Discrete Inter-agent Dynamics, Sending & Receiving Messages

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Discrete Agent Coupling via Messages

- Within AnyLogic, agents can be coupled by either discrete (instantaneous and individuated) or continuous (ongoing and gradual) coupling
- The preferred mechanism for discrete coupling is *messages* sent between agents
  - Many types of messages payloads are possible
  - An agent can send a given message to one or more agents
  - Frequently messages are sent locally to neighbors within the environment
    - Neighboring nodes on the network
    - Nearby neighbors in space

Messages & Statecharts

- Messages may be handled in many ways
- One of the most common ways in which messages are handled is by statecharts
  - A transition can be triggered (“guarded” or gated) by a message
  - A transition may be associated with an action that fires off a message to other agents (or to other statecharts within the agent)

Hands on Model Use Ahead

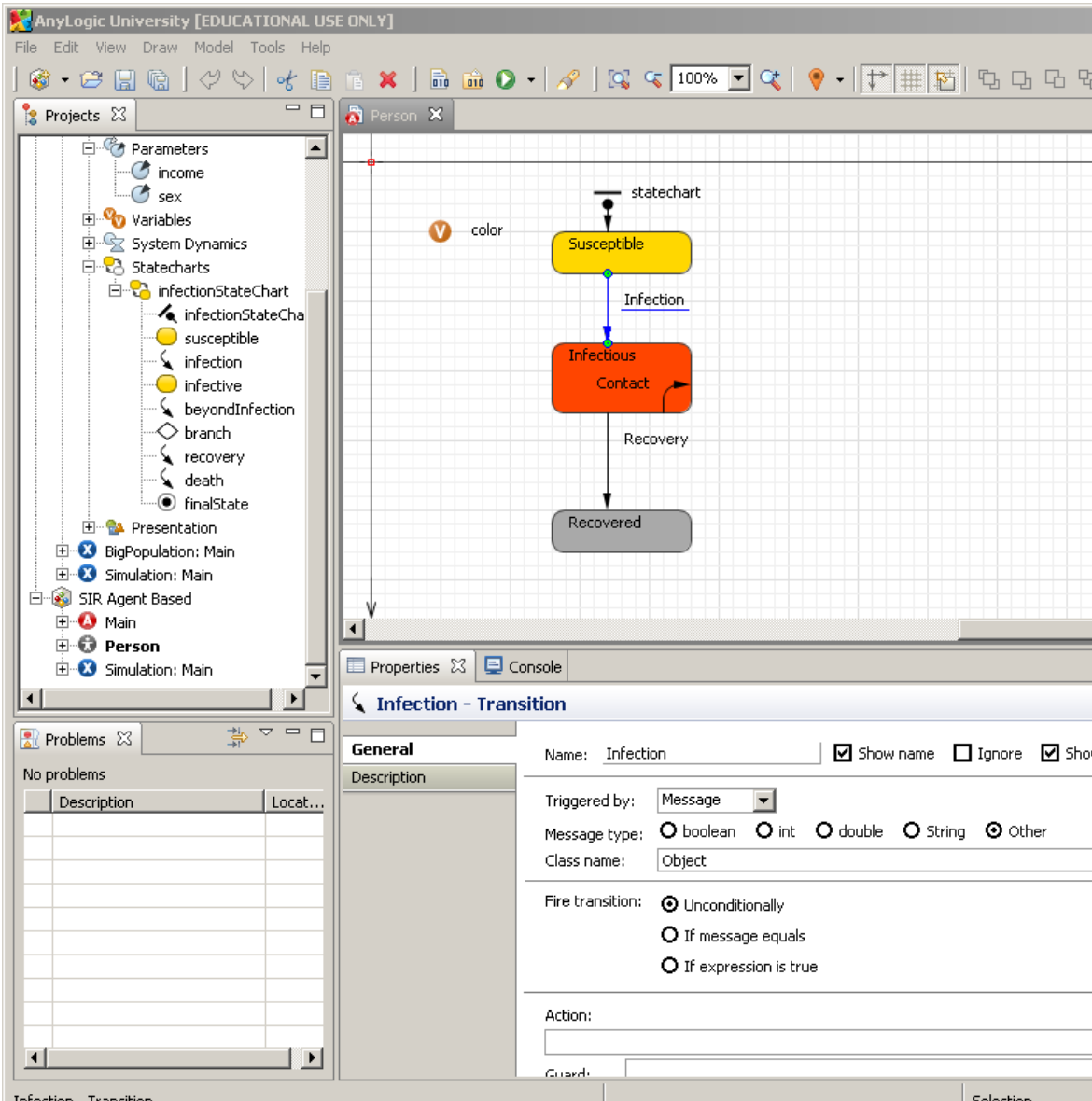
Load Sample model:

SIR Agent Based.alp

Open Up “Person” class

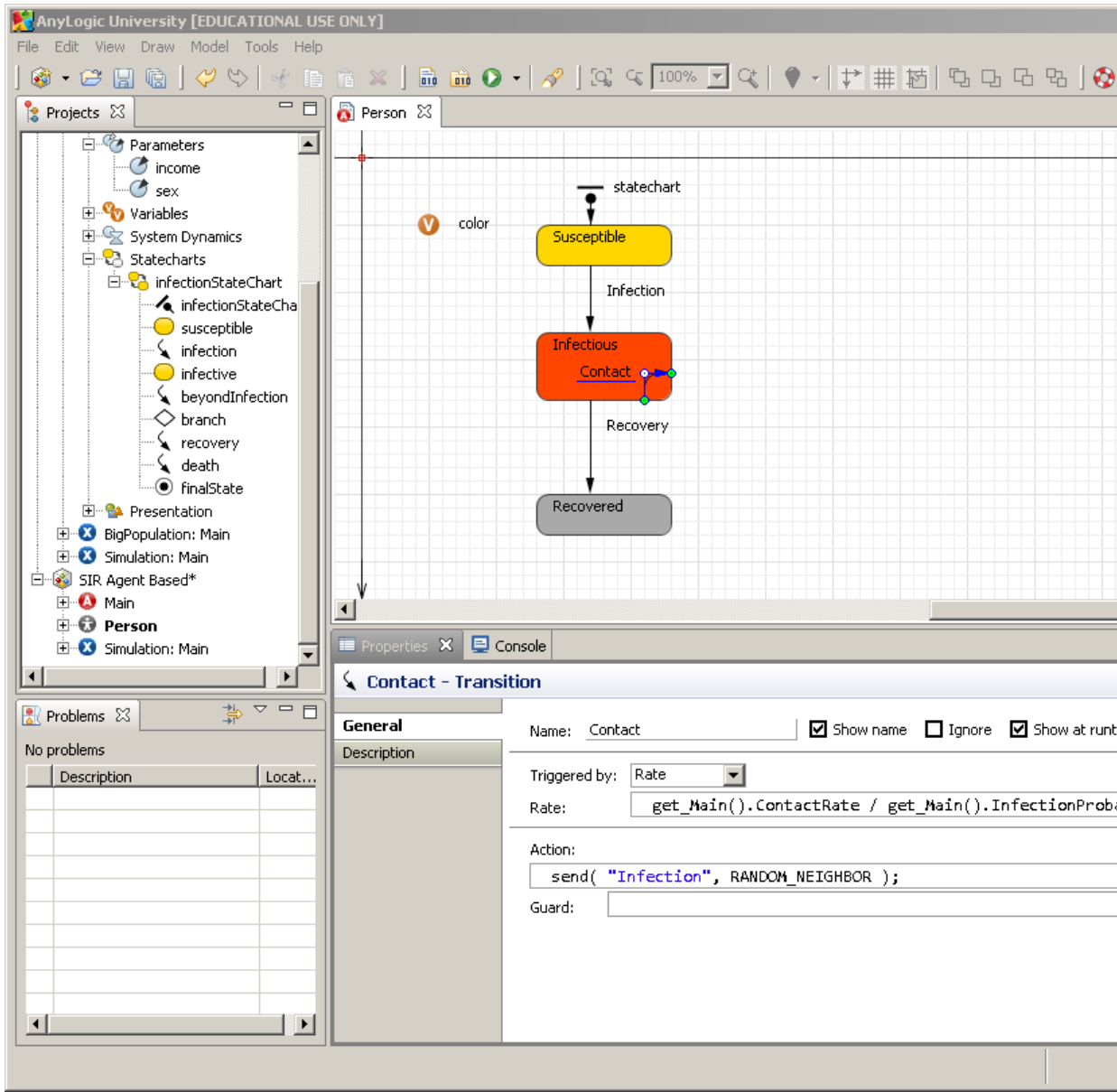
Receiving a Message

- In this case, only 1 message type exists, so the simple fact that a message has been received is sufficient; there is no need to inspect message contents



Sending a Message

- (Self-transition because remains in state)



Message Sending

- Messages may be sent to either
  - A particular, explicitly specified agent
  - An implicitly specified class of agents
    - Neighboring agents in the environment topology
    - Random agents
    - All agents
    - Any connected agents
    - All connected agents
- Mechanism:
  - send(*Message*, *DestinationObject*)
  - send(*Message*, *AgentClassId*)

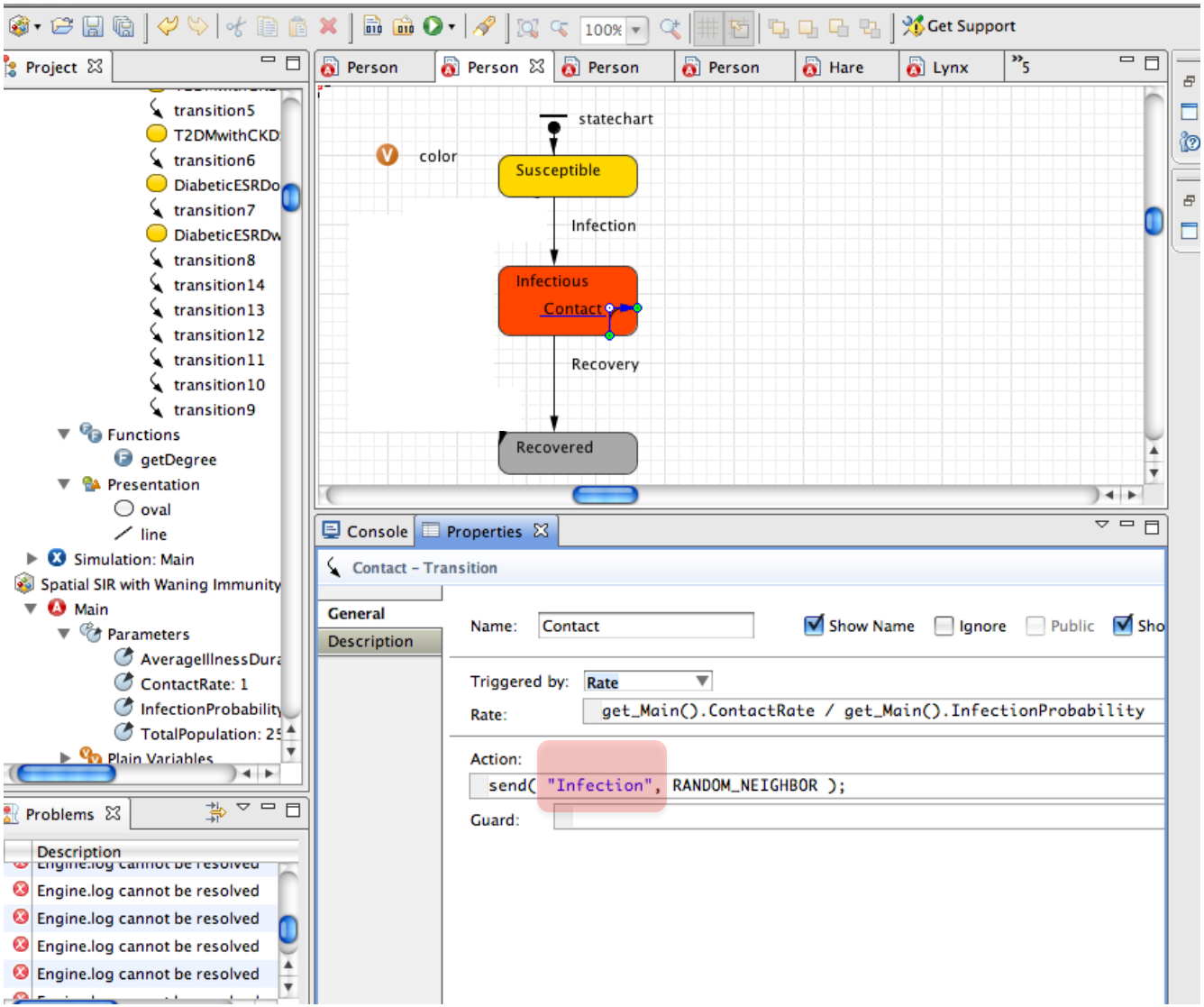
Synchronous vs. Asynchronous Delivery

- Messages may be sent in two ways
  - Via ***send***: Asynchronous (scheduled)
    - Delivery occurs sometime after call to send
    - This is like sending a text message – it can be read later
  - Via ***deliver:*** Synchronous (immediately called)
    - Risks infinite loops in delivery (if destination also calls deliver in the reverse direction)
    - This is like calling the other person's phone – you demand their attention immediately

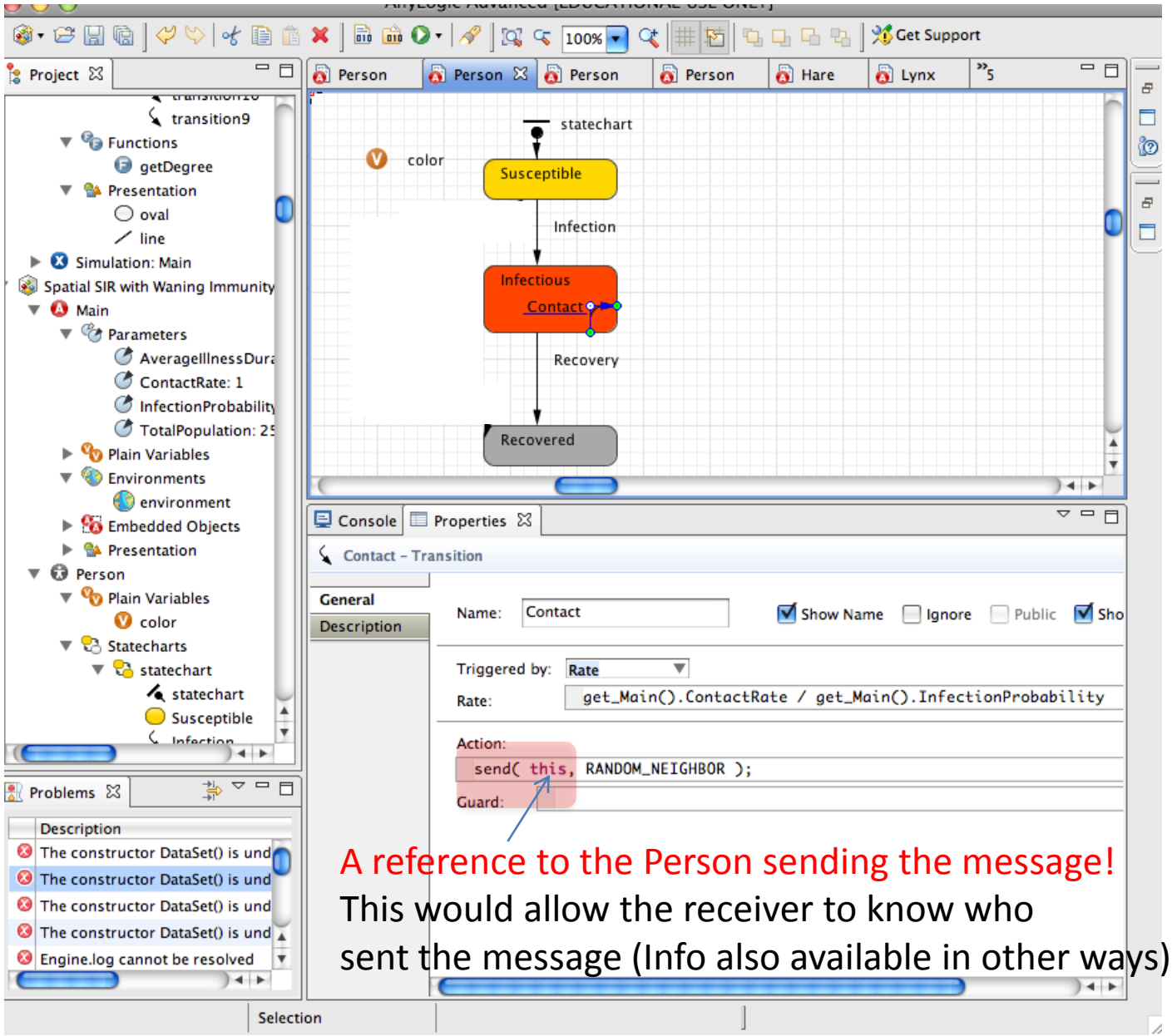
Message Payloads

- Sometimes just the fact that a message has been sent provides us with all of the information we need
- Sometimes just distinguishing different message types is sufficient
- We will sometimes send messages with payloads of data that provide extra information, e.g.
  - The agent that sent the message (eg that is infecting us)
  - Particular parameters
- Can send messages different payload types
  - Boolean/int/double/String/Other (can specify class type)

Sending a Message with a String Payload



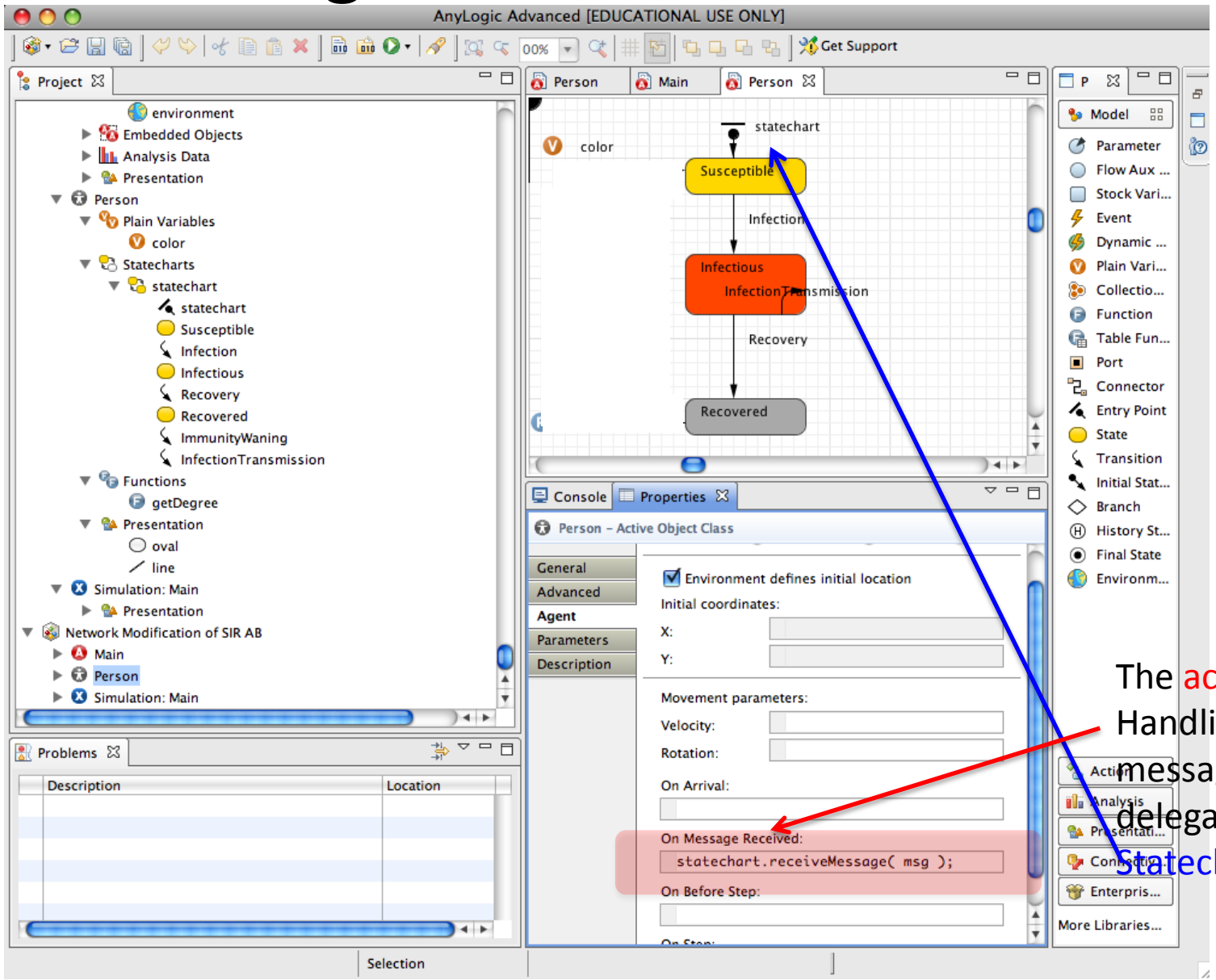
Sending a Message with Object Payload



A reference to the Person sending the message!

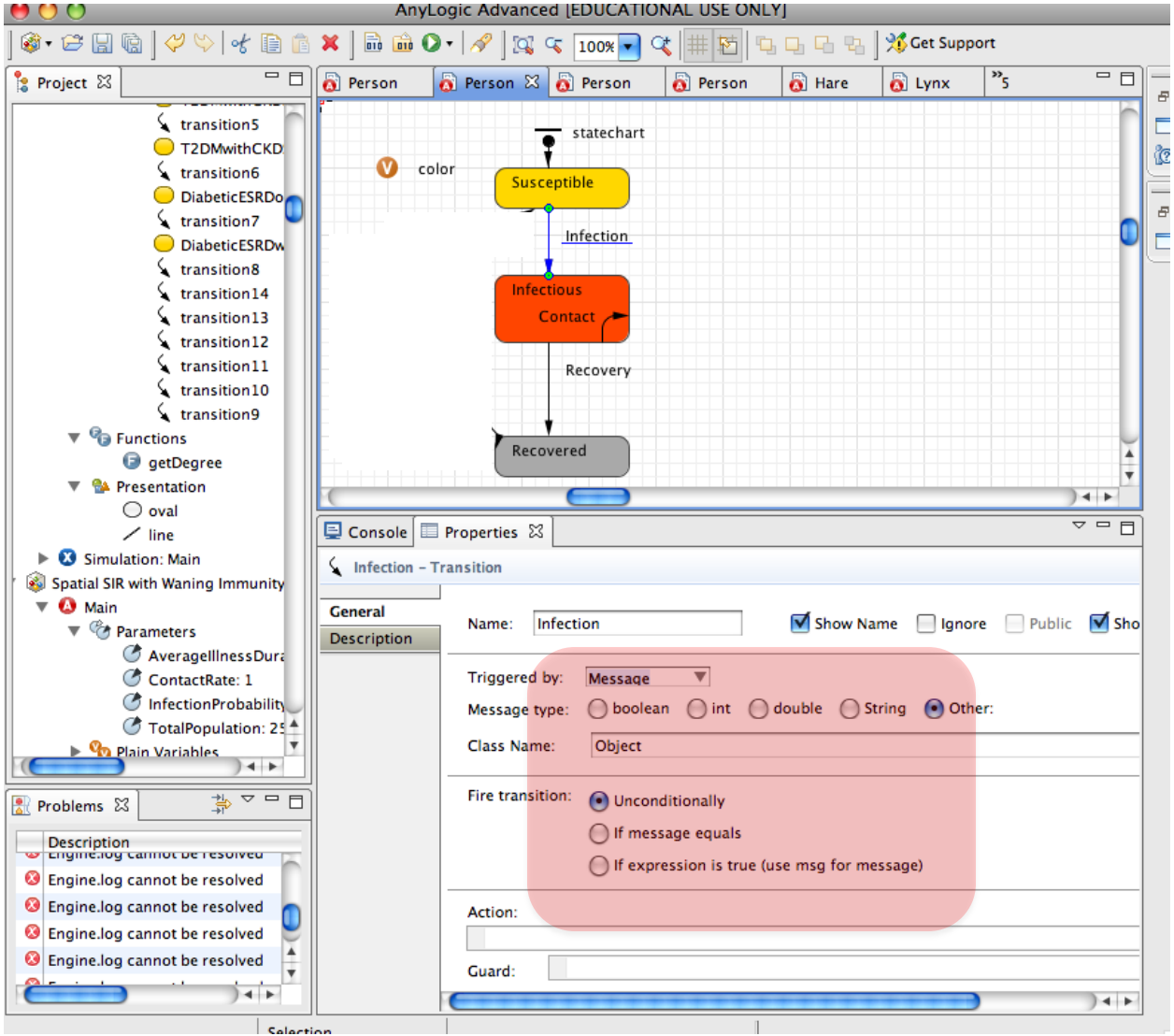
This would allow the receiver to know who sent the message (Info also available in other ways)

Receiving a Message: Forwarding Messages on to the Statechart



The action for Handling received messages delegates to the Statechart object

Receiving a Message

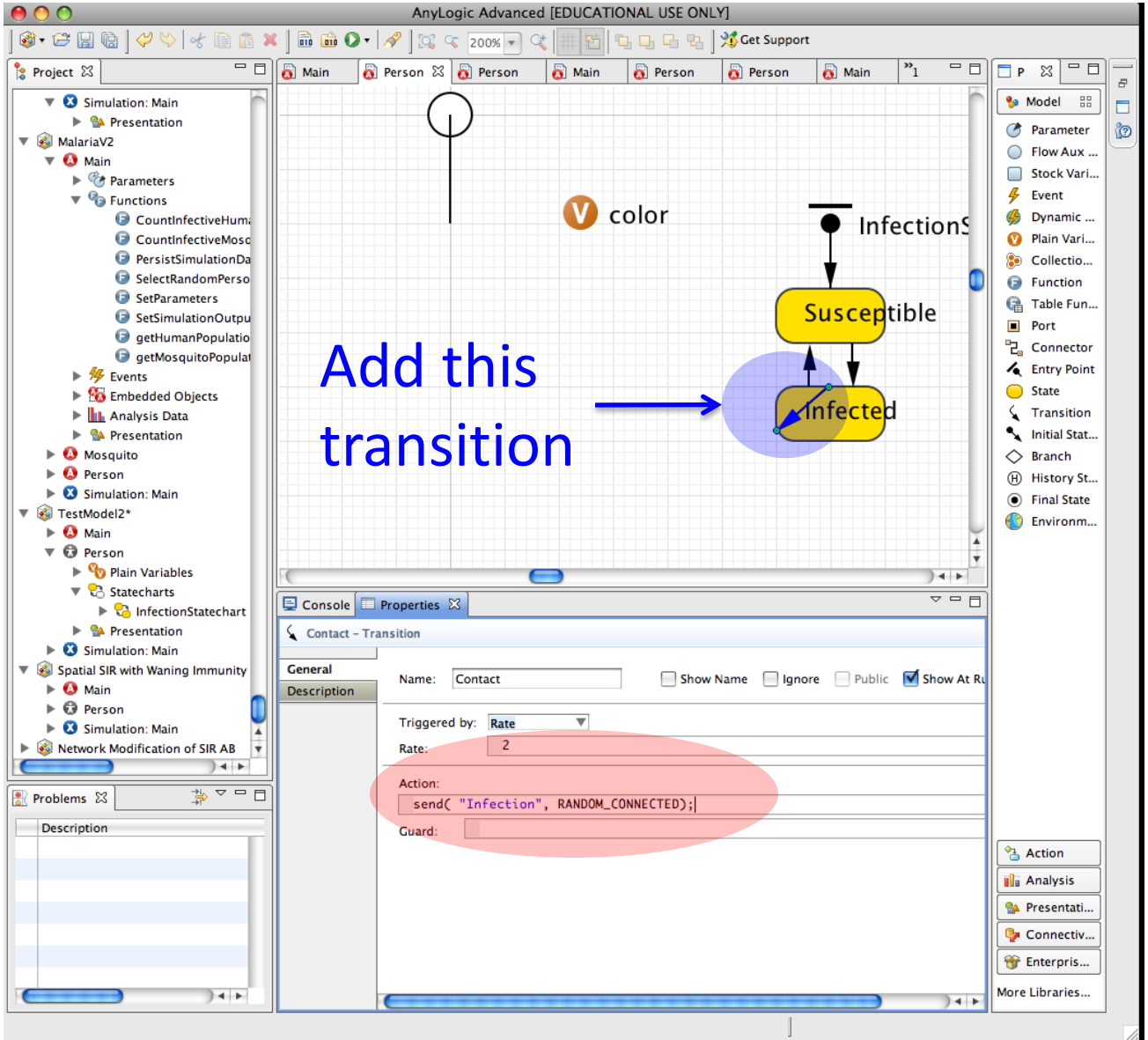


Hands on Model Use Ahead

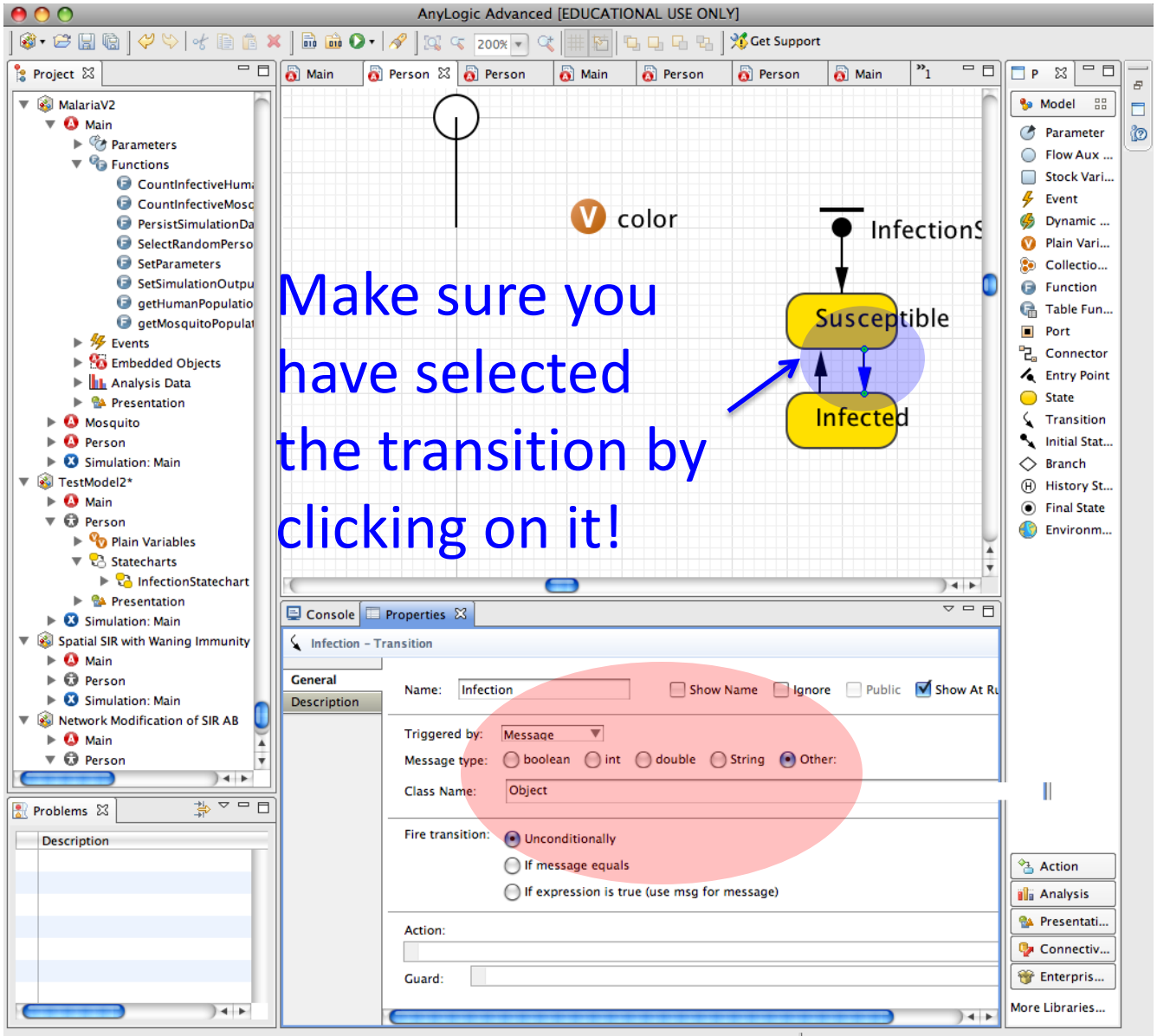
Load Previous Built [& Provided] Model:

MinimalistNetworkABMModel

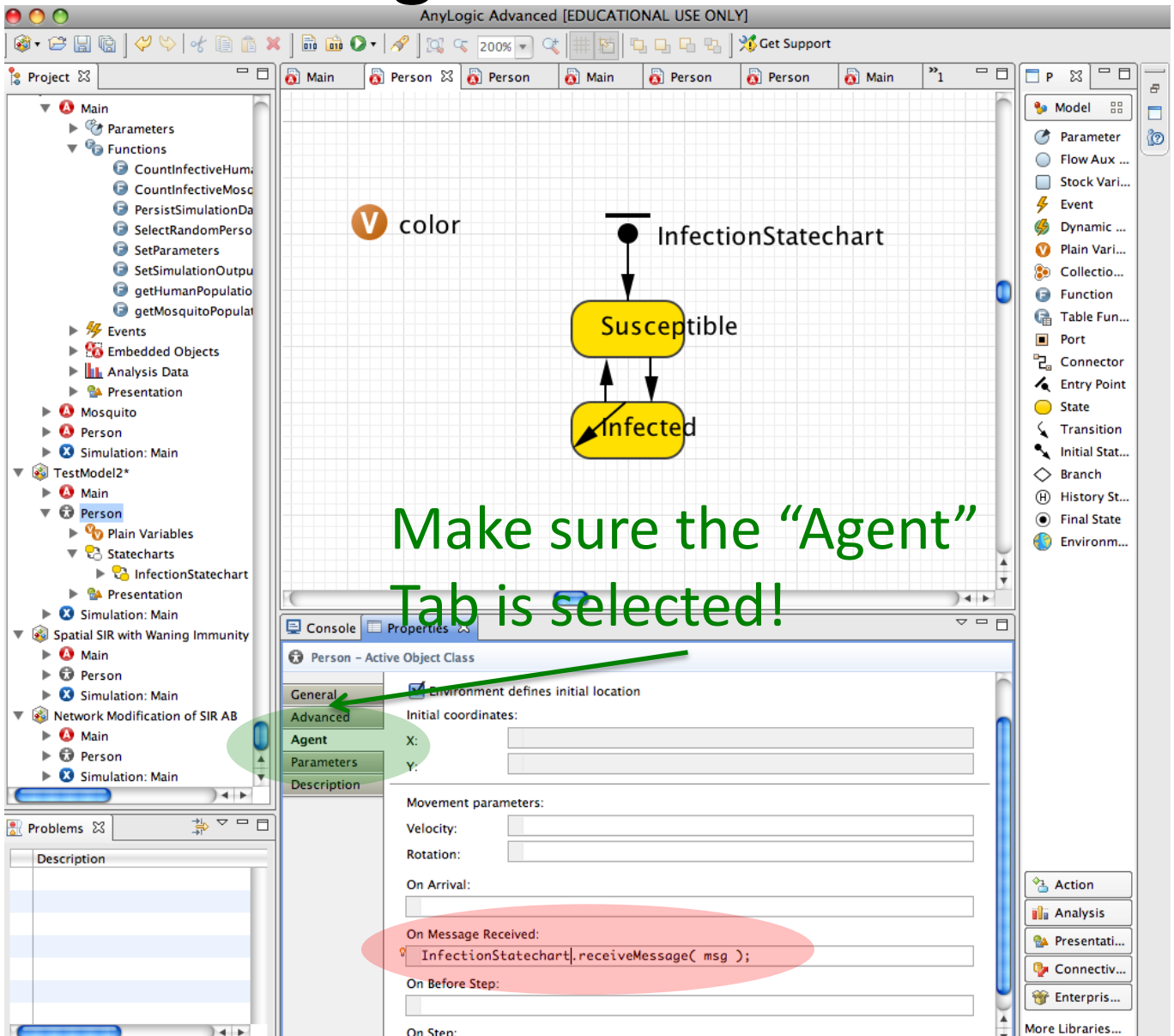
Sending Messages
Using a “Contact” Event to Spread Infection



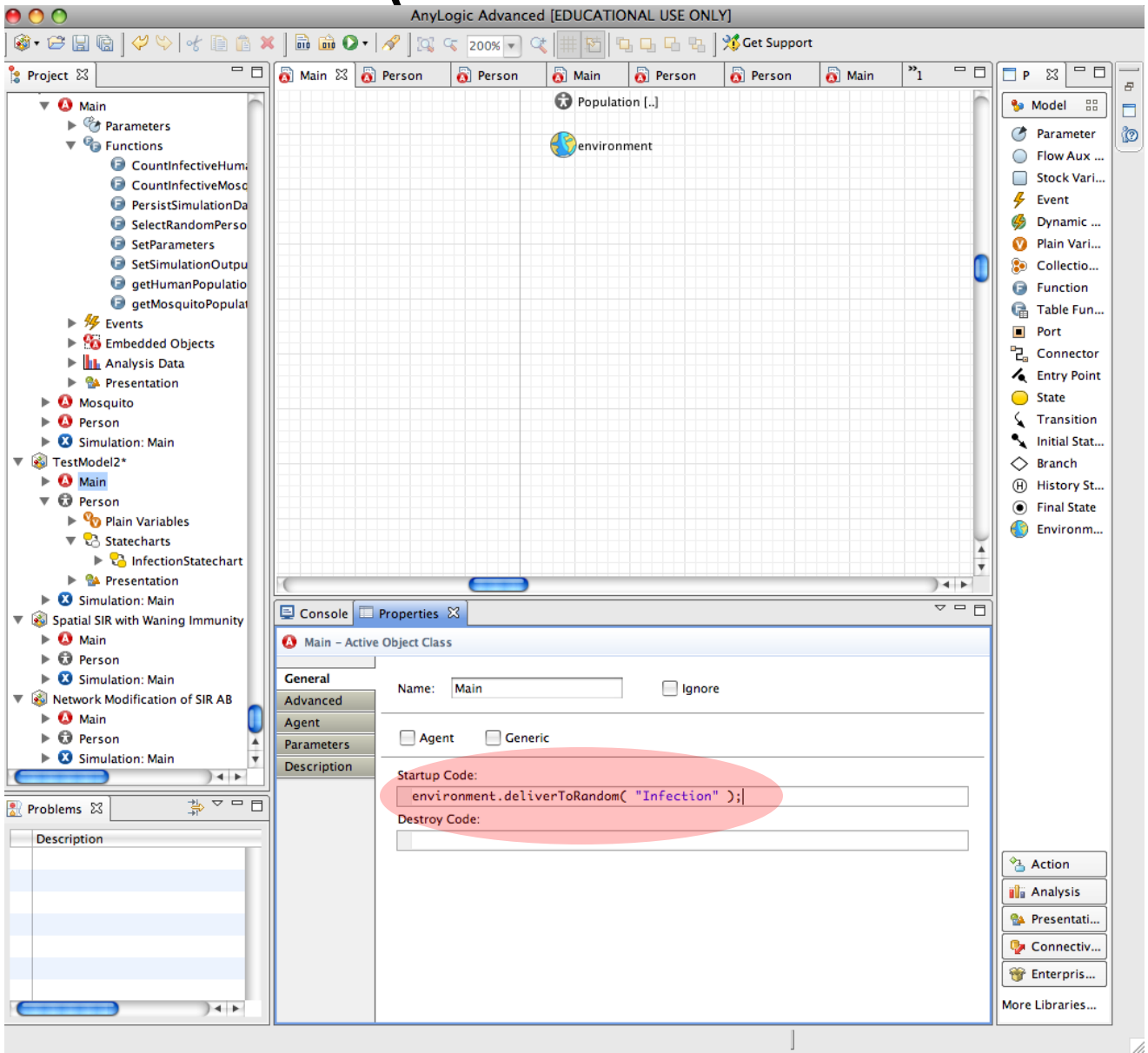
Transition Type: Message Triggered
Making Infection Depend on a Message



Setting “Person” so forwards Infection Message to Statechart



Setting Startup Code So Initially Infects a Random Person (so start with 1 infective)



Infection Percolation over the Network