Addressing Model Defects in AnyLogic

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Using Modeling to Prepare for Changing Healthcare Needs

Duke-NUS

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Model Appropriateness Consideration

- Have we built the right model?
- Have we built the model right?

Have We Built the Right Model?

- This is the province of “validation”
- We can rarely validate the model – only seek to
  - Build confidence
  - Disconfirm it
- This is specific to model purpose
- Here, a lapse is either
  - an oversimplification of the situation
  - An inaccurate “dynamic hypothesis” as to how things work

Have We Built the Model Right?

- Did we implement our planned model logic as we had intended?
  - Did we want one thing and put in place mechanisms that entailed another thing
  - This is the province of classic testing & quality assurance
    - Peer reviews
    - Testing (e.g. Junit)
- Here, a lapse is typically a model "defect" (build error or *bug)*
  - In this lecture, we will be dealing with identifying this sort of defect

Build Errors

- Build errors can be recognized in the “Problems” window
- These can be filtered by the selected component in the hierarchy
- Continuous Integration: While builds occur automatically as needed when running the model, try to build very frequently (for each small change)
  - This helps you to quickly identify the source of the problem
  - This speeds resolution, since the change is fresh in your mind
  - This may alert you to the need for a different approach

Debugging: Faults, Failures

- A “fault” is an underlying defect
- A failure is a visible problem, e.g.
  - Model “crashes”
  - Model will not run
  - Model is reporting values that are patently impossible given the implications of our intensions
    - Carcasses arising and walking
    - People recovering form a lifelong illness
    - People moving on a surface that should be impassable (e.g. a river)

Surprises & Failures

- Often complex models (including ABMs) exhibit surprising emergent properties
  - There may be things we consider very implausible that are jointly implied of various pieces of our model specification
  - There may even be things we consider “impossible” given our intended model structure that are in fact implied by it – we just didn’t realize this!

Some Model "Surprises" Reflect…

- Mistakes in our implementation (divergence of "what we told the model to do" from "what we intended to tell the model to do")
  - Typing "a/a+b" rather than "a/(a+b)"
  - Misunderstanding of how a type of model building block (e.g. a guard in a rate transition) "works"
- Unrealistic aspects of our plan ("what we intended to tell the model to do" had hidden inconsistences with how the world works)
- Discoveries about what could happen in the world
- We are focusing here on the first of these issues, but need to realize that it often takes time to figure out in which category a given surprise lies!

What is Debugging?

- Debugging is the process of finding and removing the defects (faults) in our program, based on observations of “failures” or “aberrant behaviour”

Best Debugging Strategy: Avoiding It!

- Defensive Programming
- Offensive Programming

We will talk about best practices for these approaches in a separate lecture

Offensive Programming: Try to Get Broken Program to Fail Early, Hard

- Asserts: Proactively scan for and flag incorrect assumptions, aborting the program as a result
- Fill memory allocated with illegal values
- Fill object w/illegal data just before deletion
- Set buffers at end of heap, so that overwrites likely trigger page fault
- Setting default values to be illegal in enums
- We will talk about Assertions & Error Handling later this week

Assertion Goal: Fail Early!

- Alert programmer to misplaced assumptions as early as possible
- Benefits
  - Documents assumptions
  - Reduces likelihood that error will slip through
    - Helps discourage “lazy” handling of only common case
    - Forces developer to deal explicitly with bug before continuing
  - Reduces debugging time
  - Helps improve thoroughness of tests

Avoid Side Effects in Assertions

- Because assertions may be completely removed from the program, it is unsafe to rely on side effects occuring in them

```
assert ++i < max;
```

Arnold et al. The Java Programming Language, Fourth Edition. 2006.

Arnold et al. The Java Programming Language, Fourth Edition. 2006.

Enabling Assertions in Java

- 2 ways
  - Usual: Via java runtime command line

    -enableassertions/-ea[*descriptor*]

    - e.g.

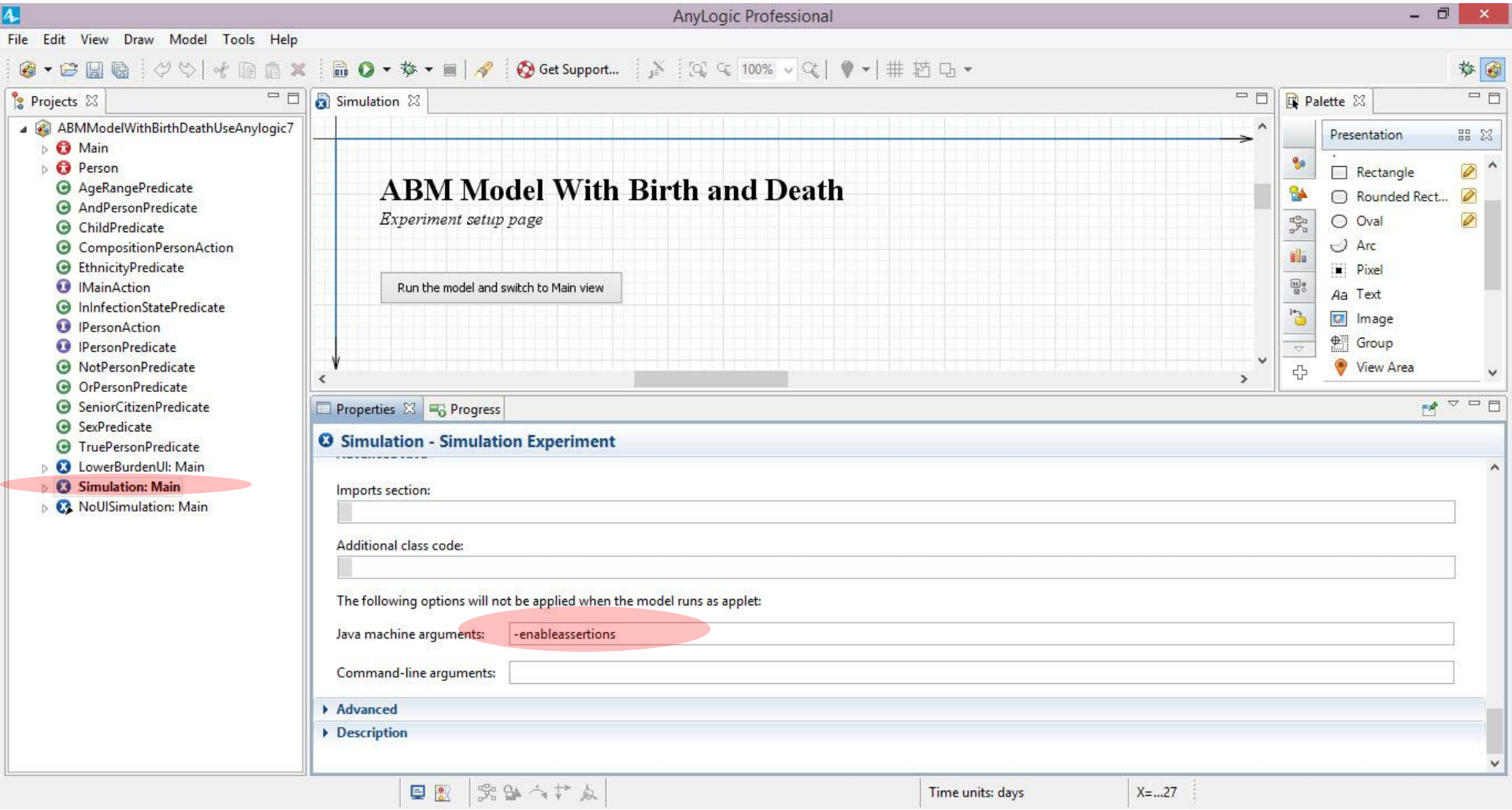
      ```
      -enableassertions:com.acme.Plotter
      -enableassertions:com.acme...
      ```

    -disableassertions/-da[*descriptor*]

  - Less common: via reflection (ClassLoader)

    ```
    public void setDefaultAssertionStatus(boolean enabled)
    public void setPackageAssertionStatus(String packageName, boolean
      enabled)
    public void setClassAssertionStatus(String className,
      boolean enabled)
    ```

Enabling Assertions in AnyLogic



Assertions in Later AnyLogic Versions

- In some later AnyLogic versions, should enable assertions only in the model itself
- This is simple to do
  - Uses the package name
- More details on this are available on request

AspectJ and Eclipse

- AspectJ is a language that allows for succinctly describing “cross cutting” functionality in programs – such as tracing or logging requests
- AspectJ can automatically insert tracing instrumentation into our code
  - This gives us many of the benefits of manual tracing program execution without the need for the markup & mark-down work
- If time permits, we will present this method on Friday

A Powerful Debugging Approach

- Save a copy of your model just for debugging
- Simplify error occurrence as much as possible
- Locate fault source
  - Gather data or context that reproduces problem
    - Rip out whole areas of model to see simplest condition that (sometimes just seeing what eliminates error immediately clues in to what it might be)
  - Record what have done

  do
    - Analyze data & form hypothesis about defect
    - Determine how to prove/disprove hypothesis
    - Prove or disprove hypothesis
    - Think about defect

  Until can fix defect
  - Look for similar errors that may not yet be found
  - Figure out what about *process* left vulnerable to this error

Important Elements

- “Localizing” problem (Simplifying model & input until discover minimum required mechanism)
  - Save away original model (so don’t modify!)
  - Comparing good & bad versions: What is different?
  - Note down what does & does not work
  - Seeing path of execution (particularly around fault location)
- Alternate between thinking & experimenting
- Observing model state (“situation”) at points preceding error
- Compare with previous versions that were working
- Read error messages given by AnyLogic
- Confirming certain assumptions are true prior to error
- Talk with someone about issue/perform a peer review
- Specify and investigate top hypotheses

Debugging AnyLogic

- AnyLogic's researcher & professional versions now contains a debugger
- Alternatively, you can attach to AnyLogic from debuggers such as Eclipse
  - The key thing is to set anylogic to use a port

Debugging Options

- Debugging is the process of locating and fixing the faults behind observed failures
- Using output for manual tracing & reporting
  - A valuable option here is to use this interactively
- Using model navigation mechanisms to inspect information about the model
- Using AspectJ for tracing/logging
- Using tools like log4j for customizable logging
- Using an external debugger (e.g. via eclipse)
- Using AnyLogic Professional/Research debugger

Using output for manual tracing & reporting

- Pros
  - Minimal learning curve
  - Flexible
  - Easily targeted
- Cons
  - Requires time-consuming manual
    - “markup”
    - de-markup
  - Can require many build/simulation iterations to localize problem
  - Limited capacity of console

Output to the Console: How To

- System.err.println(String)
  - System.err.println("Sent cure message to person ["
    + associatedPerson + "]");
  - This will appear in red
- traceln(String)
- System.out.println(String)

Use in AnyLogic

Person | Main | AgentEntity.java

```
    }

    public void Cure()
    {
//      associatedPerson.send("Cured!", associatedPerson);
        associatedPerson.deliver("Cured!", associatedPerson);
        System.err.println("Sent cure message to person [" + associatedPerson + "]");
    }
    @Override
    public String toString()
    {
        return "Entity for agent " + associatedPerson;
    }

    /**
     * This number is here for model snapshot storing purpose<br>
     * It needs to be changed when this class gets changed
     */
    private static final long serialVersionUID = 1L;
```

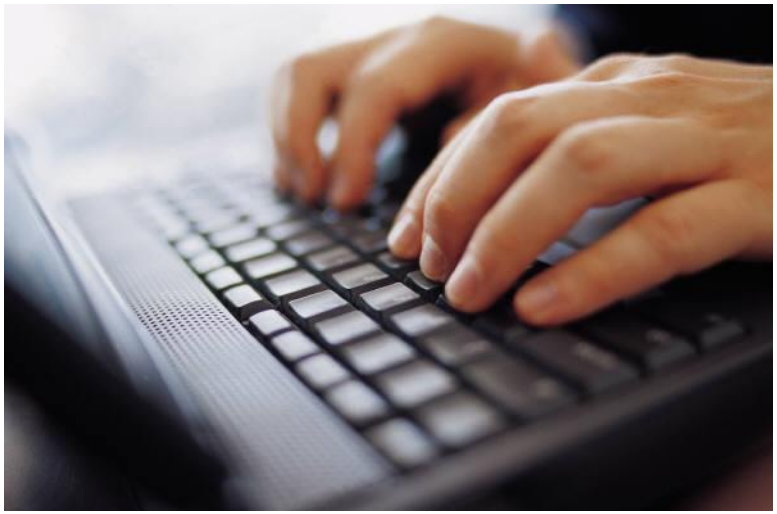
Properties | Console

```
<terminated> anylogic config [Java Application] C:\Program Files (x86)\AnyLogic 6\jre\bin\javaw.exe (Jan 15, 2010 12:07:43 PM)
Sent cure message to person [root.Population[0]]
Sent cure message to person [root.Population[6]]
Sent cure message to person [root.Population[88]]
I was cured!
I was cured!
I was cured!
I was cured!
Sent cure message to person [root.Population[95]]
I was cured!
Sent cure message to person [root.Population[60]]
I was cured!
Sent cure message to person [root.Population[37]]
I was cured!
```

Interactive reporting

- AnyLogic's support of interactive mechanisms allows us to custom-trigger reporting through user interface actions
  - Button push
  - Mouse click
- We can also use elements like sliders to change things in a way that hints as to the nature of a problem
- This reporting may be
  - Custom-built for debugging
  - Built in, but not typically used here

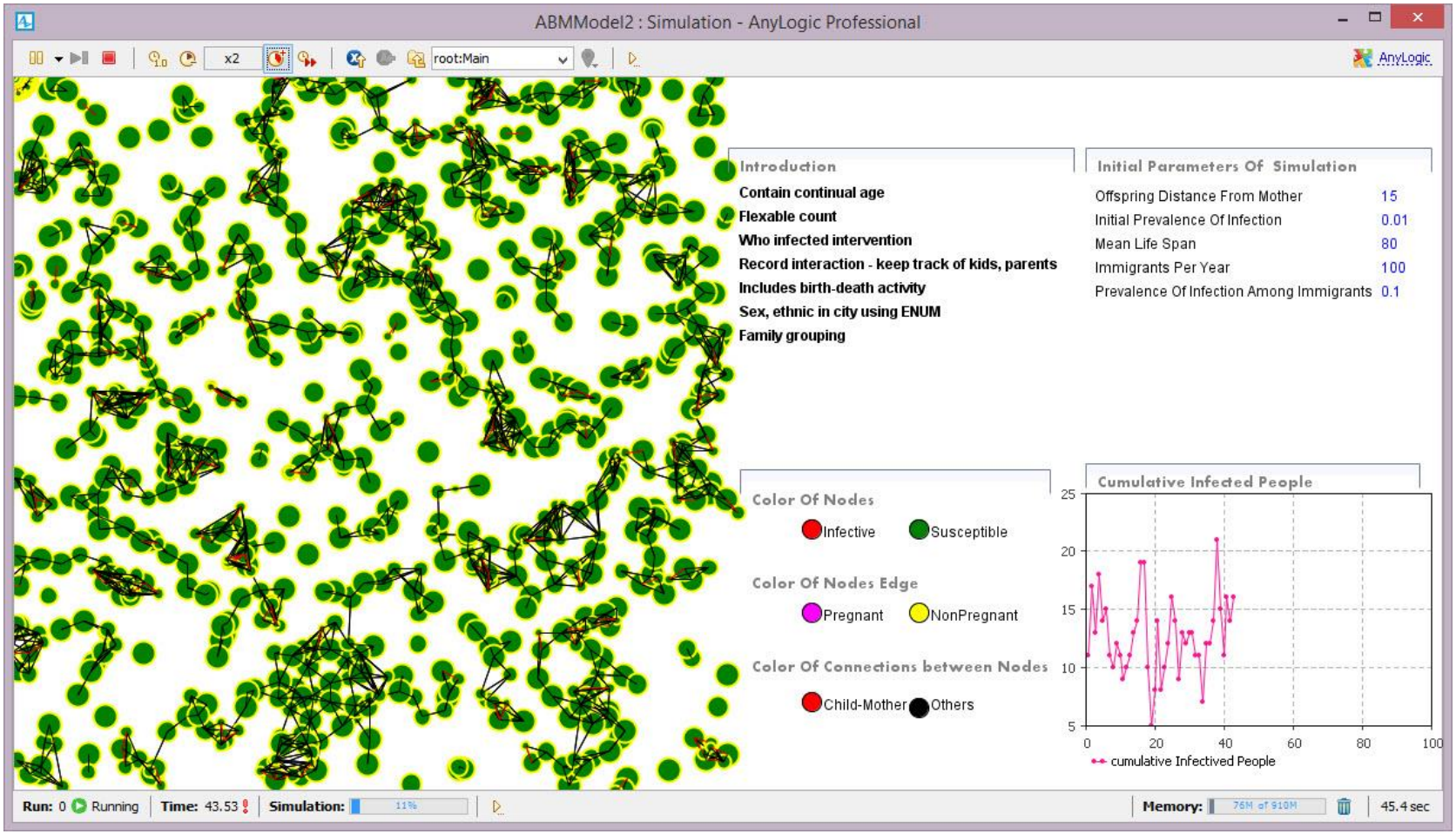
Hands on Model Use Ahead

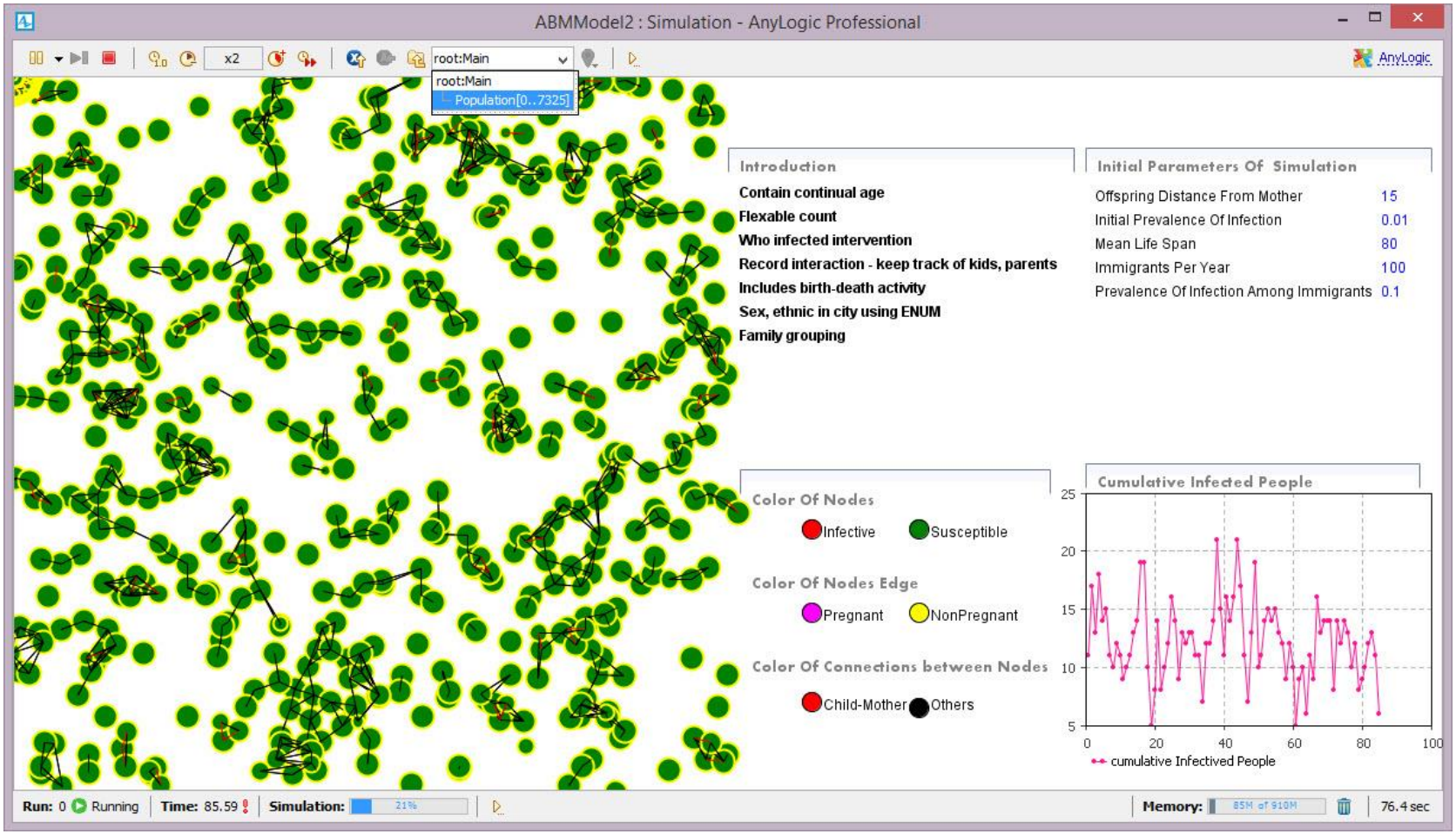


Load Provided Shared Model:

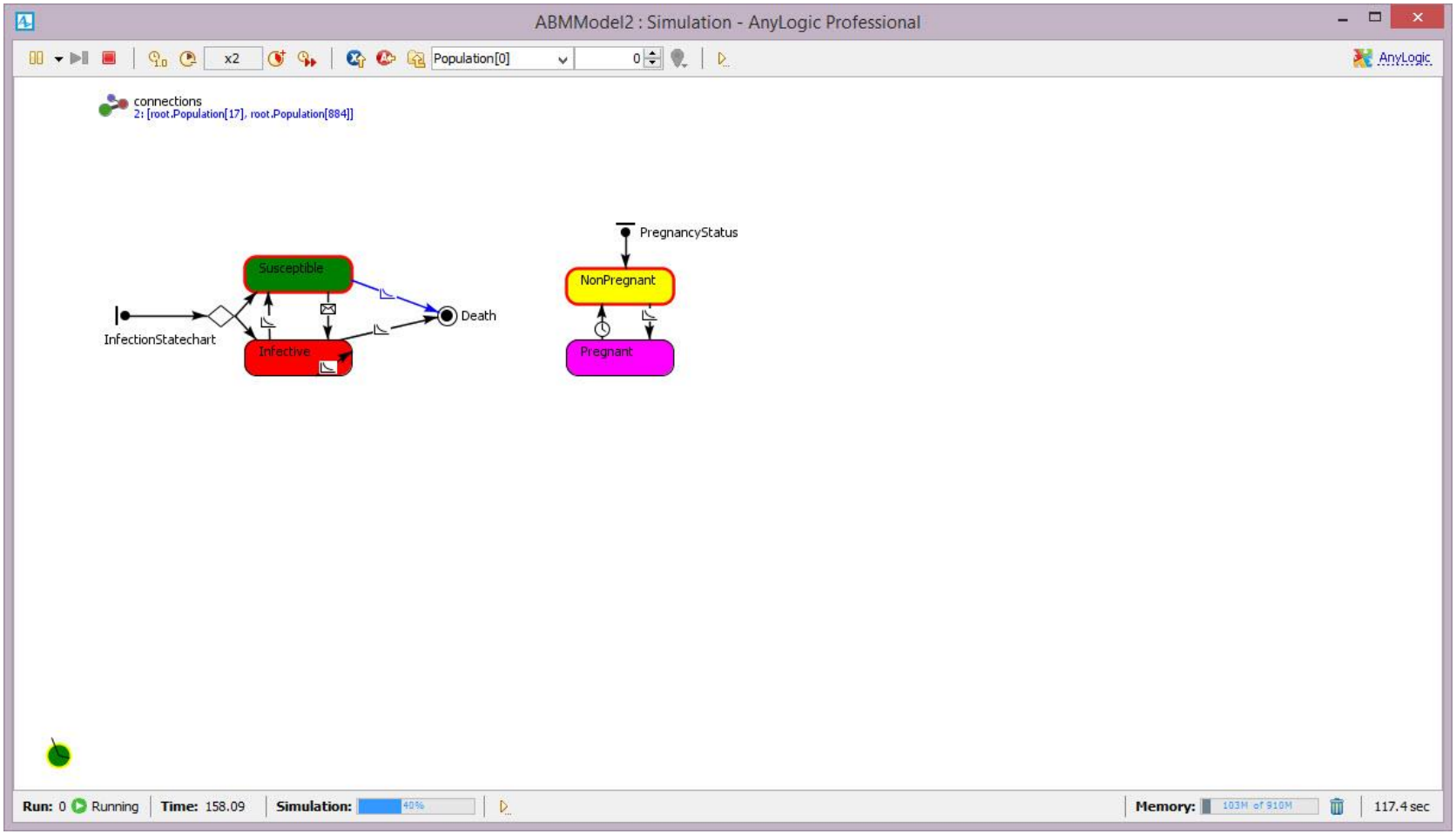
ABMModelWithBirthDeath

Population View

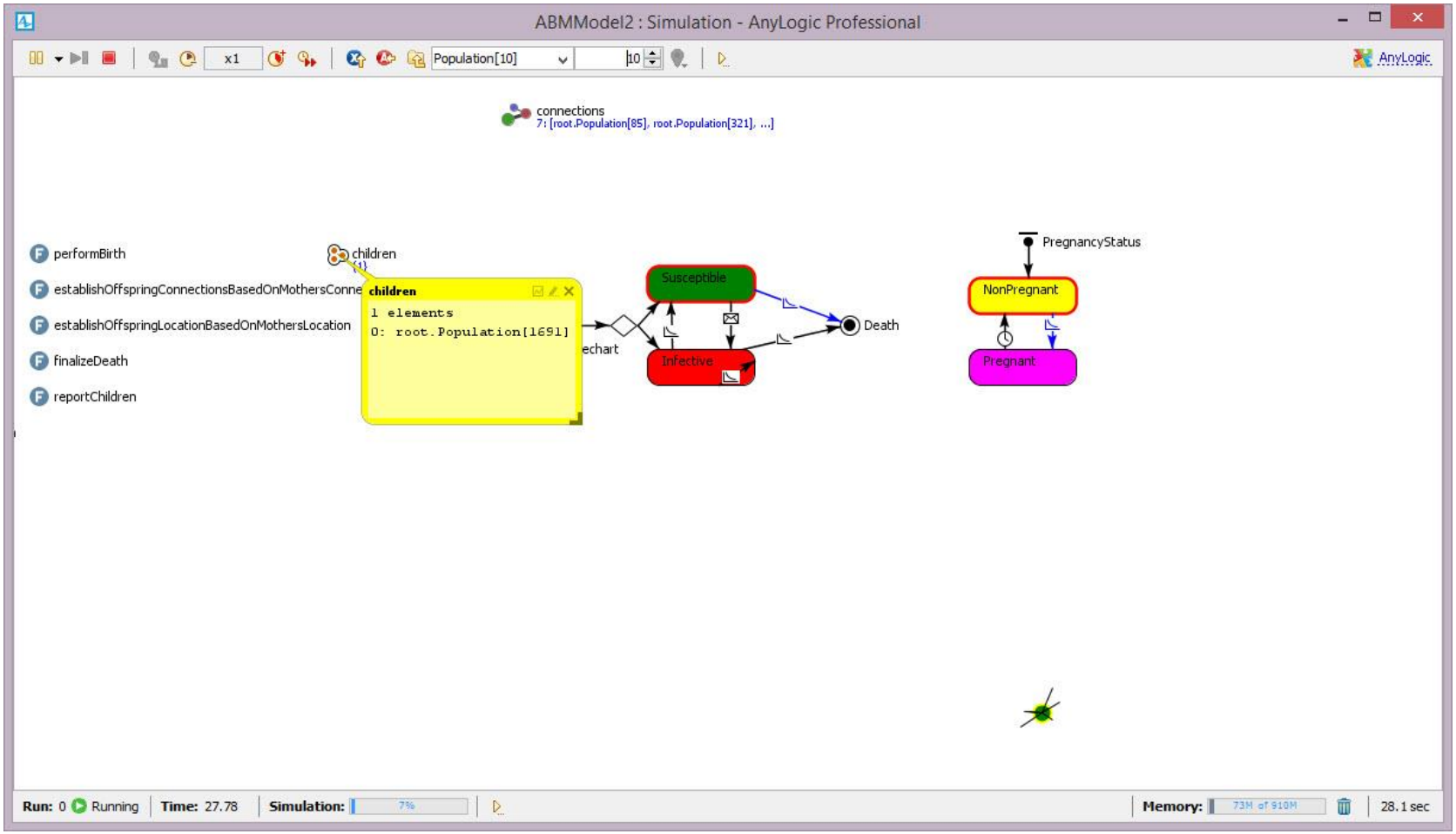



ABMModel2 : Simulation - AnyLogic Professional
x2
root:Main
root:Main
Population[0..7325]
AnyLogic
Introduction
Contain continual age
Flexable count
Who infected intervention
Record interaction - keep track of kids, parents
Includes birth-death activity
Sex, ethnic in city using ENUM
Family grouping
Initial Parameters Of Simulation
Offspring Distance From Mother 15
Initial Prevalence Of Infection 0.01
Mean Life Span 80
Immigrants Per Year 100
Prevalence Of Infection Among Immigrants 0.1
Color Of Nodes
Infective
Susceptible
Color Of Nodes Edge
Pregnant
NonPregnant
Color Of Connections between Nodes
Child-Mother
Others
Cumulative Infected People
25
20
15
10
5
0
20
40
60
80
100
cumulative Infectived People
Run: 0 Running
Time: 85.59
Simulation:
21%
Memory:
85M of 910M
76.4 sec

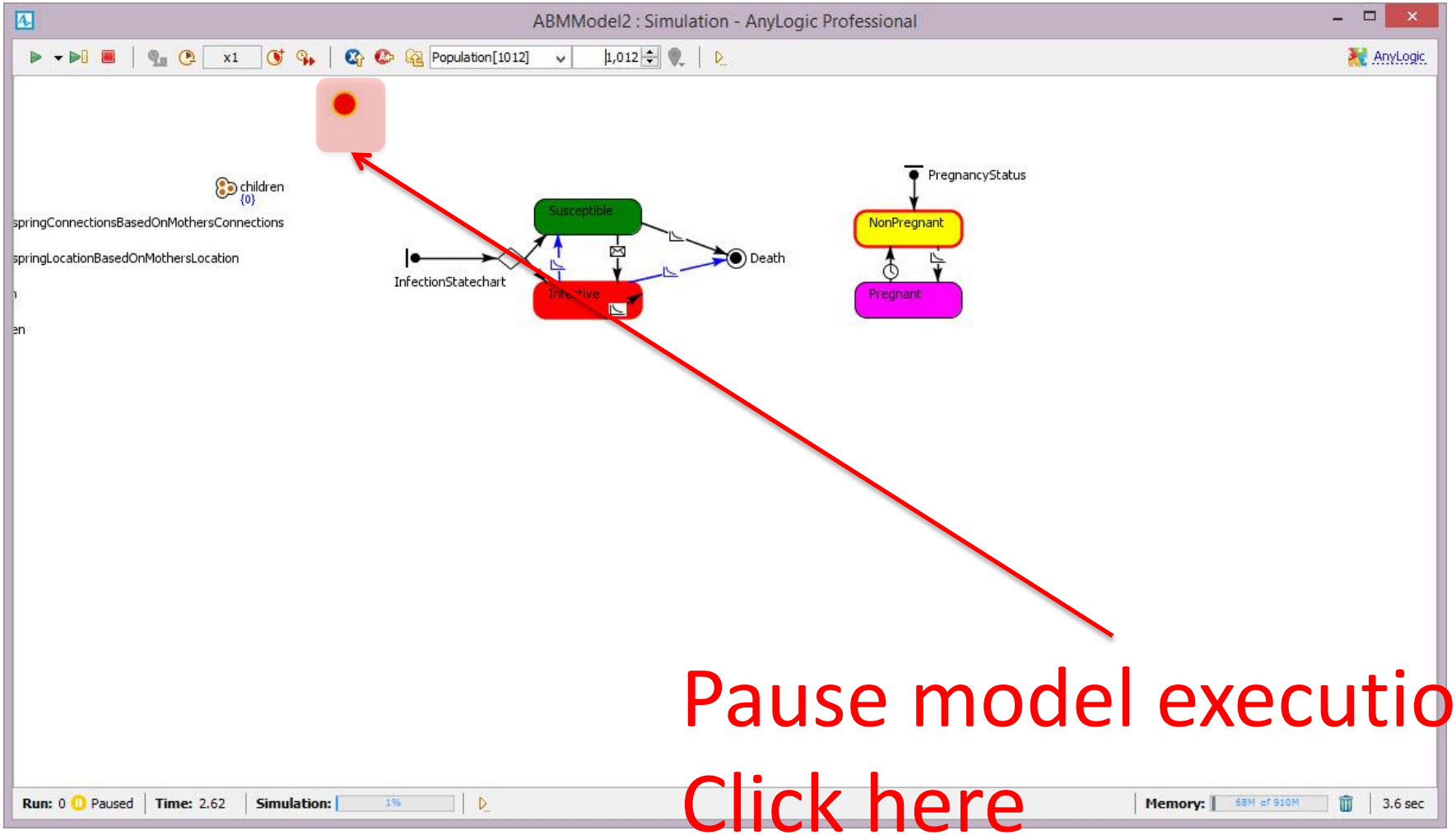
Person-Level View



Examining Contents of Collection



Examining Contents of Collection



Pause model execution

Click here

Custom Reporting

Properties | Progress | Console

anylogic config [Java Application] D:\Program Files\AnyLogic 7 Professional\jre\bin\javaw.exe (2014-04-11 4:23:11 PM)

```
Population member root.Population[696] has died.
Population member root.Population[385] has died.
Summary statistics for time 2.0Seniors and Children: 535
First Nations: 246
Senior Citizens: 260
Men: 594
Metis: 230
Women: 598
First Nations Females: 116
First Nations Males: 130
Children: 275
Metis Males: 105
Population member root.Population[170] has died.
A baby has been born!  Baby's id is root.Population[1209] while the mother is root.Population[498]
A baby has been born!  Baby's id is root.Population[1211] while the mother is root.Population[526]
Population member root.Population[620] has died.
A baby has been born!  Baby's id is root.Population[1213] while the mother is root.Population[440]
A baby has been born!  Baby's id is root.Population[1222] while the mother is root.Population[1086]
Population member root.Population[109] has died.
Population member root.Population[887] has died.
A baby has been born!  Baby's id is root.Population[1233] while the mother is root.Population[772]
Population member root.Population[1103] has died.
A baby has been born!  Baby's id is root.Population[1239] while the mother is root.Population[158]
Population member root.Population[0] has died.
Population member root.Population[1158] has died.
Population member root.Population[54] has died.
A baby has been born!  Baby's id is root.Population[1250] while the mother is root.Population[1141]
Population member root.Population[740] has died.
```

Logging

- *Logging* is the process of recording a record (trace) of events during program execution
  - *Recording can be made to a database, files, text console, etc.*
- Logging can be performed at a variety of levels of detail
- Log4j is one logging framework

Logging with Log4j

- Use of config files to configure
- Different levels of logger
  - TRACE, DEBUG, INFO, WARN, ERROR and FATAL
- A given logger can be associated with Multiple output streams
- Doing error uploads to a server
- Sending email (?)

```
public class Logger {

   // Creation & retrieval methods:
   public static Logger getRootLogger();
   public static Logger getLogger(String name);

   // printing methods:
   public void trace(Object message);
   public void debug(Object message);
   public void info(Object message);
   public void warn(Object message);
   public void error(Object message);
   public void fatal(Object message);

   // generic printing method:
   public void log(Level l, Object message);
}
```

Example use of Log4j

```
 // get a logger instance named "com.foo"
Logger  logger = Logger.getLogger("com.foo");

logger.warn("Low fuel level.");

   logger.info(“general information");
   // This request is disabled, because DEBUG < INFO.
logger.debug("Starting search for nearest gas
station.");
```

Config File

Here are example configuration files

```
# Set root logger level to DEBUG and its only appender to
A1.
log4j.rootLogger=DEBUG, A1

# A1 is set to be a ConsoleAppender.
log4j.appender.A1=org.apache.log4j.ConsoleAppender

# A1 uses PatternLayout.
log4j.appender.A1.layout=org.apache.log4j.PatternLayout
log4j.appender.A1.layout.ConversionPattern=%-4r [%t] %-5p
%c %x - %m%n
```

Config File: Suppressing Selective Information

```
log4j.rootLogger=DEBUG, A1
log4j.appender.A1=org.apache.log4j.ConsoleAppender
log4j.appender.A1.layout=org.apache.log4j.PatternLayout

# Print the date in ISO 8601 format
log4j.appender.A1.layout.ConversionPattern=%d [%t] %-5p
%c - %m%n

# Print only messages of level WARN or above in the
package com.foo.
log4j.logger.com.foo=WARN
```

Multiple Outputs

- log4j.rootLogger=debug, **stdout, R**
  log4j.appender.**stdout**=org.apache.log4j.ConsoleAppender
  log4j.appender.stdout.layout=org.apache.log4j.PatternLayout

- # Pattern to output the caller's file name and line number.
  log4j.appender.stdout.layout.ConversionPattern=%5p [%t] **(%F:%L)** - %m%n

- log4j.appender.**R**=org.apache.log4j.RollingFileAppender
  log4j.appender.R.File=example.log
  log4j.appender.R.MaxFileSize=**100KB**
- # Keep one backup file log4j.appender.R.MaxBackupIndex=1
  log4j.appender.R.layout=org.apache.log4j.PatternLayout
  log4j.appender.R.layout.ConversionPattern=%p %t %c - %m%n

Using the External Eclipse Debugger with AnyLogic

External Debugging in Eclipse

- The “Eclipse” editor is one of the most popular extant software development tools
- Eclipse offers plug-ins of many sorts
  - Debuggers
  - Profilers
  - Visualization tools
  - Version control of models
- Eclipse can be used to debug AnyLogic models at the Java source-code level

Overview: Setting up External Eclipse Debugging in AnyLogic

- In anylogic, Set the jvm options for socket based debugging (e.g. eclipse)
  - go to "Properties" on the "Simulation" to run for the anylogic model
  - Set the "Java Machine Arguments" as follows:

-Xdebug -Xnoagent -Djava.compiler=NONE -Xrunjdwp:transport=dt_socket,server=y,suspend=n,address=8321

- in eclipse, create a debug configuration
  - use "Remote Java Application”
    - no project
    - for "Connection Type", select "Standard (Socket Attach)”
    - for "Connection properties”, Use
      - Host: localhost
      - Port 8321

Steps Required for Eclipse Debugging

- One time set-up for a particular model
  - Set up AnyLogic to allow debugging connections
  - Set up Eclipse to know
    - How to connect to AnyLogic
    - Where to look for source code files
- Every time want to debug
  - Go to Eclipse
  - Tell debugger to connect to AnyLogic process
  - Interrupt process
  - Set breakpoints, etc.

One-Time Setup In AnyLogic

- -Xdebug -Xnoagent -Djava.compiler=NONE -Xrunjdwp:transport=dt_socket,server=y,suspend=n,address=8321
- These go under the "Advanced" tab of the simulation run to use

Setting up Debug Configurations

Debug - WenyiDecisionTree12_2010/trunk/treeinterfacev3/src/ca/usask/cs/Gui/UseExistingTreeGui.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Resume
Suspend
Terminate
Step Into
Step Over
Step Return
Run to Line
Use Step Filters Shift+F5

Run Ctrl+F11
Debug F11
Profile

Profile History
Profile As
Profile Configurations...

Run History
Run As
Run Configurations...

Debug History
Debug As
Debug Configurations...

Toggle Breakpoint Ctrl+Shift+B
Toggle Line Breakpoint
Toggle Method Breakpoint
Toggle Watchpoint
Skip All Breakpoints
Remove All Breakpoints
Add Java Exception Breakpoint...
Add Class Load Breakpoint...

All References...
All Instances... Ctrl+Shift+N
Watch
Inspect Ctrl+Shift+I
Display Ctrl+Shift+D
Execute Ctrl+U
Force Return Alt+Shift+F
Step Into Selection

External Tools

VensimSimulationController
logger
branchNumber
counter
curTime
decisionTreeStartTime
modelFileName

Main.java | LoadXML.java | InterfaceHandler.jav | CreateNewTreeGui.jav

Outline | Projects

ca.usask.cs.Gui
import declarations
> UseExistingTreeGui 90
BackListener
BuildPictureListener
FileChooserListener
serialVersionUID : long
backBotton : JButton
browseFile : JButton
interfaceHandler : InterfaceHandler
loadVensimUI : LoadVensimGui
runTreeBotton : JButton
specifyTree : JLabel
vensimName : String
xmlErrorMsg : JLabel
xmlLocaton : JTextField
UseExistingTreeGui(LoadVensimGui, InterfaceHa
contentPaneLayout() : void
initComponents() : void
setDefaultValue() : void

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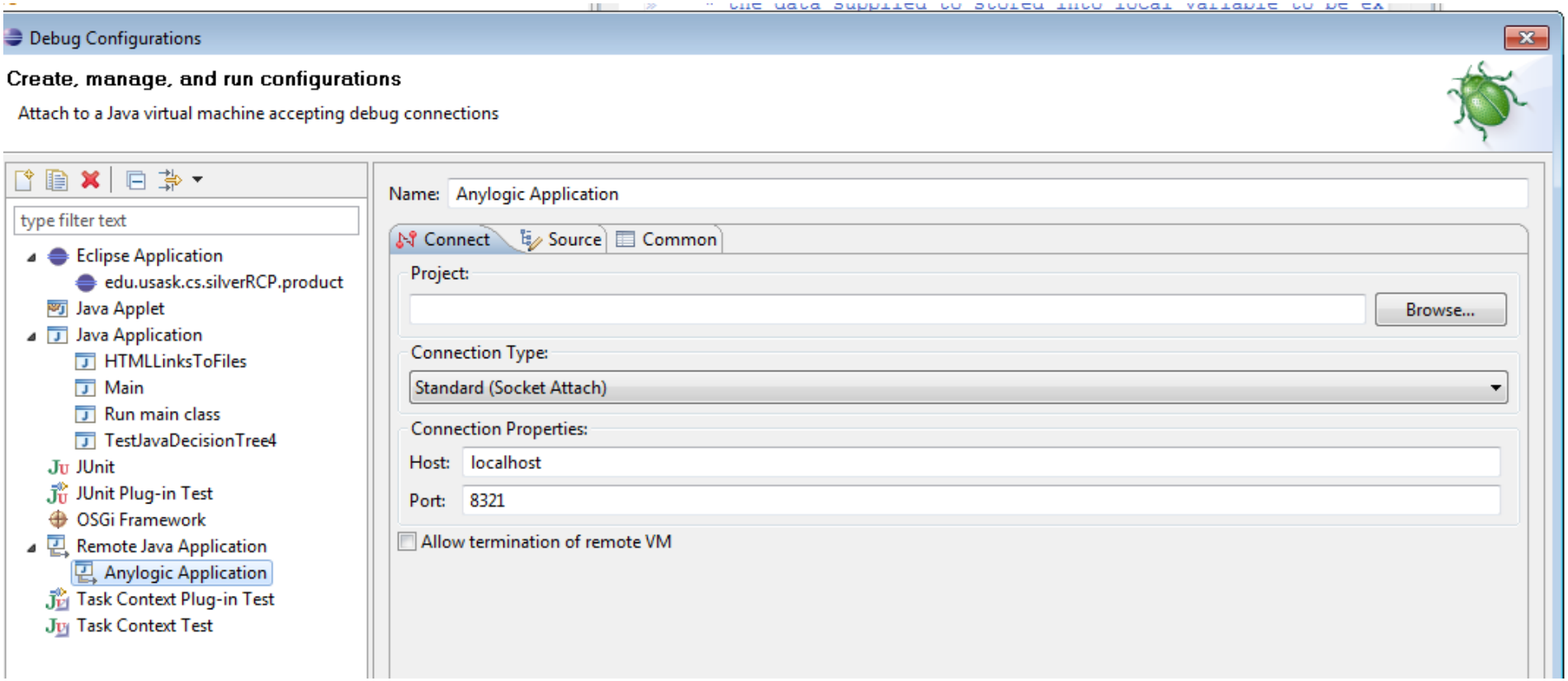
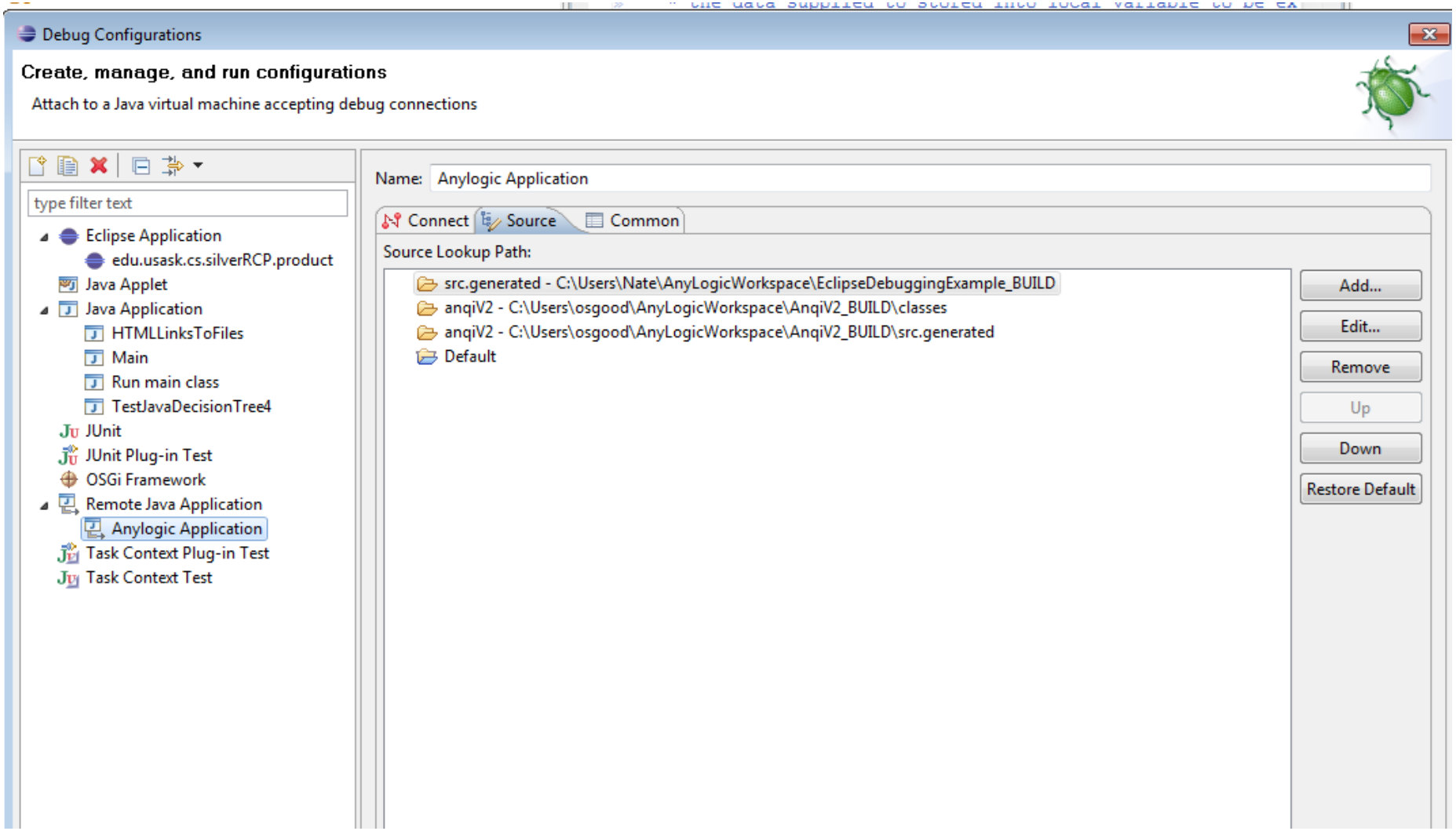
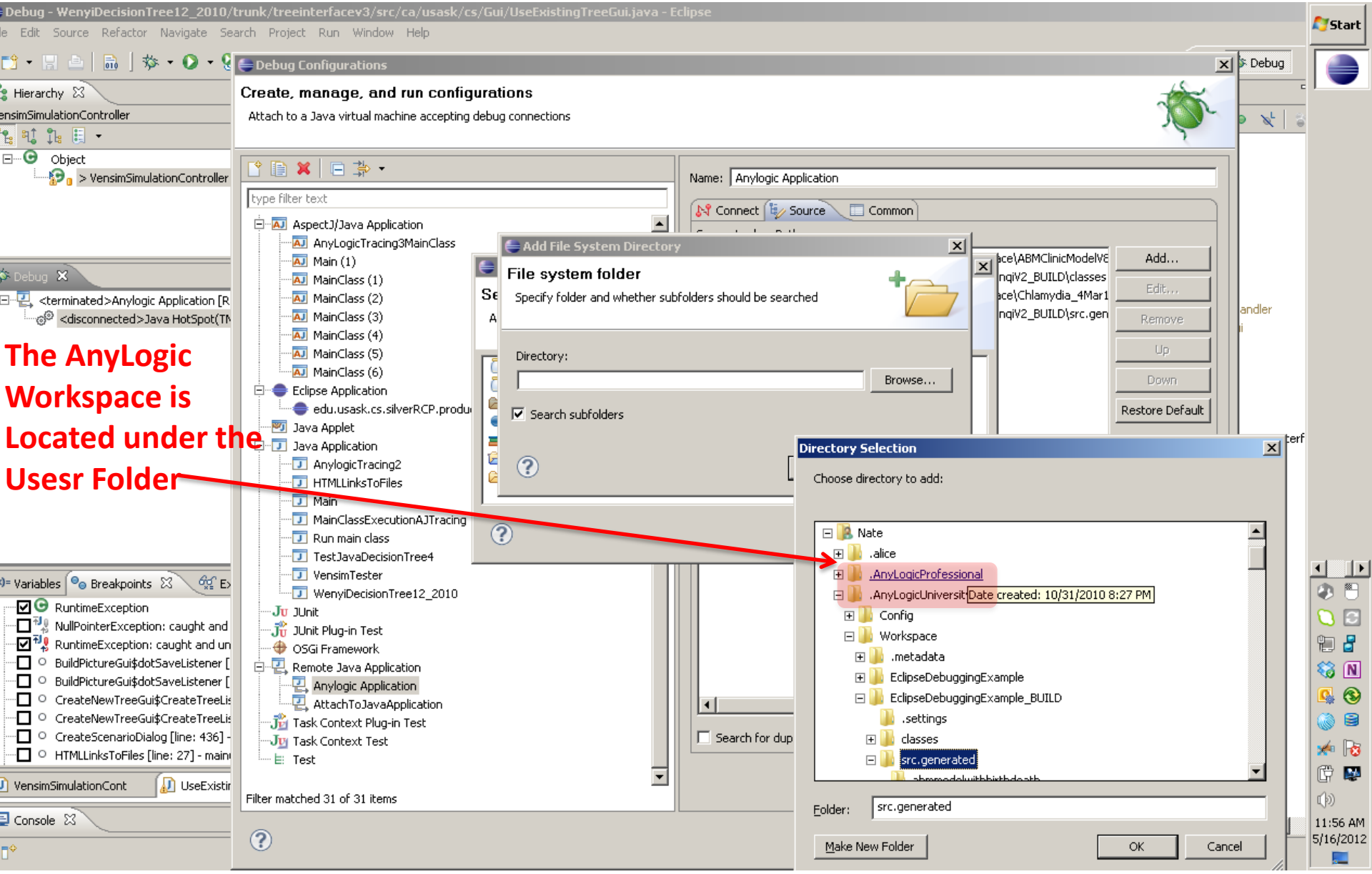
Set up: Creating a Debugging Configuration in Eclipse



Setting Up Source Code Folders



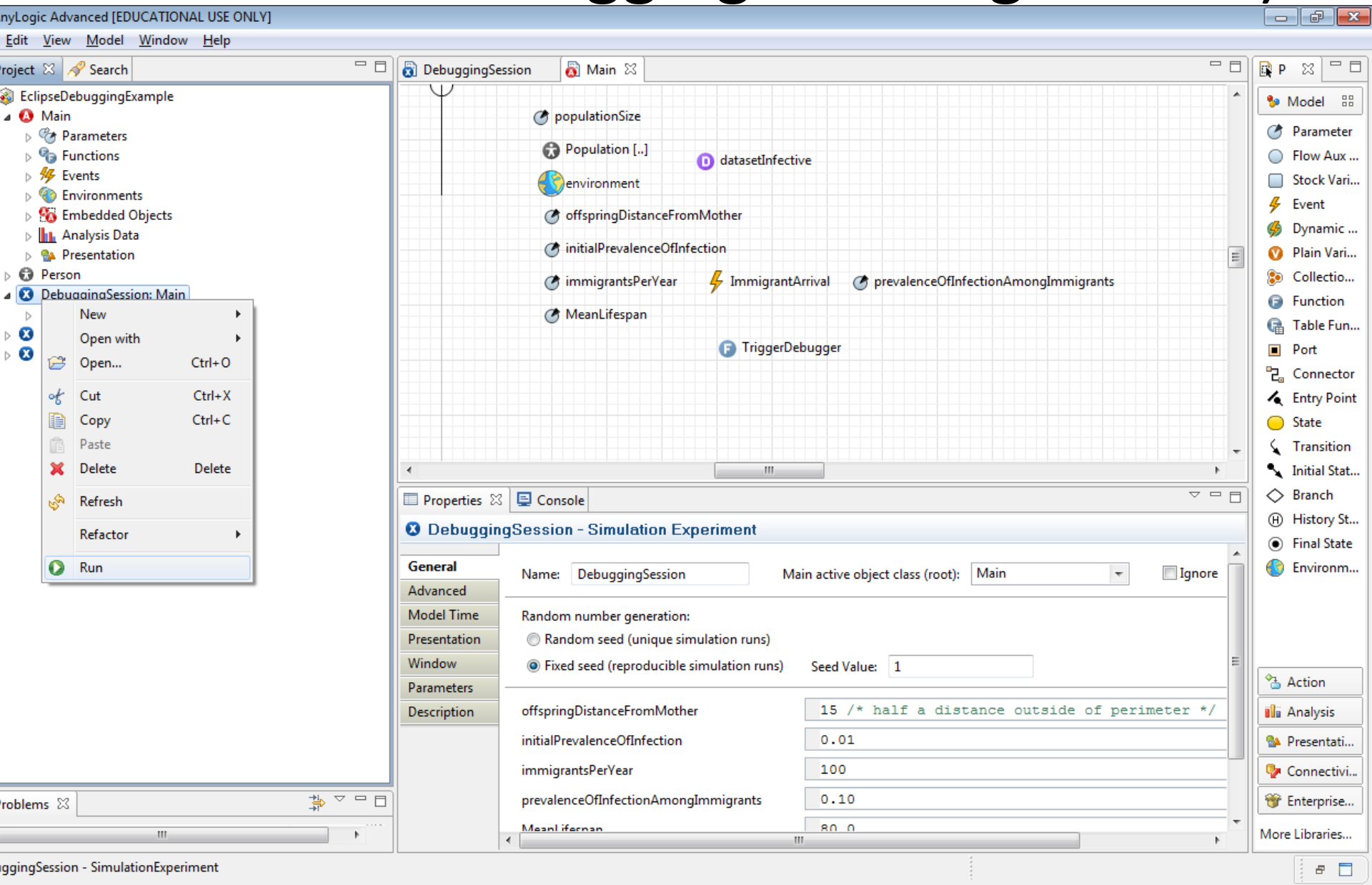
Add Source Folder



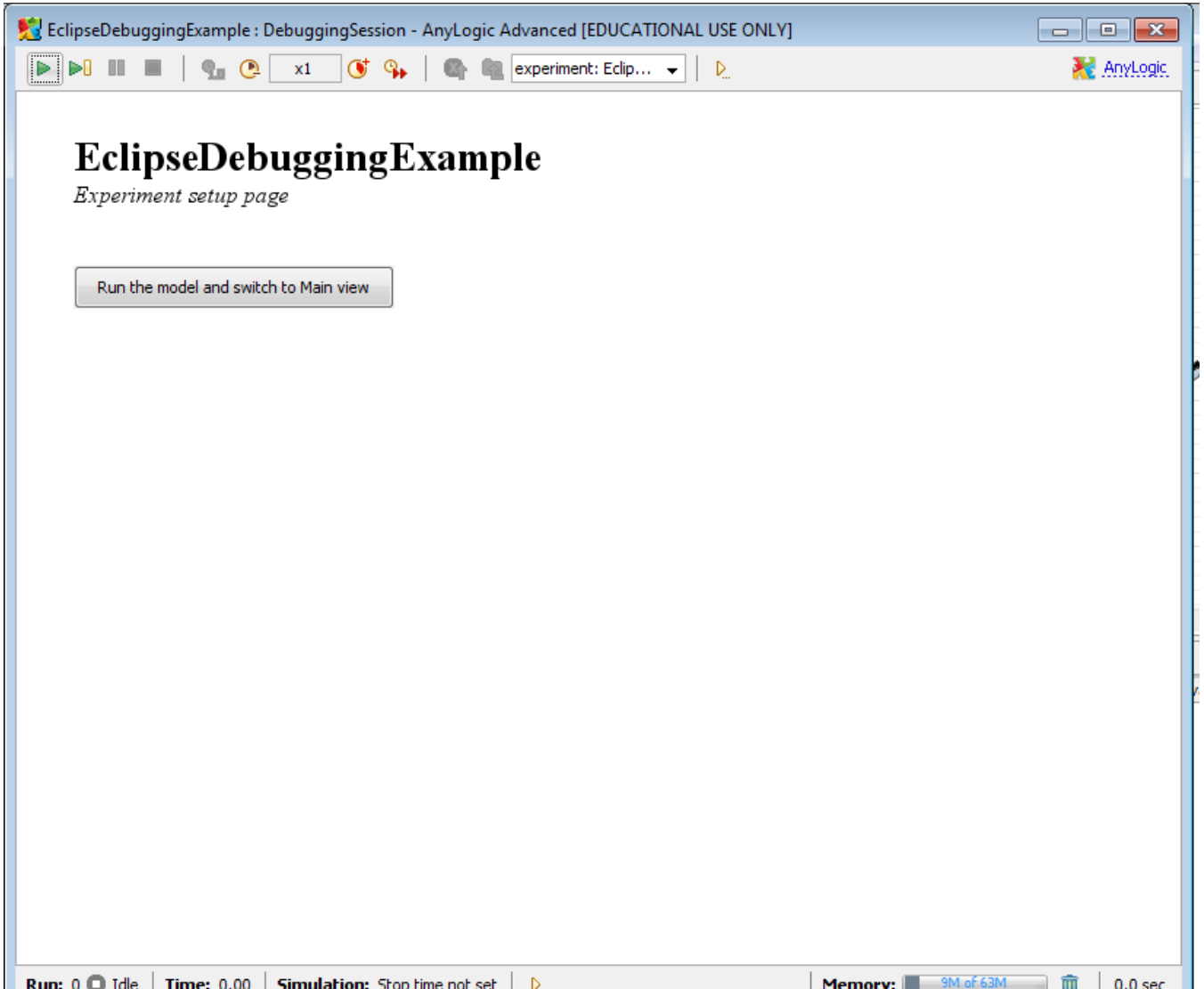
Once Set up, Can…

- Set breakpoints
- See the variables, with symbolic information
- Suggestions
  - Set a breakpoint on a thrown runtime exception (regardless of whether caught)
  - Throw a caught runtime exception from model startup code
  - When catch this in Eclipse, can then use to set breakpoints (including in other files)

Start AnyLogic Model (Experiment with Extra Debugging JVM Arguments)



Leave on Opening Screen for Now (So We can Set up Eclipse)



In Eclipse, Open “Debug” Perspective

Java - C:\Users\Nate\AnyLogicWorkspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Person.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Pac | Hie | Dec | Sea | De | Co

- AnylogicDebugProject
- AnyLogicTracing
  - src
    - (default package)
      - CTest.java
      - MainClass.java
        - MainClass
          - foo(int) : void
          - main(String[]) : void
      - MethodCalls.aj
  - JRE System Library [JavaSE-1.6]
  - AspectJ Runtime Library
  - AnyLogicTracing.jar
  - AnyLogicTracing1.jar
- AnyLogicTracing2
  - src
    - (default package)
      - CTest.java
      - DefaultTracingFilter.java
      - ITracingFilter.java
      - MainClass.java
      - MethodCallTracing1.aj
  - JRE System Library [JavaSE-1.6]
  - AspectJ Runtime Library
  - AnyLogicTracing2.jar
- AnyLogicTracing3
  - src
    - AnyLogicTracing3
      - DefaultTracingFilter.java
      - ITracingFilter.java
      - MainClass.java
      - MethodCallTracing2.aj
  - JRE System Library [JavaSE-1.6]
  - AspectJ Runtime Library
  - AnyLogicTracing3.jar

DefaultTracingFilter | Main.java | Person.java | 11

```
void PerformBirth( ) {

Person mother = this;
Person offspring = get_Main().add_Population((dou
traceln("A baby has been born! Baby's id is " +
// establish connections of infant
EstablishOffspringConnectionsBasedOnMothersConnec
// now position the baby to be close to the mothe
EstablishOffspringLocationBasedOnMothersLocation(

}

void EstablishOffspringConnectionsBasedOnMothers

// now establish links between the baby and all c

if (mother.getConnections() != null) // guard ag
    for (Agent a : mother.getConnections())
        {
        Person p = (Person) a;
        offspring.connectTo(p);
        }

// Finally, establish a link between the baby and
//  (we do this last so we don't have to worry th
//  the mother's connections is to this offspring
offspring.connectTo(this);


}
```

Outline | History | Call Hi

- new ShapeGroup() {...}
- CurrentAge() : double
- drawModelElements(Panel,
- enterState(short, boolean) : void
- EstablishOffspringConnectionsBasedOnMothersConnectior
- EstablishOffspringLocationBasedOnMothersLocation(Perso
- evaluateRateOf(TransitionRate) : double
- evaluateTimeoutOf(TransitionTimeout) : double
- executeActionOf(Statechart) : void
- executeActionOf(TransitionMessage, Object) : void
- executeActionOf(TransitionRate) : void
- executeActionOf(TransitionTimeout) : void
- exitState(short, Transition, boolean, Statechart) : void
- FertilityRateAgeSexEthnicity(double, Sex, Ethnicity) : double
- FinalizeDeath() : void
- get_Main() : Main
- getNameOf(Statechart) : String
- getNameOf(TransitionMessage) : String
- getNameOf(TransitionRate) : String

Java

- Aspect Visualization
- Debug
- Java Browsing
- Other...

Problems | Cross References

841 errors, 281 warnings, 0 others (Filter matched 200 of 1122 items)

Description	Resource
Errors (100 of 841 items)	
ClassMatcher cannot be resolved to a type	GUIPrimePath...
ClassMatcher cannot be resolved to a type	GridPanel_Inte...
ClassMatcher cannot be resolved to a type	GridPanel_Inte...
ClassMatcher cannot be resolved to a type	SandboxMain...
ClassMatcher cannot be resolved to a type	SandboxMain...
ClassMatcher cannot be resolved to a type	ValidationTest...
ClassMatcher cannot be resolved to a type	ValidationTest...
ComponentNotFoundException cannot be re	AddArtifactGU...
ComponentNotFoundException cannot be re	AddArtifactGU...

Writable | Smart Insert | 520 : 1 | Build Project

Start Debugger

Debug - WenyiDecisionTree12_2010/trunk/treeinterfacev3/src/ca/usask/cs/Gui/UseExistingTreeGui.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

1 Anylogic Application
2 AnylogicTracing2
3 VensimTester
4 WenyiDecisionTree12_2010
5 AnyLogicTracing3MainClass
6 MainClass (6)
7 MainClass (5)
8 MainClass (4)
9 MainClass (3)
MainClass (2)
edu.usask.cs.silverRCP.product
MainClassExecutionAJTracing

Debug As
Debug Configurations...
Organize Favorites...

Hierarchy
VensimSimulationController
Object
> VensimSi

VensimSimulationController
logger
branchNumber
counter
curTime
decisionTreeStartTime
modelFileName

Debug
<terminated>Anylo
<disconnected
st:8321]

Variables Breakpoints Expressions
RuntimeException
NullPointerException: caught and uncaught
RuntimeException: caught and uncaught
BuildPictureGui$dotSaveListener [line: 207] - actionPerformed(ActionEvent)
BuildPictureGui$dotSaveListener [line: 264] - checkXML()
CreateNewTreeGui$CreateTreeListener [line: 1054] - actionPerformed(ActionEvent)
CreateNewTreeGui$CreateTreeListener [line: 1055] - actionPerformed(ActionEvent)
CreateScenarioDialog [line: 436] - new Anonymous
HTMLLinksToFiles [line: 27] - main(String[])

VensimSimulationCont | UseExistingTreeGui.j | Main.java | LoadXML.java | InterfaceHandler.jav | CreateNewTreeGui.jav | 17

Console

Outline Projects
ca.usask.cs.Gui
import declarations
> UseExistingTreeGui 90
BackListener
BuildPictureListener
FileChooserListener
serialVersionUID : long
backBotton : JButton
browseFile : JButton
interfaceHandler : InterfaceHandler
loadVensimUI : LoadVensimGui
runTreeBotton : JButton
specifyTree : JLabel
vensimName : String
xmlErrorMsg : JLabel
xmlLocaton : JTextField
UseExistingTreeGui(LoadVensimGui, Interf
contentPaneLayout() : void
initComponents() : void
setDefaultValue() : void

Writable Smart Insert 209 : 9

Start
Debug
11:58 AM
5/16/2012

Following Connection

Debug - WenyiDecisionTree12_2010/trunk/treeinterfacev3/src/ca/usask/cs/Gui/UseExistingTreeGui.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Hierarchy

VensimSimulationController

Object
> VensimSimulationController 48

VensimSimulationController
logger
branchNumber
counter
curTime
decisionTreeStartTime
modelFileName

Debug

Anylogic Application [Remote Java Application]
Java HotSpot(TM) 64-Bit Server VM[localhost:8321]
Daemon Thread [AnyLogic presentation frame manager] (Running)
Thread [DestroyJavaVM] (Running)
Thread [AnyLogic simulation performance monitor] (Running)
Thread [AWT-EventQueue-0] (Running)
Daemon Thread [AWT-Windows] (Running)
Thread [AWT-Shutdown] (Running)

Variables Breakpoints Expressions

RuntimeException
NullPointerException: caught and uncaught
RuntimeException: caught and uncaught
BuildPictureGui$dotSaveListener [line: 207] - actionPerformed(ActionEvent)
BuildPictureGui$dotSaveListener [line: 264] - checkXML()
CreateNewTreeGui$CreateTreeListener [line: 1054] - actionPerformed(ActionEvent)
CreateNewTreeGui$CreateTreeListener [line: 1055] - actionPerformed(ActionEvent)
CreateScenarioDialog [line: 436] - new Anonymous
HTMLLinksToFiles [line: 27] - main(String[])

VensimSimulationCont | UseExistingTreeGui.j | Main.java | LoadXML.java | InterfaceHandler.jav | CreateNewTreeGui.jav

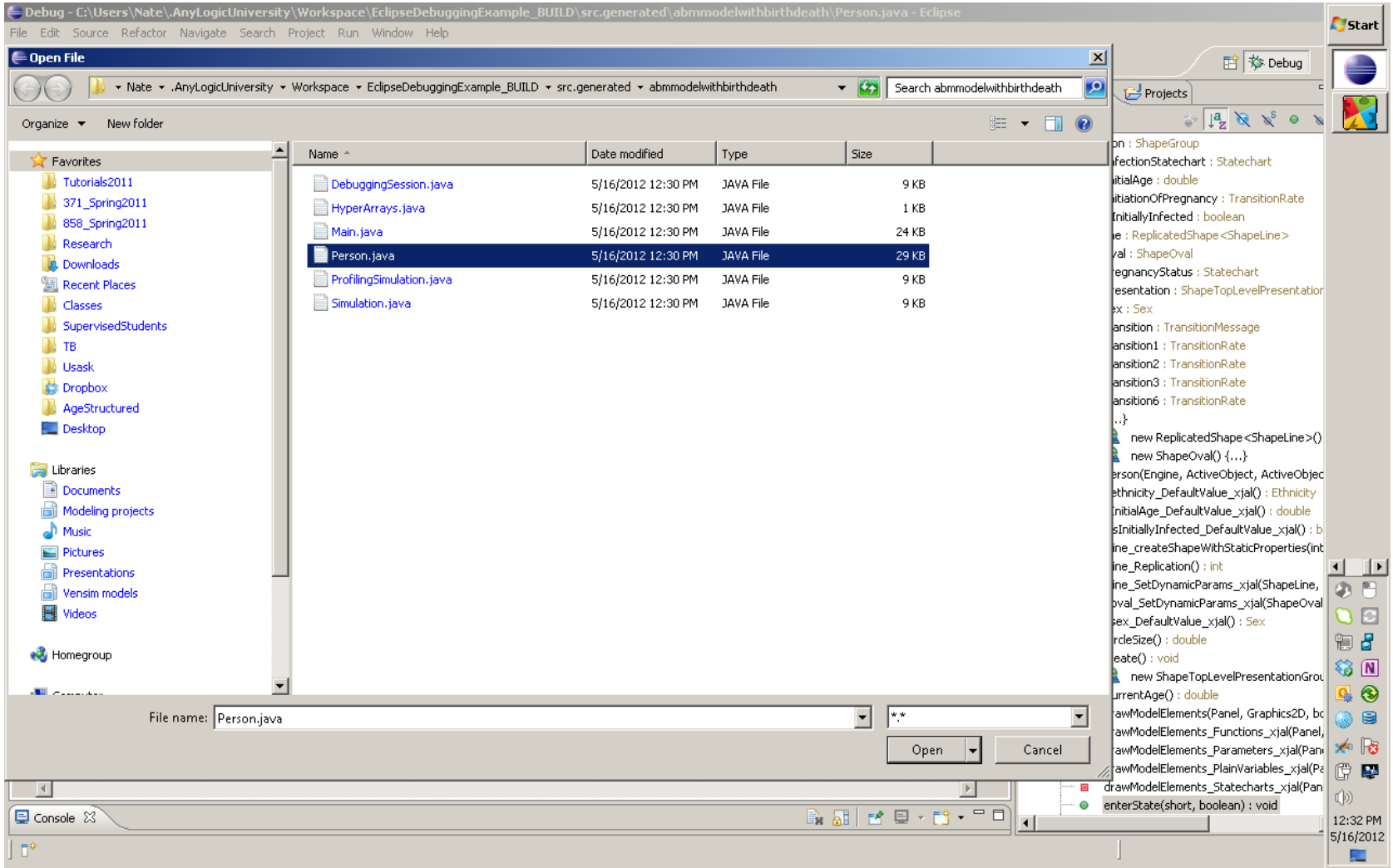
Console

Outline Projects

ca.usask.cs.Gui
import declarations
> UseExistingTreeGui 90
BackListener
BuildPictureListener
FileChooserListener
serialVersionUID : long
backBotton : JButton
browseFile : JButton
interfaceHandler : InterfaceHandler
loadVensimUI : LoadVensimGui
runTreeBotton : JButton
specifyTree : JLabel
vensimName : String
xmlErrorMsg : JLabel
xmlLocaton : JTextField
UseExistingTreeGui(LoadVensimGui, InterfaceHa
contentPaneLayout() : void
initComponents() : void
setDefaultValue() : void

Writable | Smart Insert | 209 : 9

Open Up Java Files from the Workspace Folder for this Project to Inspect Source & Set Breakpoints



Now Can Set Breakpoints in Main.java or Elsewhere (Here: Person.java)

Debug - C:\Users\Nate\.AnyLogicUniversity\Workspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Person.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

- Anylogic Application [Remote Java Application]
  - Java HotSpot(TM) 64-Bit Server VM[localhost:8321]
    - Daemon Thread [AnyLogic presentation frame manager] (Running)
    - Thread [DestroyJavaVM] (Running)
    - Thread [AnyLogic simulation performance monitor] (Running)
    - Thread [AWT-EventQueue-0] (Running)

Variables | Breakpoints | Expressions

- VensimSimulationController [line: 397] - resetGame(double, String)
- VensimTester [line: 80] - TestRun(int, File, File)
- XMLController [line: 247] - writeBasicDecisionTree(Element)
- XMLController [line: 355] - writeTreeNode(Element, TreeNode)
- Main [entry] - IsClinicOpen()
- Main [entry] - internPopulationAsSet()
- [x] Person [entry] - PerformBirth()

Person.java | Main.java

Double-click in dappled/stippled area on line Where want to stop execution

```
}
void
PerformBirth( ) {

Person mother = this;
Person offspring = get_Main().add_Population((double) 0, ethnicity, RandomSex(), this.IsInfected());
traceln("A baby has been born! Baby's id is " + offspring + " while the mother is " + this);
// establish connections of infant
EstablishOffspringConnectionsBasedOnMothersConnections(offspring, mother);
// now position the baby to be close to the mother (otherwise leads to stretching of mother's connections acr
EstablishOffspringLocationBasedOnMothersLocation(offspring, mother);
}
```

Console

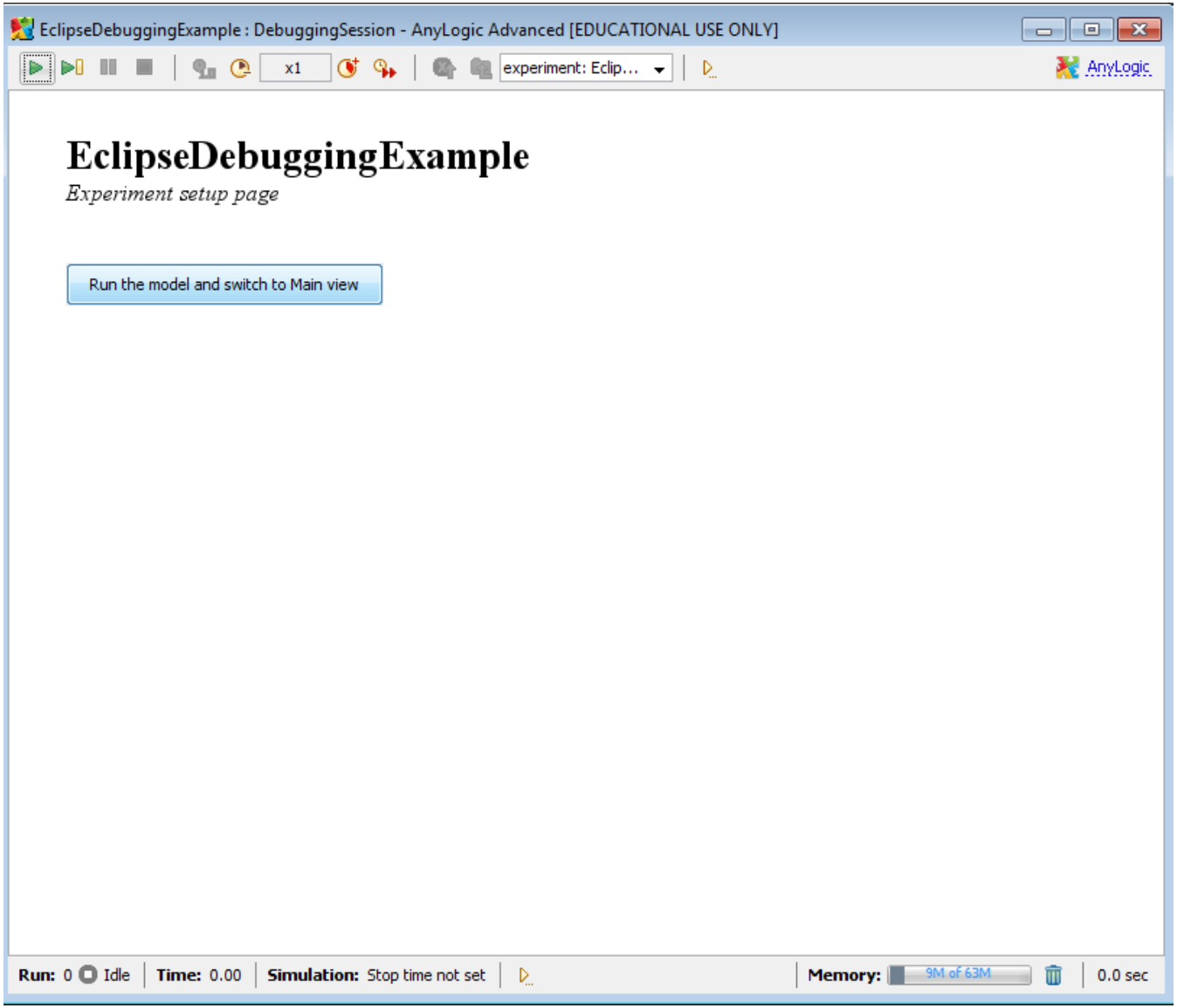
Outline | Projects

- drawModelElements_PlainVariables_xjal(Pa
- drawModelElements_Statecharts_xjal(Pan
- enterState(short, boolean) : void
- EstablishOffspringConnectionsBasedOnMo
- EstablishOffspringLocationBasedOnMother
- evaluateRateOf(TransitionRate) : double
- evaluateTimeoutOf(TransitionTimeout) : d
- executeActionOf(Statechart) : void
- executeActionOf(TransitionMessage, Obje
- executeActionOf(TransitionRate) : void
- executeActionOf(TransitionTimeout) : voic
- exitState(short, Transition, boolean, State
- FertilityRateAgeSexEthnicity(double, Sex,
- FinalizeDeath() : void
- get_Main() : Main
- getNameOf(Statechart) : String
- getNameOf(TransitionMessage) : String
- getNameOf(TransitionRate) : String
- getNameOf(TransitionTimeout) : String
- getNameOfState(short) : String
- getPersistentShape(int) : Object
- getStatechartOf(TransitionMessage) : Sta
- getStatechartOf(TransitionRate) : Statech
- getStatechartOf(TransitionTimeout) : Stat
- IsInfected() : boolean
- isInReproductiveYears(double) : boolean
- onChange() : void
- onChange_ethnicity() : void
- onChange_InitialAge() : void
- onChange_isInitiallyInfected() : void
- onChange_sex() : void
- onClickModelAt(Panel, double, double, int,
- onClickModelAt_Parameters_xjal(Panel, dc
- onClickModelAt_PlainVariables_xjal(Panel,
- onDestroy() : void
- onReceive(Object, AgentContinuous2D) :
- PerformBirth() : void

Read-Only | Smart Insert | 525 : 1

Start | Debug | 12:52 PM 5/16/2012

Return to AnyLogic & Start Simulation via Button Push



When Breakpoint is Hit, Will See Reach Point

Debug - C:\Users\Nate\.AnyLogicUniversity\Workspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Person.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

Daemon Thread [AnyLogic model execution thread] (Suspended (entry into method PerformBirth in Person))
- Person.PerformBirth() line: 526
- Person.executeActionOf(TransitionTimeout) line: 335
- TransitionTimeout.execute() line: not available
- Engine.n() line: not available
- Engine.a(Engine) line: not available

Variables | Breakpoints | Expressions

- VensimSimulationController [line: 397] - resetGame(double, String)
- VensimTester [line: 80] - TestRun(int, File, File)
- XMLController [line: 247] - writeBasicDecisionTree(Element)
- XMLController [line: 355] - writeTreeNode(Element, TreeNode)
- Main [entry] - IsClinicOpen()
- Main [entry] - internPopulationAsSet()
- Person [entry] - PerformBirth()

Person.java | Main.java

```
void
 PerformBirth( ) {

Person mother = this;
Person offspring = get_Main().add_Population((double) 0, ethnicity, RandomSex(), this.IsInfected());
traceln("A baby has been born! Baby's id is " + offspring + " while the mother is " + this);
// establish connections of infant
EstablishOffspringConnectionsBasedOnMothersConnections(offspring, mother);
// now position the baby to be close to the mother (otherwise leads to stretching of mother's connections acr
EstablishOffspringLocationBasedOnMothersLocation(offspring, mother);
 }

void
```

Console

Outline | Projects

- drawModelElements_PlainVariables_xjal(Pa
- drawModelElements_Statecharts_xjal(Pan
- enterState(short, boolean) : void
- EstablishOffspringConnectionsBasedOnMo
- EstablishOffspringLocationBasedOnMother
- evaluateRateOf(TransitionRate) : double
- evaluateTimeoutOf(TransitionTimeout) : d
- executeActionOf(Statechart) : void
- executeActionOf(TransitionMessage, Obje
- executeActionOf(TransitionRate) : void
- executeActionOf(TransitionTimeout) : voic
- exitState(short, Transition, boolean, State
- FertilityRateAgeSexEthnicity(double, Sex,
- FinalizeDeath() : void
- get_Main() : Main
- getNameOf(Statechart) : String
- getNameOf(TransitionMessage) : String
- getNameOf(TransitionRate) : String
- getNameOf(TransitionTimeout) : String
- getNameOfState(short) : String
- getPersistentShape(int) : Object
- getStatechartOf(TransitionMessage) : Sta
- getStatechartOf(TransitionRate) : Statech
- getStatechartOf(TransitionTimeout) : Stat
- IsInfected() : boolean
- isInReproductiveYears(double) : boolean
- onChange() : void
- onChange_ethnicity() : void
- onChange_InitialAge() : void
- onChange_isInitiallyInfected() : void
- onChange_sex() : void
- onClickModelAt(Panel, double, double, int,
- onClickModelAt_Parameters_xjal(Panel, dc
- onClickModelAt_PlainVariables_xjal(Panel,
- onDestroy() : void
- onReceive(Object, AgentContinuous2D) :
- PerformBirth() : void

Start

12:52 PM
5/16/2012

Read-Only | Smart Insert | 526 : 1

Can Single Step, Explore & Modify Variable Contents, etc.

Debug - C:\Users\Nate\.AnyLogicUniversity\Workspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Person.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

Thread [AWT-Shutdown] (Running)
Daemon Thread [AnyLogic model execution thread] (Suspended)
Person.PerformBirth() line: 527
Person.executeActionOf(TransitionTimeout) line: 335
TransitionTimeout.execute() line: not available

Variables | Breakpoints | Expressions

Name	Value
this	Person (id=45)
mother	Person (id=45)
a	Engine (id=47)
a	EnvironmentContinuous2D (id=56)
appearanceTime	0.0
b	Main (id=60)
b	LinkedList<E> (id=61)
c	null
circlesize	10.0
color	Color (id=72)
d	Main$_Population_Class (id=76)
d	66.6360863667524
Delivery	TransitionTimeout (id=46)
e	null
e	239.18606932080488
ethnicity	Person$Ethnicity (id=82)

Person.java | Main.java

```
void
 PerformBirth( ) {

Person mother = this;
Person offspring = get_Main().add_Population((double) 0, ethnicity, RandomSex(), this.IsInfected());
traceln("A baby has been born! Baby's id is " + offspring + " while the mother is " + this);
// establish connections of infant
EstablishOffspringConnectionsBasedOnMothersConnections(offspring, mother);
```

Console

Outline | Projects

drawModelElements_PlainVariables_xjal(Pa
drawModelElements_Statecharts_xjal(Pan
enterState(short, boolean) : void
EstablishOffspringConnectionsBasedOnMo
EstablishOffspringLocationBasedOnMother
evaluateRateOf(TransitionRate) : double
evaluateTimeoutOf(TransitionTimeout) : d
executeActionOf(Statechart) : void
executeActionOf(TransitionMessage, Obje
executeActionOf(TransitionRate) : void
executeActionOf(TransitionTimeout) : voic
exitState(short, Transition, boolean, State
FertilityRateAgeSexEthnicity(double, Sex,
FinalizeDeath() : void
get_Main() : Main
getNameOf(Statechart) : String
getNameOf(TransitionMessage) : String
getNameOf(TransitionRate) : String
getNameOf(TransitionTimeout) : String
getNameOfState(short) : String
getPersistentShape(int) : Object
getStatechartOf(TransitionMessage) : Sta
getStatechartOf(TransitionRate) : Statech
getStatechartOf(TransitionTimeout) : Stat
IsInfected() : boolean
isInReproductiveYears(double) : boolean
onChange() : void
onChange_ethnicity() : void
onChange_InitialAge() : void
onChange_isInitiallyInfected() : void
onChange_sex() : void
onClickModelAt(Panel, double, double, int,
onClickModelAt_Parameters_xjal(Panel, do
onClickModelAt_PlainVariables_xjal(Panel,
onDestroy() : void
onReceive(Object, AgentContinuous2D) :
PerformBirth() : void

Read-Only | Smart Insert | 527 : 1

Start

12:54 PM
5/16/2012

Warning: Breakpoints are Not Shown in Source Window – Just in “Breakpoints” area

Press “Resume” to Continue – Awaiting a Breakpoint

Debug - C:\Users\Nate\AnyLogicWorkspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Person.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

Resume (F8)

Java HotSpot(TM) Client VM[localhost:8321]
- Thread [DestroyJavaVM] (Running)
- Daemon Thread [AnyLogic presentation frame manager] (Running)
- Thread [AnyLogic simulation performance monitor] (Running)
- Thread [AWT-EventQueue-0] (Running)
- Thread [AWT-Shutdown] (Running)
- Daemon Thread [AWT-Windows] (Running)
- Daemon Thread [AnyLogic ShapeControl action handler] (Suspended (exception RuntimeException))
  - Main.TriggerDebugger() line: 441

Variables | Breakpoints | Expressions

- Main [line: 73] - Main
- Main [line: 76] - Main
- Main [line: 323] - Main
- Main [line: 345] - Main
- Main [line: 2421] - Main
- MainClass [line: 12] - main(String[])
- Person [line: 518] - Person
- Person [line: 520] - Person

MainClass.java | DefaultTracingFilter | MainClass.java | DefaultTracingFilter | Person.java | Main.java

```
void PerformBirth() {

Person mother = this;
Person offspring = get_Main().add_Population((double) 0, ethnicity, RandomSex(), this.IsInfected());
traceln("A baby has been born! Baby's id is " + offspring + " while the mother is " + this);
// establish connections of infant
EstablishOffspringConnectionsBasedOnMothersConnections(offspring, mother);
// now position the baby to be close to the mother (otherwise leads to stretching of mother's connections ac
EstablishOffspringLocationBasedOnMothersLocation(offspring, mother);

}
```

Outline

- new ShapeGroup() {...}
- CurrentAge() : double
- drawModelElements(Panel, Graphics2D,
- enterState(short, boolean) : void
- EstablishOffspringConnectionsBasedOnI
- EstablishOffspringLocationBasedOnMotl
- evaluateRateOf(TransitionRate) : double
- evaluateTimeoutOf(TransitionTimeout) :
- executeActionOf(Statechart) : void
- executeActionOf(TransitionMessage, Ob
- executeActionOf(TransitionRate) : void
- executeActionOf(TransitionTimeout) : vc
- exitState(short, Transition, boolean, State
- FertilityRateAgeSexEthnicity(double, Sex,
- FinalizeDeath() : void
- get_Main() : Main
- getNameOf(Statechart) : String
- getNameOf(TransitionMessage) : String
- getNameOf(TransitionRate) : String
- getNameOf(TransitionTimeout) : String
- getNameOfState(short) : String
- getPersistentShape(int) : Object
- getStatechartOf(TransitionMessage) : Sta
- getStatechartOf(TransitionRate) : Statech
- getStatechartOf(TransitionTimeout) : Sta
- IsInfected() : boolean
- isInReproductiveYears(double) : boolean
- onChange() : void
- onChange_ethnicity() : void
- onChange_InitialAge() : void
- onChange_isInitiallyInfected() : void
- onChange_sex() : void
- onClickModelAt(Panel, double, double, i
- onDestroy() : void
- onReceive(Object, Agent) : void
- PerformBirth() : void

Writable | Smart Insert | 516 : 1 | Build Project

Example Breakpoint in Main

Debug - C:\Users\Nate\AnyLogicWorkspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Main.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

- Thread [AWT-Shutdown] (Running)
- Daemon Thread [AWT-Windows] (Running)
- Daemon Thread [AnyLogic model execution thread] (Suspended (breakpoint at line 345 in Main))
  - Main.add_Population(double, Person$Ethnicity, Person$Sex, boolean) line: 345
  - Main.executeActionOf(EventRate) line: 289
  - EventRate.execute() line: not available
  - Engine.h() line: not available
  - Engine.a(Engine) line: not available
  - Engine$a.run() line: not available

Variables | Breakpoints | Expressions

- Main [line: 73] - Main
- Main [line: 76] - Main
- Main [line: 323] - Main
- Main [line: 345] - Main
- Main [line: 2421] - Main
- MainClass [line: 12] - main(String[])
- Person [line: 518] - Person
- Person [line: 520] - Person

MainClass.java | DefaultTracingFilter | MainClass.java | DefaultTracingFilter | Person.java | Main.java

```
 * @return newly created embedded object
 */
public Person add_Population( double InitialAge, Person.Ethnicity ethnicity, Person.Sex sex, boolean isInit
    int index = Population.size();
    Person object = instantiate_Population_xjal( index );
    // setup parameters:
    object.InitialAge = InitialAge;
    object.ethnicity = ethnicity;
    object.sex = sex;
    object.isInitiallyInfected = isInitiallyInfected;
    // finish embedded object creation
    create_Population_xjal( object, index );
    object.start();
    return object;
}
```

Outline

- add_Population(double, Ethnicity, Sex, b
- create() : void
- create_Population_xjal(Person, int) : void
- drawModelElements(Panel, Graphics2D,
- evaluateRateOf(EventRate) : double
- evaluateTimeoutOf(EventTimeout) : dou
- executeActionOf(EventRate) : void
- executeActionOf(EventTimeout) : void
- getEmbeddedObjects() : List<Object>
- getFirstOccurrenceTime(EventTimeout)
- getModeOf(EventTimeout) : int
- getNameOf(ActiveObject) : String
- getNameOf(ActiveObjectCollection<?>)
- getNameOf(EventRate) : String
- getNameOf(EventTimeout) : String
- getNameOfShape(int) : String
- getPersistentShape(int) : Object
- getShapeEmbeddedObject(int) : Object
- getShapeReplication(int) : int
- getShapeType(int) : int
- getShapeX(int, int) : double
- getShapeY(int, int) : double
- instantiate_Population_xjal(int) : Person
- onChange() : void
- onChange_immigrantsPerYear() : void
- onChange_initialPrevalenceOfInfection()
- onChange_MeanLifespan() : void
- onChange_offspringDistanceFromMothe
- onChange_populationSize() : void
- onChange_prevalenceOfInfectionAmon
- onClickModelAt(Panel, double, double, i
- onDestroy() : void
- onStartup() : void
- remove_Population(Person) : boolean
- set_immigrantsPerYear(double) : void
- set_initialPrevalenceOfInfection(double)

Build Project

Example Breakpoint in Person

Debug - C:\Users\Nate\AnyLogicWorkspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Person.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

Thread [AWT-Shutdown] (Running)
Daemon Thread [AWT-Windows] (Running)
Daemon Thread [AnyLogic model execution thread] (Suspended (breakpoint at line 518 in Person))
Person.PerformBirth() line: 518
Person.executeActionOf(TransitionTimeout) line: 333
TransitionTimeout.execute() line: not available
Engine.h() line: not available
Engine.a(Engine) line: not available
Engine$a.run() line: not available

Variables | Breakpoints | Expressions

Main [line: 73] - Main
Main [line: 76] - Main
Main [line: 323] - Main
Main [line: 2421] - Main
MainClass [line: 12] - main(String[])
Person [line: 518] - Person
Person [line: 520] - Person
PodSchedule [line: 293] - PodSchedule

MainClass.java | DefaultTracingFilter | MainClass.java | DefaultTracingFilter | Person.java | Person.java

```
void PerformBirth() {
Person mother = this;
Person offspring = get_Main().add_Population((double) 0, ethnicity, RandomSex(), this.IsInfected());
traceln("A baby has been born! Baby's id is " + offspring + " while the mother is " + this);
// establish connections of infant
EstablishOffspringConnectionsBasedOnMothersConnections(offspring, mother);
// now position the baby to be close to the mother (otherwise leads to stretching of mother's connections ac
EstablishOffspringLocationBasedOnMothersLocation(offspring, mother);
}

void EstablishOffspringConnectionsBasedOnMothersConnections( Person offspring, Person mother ) {
```

Outline

new ShapeGroup() {...}
CurrentAge() : double
drawModelElements(Panel, Graphics2
enterState(short, boolean) : void
EstablishOffspringConnectionsBasedC
EstablishOffspringLocationBasedOnM
evaluateRateOf(TransitionRate) : doub
evaluateTimeoutOf(TransitionTimeou
executeActionOf(Statechart) : void
executeActionOf(TransitionMessage,
executeActionOf(TransitionRate) : voi
executeActionOf(TransitionTimeout) :
exitState(short, Transition, boolean, St
FertilityRateAgeSexEthnicity(double, S
FinalizeDeath() : void
get_Main() : Main
getNameOf(Statechart) : String
getNameOf(TransitionMessage) : Strin
getNameOf(TransitionRate) : String
getNameOf(TransitionTimeout) : Strin
getNameOfState(short) : String
getPersistentShape(int) : Object
getStatechartOf(TransitionMessage) :
getStatechartOf(TransitionRate) : State
getStatechartOf(TransitionTimeout) :
IsInfected() : boolean
isInReproductiveYears(double) : boole
onChange() : void
onChange_ethnicity() : void
onChange_InitialAge() : void
onChange_isInitiallyInfected() : void
onChange_sex() : void
onClickModelAt(Panel, double, doubl
onDestroy() : void
onReceive(Object, Agent) : void
PerformBirth() : void

Build Project

Once at Breakpoint, Can Look at Variables, Single Step, etc.

Debug - C:\Users\Nate\AnyLogicWorkspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Person.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

Thread [AWT-Shutdown] (Running)
Daemon Thread [AWT-Windows] (Running)
Daemon Thread [AnyLogic model execution thread] (Suspended (breakpoint at line 518 in Person))
Person.PerformBirth() line: 518
Person.executeActionOf(TransitionTimeout) line: 333
TransitionTimeout.execute() line: not available
Engine.h() line: not available
Engine.a(Engine) line: not available
Engine$a.run() line: not available

Step Over (F6)

Variables | Breakpoints | Expressions

Main [line: 73] - Main
Main [line: 76] - Main
Main [line: 323] - Main
Main [line: 2421] - Main
MainClass [line: 12] - main(String[])
Person [line: 518] - Person
Person [line: 520] - Person
PodSchedule [line: 293] - PodSchedule

MainClass.java | DefaultTracingFilter | MainClass.java | DefaultTracingFilter | Person.java | Person.java

```
void PerformBirth() {

Person mother = this;
Person offspring = get_Main().add_Population((double) 0, ethnicity, RandomSex(), this.IsInfected());
traceln("A baby has been born! Baby's id is " + offspring + " while the mother is " + this);
// establish connections of infant
EstablishOffspringConnectionsBasedOnMothersConnections(offspring, mother);
// now position the baby to be close to the mother (otherwise leads to stretching of mother's connections ac
EstablishOffspringLocationBasedOnMothersLocation(offspring, mother);

}

void EstablishOffspringConnectionsBasedOnMothersConnections( Person offspring, Person mother ) {
```

Outline

new ShapeGroup() {...}
CurrentAge() : double
drawModelElements(Panel, Graphics2D,
enterState(short, boolean) : void
EstablishOffspringConnectionsBasedOnI
EstablishOffspringLocationBasedOnMotl
evaluateRateOf(TransitionRate) : double
evaluateTimeoutOf(TransitionTimeout) :
executeActionOf(Statechart) : void
executeActionOf(TransitionMessage, Ob
executeActionOf(TransitionRate) : void
executeActionOf(TransitionTimeout) : vc
exitState(short, Transition, boolean, State
FertilityRateAgeSexEthnicity(double, Sex,
FinalizeDeath() : void
get_Main() : Main
getNameOf(Statechart) : String
getNameOf(TransitionMessage) : String
getNameOf(TransitionRate) : String
getNameOf(TransitionTimeout) : String
getNameOfState(short) : String
getPersistentShape(int) : Object
getStatechartOf(TransitionMessage) : Sta
getStatechartOf(TransitionRate) : Statech
getStatechartOf(TransitionTimeout) : Sta
IsInfected() : boolean
isInReproductiveYears(double) : boolean
onChange() : void
onChange_ethnicity() : void
onChange_InitialAge() : void
onChange_isInitiallyInfected() : void
onChange_sex() : void
onClickModelAt(Panel, double, double, i
onDestroy() : void
onReceive(Object, Agent) : void
PerformBirth() : void

Read-Only | Smart Insert | 518 : 22 | Build Project

Variables Displayed

Debug - C:\Users\Nate\AnyLogicWorkspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Person.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

Thread [AWT-Shutdown] (Running)
Daemon Thread [AWT-Windows] (Running)
Daemon Thread [AnyLogic model execution thread] (Suspended (breakpoint at line 520 in Person))
Person.PerformBirth() line: 520
Person.executeActionOf(TransitionTimeout) line: 333
TransitionTimeout.execute() line: not available
Engine.h() line: not available
Engine.a(Engine) line: not available
Engine$a.run() line: not available

Variables | Breakpoints | Expressions

Name	Value
this	Person (id=61)
mother	Person (id=61)
offspring	Person (id=64)

MainClass.java | DefaultTracingFilter | MainClass.java | DefaultTracingFilter | Person.java | Person.java

```
void PerformBirth() {

Person mother = this;
Person offspring = get_Main().add_Population((double) 0, ethnicity, RandomSex(), this.IsInfected());
traceln("A baby has been born! Baby's id is " + offspring + " while the mother is " + this);
// establish connections of infant
EstablishOffspringConnectionsBasedOnMothersConnections(offspring, mother);
// now position the baby to be close to the mother (otherwise leads to stretching of mother's connections ac
EstablishOffspringLocationBasedOnMothersLocation(offspring, mother);

}

void EstablishOffspringConnectionsBasedOnMothersConnections( Person offspring, Person mother ) {
```

Outline

new ShapeGroup() {...}
CurrentAge() : double
drawModelElements(Panel, Graphics2D,
enterState(short, boolean) : void
EstablishOffspringConnectionsBasedOnI
EstablishOffspringLocationBasedOnMotl
evaluateRateOf(TransitionRate) : double
evaluateTimeoutOf(TransitionTimeout) :
executeActionOf(Statechart) : void
executeActionOf(TransitionMessage, Ob
executeActionOf(TransitionRate) : void
executeActionOf(TransitionTimeout) : vo
exitState(short, Transition, boolean, State
FertilityRateAgeSexEthnicity(double, Sex,
FinalizeDeath() : void
get_Main() : Main
getNameOf(Statechart) : String
getNameOf(TransitionMessage) : String
getNameOf(TransitionRate) : String
getNameOf(TransitionTimeout) : String
getNameOfState(short) : String
getPersistentShape(int) : Object
getStatechartOf(TransitionMessage) : Sta
getStatechartOf(TransitionRate) : Statech
getStatechartOf(TransitionTimeout) : Sta
IsInfected() : boolean
isInReproductiveYears(double) : boolean
onChange() : void
onChange_ethnicity() : void
onChange_InitialAge() : void
onChange_isInitiallyInfected() : void
onChange_sex() : void
onClickModelAt(Panel, double, double, i
onDestroy() : void
onReceive(Object, Agent) : void
PerformBirth() : void

1 : 1 | Build Project

Terminating Execution from AnyLogic Console

AnyLogic Advanced [EDUCATIONAL USE ONLY]

File Edit View Model Window Help

Project | Search

- EclipseDebuggingExample
  - Main
    - Parameters
    - Functions
    - Events
    - Environments
    - Embedded Objects
    - Analysis Data
    - Presentation
  - Person
  - DebuggingSession: Main
    - Presentation
  - ProfilingSimulation: Main
  - Simulation: Main

DebuggingSession | Main

populationSize
Population [..]
datasetInfective
environment
offspringDistanceFromMother
initialPrevalenceOfInfection
immigrantsPerYear
ImmigrantArrival
prevalenceOfInfectionAmongImmigrants
MeanLifespan
TriggerDebugger

Properties | Console

anylogic config [Java Application] C:\Program Files (x86)\AnyLogic 6\jre\bin\javaw.exe (N Terminate 2:17:09 PM)

```
Listening for transport dt_socket at address: 8321
Threw & caught exception
Population member root.Population[46] has died.
Population member root.Population[494] has died.
Population member root.Population[166] has died.
Population member root.Population[727] has died.
Population member root.Population[13] has died.
Population member root.Population[156] has died.
Population member root.Population[115] has died.
Population member root.Population[554] has died.
Population member root.Population[719] has died.
Population member root.Population[776] has died.
```

Problems

Model

Parameter
Flow Aux ...
Stock Vari...
Event
Dynamic ...
Plain Vari...
Collectio...
Function
Table Fun...
Port
Connector
Entry Point
State
Transition
Initial Stat...
Branch
History St...
Final State
Environm...

Action
Analysis
Presentati...
Connectivi...
Enterprise...
More Libraries...

Eclipse is Now Detached

Debug - C:\Users\Nate\AnyLogicWorkspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Person.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

<terminated>Anylogic Application [Remote Java Application]
<disconnected>Java HotSpot(TM) Client VM[localhost:8321]

Variables | Breakpoints | Expressions

MainClass.java | DefaultTracingFilter | MainClass.java | DefaultTracingFilter | Person.java | Person.java

```
void PerformBirth() {

Person mother = this;
Person offspring = get_Main().add_Population((double) 0, ethnicity, RandomSex(), this.IsInfected());
traceln("A baby has been born! Baby's id is " + offspring + " while the mother is " + this);
// establish connections of infant
EstablishOffspringConnectionsBasedOnMothersConnections(offspring, mother);
// now position the baby to be close to the mother (otherwise leads to stretching of mother's connections ac
EstablishOffspringLocationBasedOnMothersLocation(offspring, mother);

}

void EstablishOffspringConnectionsBasedOnMothersConnections( Person offspring, Person mother ) {
```

Outline

- new ShapeGroup() {...}
- CurrentAge() : double
- drawModelElements(Panel, Graphics2D,
- enterState(short, boolean) : void
- EstablishOffspringConnectionsBasedOnI
- EstablishOffspringLocationBasedOnMotl
- evaluateRateOf(TransitionRate) : double
- evaluateTimeoutOf(TransitionTimeout) :
- executeActionOf(Statechart) : void
- executeActionOf(TransitionMessage, Ob
- executeActionOf(TransitionRate) : void
- executeActionOf(TransitionTimeout) : vo
- exitState(short, Transition, boolean, State
- FertilityRateAgeSexEthnicity(double, Sex,
- FinalizeDeath() : void
- get_Main() : Main
- getNameOf(Statechart) : String
- getNameOf(TransitionMessage) : String
- getNameOf(TransitionRate) : String
- getNameOf(TransitionTimeout) : String
- getNameOfState(short) : String
- getPersistentShape(int) : Object
- getStatechartOf(TransitionMessage) : Sta
- getStatechartOf(TransitionRate) : Statech
- getStatechartOf(TransitionTimeout) : Sta
- IsInfected() : boolean
- isInReproductiveYears(double) : boolean
- onChange() : void
- onChange_ethnicity() : void
- onChange_InitialAge() : void
- onChange_isInitiallyInfected() : void
- onChange_sex() : void
- onClickModelAt(Panel, double, double, i
- onDestroy() : void
- onReceive(Object, Agent) : void
- PerformBirth() : void

1 : 1 | Build Project

Remembering Breakpoints

- Note Eclipse *does* remember breakpoints from session to session
- So breakpoints that set earlier in an anylogic session will work again even after close eclipse and restart it again
- Suggestions
  - Consider creating a common breakpoints (e.g. at Main.start)
  - Disable and enable breakpoints rather than deleting them

Example of Debugging Session

Debug - U:\Classes\371_Spring2009\Project\Deliverable 4\Milestone4\newDev\newDev\src\oneoak\digdug\gui\MainWindow.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

- Anylogic Application [Remote Java Application]
  - Java HotSpot(TM) Client VM[localhost:8321] (Suspended)
    - Daemon Thread [AnyLogic model execution thread] (Suspended)
      - FileOutputStream.writeBytes(byte[], int, int) line: not available [native method]
      - FileOutputStream.write(byte[], int, int) line: not available
      - BufferedOutputStream.flushBuffer() line: not available
      - BufferedOutputStream.flush() line: not available
      - PrintStream.write(byte[], int, int) line: not available
      - StreamEncoder.writeBytes() line: not available
      - StreamEncoder.implFlushBuffer() line: not available
      - StreamEncoder.flushBuffer() line: not available
      - OutputStreamWriter.flushBuffer() line: not available
      - PrintStream.write(String) line: not available
      - PrintStream.print(String) line: not available
      - PrintStream.println(Object) line: not available
      - Utilities.traceln(Object) line: not available
      - Person.PerformBirth() line: 520
      - Person.executeActionOf(TransitionTimeout) line: 333
      - TransitionTimeout.execute() line: not available
      - Engine.h() line: not available
      - Engine.a(Engine) line: not available
      - Engine$a.run() line: not available
    - Daemon System Thread [TimerQueue] (Suspended)
    - Thread [DestroyJavaVM] (Suspended)
    - Daemon Thread [AnyLogic presentation frame manager] (Suspended)
    - Thread [AnyLogic simulation performance monitor] (Suspended)
    - Thread [AWT-EventQueue-0] (Suspended)
    - Thread [AWT-Shutdown] (Suspended)
    - Daemon Thread [AWT-Windows] (Suspended)
    - Daemon System Thread [Java2D Disposer] (Suspended)
    - Daemon System Thread [Attach Listener] (Suspended)
    - Daemon System Thread [Signal Dispatcher] (Suspended)
    - Daemon System Thread [Finalizer] (Suspended)
    - Daemon System Thread [Reference Handler] (Suspended)
    - Daemon Thread [Image Fetcher 0] (Suspended)

Another Route: Catching Exceptions at Defined Places of Interest

Example Setup: Set up Function to Trigger the Debugger

AnyLogic Advanced [EDUCATIONAL USE ONLY]

File Edit View Model Window Help

Project | Search

- EclipseDebuggingExample*
  - Main
    - Parameters
    - Functions
    - Events
    - Environments
    - Embedded Objects
    - Analysis Data
    - Presentation
  - Person
  - DebuggingSession: Main
    - Presentation
  - ProfilingSimulation: Main
  - Simulation: Main

DebuggingSession | Main

populationSize
Population [..]
datasetInfective
environment
offspringDistanceFromMother
initialPrevalenceOfInfection
immigrantsPerYear
ImmigrantArrival
prevalenceOfInfectionAmongImmigrants
MeanLifespan
TriggerDebugger

Properties | Console

TriggerDebugger - Function

General
Code
Description

Function body:

```
try
{
    throw new RuntimeException("arbitrary");
}
catch (RuntimeException e)
{
    traceln("Threw & caught exception");
}
```

Model

Parameter
Flow Aux ...
Stock Vari...
Event
Dynamic ...
Plain Vari...
Collectio...
Function
Table Fun...
Port
Connector
Entry Point
State
Transition
Initial Stat...
Branch
History St...
Final State
Environm...

Action
Analysis
Presentati...
Connectivi...
Enterprise...
More Libraries...

Problems

In Startup Code for Model, Call Function

AnyLogic Advanced [EDUCATIONAL USE ONLY]

File Edit View Model Window Help

Project | Search

- EclipseDebuggingExample*
  - Main
    - Parameters
    - Functions
    - Events
    - Environments
    - Embedded Objects
    - Analysis Data
    - Presentation
  - Person
  - DebuggingSession: Main
    - Presentation
  - ProfilingSimulation: Main
  - Simulation: Main

DebuggingSession | Main

populationSize
Population [..]
datasetInfective
environment
offspringDistanceFromMother
initialPrevalenceOfInfection
immigrantsPerYear
ImmigrantArrival
prevalenceOfInfectionAmongImmigrants
MeanLifespan
TriggerDebugger

Properties | Console

Main - Active Object Class

General | Advanced | Agent | Parameters | Description

Name: Main Ignore

Agent Generic

Startup Code:

```
environment.deliverToRandom("Infect!");
TriggerDebugger();
```

Destroy Code:

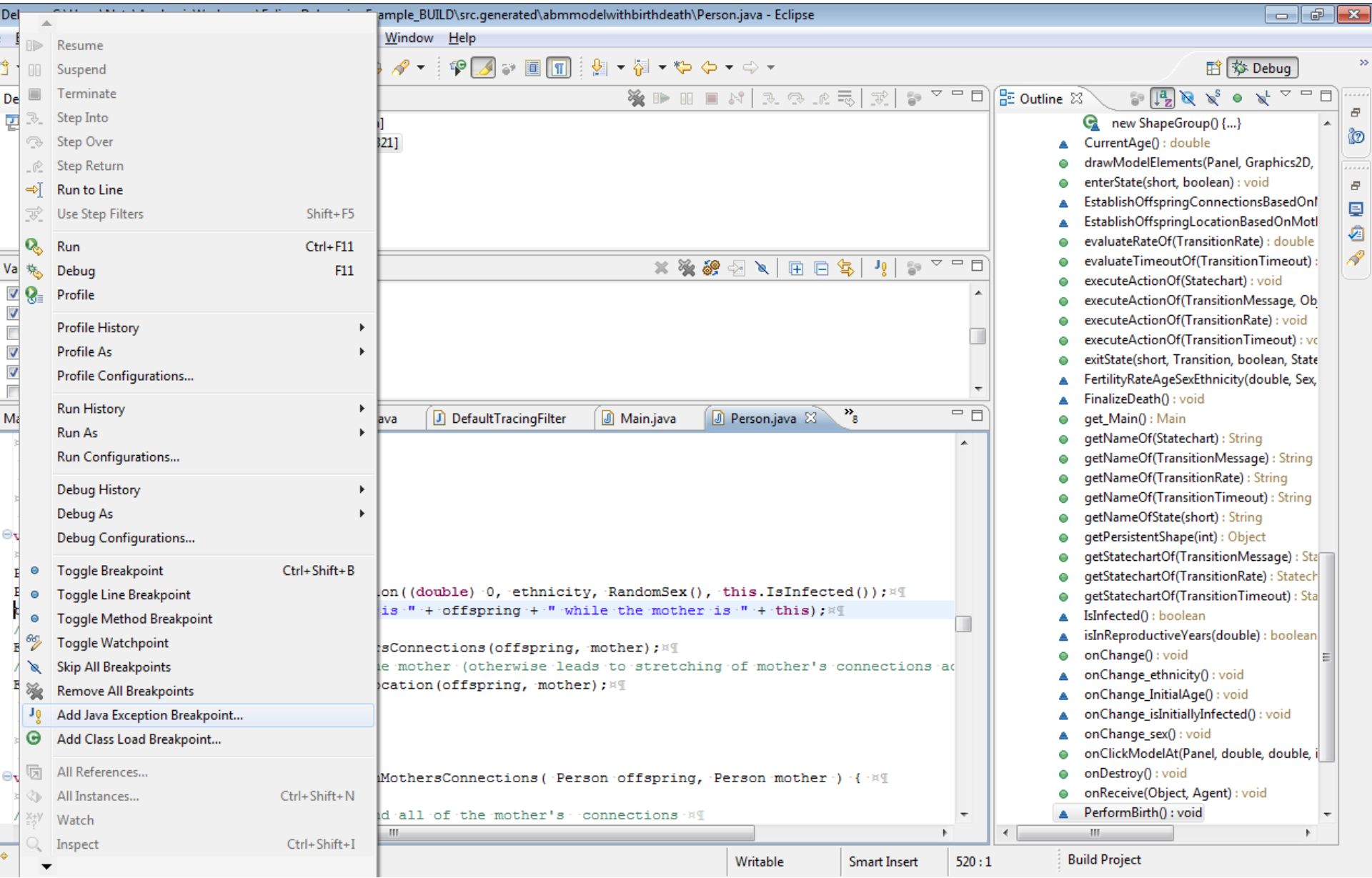
Model

Parameter
Flow Aux ...
Stock Vari...
Event
Dynamic ...
Plain Vari...
Collectio...
Function
Table Fun...
Port
Connector
Entry Point
State
Transition
Initial Stat...
Branch
History St...
Final State
Environm...

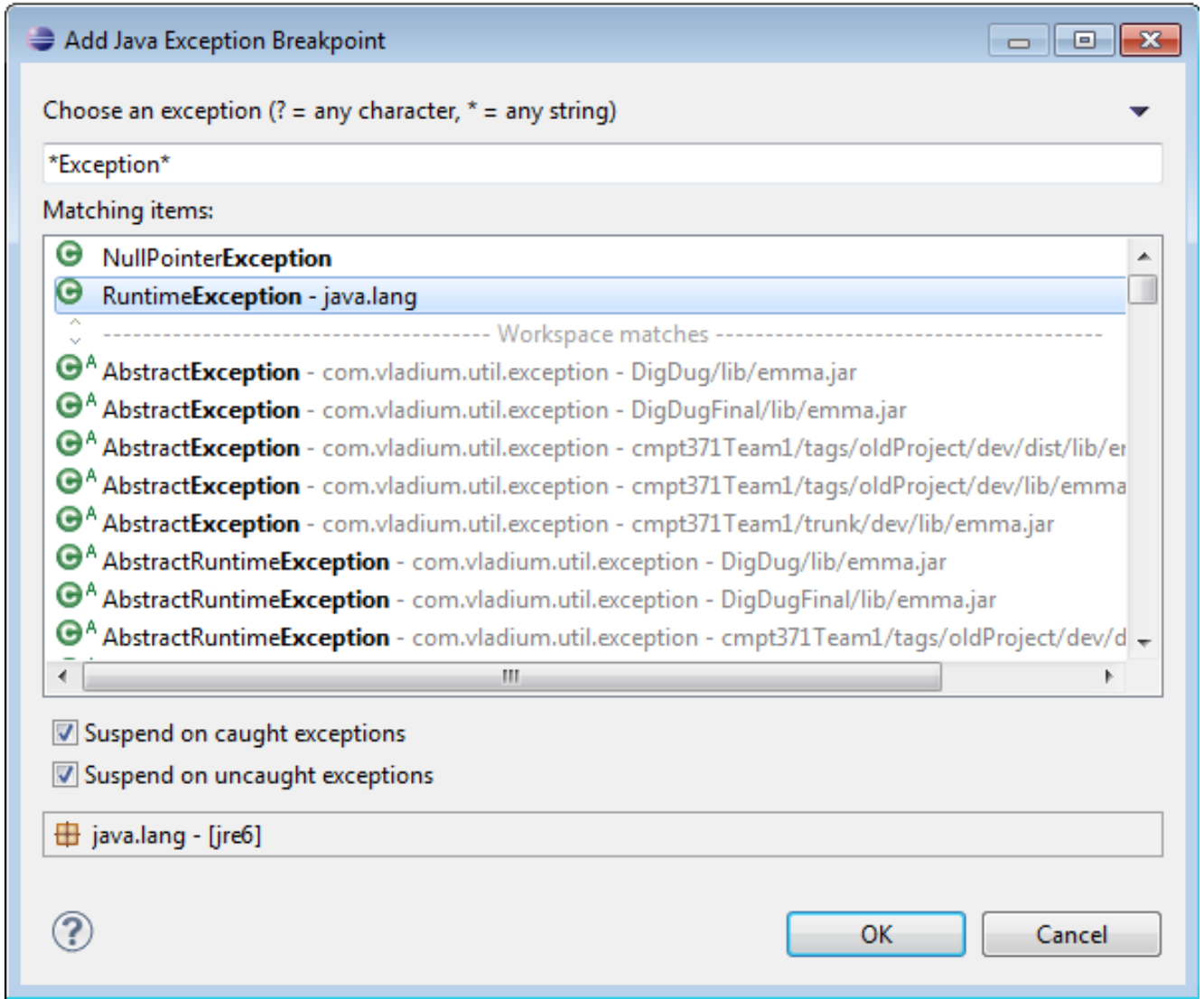
Action
Analysis
Presentati...
Connectivi...
Enterprise...
More Libraries...

Problems

Request Creation of Exception Breakpoint



Request as Breakpoint Regardless of Handling



Should Now be in List of Enabled Breakpoints

Debug - C:\Users\Nate\AnyLogicWorkspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Person.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

<terminated> Anylogic Application [Remote Java Application]
<disconnected> Java HotSpot(TM) Client VM[localhost:8321]

Variables | Breakpoints | Expressions

- [x] RuntimeException
- [ ] NullPointerException: caught and uncaught
- [x] RuntimeException: caught and uncaught
- [ ] CreateScenarioDialog [line: 436] - new Anonymous
- [ ] HTMLLinksToFiles [line: 27] - main(String[])
- [ ] HTMLLinksToFiles [line: 29] - main(String[])

MainClass.java | DefaultTracingFilter | MainClass.java | DefaultTracingFilter | Main.java | Person.java

```
}
void PerformBirth() {
Person mother = this;
Person offspring = get_Main().add_Population((double) 0, ethnicity, RandomSex(), this.IsInfected());
traceln("A baby has been born! Baby's id is " + offspring + " while the mother is " + this);
// establish connections of infant
EstablishOffspringConnectionsBasedOnMothersConnections(offspring, mother);
// now position the baby to be close to the mother (otherwise leads to stretching of mother's connections ac
EstablishOffspringLocationBasedOnMothersLocation(offspring, mother);
}
void EstablishOffspringConnectionsBasedOnMothersConnections( Person offspring, Person mother ) {
// now establish links between the baby and all of the mother's connections
```

Outline

- new ShapeGroup() {...}
- CurrentAge() : double
- drawModelElements(Panel, Graphics2D,
- enterState(short, boolean) : void
- EstablishOffspringConnectionsBasedOnI
- EstablishOffspringLocationBasedOnMotl
- evaluateRateOf(TransitionRate) : double
- evaluateTimeoutOf(TransitionTimeout) :
- executeActionOf(Statechart) : void
- executeActionOf(TransitionMessage, Ob
- executeActionOf(TransitionRate) : void
- executeActionOf(TransitionTimeout) : vc
- exitState(short, Transition, boolean, State
- FertilityRateAgeSexEthnicity(double, Sex,
- FinalizeDeath() : void
- get_Main() : Main
- getNameOf(Statechart) : String
- getNameOf(TransitionMessage) : String
- getNameOf(TransitionRate) : String
- getNameOf(TransitionTimeout) : String
- getNameOfState(short) : String
- getPersistentShape(int) : Object
- getStatechartOf(TransitionMessage) : Sta
- getStatechartOf(TransitionRate) : Statech
- getStatechartOf(TransitionTimeout) : Sta
- IsInfected() : boolean
- isInReproductiveYears(double) : boolean
- onChange() : void
- onChange_ethnicity() : void
- onChange_InitialAge() : void
- onChange_isInitiallyInfected() : void
- onChange_sex() : void
- onClickModelAt(Panel, double, double, i
- onDestroy() : void
- onReceive(Object, Agent) : void
- PerformBirth() : void

Build Project

Back in Eclipse, the Debugger Should have been Triggered & at Exception Handler

(If not, close “Main.java” and double-click on topmost “stack frame” (Where Exception is triggered

Debug - C:\Users\Nate\AnyLogicWorkspace\EclipseDebuggingExample_BUILD\src.generated\abmmodelwithbirthdeath\Main.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Debug

- Java HotSpot(TM) Client VM[localhost:8321]
  - Thread [DestroyJavaVM] (Running)
  - Daemon Thread [AnyLogic presentation frame manager] (Running)
  - Thread [AnyLogic simulation performance monitor] (Running)
  - Thread [AWT-EventQueue-0] (Running)
  - Thread [AWT-Shutdown] (Running)
  - Daemon Thread [AWT-Windows] (Running)
  - Daemon Thread [AnyLogic ShapeControl action handler] (Suspended (exception RuntimeException))
    - Main.TriggerDebugger() line: 441

Variables | Breakpoints | Expressions

- RuntimeException
- NullPointerException: caught and uncaught
- RuntimeException: caught and uncaught
- CreateScenarioDialog [line: 436] - new Anonymous
- HTMLLinksToFiles [line: 27] - main(String[])
- HTMLLinksToFiles [line: 29] - main(String[])
- HTMLLinksToFiles [line: 36] - main(String[])
- HTMLLinksToFiles [line: 38] - main(String[])

MainClass.java | DefaultTracingFilter | MainClass.java | DefaultTracingFilter | Person.java | Main.java

```
// User functions ----------------------------------------
void TriggerDebugger( ) {
try
{
    throw new RuntimeException("arbitrary");
}
catch (RuntimeException e)
{
    traceln("Threw & caught exception");
}
}
// Analysis Data Elements
```

Outline

- executeActionOf(EventTimeout) : void
- getEmbeddedObjects() : List<Object>
- getFirstOccurrenceTime(EventTimeout)
- getModeOf(EventTimeout) : int
- getNameOf(ActiveObject) : String
- getNameOf(ActiveObjectCollection<?>)
- getNameOf(EventRate) : String
- getNameOf(EventTimeout) : String
- getNameOfShape(int) : String
- getPersistentShape(int) : Object
- getShapeEmbeddedObject(int) : Object
- getShapeReplication(int) : int
- getShapeType(int) : int
- getShapeX(int, int) : double
- getShapeY(int, int) : double
- instantiate_Population_xjal(int) : Person
- onChange() : void
- onChange_immigrantsPerYear() : void
- onChange_initialPrevalenceOfInfection()
- onChange_MeanLifespan() : void
- onChange_offspringDistanceFromMothe
- onChange_populationSize() : void
- onChange_prevalenceOfInfectionAmong
- onClickModelAt(Panel, double, double, i
- onDestroy() : void
- onStartup() : void
- remove_Population(Person) : boolean
- set_immigrantsPerYear(double) : void
- set_initialPrevalenceOfInfection(double)
- set_MeanLifespan(double) : void
- set_offspringDistanceFromMother(doub
- set_populationSize(int) : void
- set_prevalenceOfInfectionAmongImmig
- setupParameters_Population_xjal(Person
- start() : void
- TriggerDebugger() : void

Using the AnyLogic Built-in Debugger

Running the Debugger

AnyLogic Professional

File Edit View Model Tools Help

Debug

- anylogic config [Java Application]
  - com.xj.anylogic.ms.MS at localhost:56409
    - Daemon Thread [AWT-Windows] (Running)
    - Thread [AWT-Shutdown] (Running)
    - Thread [AWT-EventQueue-0] (Running)
    - Daemon Thread [AnyLogic user input event pr
    - Thread [AnyLogic simulation performance mo
    - Thread [DestroyJavaVM] (Running)
    - Daemon Thread [AnyLogic presentation frame

Main.java

```
1  package sir_agent_based_networks;
2
3⊕ import java.io.Serializable;
61
62 public class Main extends Agent
63 {
64   // Parameters
65
66⊖  public
67 double  AverageIllnessDuration;
68
69⊖  /**
70    * Returns default value for par
71    * <i>This method should not be
72    */
73⊖  @AnyLogicInternalCodegenAPI
74   public double _AverageIllnessDur
75     final Main self = this;
76     return
77 15
78 ;
79   }
```

SIR Agent Based : Simulation - AnyLogic Professional

x1 AnyLogic

SIR Agent Based Model of Disease Diffusion

Model parameters

Total population:	200	
Fraction intitially infected:	0.05	
Contact rate	5.0	contacts per day
Infectivity:	0.05	
Average illness duration:	15.0	days

Network type:

- (●) Random
- ( ) Based on distance
- ( ) Ring lattice
- ( ) Small world
- ( ) Scale free

Layout type:

- (●) Random
- ( ) Arranged
- ( ) Ring
- ( ) Spring mass

Links per agent:	10
Maximum link distance:	50.0
Percent of long distance links:	0.05
M:	2

Run the model

AnyLogic

This model is © The AnyLogic Company. www.anylogic.com

The experiment design follows the paper:
Hazhir Rahmandad and John Sterman. Heterogeneity and Network Structure in the Dynamics of Diffusion: Comparing Agent-Based and Differential Equation Models. MANAGEMENT SCIENCE Vol. 54, No. 5, May 2008, pp. 998-1014

Description

We distinguish between three different states of a person: Susceptible, Infectious and Recovered. To reflect the fact that some people are already infected at the beginning of the simulation, the agent statechart entry point has a branch InitiallyInfected. The choice of the initial state is probabilistic and is based on a global model parameter PercentInitiallyInfected.

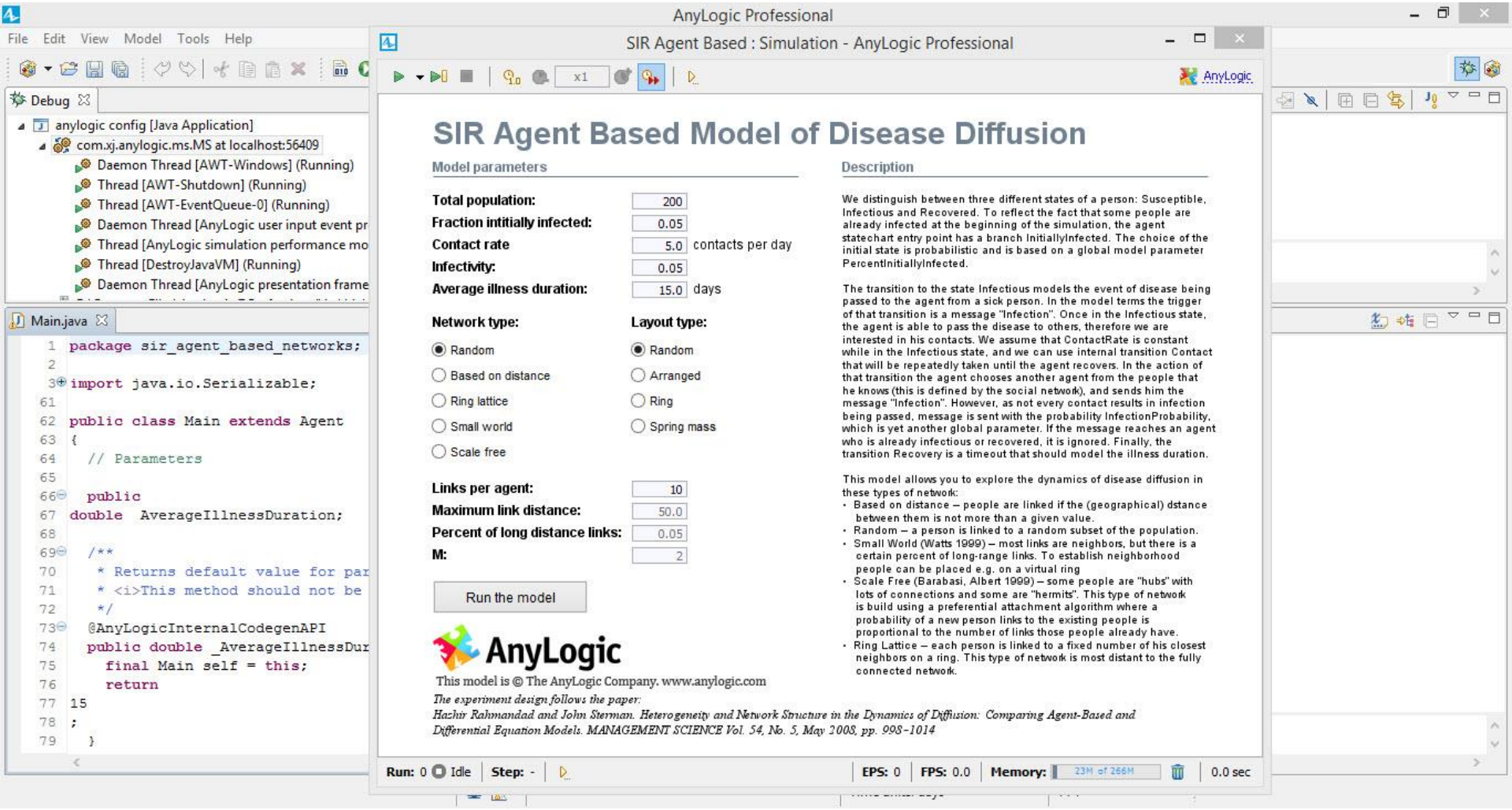
The transition to the state Infectious models the event of disease being passed to the agent from a sick person. In the model terms the trigger of that transition is a message "Infection". Once in the Infectious state, the agent is able to pass the disease to others, therefore we are interested in his contacts. We assume that ContactRate is constant while in the Infectious state, and we can use internal transition Contact that will be repeatedly taken until the agent recovers. In the action of that transition the agent chooses another agent from the people that he knows (this is defined by the social network), and sends him the message "Infection". However, as not every contact results in infection being passed, message is sent with the probability InfectionProbability, which is yet another global parameter. If the message reaches an agent who is already infectious or recovered, it is ignored. Finally, the transition Recovery is a timeout that should model the illness duration.

This model allows you to explore the dynamics of disease diffusion in these types of network:

- Based on distance – people are linked if the (geographical) dstance between them is not more than a given value.
- Random – a person is linked to a random subset of the population.
- Small World (Watts 1999) – most links are neighbors, but there is a certain percent of long-range links. To establish neighborhood people can be placed e.g. on a virtual ring
- Scale Free (Barabasi, Albert 1999) – some people are "hubs" with lots of connections and some are "hermits". This type of network is build using a preferential attachment algorithm where a probability of a new person links to the existing people is proportional to the number of links those people already have.
- Ring Lattice – each person is linked to a fixed number of his closest neighbors on a ring. This type of network is most distant to the fully connected network.

Run: 0 Idle | Step: - | EPS: 0 | FPS: 0.0 | Memory: 23M of 266M | 0.0 sec

Running the Models



Setting a Breakpoint

AnyLogic Professional

File Edit View Model Tools Help

Get Support...

Debug

- anylogic config [Java Application]
  - com.xj.anylogic.ms.MS at localhost:56422
    - Daemon Thread [AWT-Windows] (Running)
    - Thread [AWT-Shutdown] (Running)
    - Thread [AWT-EventQueue-0] (Running)
    - Thread [AnyLogic simulation performance monitor] (Running)
    - Thread [DestroyJavaVM] (Running)
    - Daemon Thread [AnyLogic presentation frame manager] (Running)
  - D:\Program Files\AnyLogic 7 Professional\jre\bin\javaw.exe (2014-04-11 4:46:28 PM)

Breakpoints

- Main [line: 818] - networkTypeToString(NetworkType)

Hit count: Suspend thread Suspend VM

Conditional Suspend when 'true' Suspend when value changes

Main.java

```
813
814
815 String
816  networkTypeToString( NetworkType type ) {
817
818 switch( type ) {
819 case NETWORK_USER_DEFINED:
820     return "Custom";
821 case NETWORK_RANDOM:
822     return "Random";
823 case NETWORK_ALL_IN_RANGE:
824     return "Based on distance";
825 case NETWORK_RING_LATTICE:
826     return "Ring lattice";
827 case NETWORK_SMALL_WORLD:
828     return "Small world";
829 case NETWORK_SCALE_FREE:
830     return "Scale free";
831 default: return "Unknown";
832 }
833
834   }
```

Variables

Time units: days

820 : 19

When we Hit the Breakpoint…

AnyLogic Professional

File Edit View Model Tools Help

Get Support...

Debug

- anylogic config [Java Application]
  - com.xj.anylogic.ms.MS at localhost:56422
    - Daemon Thread [AWT-Windows] (Running)
    - Thread [AWT-Shutdown] (Running)
    - Thread [AWT-EventQueue-0] (Running)
    - Thread [AnyLogic simulation performance monitor] (Running)
    - Thread [DestroyJavaVM] (Running)
    - Daemon Thread [AnyLogic presentation frame manager] (Running)
  - D:\Program Files\AnyLogic 7 Professional\jre\bin\javaw.exe (2014-04-11 4:46:28 PM)

Breakpoints

- Main [line: 818] - networkTypeToString(NetworkType)

Hit count: Suspend thread Suspend VM

Conditional Suspend when 'true' Suspend when value changes

Main.java

```
813
814
815 String
816  networkTypeToString( NetworkType type ) {
817
818 switch( type ) {
819 case NETWORK_USER_DEFINED:
820     return "Custom";
821 case NETWORK_RANDOM:
822     return "Random";
823 case NETWORK_ALL_IN_RANGE:
824     return "Based on distance";
825 case NETWORK_RING_LATTICE:
826     return "Ring lattice";
827 case NETWORK_SMALL_WORLD:
828     return "Small world";
829 case NETWORK_SCALE_FREE:
830     return "Scale free";
831 default: return "Unknown";
832 }
833
834   }
```

Variables

Time units: days

820 : 19

Components to Direct Execution

AnyLogic Professional

File Edit View Model Tools Help

Get Support...

Debug

- anylogic config [Java Application]
  - com.xj.anylogic.ms.MS at localhost:56422
    - Daemon Thread [AWT-Windows] (Running)
    - Thread [AWT-Shutdown] (Running)
    - Thread [AWT-EventQueue-0] (Running)
    - Thread [AnyLogic simulation performance monitor] (Running)
    - Thread [DestroyJavaVM] (Running)
    - Daemon Thread [AnyLogic presentation frame manager] (Running)
  - D:\Program Files\AnyLogic 7 Professional\jre\bin\javaw.exe (2014-04-11 4:46:28 PM)

Breakpoints

- Main [line: 818] - networkTypeToString(NetworkType)

Hit count: Suspend thread Suspend VM

Conditional Suspend when 'true' Suspend when value changes

Main.java

```
813
814
815 String
816  networkTypeToString( NetworkType type ) {
817
818 switch( type ) {
819 case NETWORK_USER_DEFINED:
820     return "Custom";
821 case NETWORK_RANDOM:
822     return "Random";
823 case NETWORK_ALL_IN_RANGE:
824     return "Based on distance";
825 case NETWORK_RING_LATTICE:
826     return "Ring lattice";
827 case NETWORK_SMALL_WORLD:
828     return "Small world";
829 case NETWORK_SCALE_FREE:
830     return "Scale free";
831 default: return "Unknown";
832 }
833
834   }
```

Variables

Time units: days

820 : 19

Visible ("In-Scope") Variables

(x)= Variables | Expressions

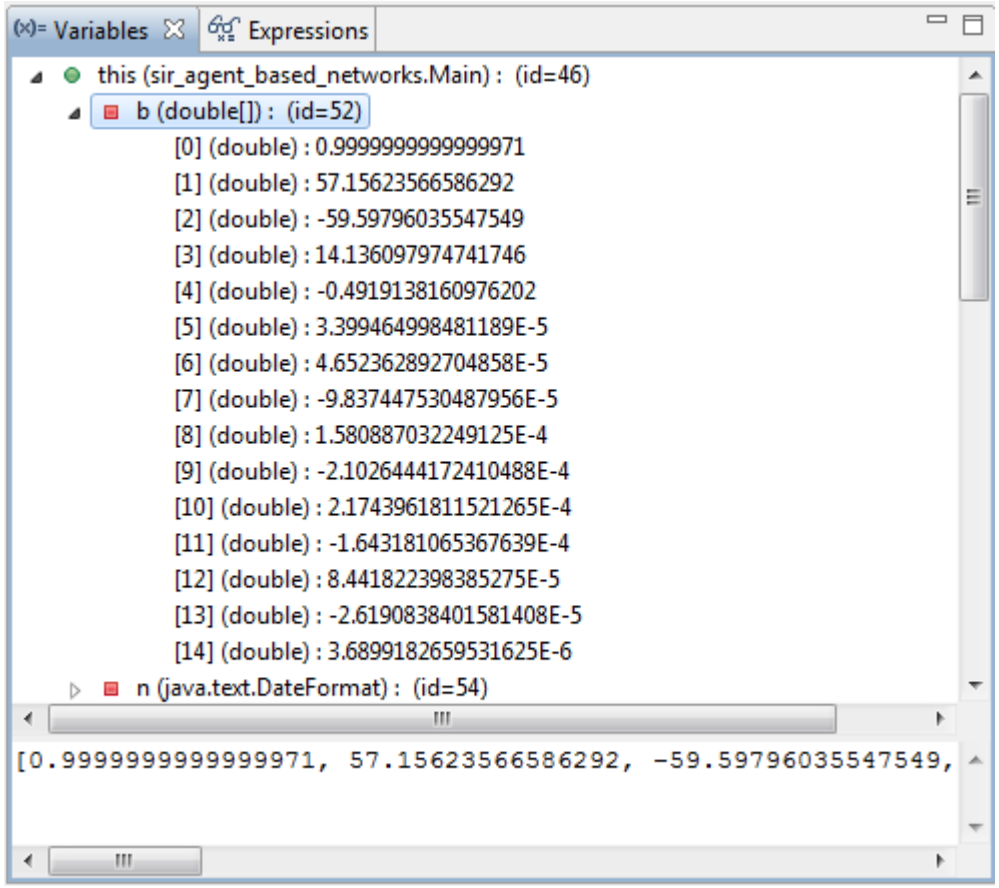
- this (sir_agent_based_networks.Main) : (id=46)
  - type (int) : 1

(x)= Variables | Expressions

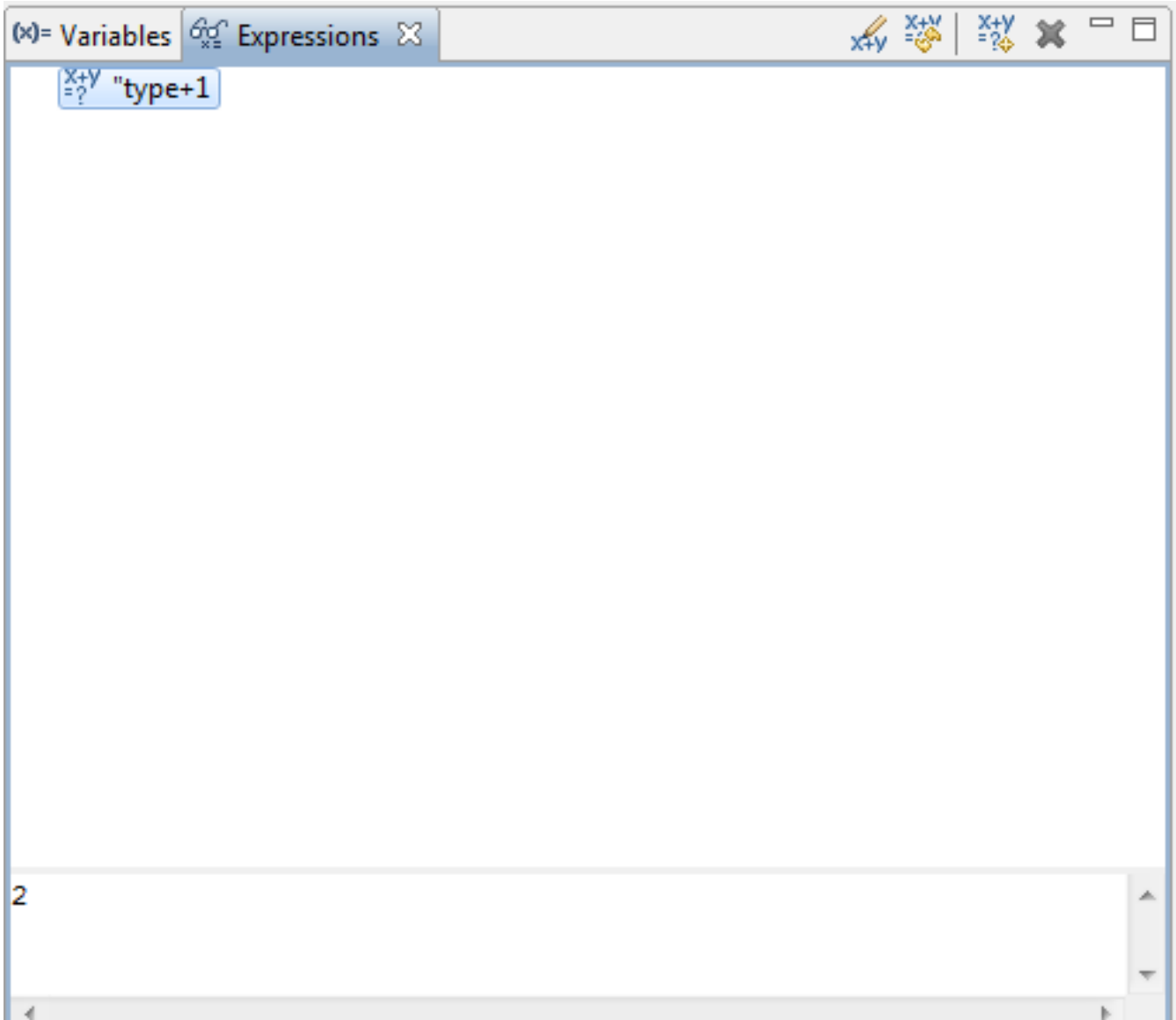
- this (sir_agent_based_networks.Main) : (id=46)
  - b (double[]) : (id=52)
  - n (java.text.DateFormat) : (id=54)
  - _NInfectiousDS_autoUpdateEvent_xjal (com.xj.anylogic.engine.Eve
  - _plot_autoUpdateEvent_xjal (com.xj.anylogic.engine.EventTimeou
  - _plot_expression0_dataSet_xjal (com.xj.anylogic.engine.analysis.Da
  - _plot_expression1_dataSet_xjal (com.xj.anylogic.engine.analysis.Da
  - _plot_expression2_dataSet_xjal (com.xj.anylogic.engine.analysis.Da
  - a (com.xj.anylogic.engine.Engine) : (id=70)
  - AverageIllnessDuration (double) : 15.0
  - b (com.xj.anylogic.engine.ActiveObject) : null
  - c (Type N/A) : null
  - ContactRate (double) : 5.0
  - d (com.xj.anylogic.engine.ActiveObjectCollection<?>) : null
  - e (java.util.LinkedHashSet<com.xj.anylogic.engine.DynamicEvent
  - environment (com.xj.anylogic.engine.EnvironmentContinuous2D
  - FractionInitiallyInfected (double) : 0.05
  - Infectivity (double) : 0.05

root

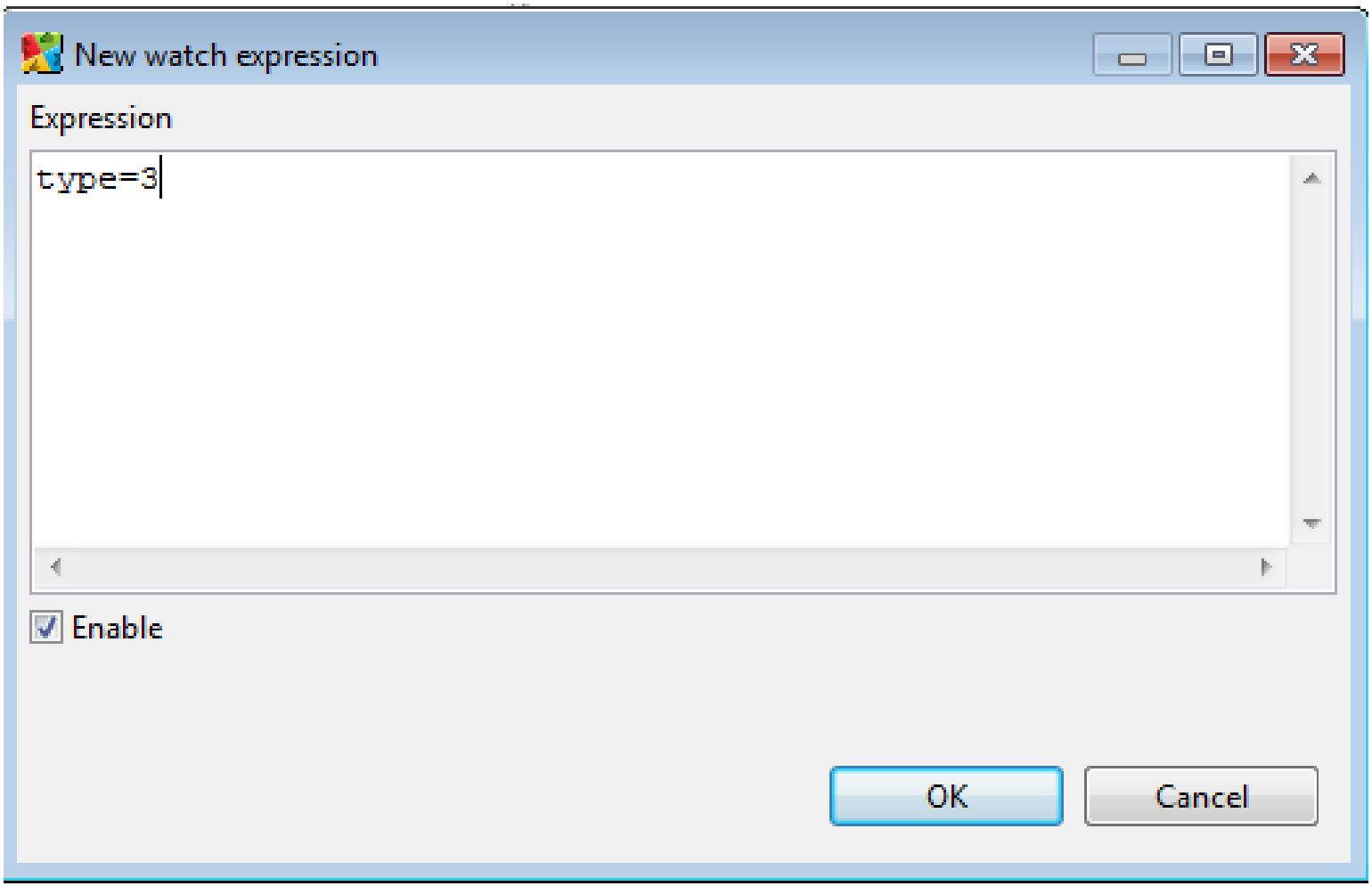
Exploring Composite Variable Values in the Debugger



Inspecting Composite Variables



Changing Variable Values During Debugging



Stepping into Auto-Generated Code

AnyLogic Professional

File Edit View Model Tools Help

Get Support...

Projects

- SIR Agent Based Networks
  - Main
    - Agents
    - Presentation
    - Parameters
    - Analysis Data
    - Functions
      - networkTypeToString
    - Links to agents
  - Person
  - Simulation: Main
  - MonteCarlo: Main

Debug

Daemon Thread [AnyLogic presentation frame manager] (Suspended (breakpoint
owns: Object (id=44)
Main.getShapeText(int, int) line: 1237
Main(Presentable).a(int, int, Panel, Graphics2D, AffineTransform, boolean) line
Main(Presentable).drawShape(int, Panel, Graphics2D, AffineTransform, boolea
ShapeTopLevelPresentationGroup(ShapeGroup).a(Panel, Graphics2D, boolean
ShapeTopLevelPresentationGroup(ShapeGroup).draw(Panel, Graphics2D, Affir
Main(Presentable).drawPresentation(Panel, Graphics2D, boolean) line: not ava

Breakpoints

- [x] Main [line: 818]
- [ ] Main [line: 819]
- [x] Main [line: 1237] - getShapeText(int, int)
- [ ] Main [line: 1247] - getShapeText(int, int)

Hit count: Suspend thread Suspend VM

Conditional Suspend when 'true' Suspend when value changes

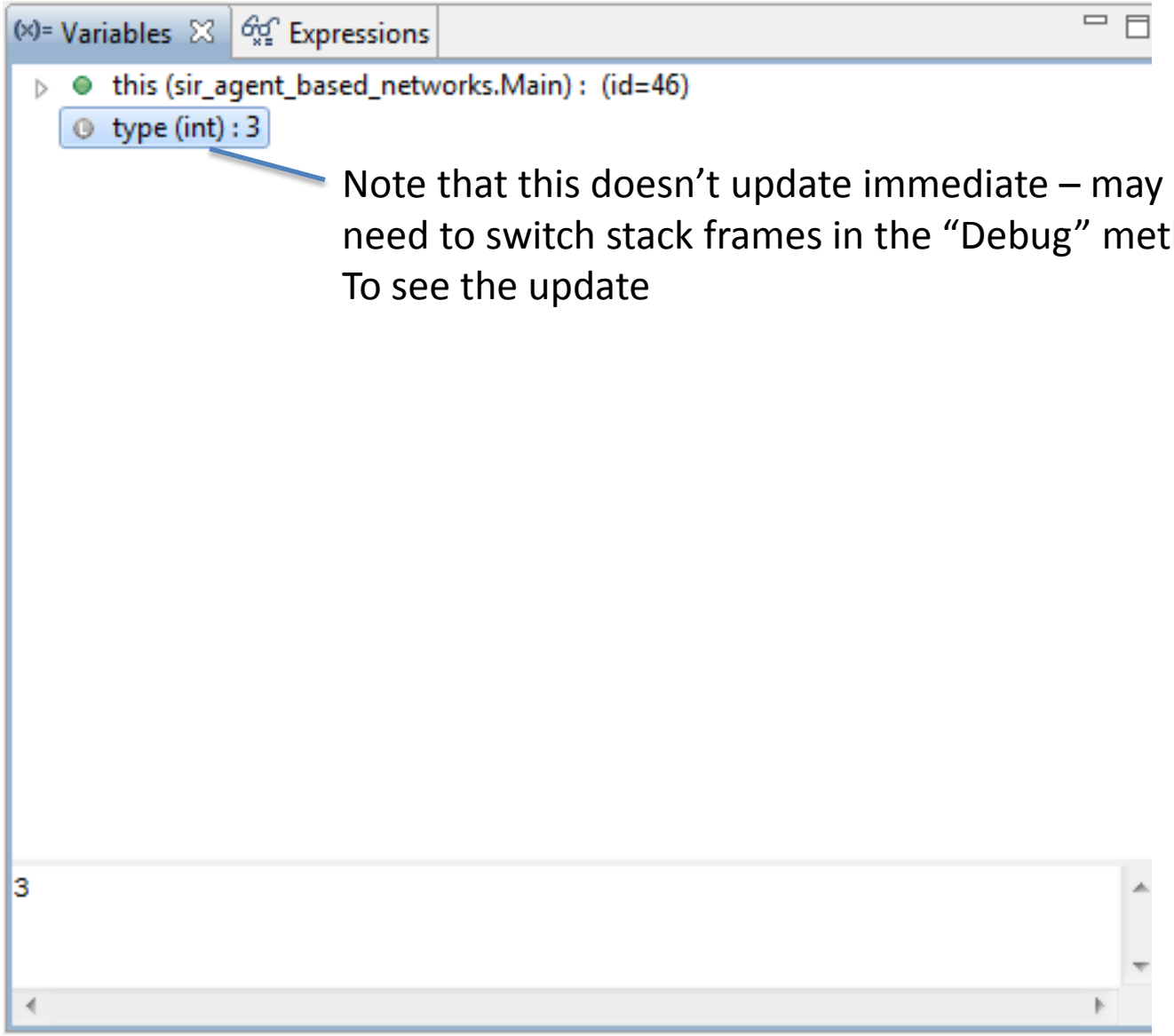
Main | **Main.java**

```
1234  @Override
1235  @AnyLogicInternalCodegenAPI
1236  public Object getShapeText( int _shape, int index ) {
1237    switch( _shape ) {
1238      case text3: return "SIR Agent Based Model of Disease Dif
1239      case text4: return "Model parameters";
1240      case text5: return "Total population:";
1241      case text6: return
1242 TotalPopulation
1243 ;
1244      case text7: return
1245 (int)( FractionInitiallyInfected * 100 ) + "%"
1246 ;
1247      case text8: return "Fraction intitially infected:";
1248      case text9: return
1249 format( ContactRate ) + " contacts per day"
1250 ;
1251      case text10: return "Contact rate";
1252      case text11: return
1253 (int)( Infectivity * 100 ) + "%"
1254 ;
1255      case text12: return "Infectivity:";
```

Variables | **Properties**

Time units: days

Seeing Result of Expression Evaluation



Note that this doesn't update immediate – may need to switch stack frames in the "Debug" method To see the update