Model Co-Creation @ {@Company: Please add your name here}

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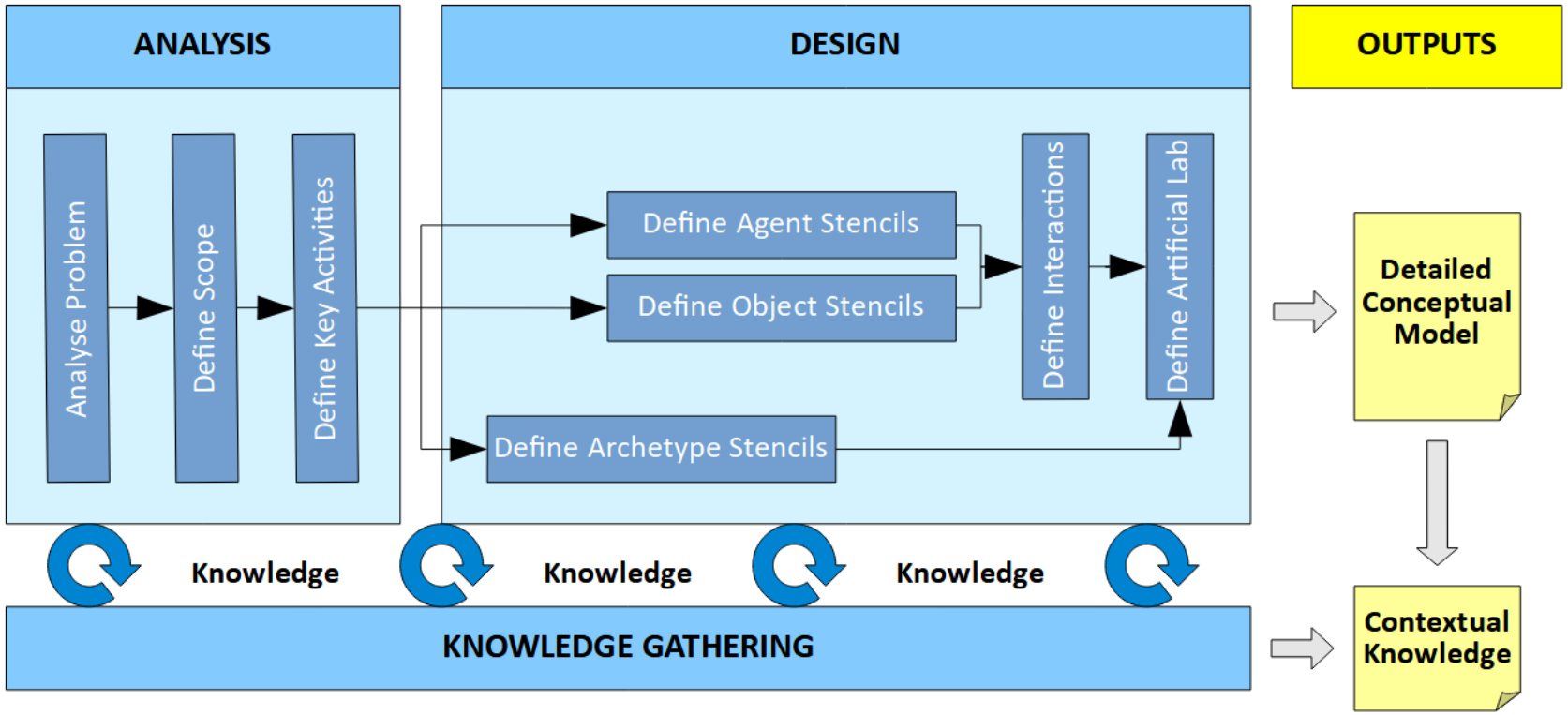
What is this all about?

- Social Simulation (formal definition)
  - Studies **socio-economic phenomena** by investigating the social macrostructures and **observable regularities** generated by the behaviour and relationships between individual **social agents**, and between agents and **the environment** in which they act.

- Agent-Based Social Simulation (ABSS)
  - Example from the Gaming World
    - SIMS4: Promotion Video (https://www.youtube.com/watch?v=dcDy1CCd-F8)
    - SIMS4: Hands-On Gameplay (https://www.youtube.com/watch?v=pXLEAHpzFks)

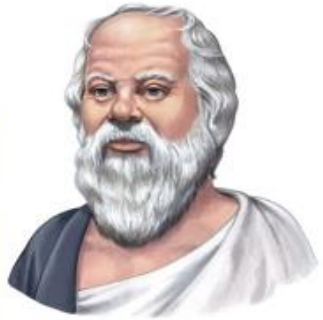
The EABSS Framework

- A structured approach ...



Engineering ABSS

- ... using mini focus groups
  - Socrates vs Confucius
    - Collaborative brainstorming
    - Information capturing
    - Debates only when needed
  - Moderators
    - Will guide
    - Will act as stakeholder (modeller)
  - Iterative process
    - Reuse of information (small printed orange remarks in the following are meant to guide the moderator)



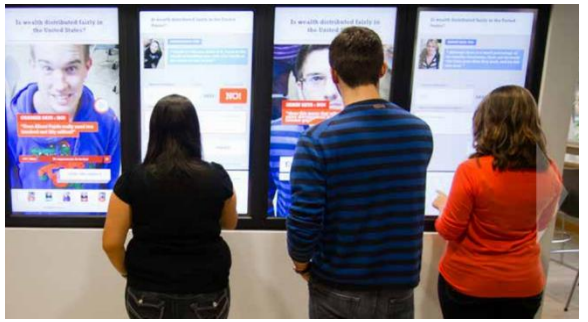
Why do we do this exercise and what do you gain?

- This helps us to: {@Company: Please edit this part}
  - improve operational procedures
  - improved customer satisfaction
  - better understand your needs

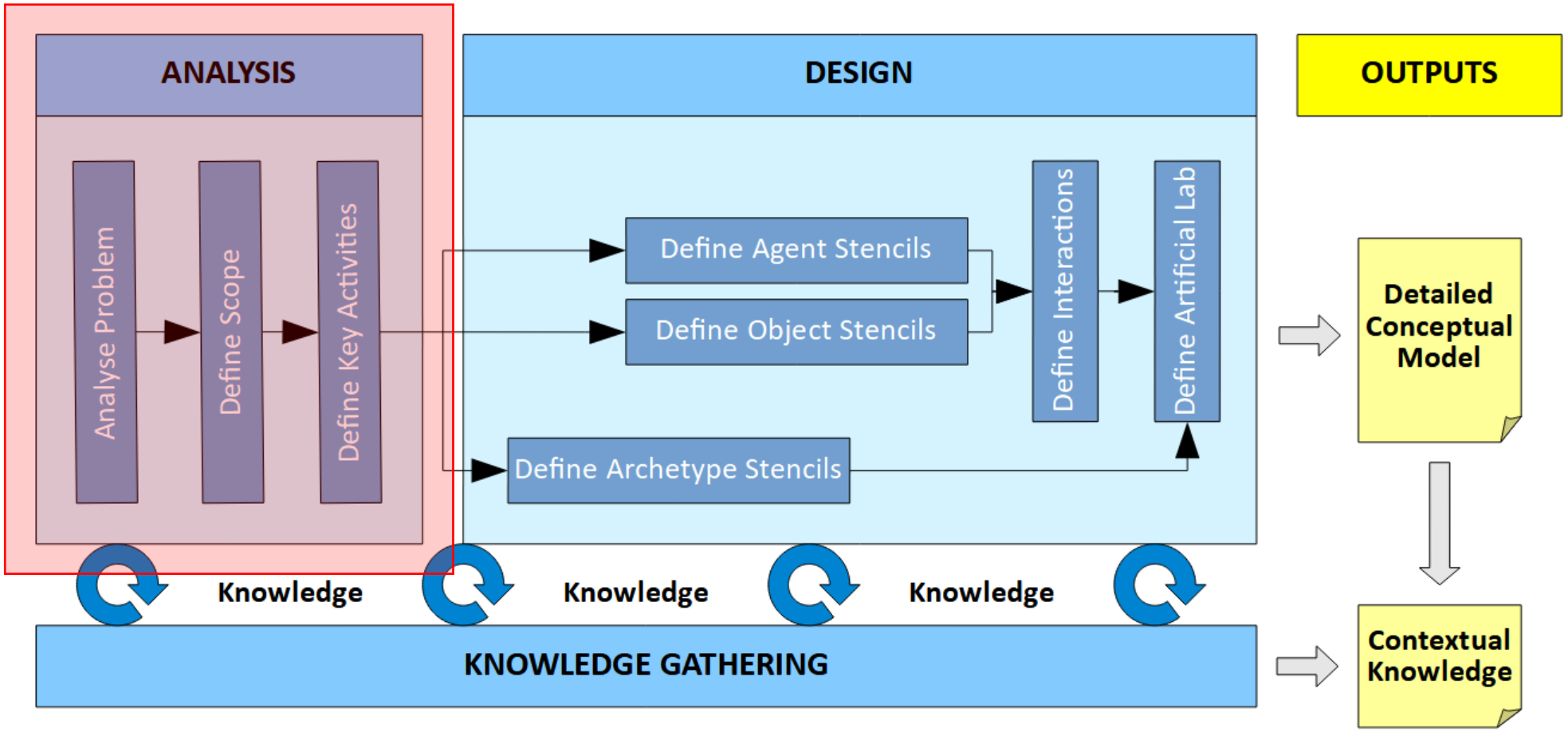
- This helps you to: {@Company: Please edit this part}
  - gain insight into the collective system operations
  - better understand how things are linked
  - meet colleagues from other areas

Example: Exploring Adaptive Architecture Design

- Context
  - The purpose of the study is to explore Adaptive Architecture design in the context of a **novel museum visit experience**, in particular the idea of having a large screen with a set of **intelligently adaptive moving content windows** that adapt position and size in response to movement and grouping of people in front of them.
- Aim (of the simulation study)
  - Study the impact of an adaptive screen (including several display windows) in a museum exhibition room



Engineering ABSS



Example: Analyse Problem

- Objectives
  - Study the interaction of "artificial intelligent" windows and visitors' movement
  - Use the model to demonstrate to architects the idea of adaptive screens (artificial intelligent windows)

- Hypotheses
  - A larger window size has a positive effect on visitor engagement
  - Space availability has a positive effect on visitor engagement
  - Screens with artificial intelligent windows attract viewers for longer

Example: Analyse Problem

- Experimental factors (look at objectives/hypotheses to work these out)
  - Visitors arrival rate
  - Initial number of windows
  - A subset of parameters of the underlying theoretical movement model (Note: This was added later)

- Responses (look at objectives/hypotheses to work these out)
  - Number of groups of visitors (visitor clusters)
  - Average time of visitors spend in the museum
  - Visual representation of the system and its dynamics

Case Study: Analyse Problem {@Company: Please provide these details for your case}

- Context
- Aim
- Objectives
- Hypotheses
- Experimental factors (model parameters/inputs)
- Responses (model outputs)

Example: Define Scope

- Scope: What and Why? (what do we need to represent to fulfil the aim; look for nouns in previous text)

Category		Element	ID	Decision	Justification
Actor	Human	Visitor	A01	Include	Main research subject
		Group	A02	Include	Important for capturing group behaviour
		Staff	A03	Exclude	Have no impact on the dynamics
	Intelligent Object	Window	A04	Include	Intelligent display unit that can make proactive decisions
		Display system	A05	Include	Controls the life cycle of each window
Physical Environment	Service	Projector	PE01	Exclude	Considered by the windows
		Screen	PE02	Include	Home of the windows
	Structure	Wall	PE03	Include	Required for motion algorithm of visitors
		Door	PE04	Include	Required for motion algorithm of visitors
		Lighting	PE05	Exclude	Not necessary for testing hypotheses
		Furniture	PE06	Exclude	Not necessary for testing hypotheses
	Weather	Temperature	PE07	Exclude	Not necessary for testing hypotheses
		Natural light	PE08	Exclude	Indoor environment
	Building	Exhibition room	PE09	Include	Location where visitors move around
		Corridor	PE10	Exclude	Not necessary for testing hypotheses
		Toilet	PE11	Exclude	Not necessary for testing hypotheses
Category		Aspect/Phenomena	ID	Decision	Justification
Social and Psychological Aspects / Phenomena	Visitor behaviour	Movement	SPAP01	Include	Required to trigger the window AI
		Vision area	SPAP02	Include	Will affect visitor movement behaviour
	Window behaviour	Movement	SPAP03	Include	Part of the AI to be tested
		Vision area	SPAP04	Include	Defines area that visitors are able to read clearly
Category		Detail to be modelled	ID	Decision	Justification
Other		N/A	O01	N/A	N/A

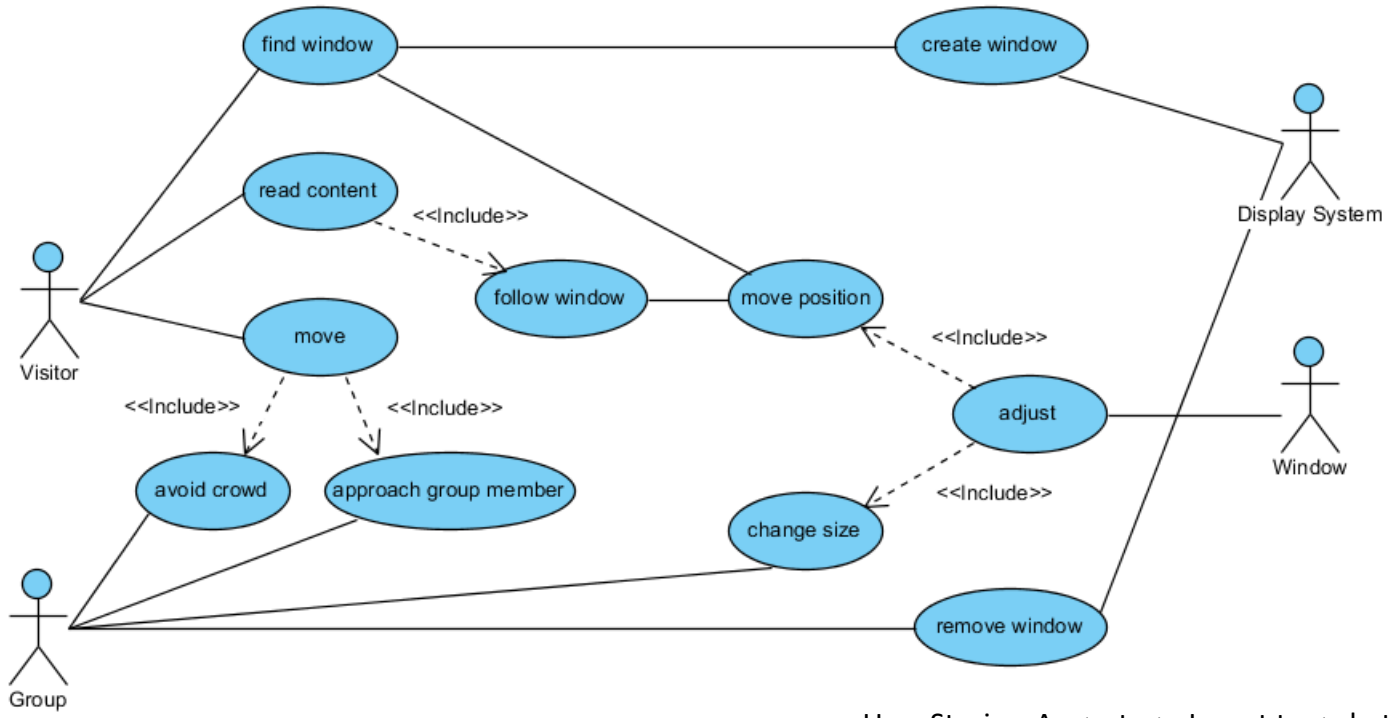
Case Study: Define Scope

Let's define the scope for our case study

What do we need to represent to fulfil the aim? Look for nouns in previous text

Example: Define Key Activities

- Key activities (actors come from scope table; use cases come from objectives/hypotheses and by creating user stories)



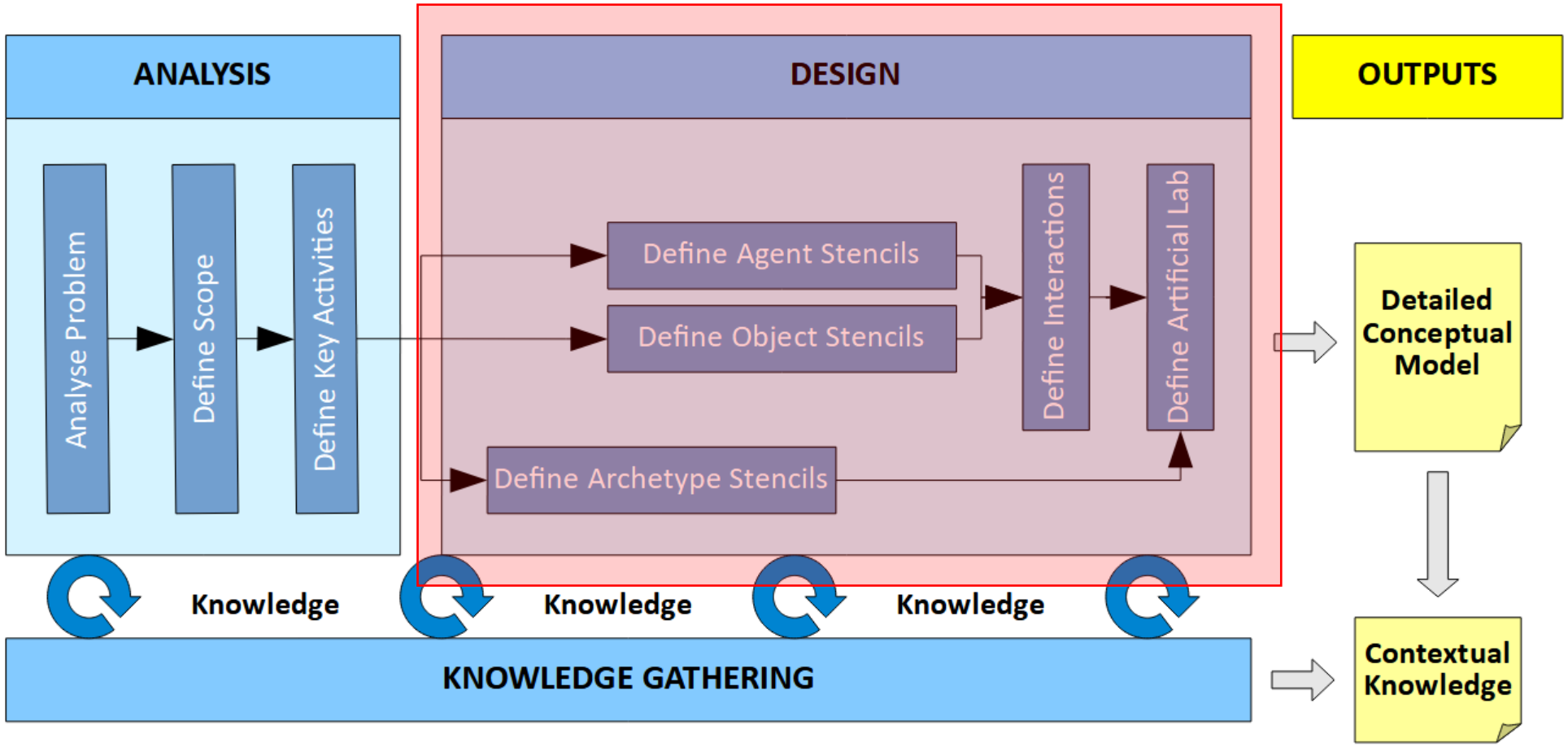
User Stories: As <actor>, I want to <what?> (so that <why?>)

Case Study: Define Key Activities

Let's define the key activities for our case study

Actors come from scope table; use cases come from objectives/hypotheses and by creating user stories

Engineering ABSS



Example: Define Archetype Stencils

- Categorisation schemata for key actors (these allow to define behaviour of actors; use habits/demographics for characterisation)

Stereotype	Reading time(second)
Not-interested	3-10
General-visitor	10-40
Researcher	40-90

Stereotype	Speed(meter per second)	Collision radius(meter)
Child	1.4-1.8	0.11-0.15
Adult	1.2-1.4	0.20-0.25

Note: The values are not really required at this stage, but you should capture them if they emerge from the discussion

Case Study: Define Archetypes Stencils

Let's define the archetype stencils for our case study

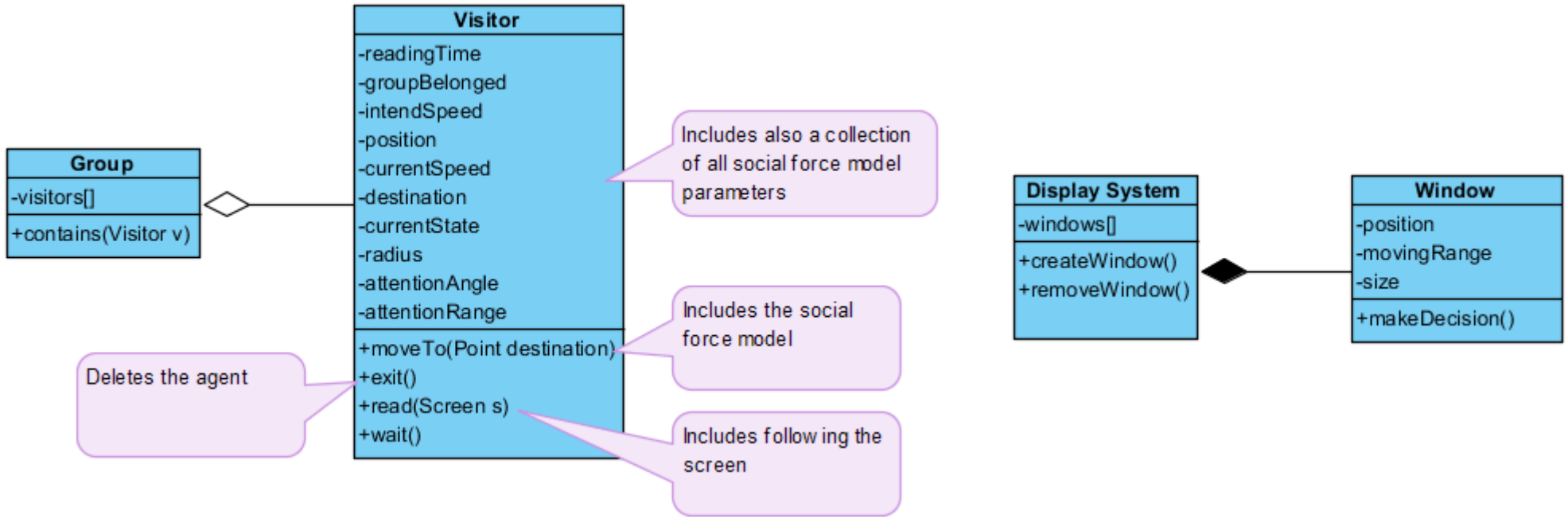
These allow to define behaviour of actors. Use habits/demographics for characterisation.

Example: Agent and Object Stencils

- The following are generated in parallel (or iteratively)
  - Classes for defining attributes and possible operations of individual/group agents/objects
  - State charts for defining possible states/transitions of agents/objects
  - Transition tables for detailing transitions in these state charts

Example: Agent and Object Stencils

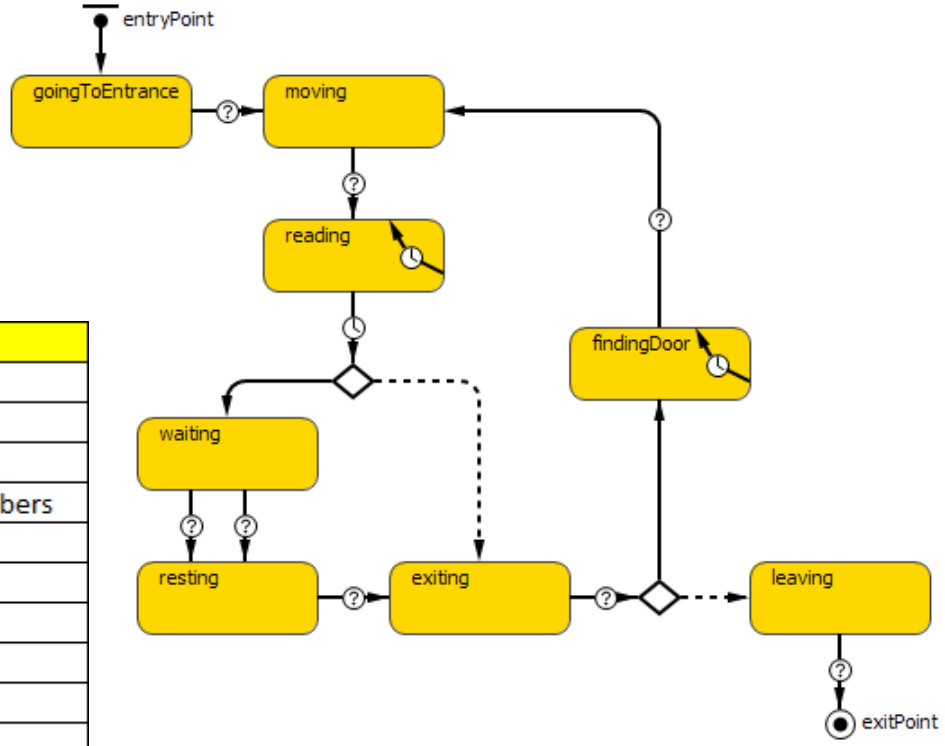
- Agent and object classes (attributes can be derived from archetype criteria and by looking at the scope table; operations can be derived from the states in the related state charts)



Note: Some of the attributes/operations will only be known once the implementation strategy is known (e.g. implementing "Movement" by using the Social Force Model)

Example: Agent and Object Stencils

- State chart of **visitor agent** (states can often be derived from use cases)



- Transition table of **visitor agent**

From state	To state	Triggered by	When?
goingToEntrance	moving	Condition	Agent arrived at destination
moving	reading	Condition	Agent arrived at destination
reading	reading	Timeout (Internal)	Agent follows the nearest window
reading	waiting	Timeout+Condition	After reading time elapsed and agent needs to wait for group members
waiting	resting	Condition	Agent arrived at destination
waiting	resting	Condition	Agent is close to destination and is part of a group
resting	exiting	Condition	All group members have finished reading
reading	exiting	Timeout+Condition	After reading time elapsed and agent is individual
exiting	findingDoor	Condition+Condition	There are other rooms available
findingDoor	findingDoor	Timeout (Internal)	Agent looks for nearest door
findingDoor	moving	Condition	Agent arrived at destination
exiting	leaving	Condition+Condition	This was the last room to go

Case Study: Define Agent and Object Stencils

Let's define the agent and object stencils for our case study

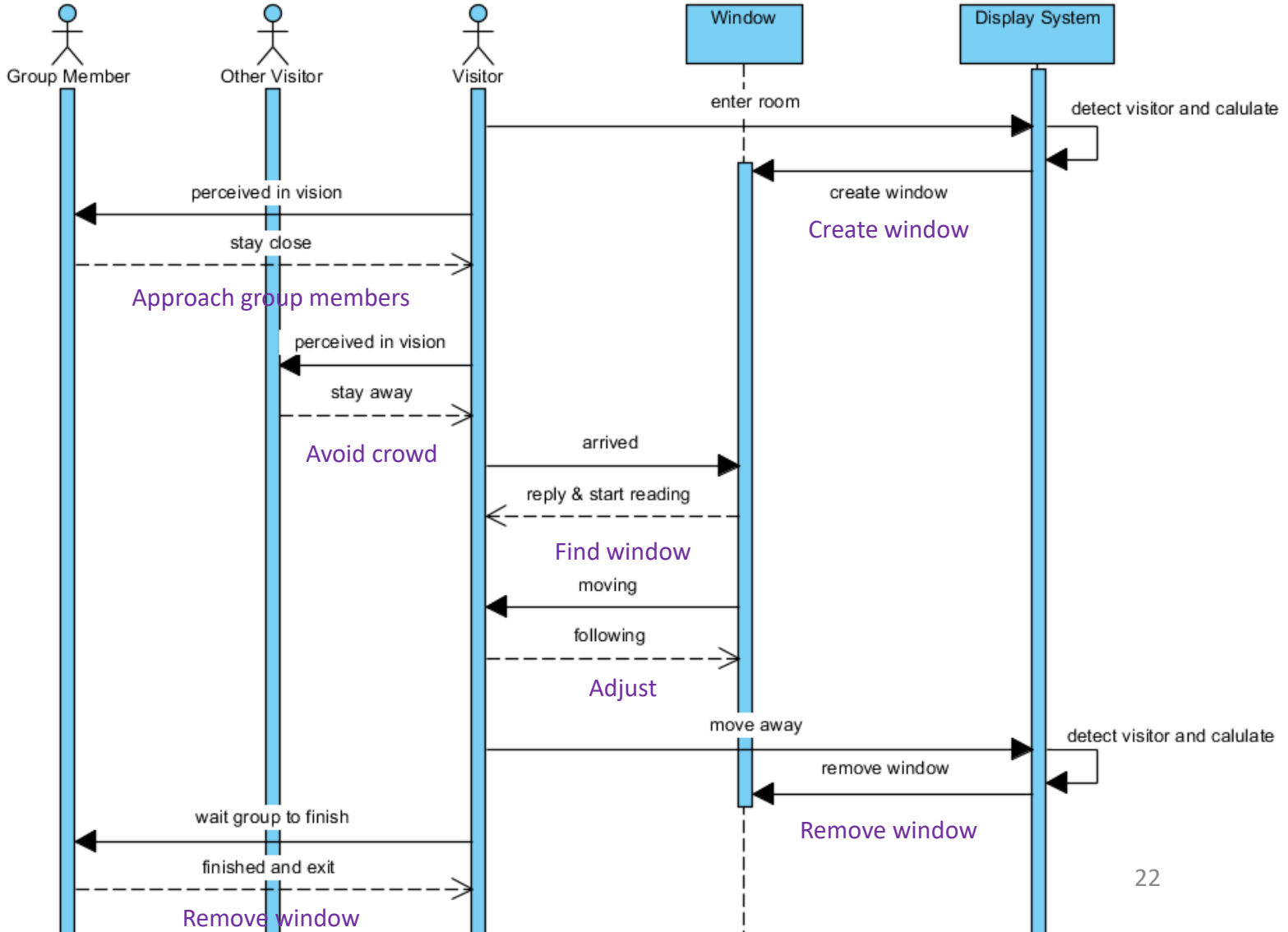
Agent and object classes: Attributes can be derived from archetype criteria and by looking at the scope table. Operations can be derived from looking at the states in the related state charts.

State charts: States can often be derived from use cases

Example: Define Interactions

- Interaction (all elements defined in the Agent and Object Stencils step need to be listed on the horizontal axis; use cases could be listed on the vertical axis; alternatively, a separate diagram could be created for each individual use case)

Note: We should also consider the "Other Visitor" actor earlier in the Scope Table and the Key Activities Diagram. Whenever we consider interaction rules between actors of the same type we require an additional actor group "Other actor" to be able to define the interactions.



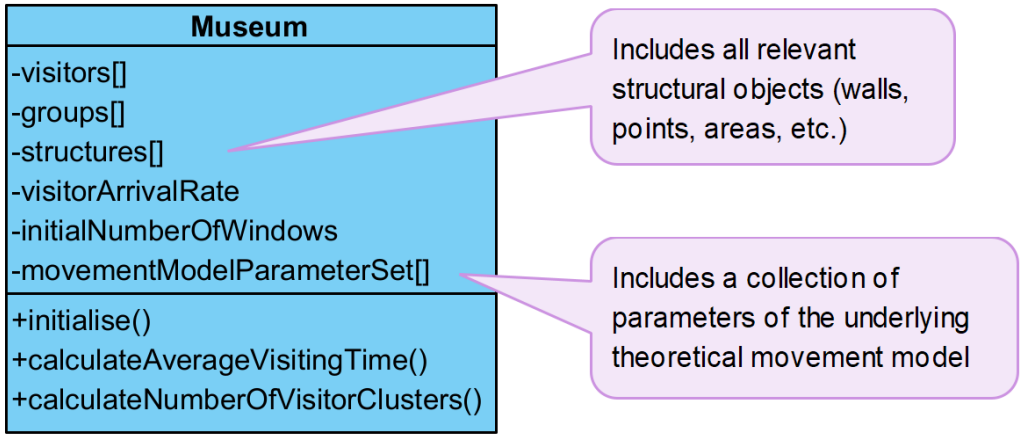
Case Study: Define Interactions

Let's define the interactions for our case study

All elements defined in the Agent and Object Stencils step need to be listed on the horizontal axis. Use cases could be listed on the vertical axis. Alternatively, a separate diagram could be created for each individual use case.

Example: Define Artificial Lab

- Artificial Lab (attributes provide storage for all agents/objects and initialisation parameters required for experimental factors; operations are related to responses)

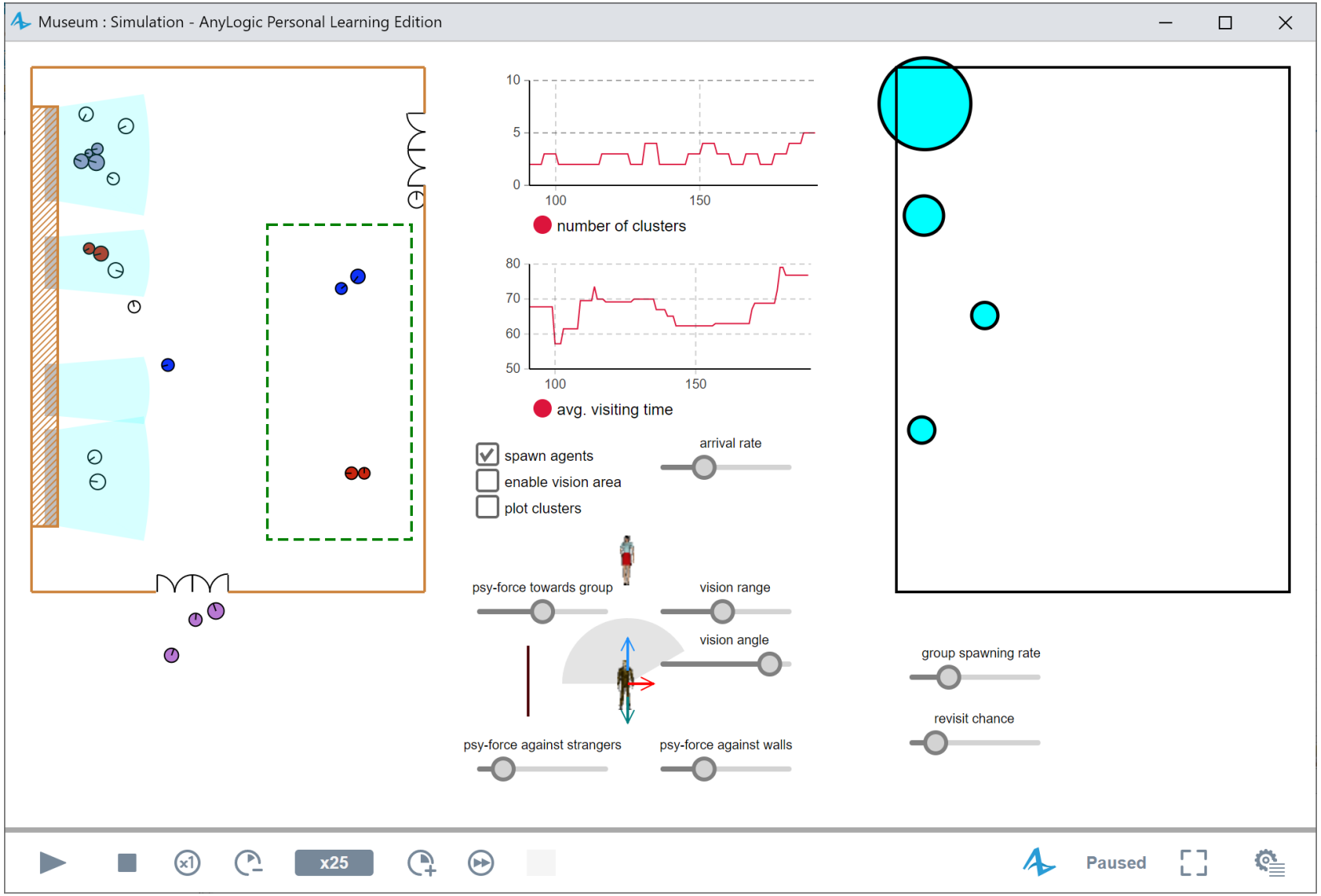


Case Study: Define Artificial Lab

Let's define the artificial lab for our case study

Attributes provide storage for all agents/objects and initialisation parameters required for experimental factors.
Operations are related to responses.

Example: The Implemented Model



Example: Extended Version (Moving Wall)