



Kova PedSim Documentation

Physics Simulation

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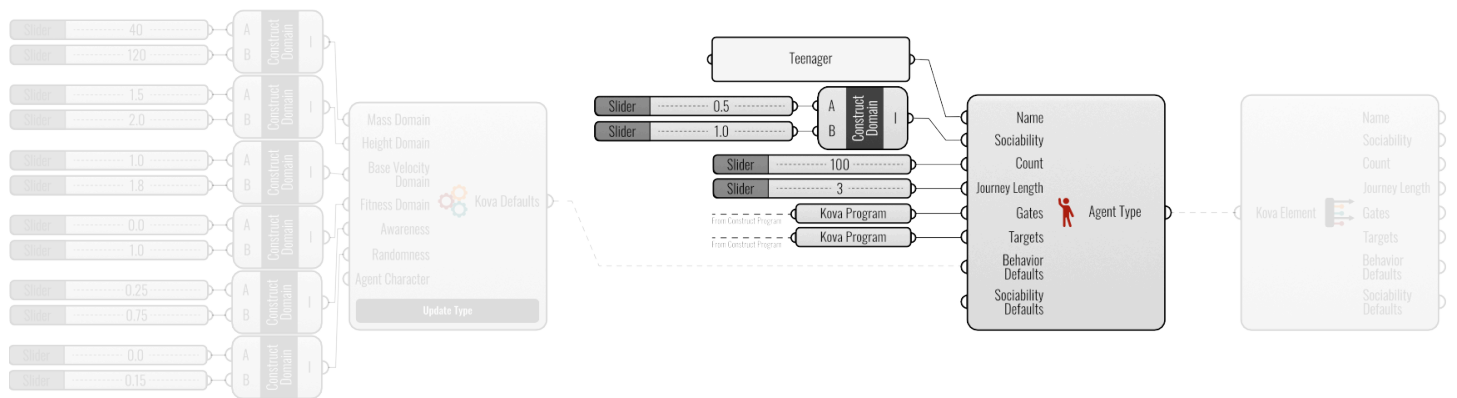
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Construct Agent Type Component

User Input Data  Kova Output Data 
Kova Input Data  Native Output Data 



Inputs

1 Name

The name of the agent type. This value is used as an identifier and does not influence the algorithm.

2 Sociability

A domain with maximum bounds of 0.0 to 1.0 that represents the agent type's social level. Two agents with similar social levels are more likely to socialize. The sociability of each agent instance will be randomly selected within this specific range.

3 Count

The total number of agents in the simulation who follow this agent behavior.

4 Journey Length

The total number of destinations this agent type will visit during the simulation.

Outputs

1 Agent Type

A compiled Kova element representing the specified agent type in the simulation.

5 Gates

The Kova program(s) this agent type can spawn from during the simulation. If multiple gates are provided, the agents will pick their gates at random.

6 Targets

The Kova program(s) this agent type can potentially visit as a target during the simulation. If the number of targets is greater than the journey length, the agents will pick their targets at random.

7 Behavior Defaults

The Kova behaviors for this agent type. Please see "Behavior Defaults" for more details.

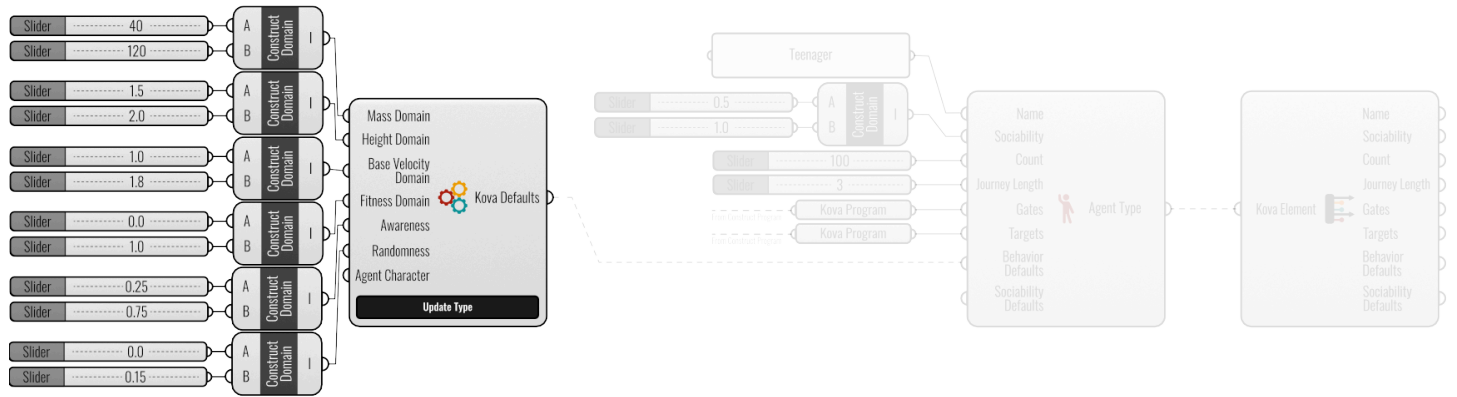
8 Sociability Defaults

The Kova social behaviors for this agent type. Please see "Sociability Defaults" for more details.



Agent Behavior Defaults Override

User Input Data  Kova Output Data 
Kova Input Data  Native Output Data 



Inputs

1 Mass Domain

A domain specifying the minimum and maximum mass values, in Rhino units, assignable to this agent type. This will affect the agent's movement.

2 Height Domain

A domain specifying the minimum and maximum height values, in Rhino units, assignable to this agent type. This will affect the agent's movement.

3 Base Velocity Domain

A domain specifying the base distance, in Rhino units, the agent type will travel during each iteration.

4 Fitness Domain

A domain from 0 to 1 specifying the minimum and maximum fitness values assignable to this agent type. This will affect the agent's movement.

5 Awareness

A domain between 0.0 and 1.0 specifying how familiar the agent is with their surroundings. An agent who is more aware will navigate more efficiently within the environment

6 Randomness

A domain between 0.0 and 1.0 specifying the level of randomness in an agent's movement.

7 Agent Character

The compiled Kova character which describes the visual appearance of this agent during the simulation. Please see "Agent Character" for more details.

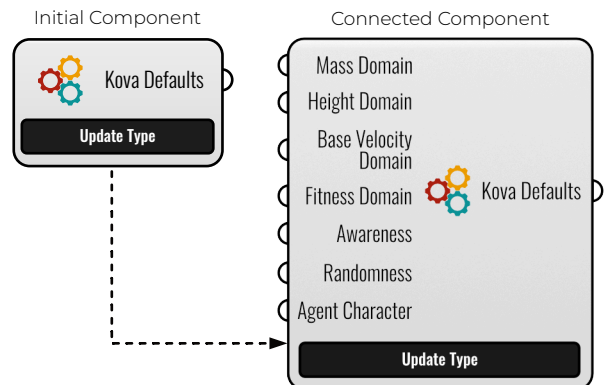
Outputs

1 Kova Defaults

A compiled set of behaviors which can be used for any agent type.

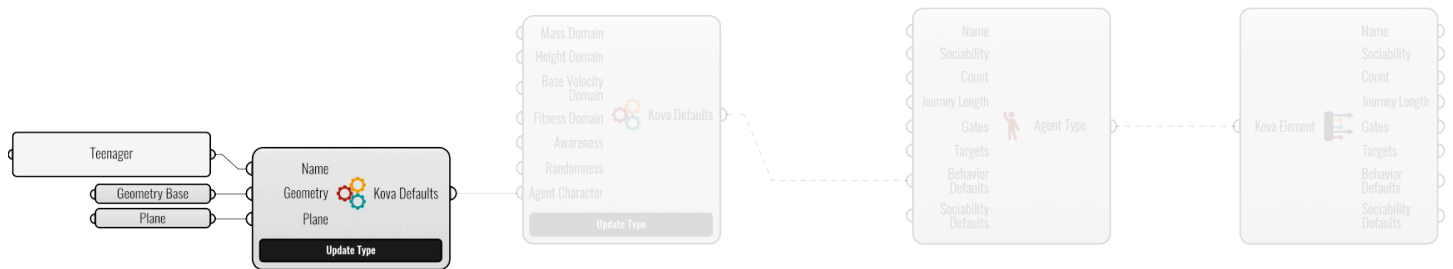
Note:

This component automatically updates its inputs based on its output connection. When placed, it will not have any inputs, but will update when connected and "Update Type" is clicked.



Agent Character Override

User Input Data  Kova Output Data 
Kova Input Data  Native Output Data 



Inputs

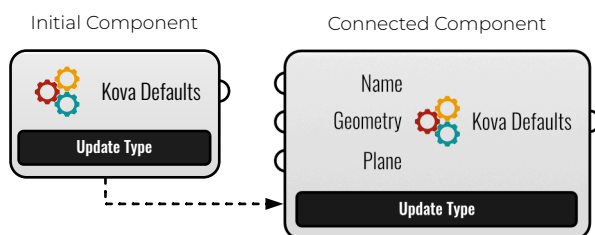
- 1 Name**
The name of the character. This value is used as an identifier and does not influence the algorithm.
- 2 Geometry**
The geometry which describes the visual appearance of the agent character. The character will be located in relation to the plane input's location and direction.
- 3 Plane**
The plane describing the origin location of the character, where the Y-Axis is forward. This will be used to orient the character to the agent's location during the simulation.

Outputs

- 1 Kova Defaults**
A compiled agent character which can be used for any agent type.

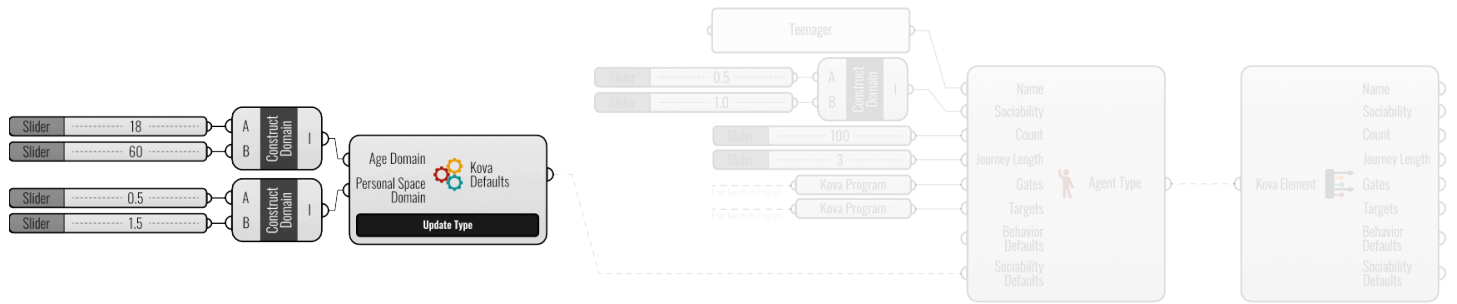
Note:

This component automatically updates its inputs based on its output connection. When placed, it will not have any inputs, but will update when connected and "Update Type" is clicked.



Agent Sociability Defaults Override

User Input Data  Kova Output Data 
Kova Input Data  Native Output Data 



Inputs

1 Age Domain

A domain describing the agent type's age. This will affect its movement and social behaviors during the simulation.

2 Personal Space Domain

A domain describing the agent type's personal radius, in Rhino units. If another agent enters this radius, there is a chance the two will socialize. Additionally, if a building enters the agent's radius, the agent will move away from it.

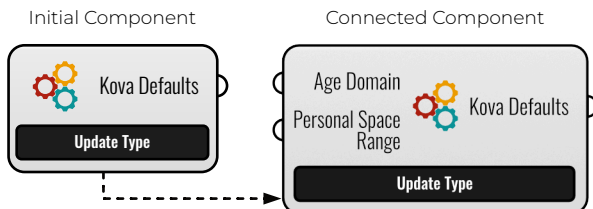
Outputs

1 Kova Defaults

A compiled set of social behaviors which can be used for any agent type.

Note:

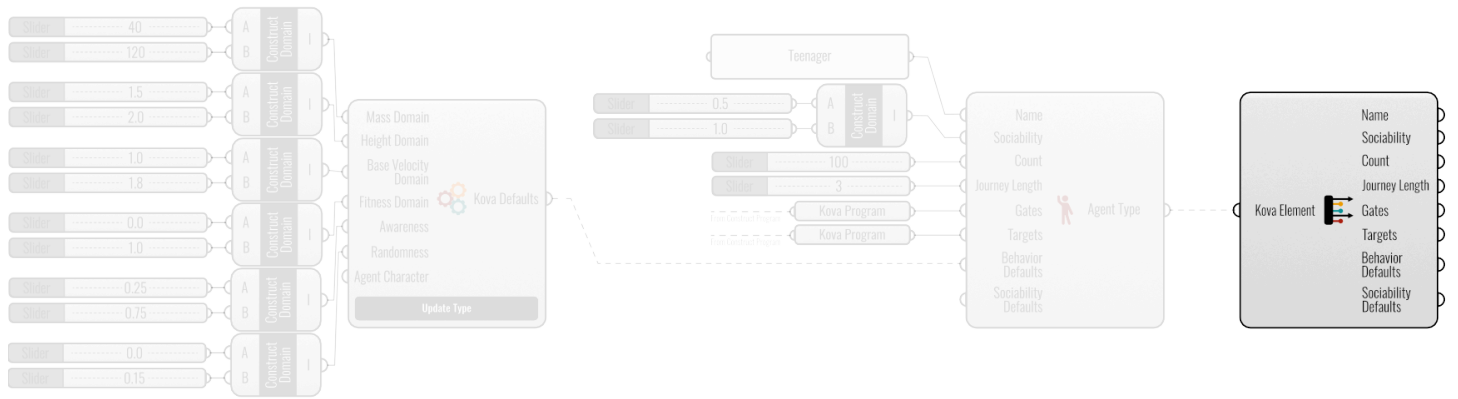
This component automatically updates its inputs based on its output connection. When placed, it will not have any inputs, but will update when connected and "Update Type" is clicked.



Agent Type Deconstructor

User Input Data Kova Output Data

Kova Input Data Native Output Data



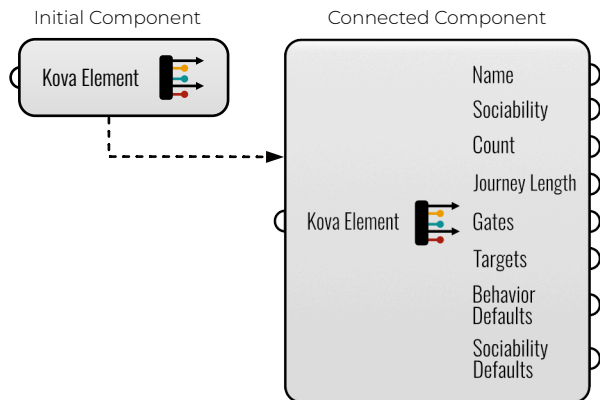
Inputs

1 Kova Element

The compiled Kova agent type class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



Outputs

1 Name

The name of the agent type. This value is used as an identifier and does not influence the algorithm.

2 Sociability

A domain that represents the agent type's social level. Two agents with similar social levels are more likely to socialize. The sociability of each agent instance will be randomly selected within this specific range.

3 Count

The total number of agents in the simulation who follow this agent behavior.

4 Journey Length

The total number of destinations this agent type was scheduled to visit during the simulation. If the agent was still active at the end of the simulation, it may not have yet visited all of its destinations.

5 Gates

The Kova program(s) this agent type can spawn from during the simulation. Please attach another Kova Deconstructor to this output to view the parameters.

6 Targets

The Kova program(s) this agent type can potentially visit as a target during the simulation. Please attach another Kova Deconstructor to this output to view the parameters.

7 Behavior Defaults

The Kova behaviors for this agent type. Please attach another Kova Deconstructor to this output to read this agent's behavior defaults.

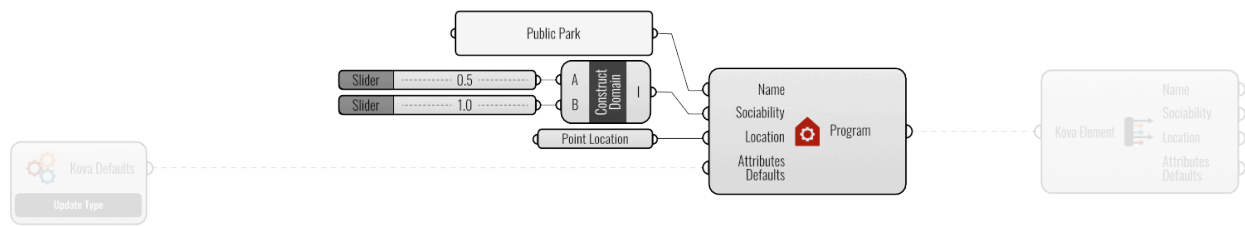
8 Sociability Defaults

The Kova social behaviors for this agent type. Please attach another Kova Deconstructor to this output to read this agent's sociability defaults.



Construct Program Component

User Input Data  Kova Output Data 
Kova Input Data  Native Output Data 



Inputs

1 Name

The name of the program. This value is used as an identifier and does not influence the algorithm.

2 Sociability

A domain which lies within 0.0 to 1.0 that represents the program's social level. The higher the program's social value, the more likely an agent is to be drawn towards its location. Each location defined will receive a sociability value within this range.

3 Location

The point(s) which represent the location of this program. They must be placed within the environment bounds.

4 Attributes Defaults

The Kova default settings for this program. Please see "Attributes Defaults" for more details.

Outputs

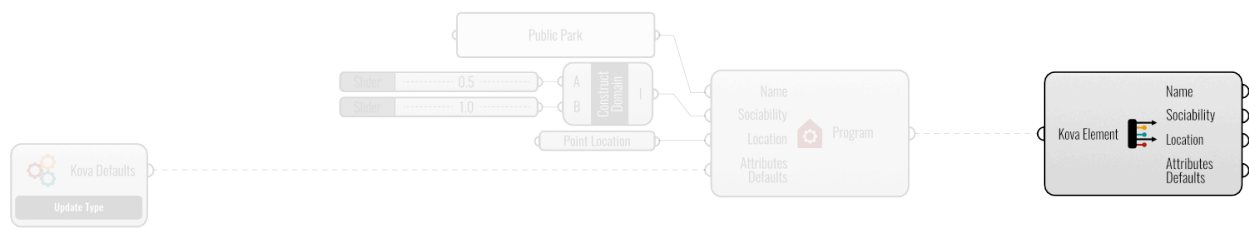
1 Program

A compiled Kova element representing the specified program in the simulation.



Program Deconstructor Component

User Input Data Kova Output Data
Kova Input Data Native Output Data



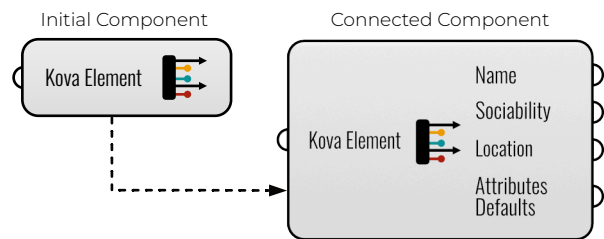
Inputs

1 Kova Element

The compiled Kova program class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



Outputs

1 Name

The name of the program. This value is used as an identifier and does not influence the algorithm.

2 Sociability

The specific sociability value defined for this program, which was created from the sociability domain. This is the value which is used to affect agent movement.

3 Location

The point which represents the location of this program.

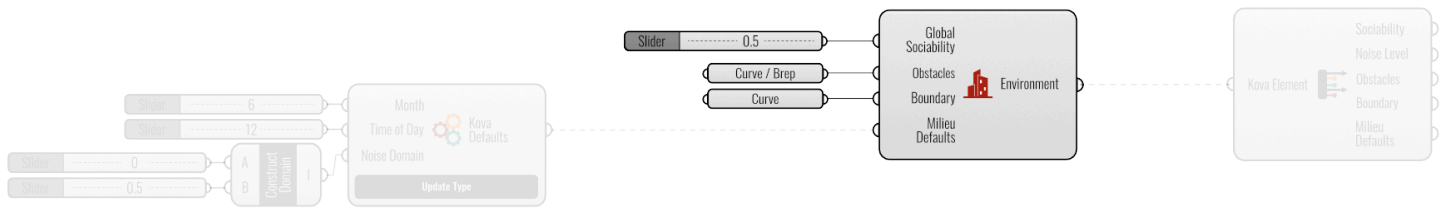
4 Attributes Defaults

The Kova default settings for this program. Please attach another Kova Deconstructor to this output to read this program's attributes defaults.



Construct Environment Component

User Input Data  Kova Output Data 
Kova Input Data  Native Output Data 



Inputs

1 Global Sociability

A number between 0.0 and 1.0 which affects the social behavior of the entire simulation. A higher value will increase the likelihood of socialization, whereas a smaller value will minimize the likelihood.

2 Obstacles

Curve(s) or brep(s) which describe obstacles within the simulation. Agents will not enter these zones. Objects must be closed.

3 Boundary

The curve that describes the outer limit of the simulation environment. Agents will not exit this boundary. The curve must be closed.

4 Milieu Defaults

The Kova default settings for this environment. Please see "Milieu Defaults" for more details.

Outputs

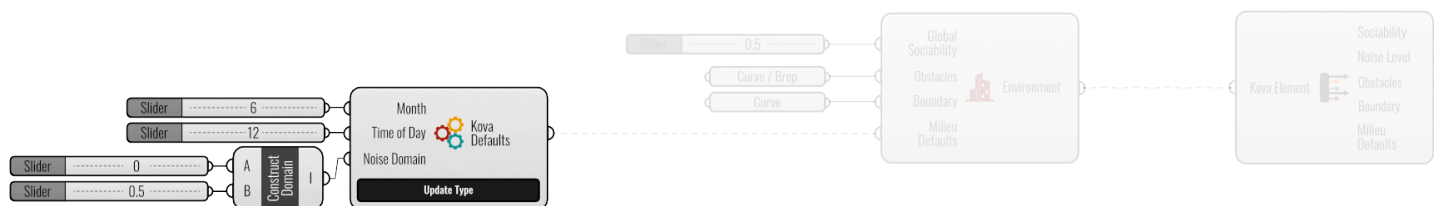
1 Environment

A compiled Kova element representing the environment in the simulation.



Milieu Defaults Override

User Input Data ■ Kova Output Data ■
Kova Input Data ■ Native Output Data ■



Inputs

1 Month

The month in which the simulation takes place. This will affect the agents' social and movement behaviors. This is a range from 1-12 where January = 1 and December = 12.

2 Time of Day

The time of day in which the simulation takes place. This will affect the agents' socialization and movement. This is a range from 0-23 where midnight = 0 and noon = 12.

3 Noise Domain

A domain in decibels which represents the level of noise the environment. An environment which is too noisy or too quiet will reduce agent socialization.

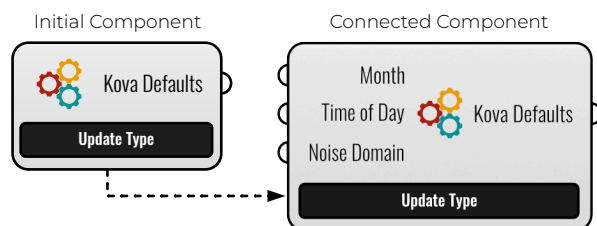
Outputs

1 Kova Defaults

A compiled set of environment parameters which can be used for the environment.

Note:

This component automatically updates its inputs based on its output connection. When placed, it will not have any inputs, but will update when connected and "Update Type" is clicked.



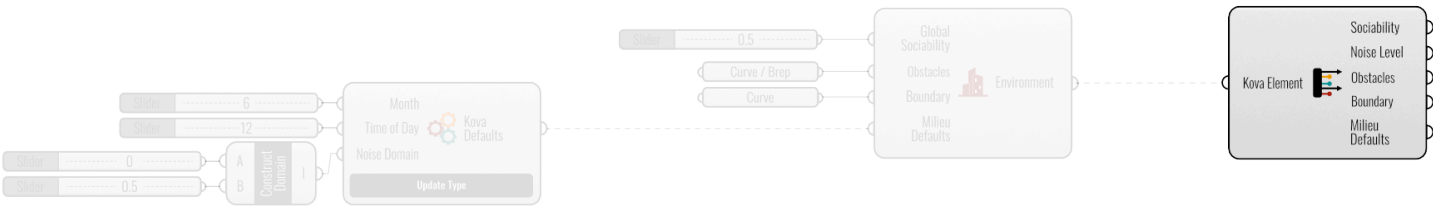
Environment Deconstructor

User Input Data

Kova Output Data

Kova Input Data

Native Output Data



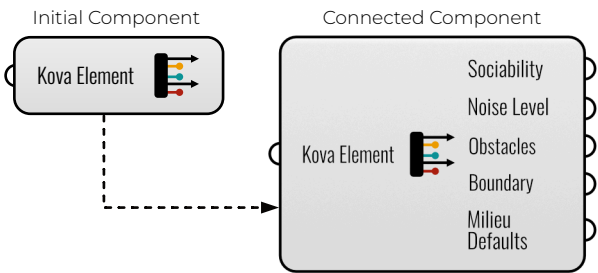
Inputs

1 Kova Element

The compiled Kova environment class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



Outputs

1 Sociability

A number between 0.0 and 1.0 which affects the social level of the population of agents. A higher value will increase the likelihood of socialization, whereas a smaller value will minimize the likelihood.

2 Noise Level

A domain from 0 to 1 which represents the level of noise the environment. A noisier environment causes a higher level of distraction and reduces the desire to socialize.

3 Obstacles

Curve(s) or brep(s) which describe obstacles within the simulation. Agents will not enter these zones.

4 Boundary

The curve that describes the outer limit of the simulation environment. Agents will not exit this boundary.

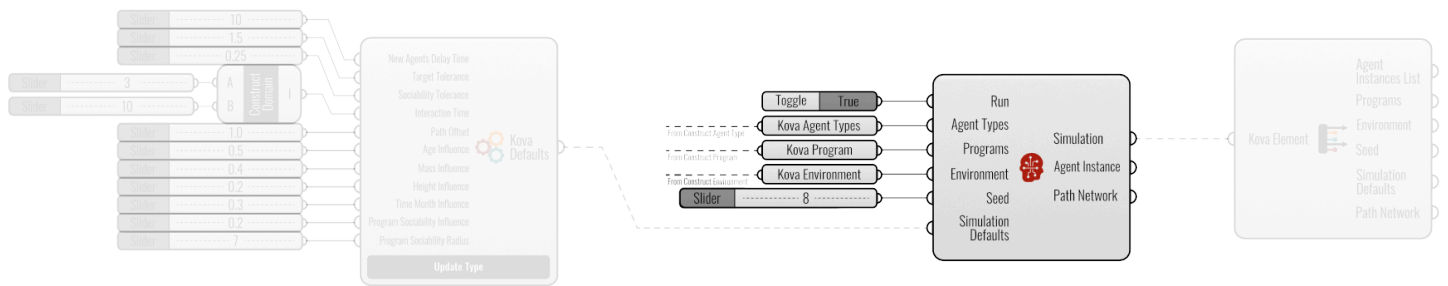
5 Milieu Defaults

The Kova default settings for this environment. Please attach another Kova Deconstructor to this output to read this environment's milieu defaults.



Compile Simulation Component

User Input Data ■ Kova Output Data ■
Kova Input Data ■ Native Output Data ■



Inputs

1 Run

A boolean which defines if the compiler is currently running. Toggle to true to activate the compiler.

2 Agent Types

The Kova agent(s) which are part of this simulation. One or more agents can be connected from the Construct Agent Type component.

3 Programs

The Kova program(s) which are part of this simulation. One or more programs can be connected from the Construct Program component.

4 Environment

The Kova environment for this simulation. Only one environment can be defined using the Construct Environment component.

5 Seed

A value to initialize the pseudo-random nature of the simulation. The same seed will provide consistent results.

6 Simulation Defaults

The Kova default settings for this simulation. Please see "Simulation Defaults" for more details.

Outputs

1 Simulation

A compiled Kova element representing the entire simulation, including its parameters and defined members.

2 Agent Instances

One or more compiled Kova elements representing each of the agent instances in the simulation. Each agent instance is derived from one of the defined agent types.

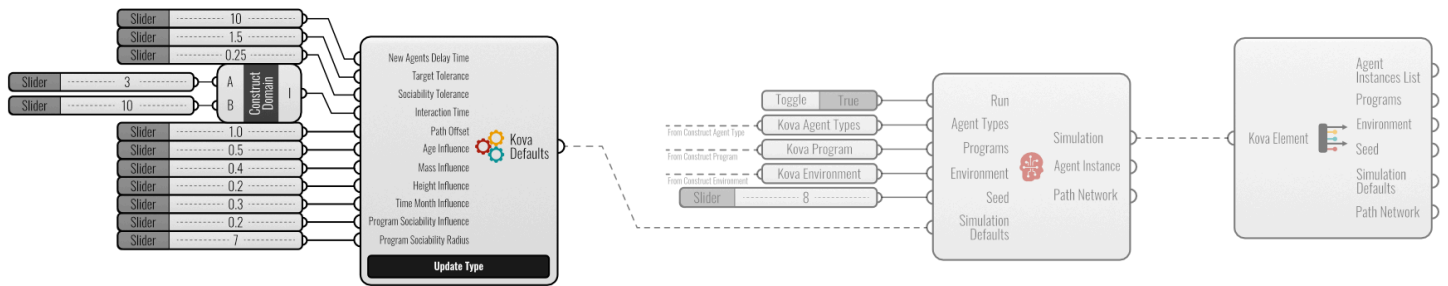
3 Path Network

A compiled Kova element representing the path network agents use to navigate through their environment.



Simulation Defaults Override

User Input Data ■ Kova Output Data ■
Kova Input Data ■ Native Output Data ■



Inputs

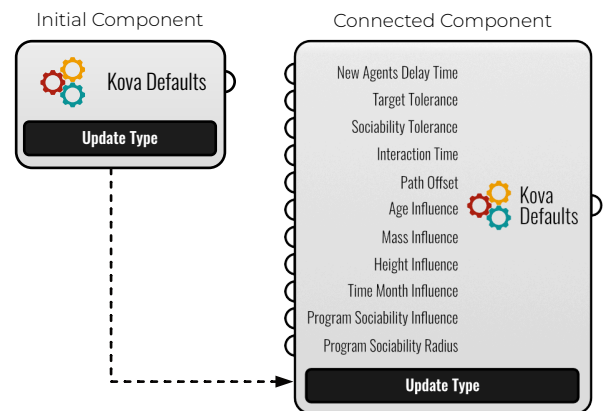
- 1 **New Agents Delay Time**
An integer that sets the interval (in iterations) for spawning new agents.
- 2 **Target Tolerance**
The distance, in Rhino units, within which an agent considers a target reached.
- 3 **Sociability Tolerance**
A value from 0.0 to 1.0 representing the maximum allowed difference in sociability for agents to interact.
- 4 **Interaction Time**
A domain defining how many iterations two agents can stay socially engaged with one another.
- 5 **Path Offset**
A number specifying the distance, in Rhino units, that agents are offset from obstacles during path planning.
- 6 **Age Influence**
A number from 0.0 to 1.0 which describes how strongly an agent's age will affect its behavior during the simulation.
- 7 **Mass Influence**
A number from 0.0 to 1.0 which describes how strongly an agent's mass will affect its behavior during the simulation.
- 8 **Height Influence**
A number from 0.0 to 1.0 which describes how strongly an agent's height will affect its behavior during the simulation.
- 9 **Time Month Influence**
A number from 0.0 to 1.0 which describes how strongly the defined month and time of day will influence agent movement during the simulation.
- 10 **Program Sociability Influence**
A number from 0.0 to 1.0 which describes how strongly the program's social level will influence agent movement during the simulation.
- 11 **Program Sociability Radius**
The radius around a program's location, in Rhino units, in which a program's sociability will affect agent movement.

Outputs

- 1 **Kova Defaults**
A compiled set of parameters which can be used for the simulation.

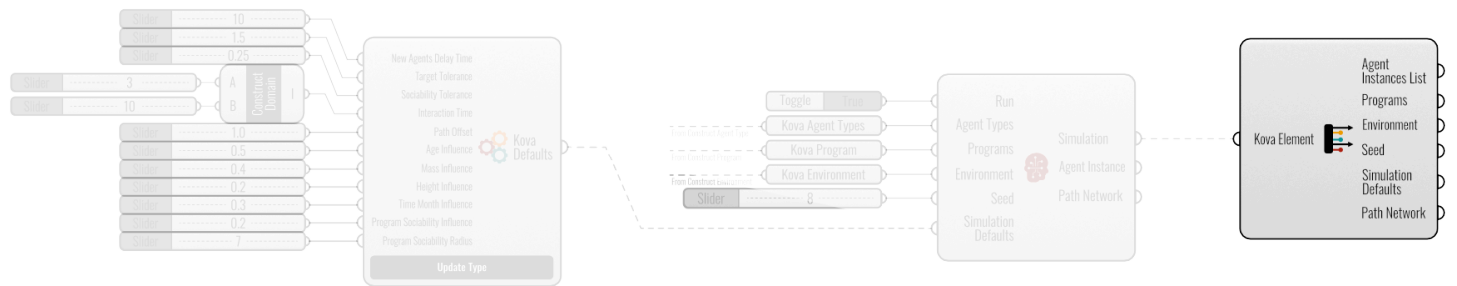
Note:

This component automatically updates its inputs based on its output connection. When placed, it will not have any inputs, but will update when connected and "Update Type" is clicked.



Simulation Deconstructor Component

User Input Data ■ Kova Output Data ■
Kova Input Data ■ Native Output Data ■



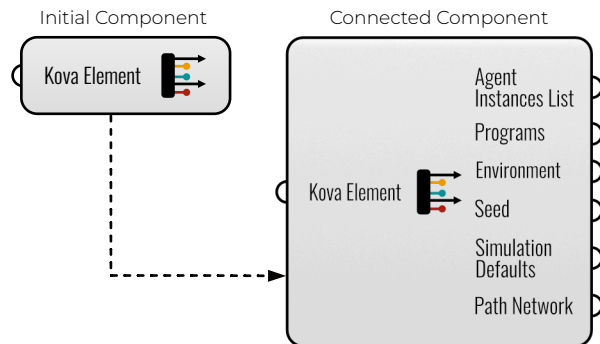
Inputs

1 Kova Element

The compiled Kova simulation class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



Outputs

1 Agent Instances List

A list of individual agents which will be used during the simulation. These have been generated from the defined agent types.

2 Programs

The Kova programs for this simulation. Please attach another Kova Deconstructor to this output to obtain the geometry and settings for this element.

3 Environment

The Kova environment for this simulation. Please attach another Kova Deconstructor to this output to obtain the geometry and settings for this element.

4 Seed

A value to initialize the pseudo-random nature of the simulation. The same seed will provide consistent results across different iterations of the same simulation..

5 Simulation Defaults

The Kova default settings for this simulation. Please attach another Kova Deconstructor to this output to read the simulation defaults.

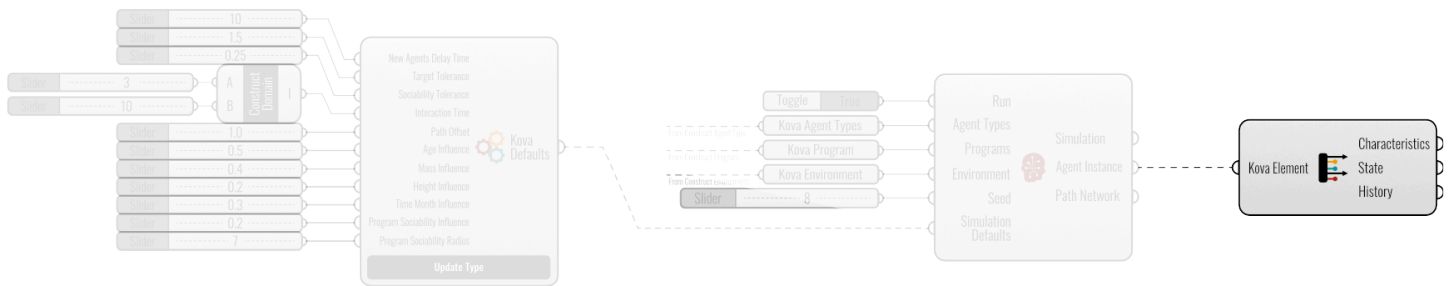
6 Path Network

The Kova network for this simulation. Please attach another Kova Deconstructor to this output to obtain the geometry and settings for this element.



Agent Instance Deconstructor

User Input Data ■ Kova Output Data ■
Kova Input Data ■ Native Output Data ■



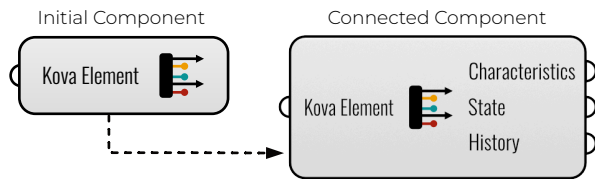
Inputs

1 Kova Element

The compiled Kova agent instance class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



Outputs

1 Characteristics

A compiled element which holds all of the characteristics for this agent. Please attach another Kova Deconstructor to this output to obtain the data for this element.

2 State

A compiled element which describes the agent's state at the current iteration. Please attach another Kova Deconstructor to obtain the data for this element.

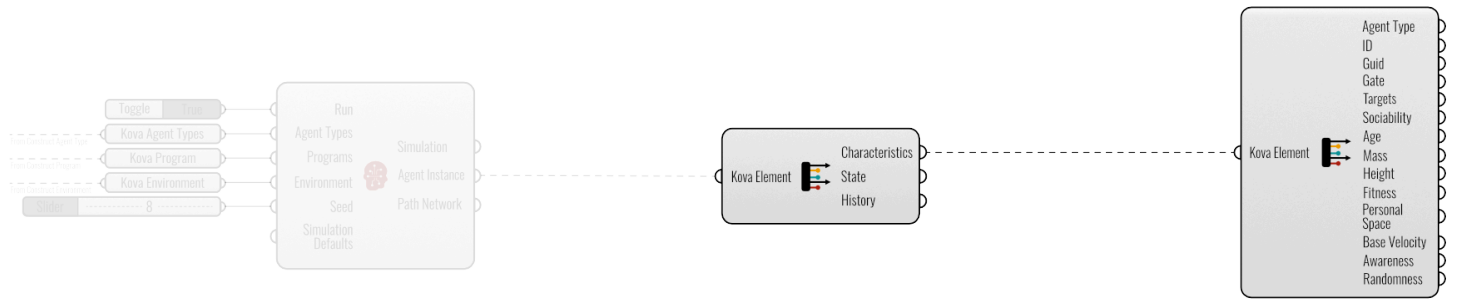
3 History

A compiled element which holds the simulation history for this agent. Please attach another Kova Deconstructor to this output to obtain the data for this element.



Agent Characteristics Deconstructor

User Input Data ■ Kova Output Data ■
Kova Input Data ■ Native Output Data ■



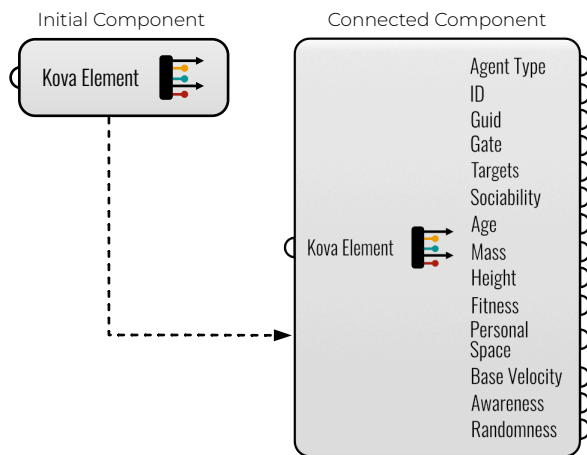
Inputs

1 Kova Element

The compiled Kova characteristics class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



Outputs

1 Agent Type

The name of the agent type that this instance is derived from.

2 ID

A two-part index key: the first digit denotes agent type, the second identifies the specific instance.

3 Guid

A globally unique identifier assigned to each agent instance for consistent tracking throughout the simulation.

4 Gate

The Kova compiled program from which this agent instance will spawn from.

5 Targets

The Kova compiled program(s) this agent instance will visit during the simulation.

6 Sociability

The agent's sociability value, which determines its interaction with other agents. This is derived from its agent type's sociability domain.

7 Age

The agent's age, which affects its movement and social behaviors during the simulation. This is derived from its agent type's age domain.

8 Mass

The agent's mass, which affects its movement during the simulation. This is derived from its agent type's domain.

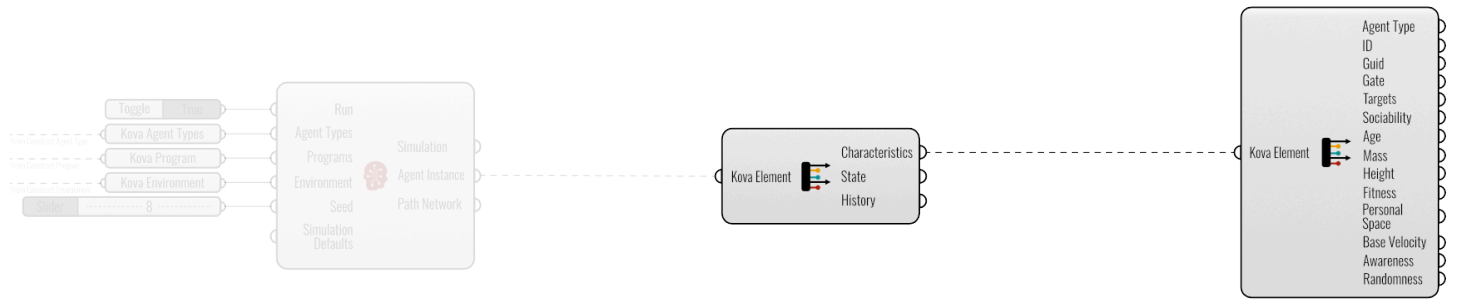
9 Height

The agent's height, which affects its movement during the simulation. This is derived from its agent type's domain.



Agent Characteristics Deconstructor

User Input Data ■ Kova Output Data ■
Kova Input Data ■ Native Output Data ■



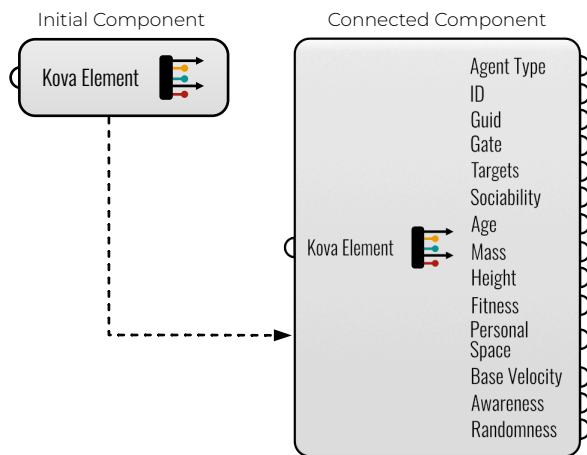
Inputs

1 Kova Element

The compiled Kova characteristics class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



Outputs

10 Fitness

The agent's fitness, which affects its movement during the simulation. This is derived from its agent type's domain.

11 Personal Space

The agent's personal radius. If another agent enters this radius, there is a chance the two will socialize. This is derived from its agent type's personal space domain.

12 Base Velocity

The base distance the agent instance will travel during each iteration, derived from its agent type's base velocity domain.

13 Awareness

A number between 0.0 and 1.0 specifying how familiar the agent is with their surroundings.

14 Randomness

A domain between 0.0 and 1.0 specifying the level of randomness in an agent's movement.



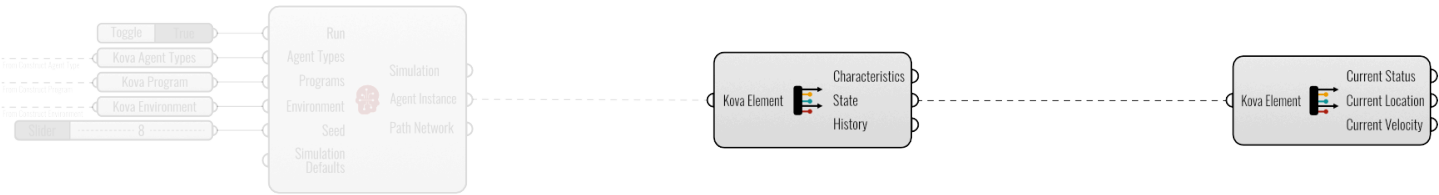
Agent State Deconstructor

User Input Data

Kova Output Data

Kova Input Data

Native Output Data

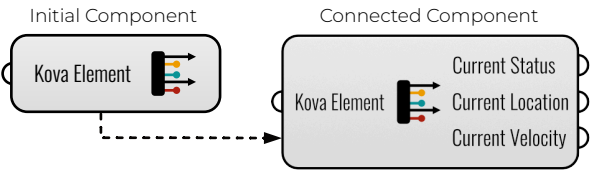


Inputs

- 1 Kova Element
- The compiled Kova agent state class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



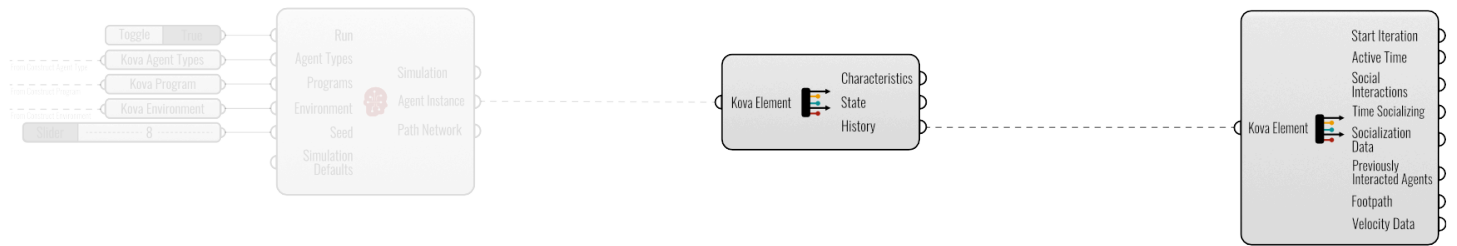
Outputs

- 1 Current Status
- The agent's current status at the active iteration, such as "Moving" or "Socializing".
- 2 Current Location
- The agent's current x,y,z location at the active iteration.
- 3 Current Velocity
- The agent's current velocity vector at the active iteration.



Agent History Deconstructor

User Input Data  Kova Output Data 
Kova Input Data  Native Output Data 



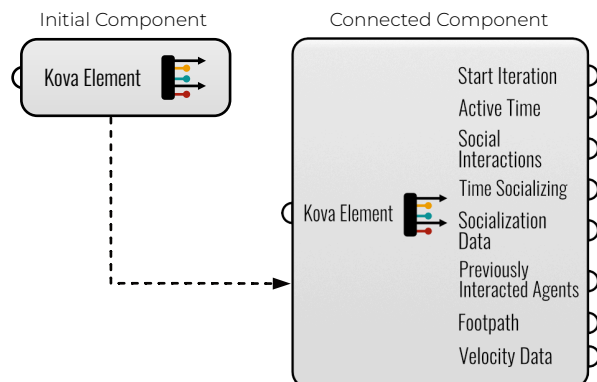
Inputs

1 Kova Element

The compiled Kova agent history class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



Outputs

1 Start Iteration

The iteration which this agent was instantiated.

2 Active Time

The total number of iterations during which this agent was actively involved in the simulation

3 Social Interactions

The total number of social interactions this agent instance had during the simulation.

4 Time Socializing

The number of iterations this agent instance spent socializing during the simulation.

5 Socialization Data

The complete list of actions this agent instance took during the simulation.

6 Previously Interacted Agents

The complete list of other Kova agent instances that this agent instance interacted with during the simulation.

7 Footpath

The travel path, in points, that this agent instance followed during the simulation. The footpath contains one point per iteration in which this agent was active.

8 Velocity Data

The complete list of velocity vectors this agent instance followed during the simulation.



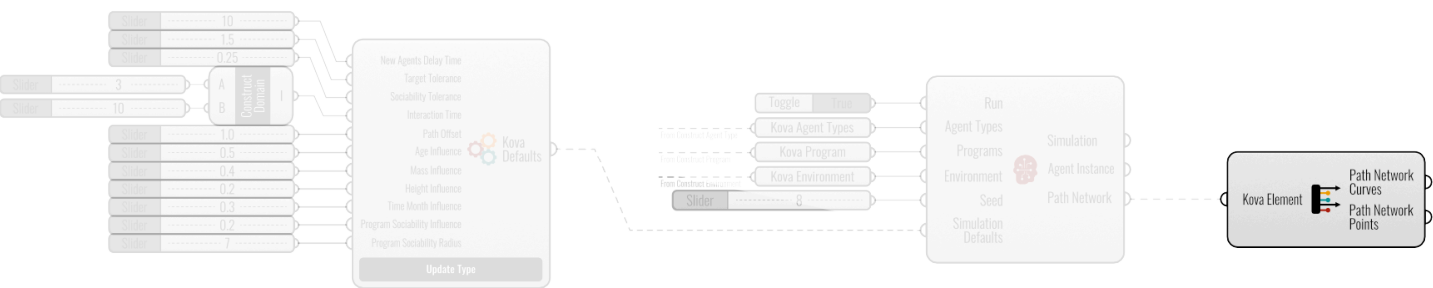
Path Network Deconstructor

User Input Data

Kova Output Data

Kova Input Data

Native Output Data

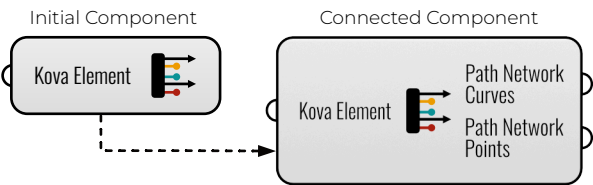


Inputs

- 1 Kova Element
- The compiled Kova path network class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



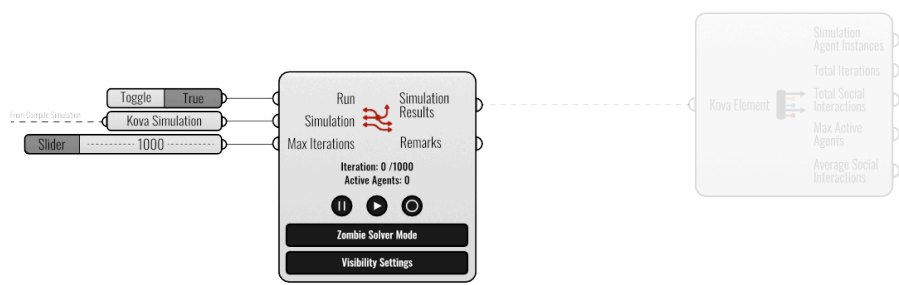
Outputs

- 1 Path Network Curves
- The curves which describe the final network edges in the simulation. The agents will use these during travel path planning to understand their intended route.
- 2 Path Network Points
- The points which describe the final network node connections in the simulation, used to plan routes.



Run Simulation Component

User Input Data Kova Output Data
Kova Input Data Native Output Data



Inputs

1 Run

A boolean which defines if the simulation is currently running or active. Toggle to true to activate the simulation.

2 Simulation

The Kova compiled simulation. Connect this from the Compile Simulation component.

3 Max Iterations

The maximum number of iterations the simulation will run for. The simulation may terminate early if all agents have completed their journeys.

Outputs

1 Simulation Results

A compiled Kova element representing the final results of the simulation, including the final agents and some simulation data.

2 Remarks

Notes about the progression of the simulation and abnormalities it encountered, if any.

Buttons

1 Iteration

"Iteration" indicates which step of the simulation is currently being processed and displayed.

2 Active Agents

"Active Agents" displays a live count of all agent instances that are currently engaged in simulation behavior.

3 Pause / Play / Step Icons

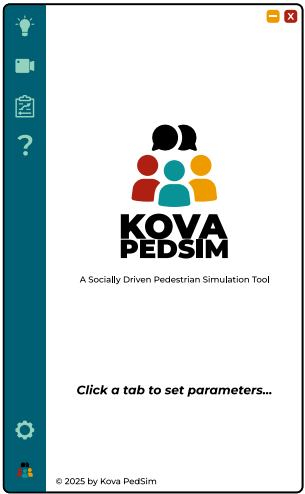
These set of three buttons controls the live simulation if the simulation is in "Step-Solver" mode. Pause and Play temporarily stop or start the simulation, while Step increments the simulation by one iteration.

4 Zombie-Solver / Step-Solver Mode

This button toggles between Zombie and Step Solver mode. Step solver mode runs and displays each iteration, while zombie mode runs the entire simulation at once without displaying the intermediate steps.

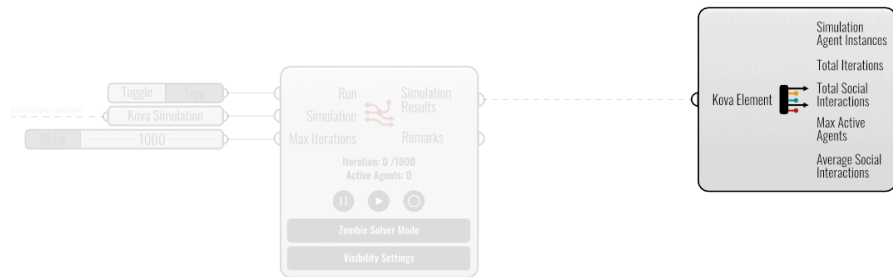
5 Visibility Settings

Click this button to open up a panel of settings for the simulation. For more information, please continue reading.



Simulation Results Deconstructor

User Input Data  Kova Output Data 
Kova Input Data  Native Output Data 



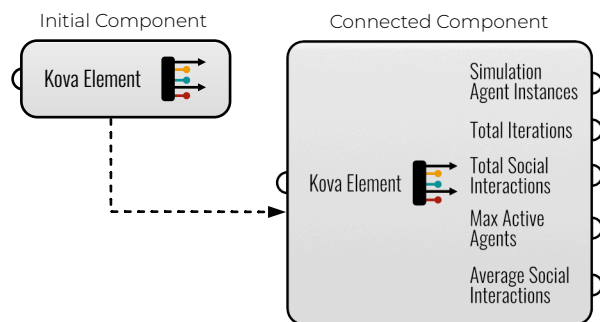
Inputs

1 Kova Element

The compiled Kova simulation results class to deconstruct.

Note:

This component automatically updates its outputs based on its input connection. When initially placed, the component will not have any outputs, but will update when connected.



Outputs

1 Simulation Agent Instances

The Kova agent instances which were used during the simulation. Please attach another Kova Deconstructor to this output to obtain information on the agents.

2 Total Iterations

The total number of time steps which occurred in the simulation.

3 Total Social Interactions

The total number of social interactions that took place during the simulation.

4 Max Active Interactions

The maximum number of agents which were active at one time during the simulation.

5 Average Social Interactions

The average number of social interactions one agent had during the simulation.



Settings

User Input Data  Kova Output Data 
Kova Input Data  Native Output Data 

Visualization Settings

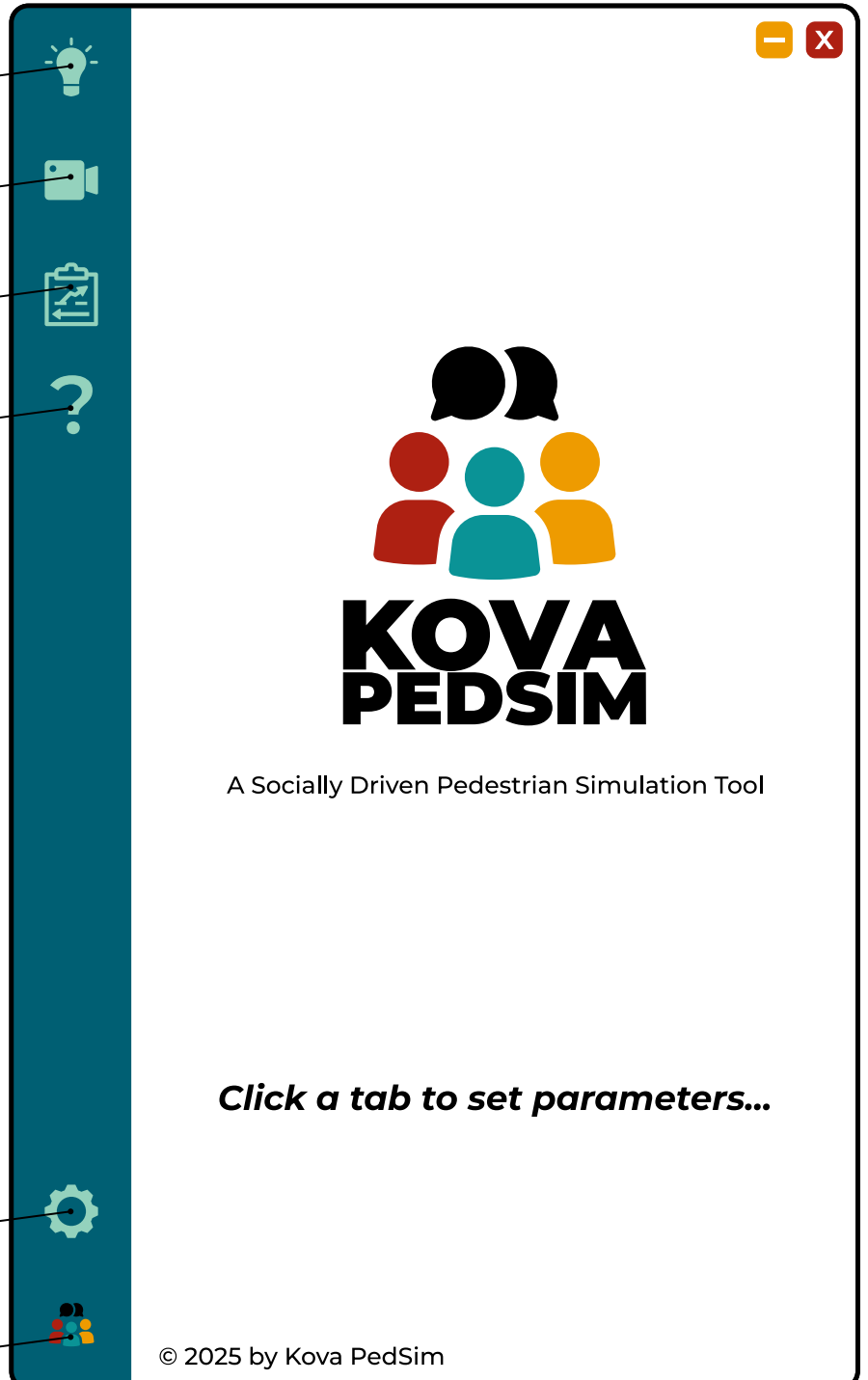
Recording Settings

Simulation Data

Help

Utilities

Kova PedSim Website



Lightbulb icon

Camera icon

Clipboard icon

Question mark icon

Settings gear icon

Group of people icon

Visualizations Settings

Customize simulation visuals with full control over agent colors, sizes, trails, and backgrounds. Tailor outputs for presentations, analysis, or branding needs. Adjust settings directly in Grasshopper to match your design goals and communicate results more clearly.

Moving Agent

Socializing Agent

Agent Size

Create Heatmap

Heatmap Type

Heatmap Minimum

Heatmap Maximum

Heatmap Colors

#FF005F73

#FFCA6702

1.5

0

500

The display color for agents whose status is "Moving".

The display color for agents whose status is "Socializing".

The size of the display dot for all agents

A toggle to create the heatmap. Please re-run the simulation to see changes

The type of heatmap. False = discrete colors True = true gradient

The lowest value mapped to the starting heatmap color

The highest value mapped to the ending heatmap color

The range of colors used for the visualized heatmap. Click on each color handle to set each gradient color.

Please re-run the simulation to see the changes..

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Record Simulation

Automatically capture each simulation frame and export as an animated GIF or a series of high-resolution images. This feature helps visualize simulation behavior over time, ideal for documentation or sharing. No external tools required -- just enable recording and export directly from Grasshopper using the controls below.

Export Recording Frames

1920

1080

Browse...

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Toggle to export individual frames for each iteration of the simulation.

The output image width in pixels (e.g., 1920)

The output image height in pixels (e.g., 1080)

The directory path where exported frames and rendered files are saved



Lightbulb icon

Camera icon

Clipboard icon

Question mark icon

Gear icon

Group of people icon

Utilities

The utilities page provides quick access to helpful external resources for Kova PedSim, including the official website, example files, and tutorial videos. Use the buttons below to easily find documentation, learning materials, and additional tools.

Submit Bugs

Feature Request

Check for Updates

Example Files

Documentation

Tutorial Videos

Explore Research

Submit

Submit

Check

Open

Open

Open

Explore

Click to report a bug on the Kova PedSim website

Click to request a feature on the Kova PedSim website

Click to check for a new update on Food4Rhino

Click to view the example files for all simulations

Click to view the documentation all for simulations

Click to watch the tutorials on Kova PedSim's YouTube channel

Click to view the research related to Kova PedSim

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