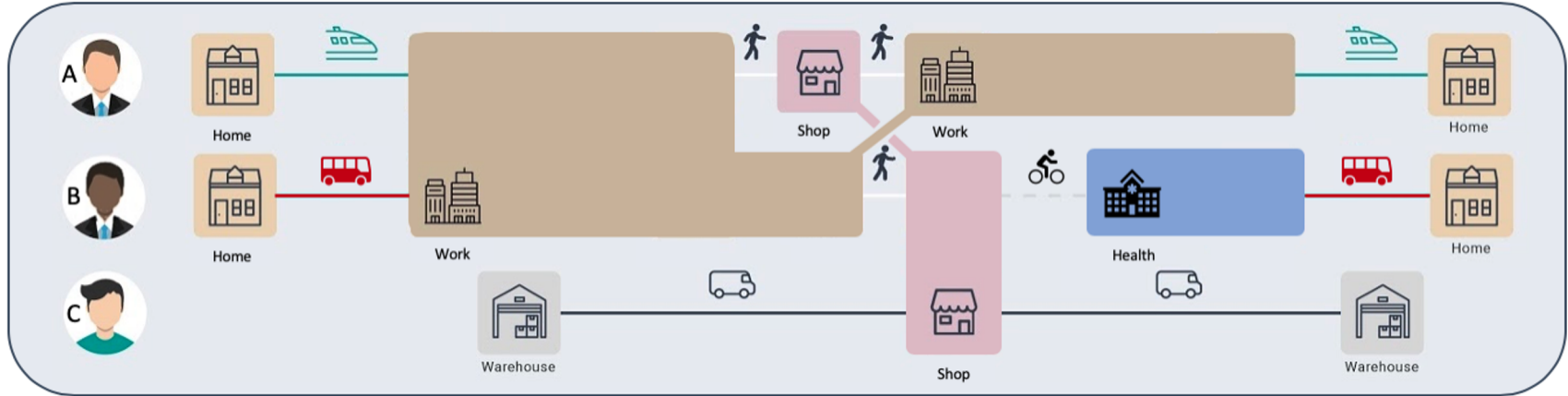
MOTIVATION: People are behaving differently, (i) new rules, (ii) new decision making and (iii) changes to employment:

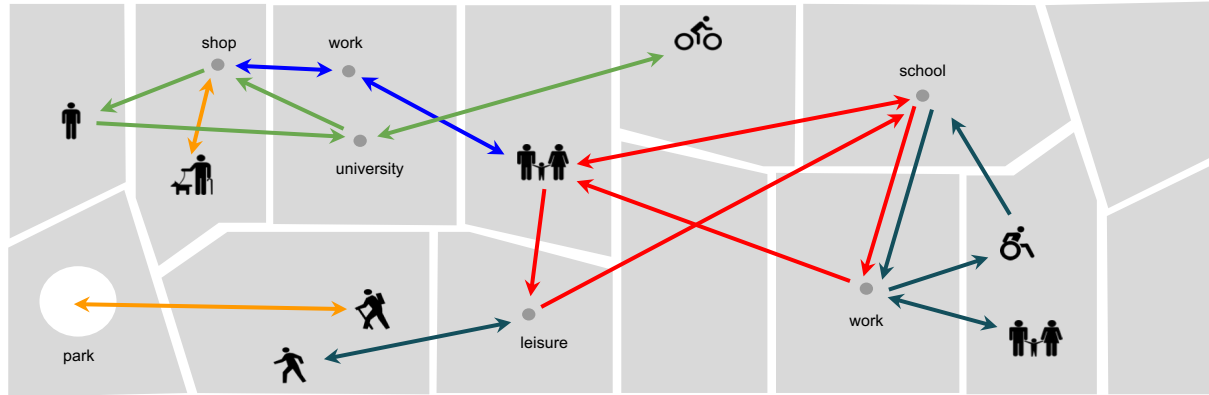*Existing models are out of date and the rules/scenarios are changing rapidly.*

We work with **ACTIVITY PLANS**:

Activity Plans include detailed disaggregate info about a population and its activities

ACTIVITY PLANS are useful for modelling transport demand:

… but also: any model or analysis that cares about where and when people are travelling or doing things, can make use of Activity Plans

PAM FEATURE (1/2) - reading and writing to and from Activity Plans and other formats/outputs:

Household Travel
Diary Surveys

Travel Diaries

MATSim

Agent Based
Models

EpiSim

Census
Commute Data

Census

Activity Plans

O-D Matrices

Transport Models

Economic Impacts

Travel Statistics

Activity Statistics

Societal Impacts

Utility
Resilience

– – – – – – – (coming sooner or later)
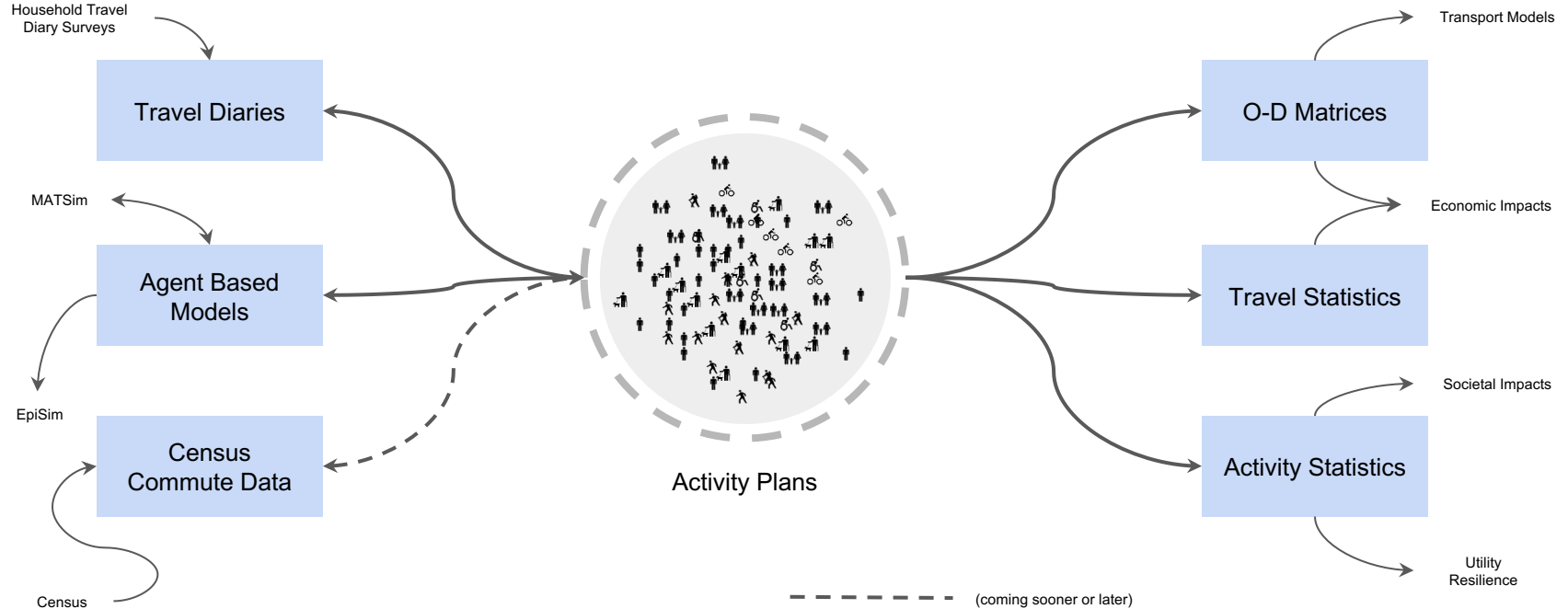
PAM CORE (1/2) –Data Structure:
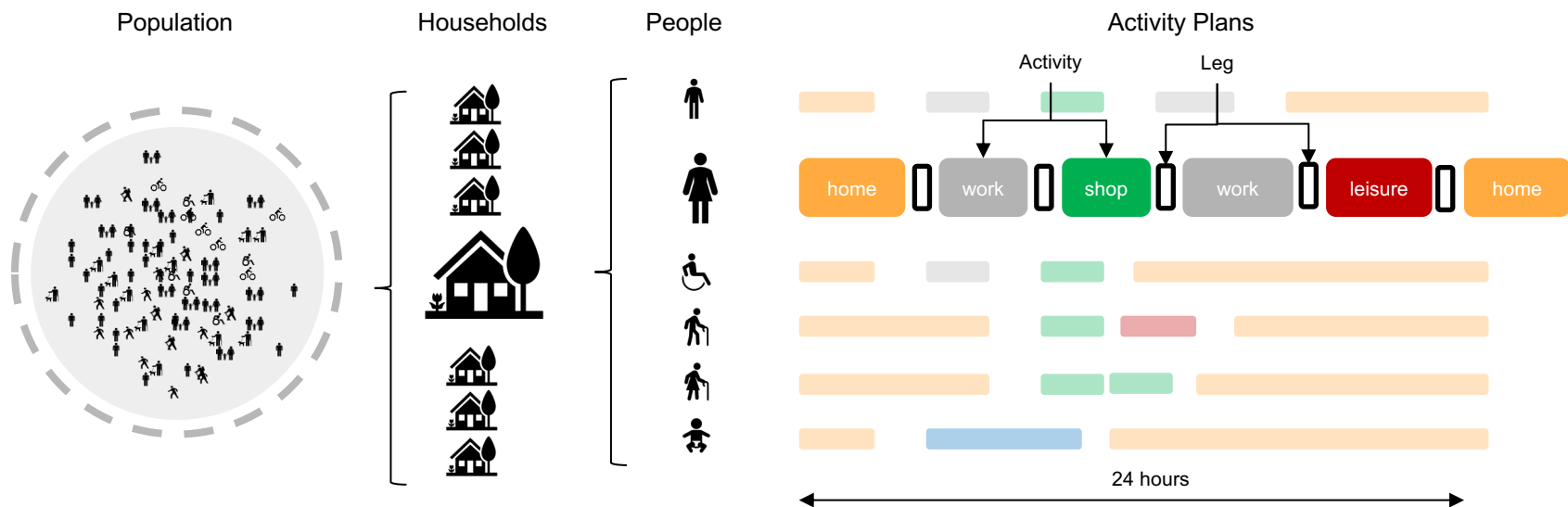
PAM FEATURE (2) - modifying activity plans using policies, for example:

if **critical worker**; *isolate household with* **p** = 0.1, *else*; **p** = 0.05

if not **critical household**; *then remove all education activities*

if **person age** > 50; *then isolate* with **p** = 0.2

if **income** > 50k; *remove work activity* **p** = 0.9

PAM CORE (2/2) – Modification Logic:

Remove shopping activities

(1) Build Activity Plans

Travel Diaries

Activity Plans Diaries

MATSim population

Baseline Population
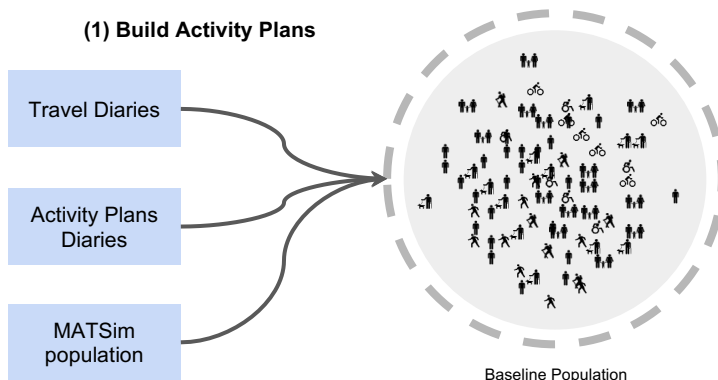
(2) Modify Population Activity Plans

Policy A

Policy B

Policy C

READ

MODIFY

WRITE

(3) Analyse and Output

Travel Diaries

Activity Plans Diaries

MATSim population

New Scenario Population

O-D Matrices

Travel Statistics

Activity Statistics
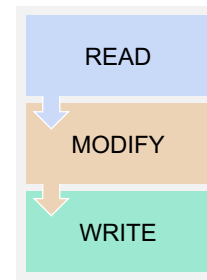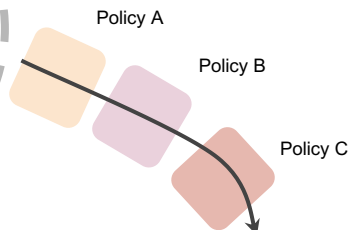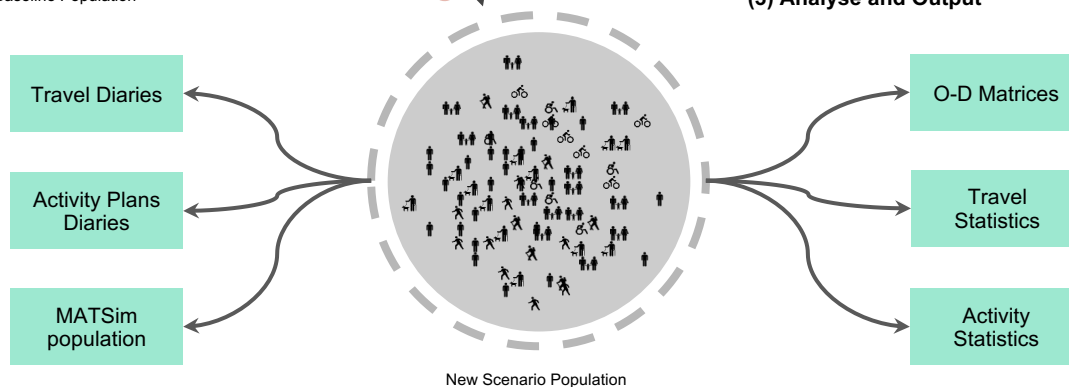
BUT - PAM is a Tool - it doesn't know what's correct, or what the most likely scenarios are:
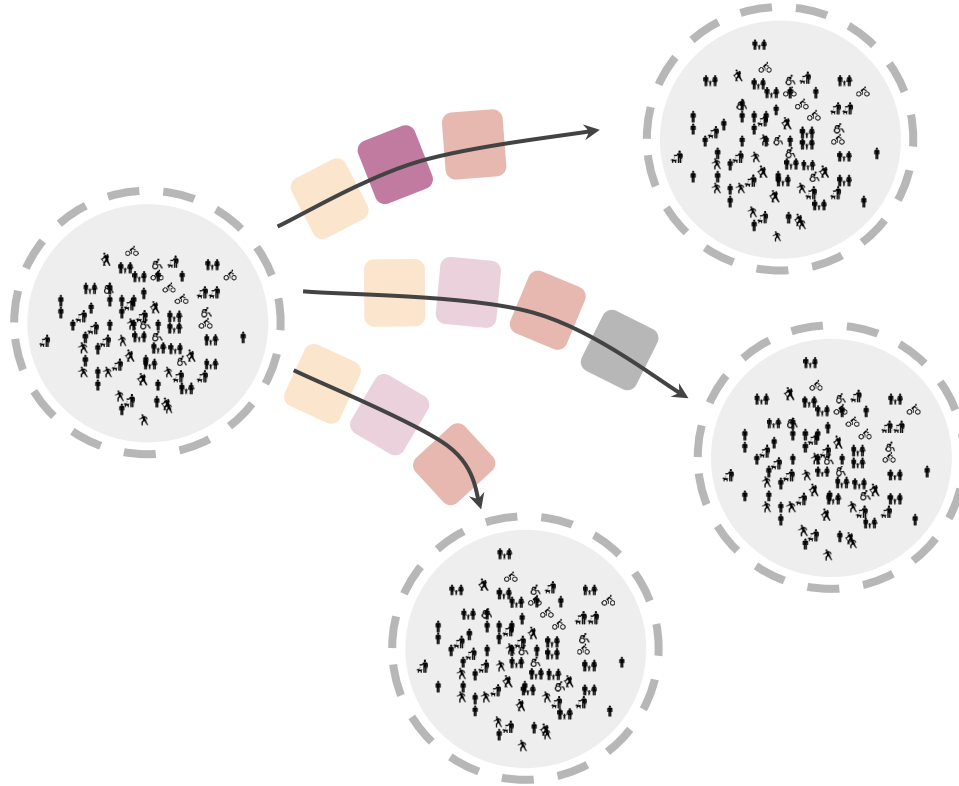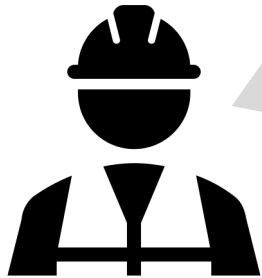
Example User Story:

"We've reduced transit services as best we can for our drivers and public safety. But we're unsure what impact this has had on people's travel behaviour.

I want to consider closing/opening some stations to better serve the existing demand, but my existing demand model is out of date…

If I can get my demand model adjusted for this new baseline then I can start to make more careful decisions – I am sure there are going to be some trade-offs between costs, risks and economic benefits."

- Local Authority Transport Planner

Baseline 19 – preliminary policy proposals for building a new demand baseline:

Previous Baseline Activity Demand

COVID-19 Baseline Activity Demand

(1. Quarantine) *(2. Education)* *(3. Leisure)* *(4. Health)* *(5. Work)* *(6. Shopping)*

Based on rate of infection, apply **household quarantine** (remove all activities & stay at home) with p = 1% per person

Remove all higher (~university) education p = 100%

Remove (remaining) education activities with p = 95% per person (including escort trips in household)

Remove all leisure activities p = 100%

Remove health activities with p = 50% per activity, including escorts trips in household

Unemployed/ furloughed (remove all work activities) with p = 10% per person

Work from home (remove all work activities) with p = 50% per work activity

Remove individual (remaining) work activities with p = 20% per work activity

Remove shopping activities with p = 50% per shopping activity

Validate changes using Open Google Mobility Data, eg:

Workplace

−64% compared to baseline

+80%
+40%
Baseline
−40%
−80%
Sat Feb 29   Sat Mar 21   Sat Apr 11

Residential

+23% compared to baseline

+80%
+40%
Baseline
−40%
−80%
Sat Feb 29   Sat Mar 21   Sat Apr 11

p = X%: preliminary guess

Baseline 19 – more <mark>advanced</mark> policy proposals (2/2):

(Key Workers and Households)

Sample and label individuals as key workers based on segmentation {income/age/race/work status/occupation}

Label key worker households, as those where all adults are critical workers

(Vulnerable Persons and Households)

Sample and label individuals as vulnerable based on segmentation {income/age/race/work status/occupation}

Label vulnerable households, as those containing a critical worker

(1. Quarantine)

Apply household quarantine with p = 0.01: Remove all activities and stay at home

Optionally differentiate between different types of household if evidence ie {critical/vulnerable}

(2. Education)

Remove all higher (~university) education, based on age and work status

*if not **critical household**; then remove all education activities, including escort education*

(3. Leisure)

Remove all leisure activities

Add health activities if not working

(4. Health)

*If not **vulnerable**; remove health activity with p = 0.5*

(5. Work)

*If not **key worker,** remove all work activities with p = 0.9, Remove remaining work activities with p = 0.5*

*If **key worker**, extend work activities to full shift*

(6. Shopping)

Remove shopping activities with p = 0.5

Reduce duration of shopping activities by 50%

Reduce shared shopping activities to single household member

PAM is Open Source and needs help, we are looking for people to help with:

Literature Review/theoretical vetting by transport modellers/planners
- ie. is the approach useful?
- ie. does the approach sound theoretically ok? - is there any existing lit?

Research - what new policies do we need - mode shift?/add daily exercise?/activities closer to home? etc

Data - we need to try out policies and validate them with data
- eg can we recreate Google mobility data for different cities with different rules?

Python dev of any level - get in touch please

Got a use case? or new output requirement? - let us know - we will add it to the project

We have more details about the project and how to get involved here:
https://github.com/arup-group/pam

Including an example notebook here:
https://github.com/arup-group/pam/blob/master/notebooks/pam-getting-started.ipynb

Feedback:
fred.shone@arup.com