



H.I.V.E. Documentation

Physics Simulation

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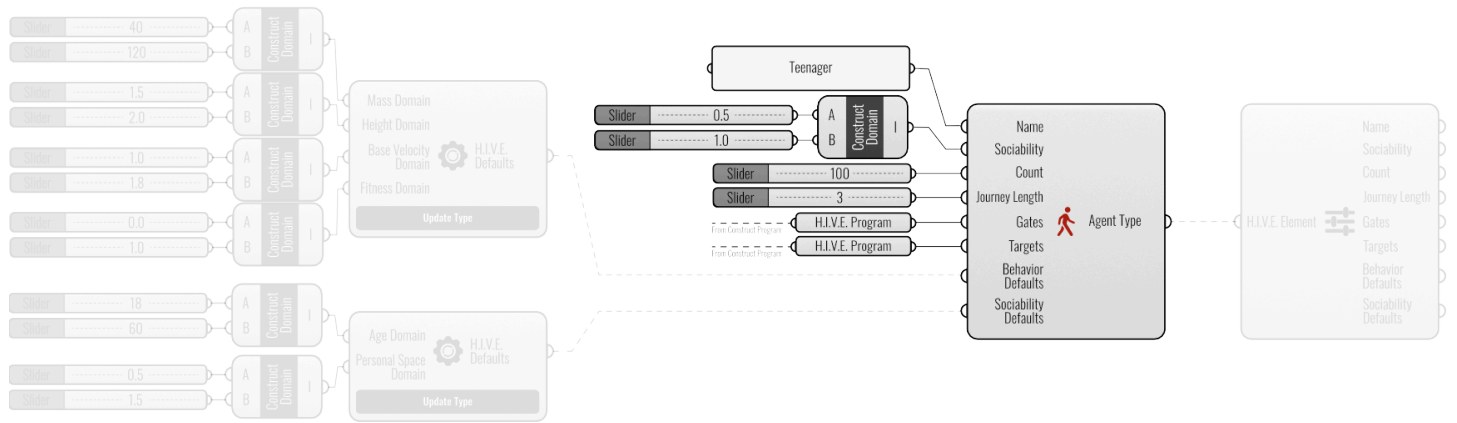
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Construct Agent Type Component

User Input Data  H.I.V.E. Output Data 
H.I.V.E. 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 H.I.V.E. element representing the specified agent type in the simulation.

5 Gates

The H.I.V.E. 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 H.I.V.E. 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 H.I.V.E. behaviors for this agent type. Please see "Behavior Defaults" for more details.

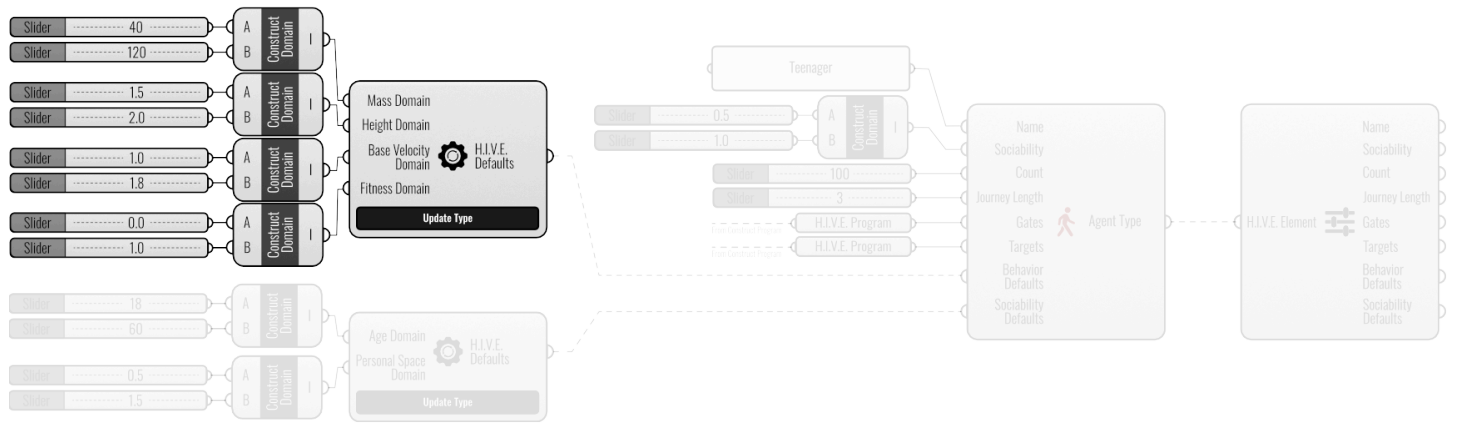
8 Sociability Defaults

The H.I.V.E. social behaviors for this agent type. Please see "Sociability Defaults" for more details.



Agent Behavior Defaults Override

User Input Data ■ H.I.V.E. Output Data ■
H.I.V.E. 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.

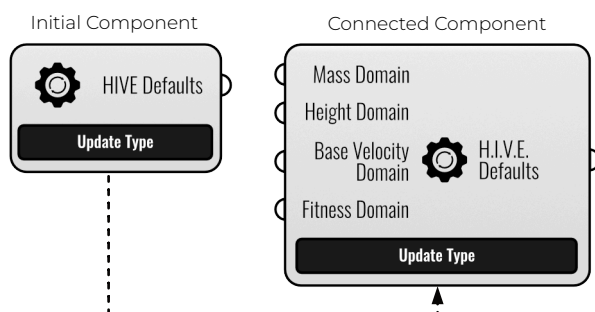
Outputs

1 H.I.V.E. Defaults

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

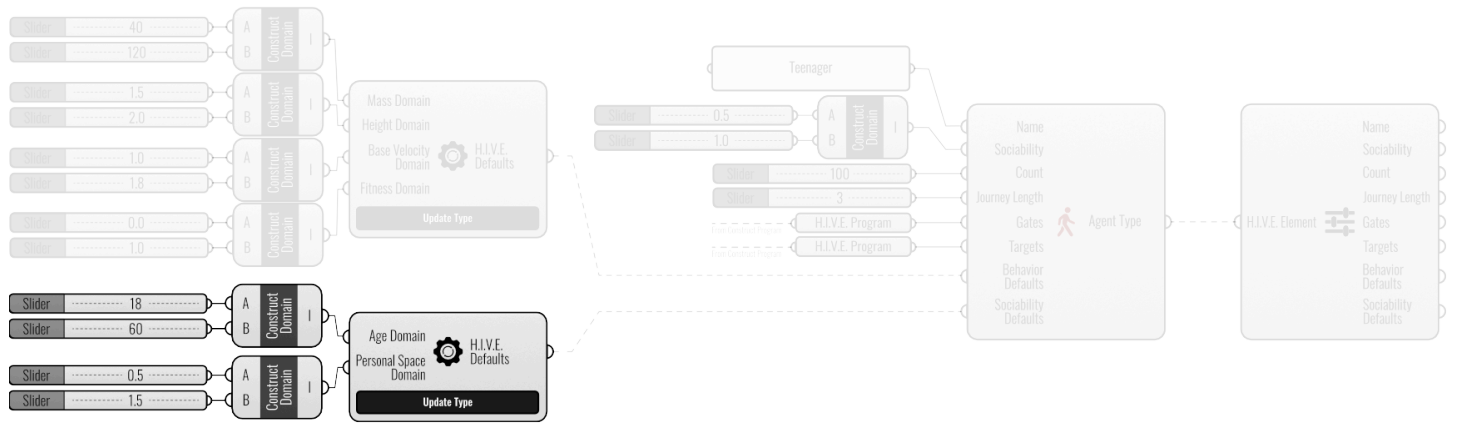
Note:

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 Sociability Defaults Override

User Input Data ■ H.I.V.E. Output Data ■
H.I.V.E. 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.

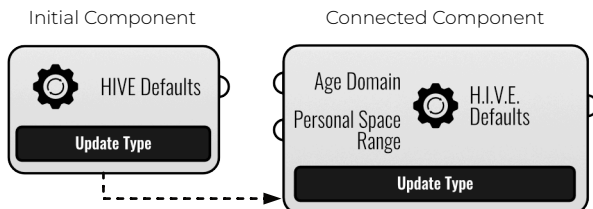
Outputs

1 H.I.V.E. Defaults

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

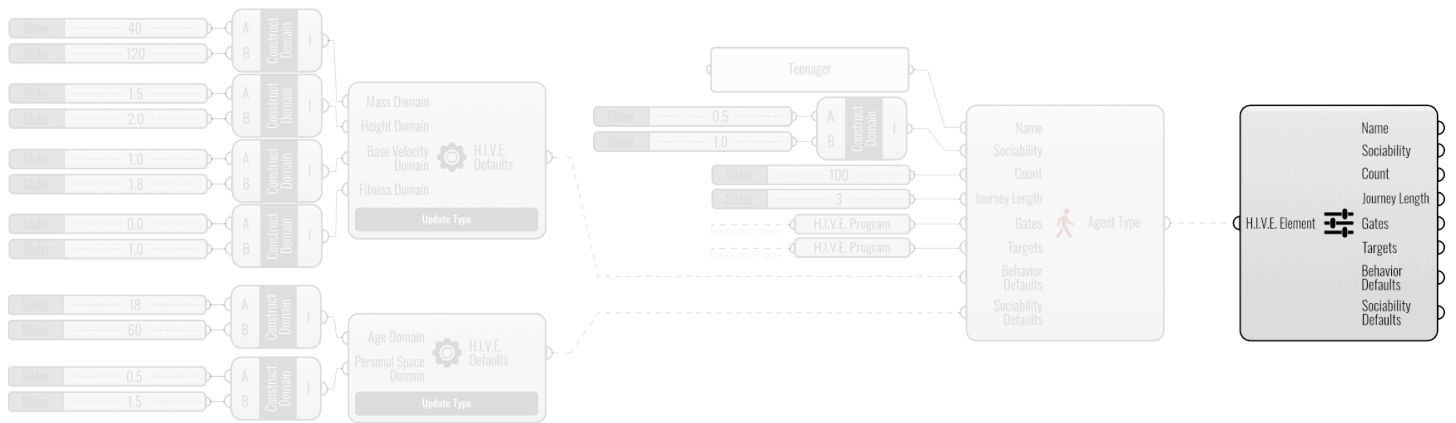
Note:

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 ■ H.I.V.E. Output Data ■
H.I.V.E. Input Data ■ Native Output Data ■



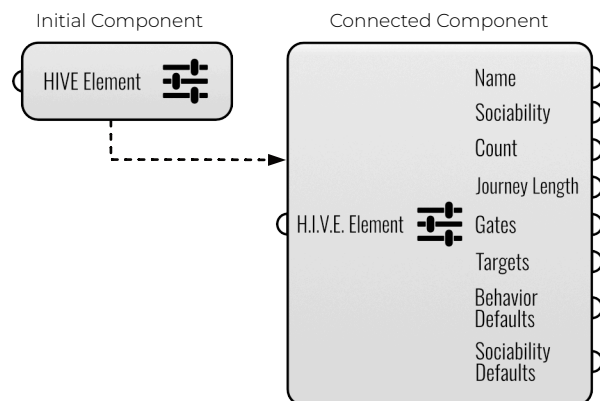
Inputs

1 H.I.V.E. Element

The compiled H.I.V.E. 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 H.I.V.E. program(s) this agent type can spawn from during the simulation. Please attach another H.I.V.E. Deconstructor to this output to view the parameters.

6 Targets

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

7 Behavior Defaults

The H.I.V.E. behaviors for this agent type. Please attach another H.I.V.E. Deconstructor to this output to read this agent's behavior defaults.

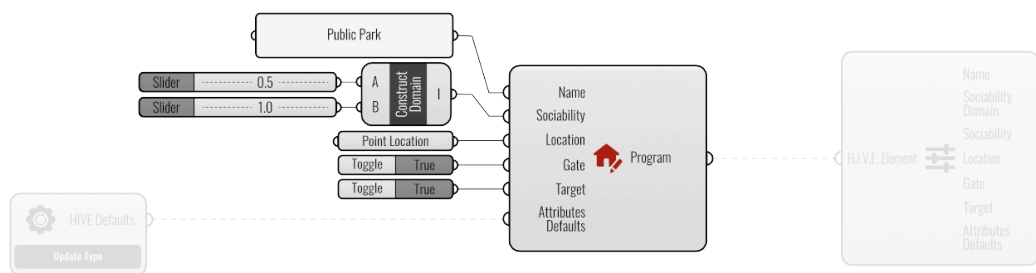
8 Sociability Defaults

The H.I.V.E. social behaviors for this agent type. Please attach another H.I.V.E. Deconstructor to this output to read this agent's sociability defaults.



Construct Program Component

User Input Data  H.I.V.E. Output Data 
H.I.V.E. 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. Each location defined will receive a sociability value within this range.

3 Location

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

4 Gate

A boolean value which indicates if this program can be considered a gate for agents to spawn from.

5 Target

A boolean value which indicates if this program can be considered a target destination for agents.

6 Attributes Defaults

The H.I.V.E. default settings for this program. There are currently no attributes defaults for this simulation.

Outputs

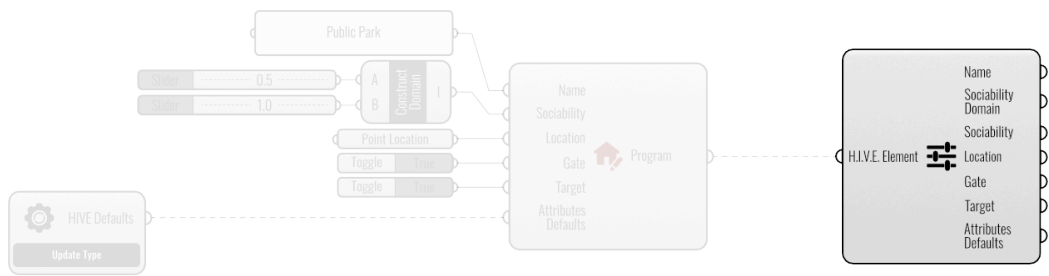
1 Program

A compiled H.I.V.E. element representing the specified program in the simulation.



Program Deconstructor Component

User Input Data H.I.V.E. Output Data
H.I.V.E. Input Data Native Output Data

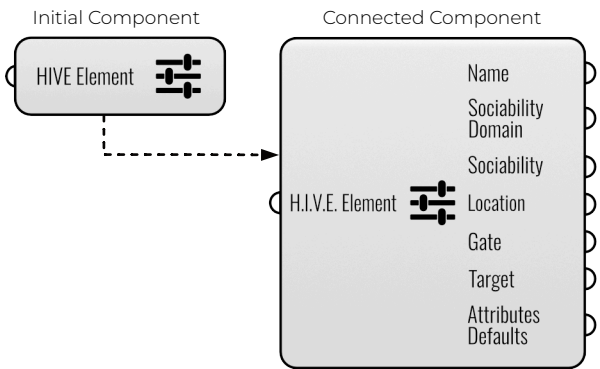


Inputs

- 1 H.I.V.E. Element
The compiled H.I.V.E. 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.



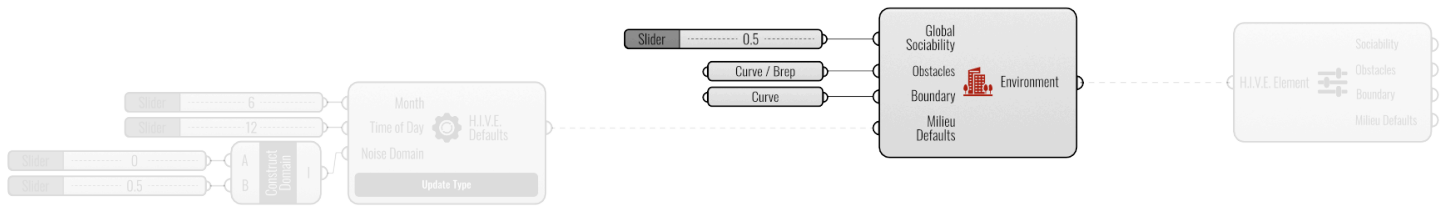
Outputs

- 1 Name
The name of the program. This value is used as an identifier and does not influence the algorithm.
- 2 Sociability Domain
A domain which lies within 0.0 to 1.0 that represents the program's social level. Each location defined will receive a sociability value within this range.
- 3 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.
- 4 Location
The point which represents the location of this program.
- 5 Attributes Defaults
The H.I.V.E. default settings for this program. There are currently no attributes defaults for this simulation.



Construct Environment Component

User Input Data  H.I.V.E. Output Data 
H.I.V.E. 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 H.I.V.E. default settings for this environment. Please see "Milieu Defaults" for more details.

Outputs

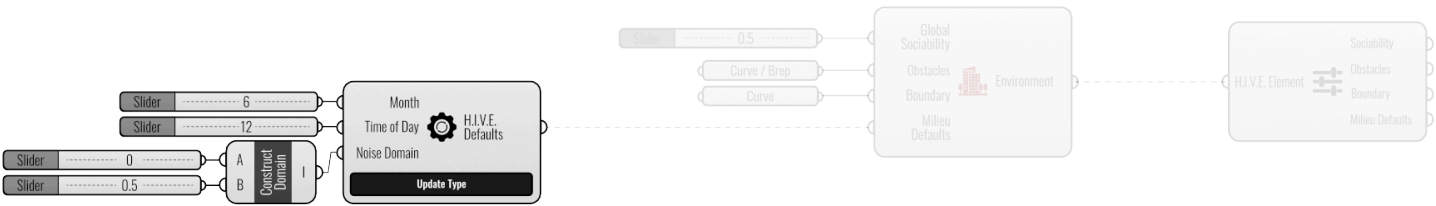
1 Environment

A compiled H.I.V.E. element representing the environment in the simulation.



Milieu Defaults Override

User Input Data H.I.V.E. Output Data
H.I.V.E. Input Data Native Output Data



Inputs

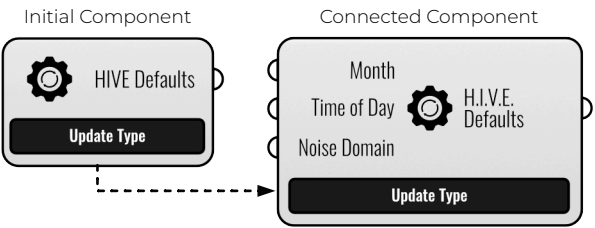
- 1 **Month**
The month in which the simulation takes place. This will affect the agents' social and movement behaviors. This is a range from 1-12 where January = 1 and December = 12.
- 2 **Time of Day**
The time of day in which the simulation takes place. This will affect the agents' socialization and movement. This is a range from 0-23 where midnight = 0 and noon = 12.
- 3 **Noise Domain**
The level of noise in the environment. This will affect the agents' social and movement behaviors.

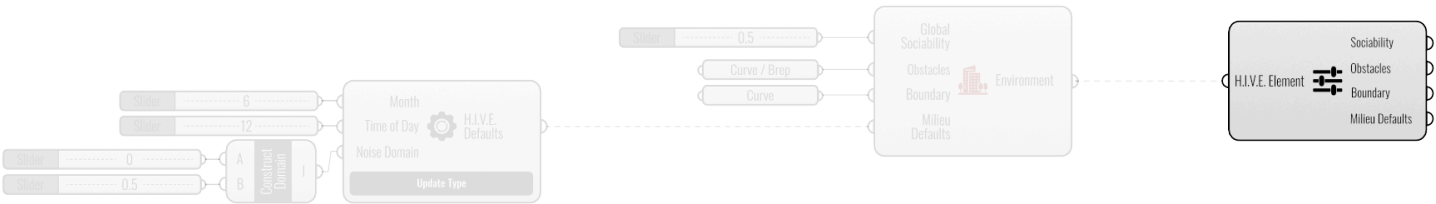
Outputs

- 1 **H.I.V.E. 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.





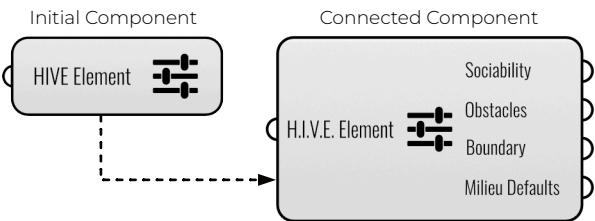
Inputs

1 H.I.V.E. Element

The compiled H.I.V.E. 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 Obstacles

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

3 Boundary

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

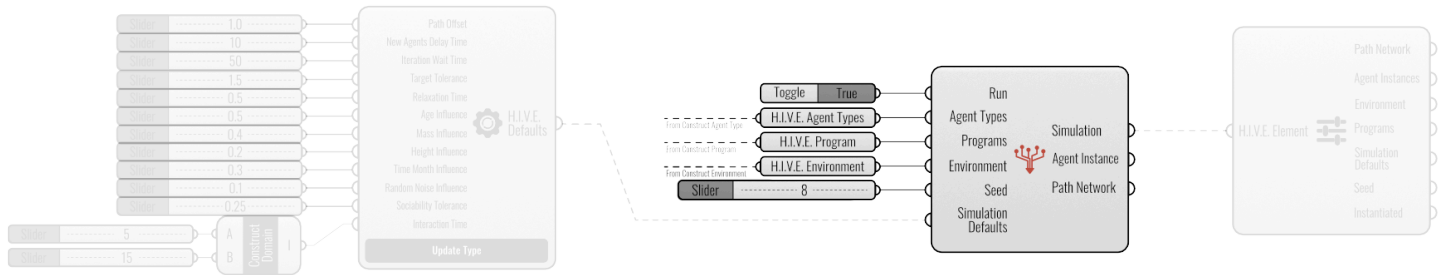
4 Milieu Defaults

The H.I.V.E. default settings for this environment. Please attach another H.I.V.E. Deconstructor to this output to read this environment's milieu defaults.



Compile Simulation Component

User Input Data  H.I.V.E. Output Data 
H.I.V.E. 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 H.I.V.E. agent(s) which are part of this simulation. One or more agents can be connected from the Construct Agent Type component.

3 Programs

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

4 Environment

The H.I.V.E. 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 H.I.V.E. default settings for this simulation. Please see "Simulation Defaults" for more details.

Outputs

1 Simulation

A compiled H.I.V.E. element representing the entire simulation, including its parameters and defined members.

2 Agent Instances

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

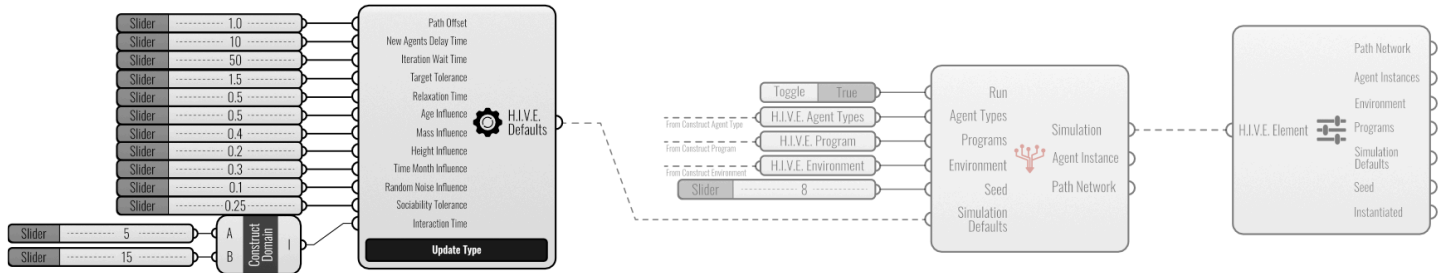
3 Path Network

A compiled H.I.V.E. element representing the path network agents use to navigate through their environment.



Simulation Defaults Override

User Input Data ■ H.I.V.E. Output Data ■
H.I.V.E. Input Data ■ Native Output Data ■



Inputs

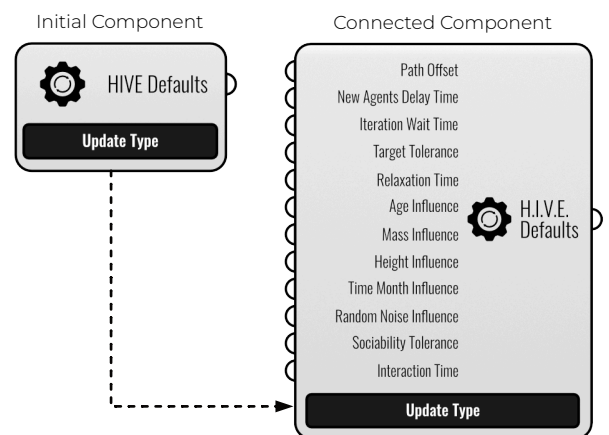
- 1 **Path Offset**
A number specifying the distance, in Rhino units, that agents are offset from obstacles during path planning.
- 2 **New Agents Delay Time**
An integer that sets the interval (in iterations) for spawning new agents.
- 3 **Iteration Wait Time**
A duration in milliseconds that sets the delay between iterations. A minimum of 50ms is recommended for smooth Grasshopper performance.
- 4 **Target Tolerance**
The distance, in Rhino units, within which an agent considers a target reached.
- 5 **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.
- 6 **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.
- 7 **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.
- 8 **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.
- 9 **Random Noise Influence**
A number from 0.0 to 1.0 which describes how strongly the environment's noise will affect agent behavior.
- 10 **Sociability Tolerance**
A value from 0.0 to 1.0 representing the maximum allowed difference in sociability for agents to interact.
- 11 **Interaction Time**
A domain defining how many iterations two agents can stay socially engaged with one another.

Outputs

- 1 **H.I.V.E. Defaults**
A compiled set of parameters which can be used for the simulation.

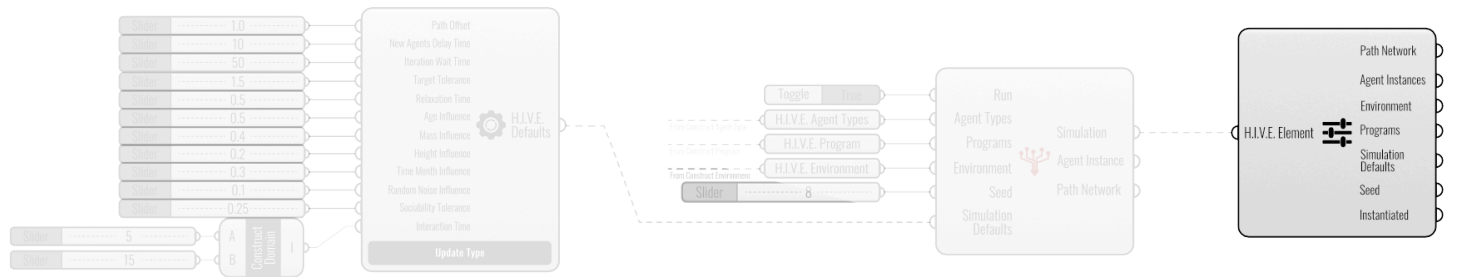
Note:

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 ■ H.I.V.E. Output Data ■
H.I.V.E. Input Data ■ Native Output Data ■



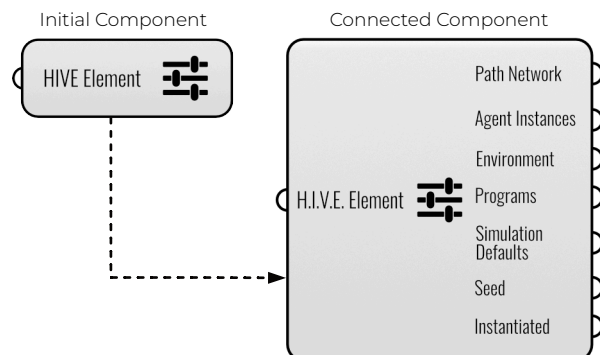
Inputs

1 H.I.V.E. Element

The compiled H.I.V.E. 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 Path Network

The H.I.V.E. network for this simulation. Please attach another H.I.V.E. Deconstructor to this output to obtain the geometry and settings for this element.

2 Agent Instances

The individual H.I.V.E. agents for this simulation. Please attach another H.I.V.E. Deconstructor to this output to obtain the geometry and information for this element.

3 Environment

The H.I.V.E. environment for this simulation. Please attach another H.I.V.E. Deconstructor to this output to obtain the geometry and settings for this element.

4 Programs

The H.I.V.E. programs for this simulation. Please attach another H.I.V.E. Deconstructor to this output to obtain the geometry and settings for this element.

5 Simulation Defaults

The H.I.V.E. default settings for this simulation. Please attach another H.I.V.E. Deconstructor to this output to read the simulation defaults.

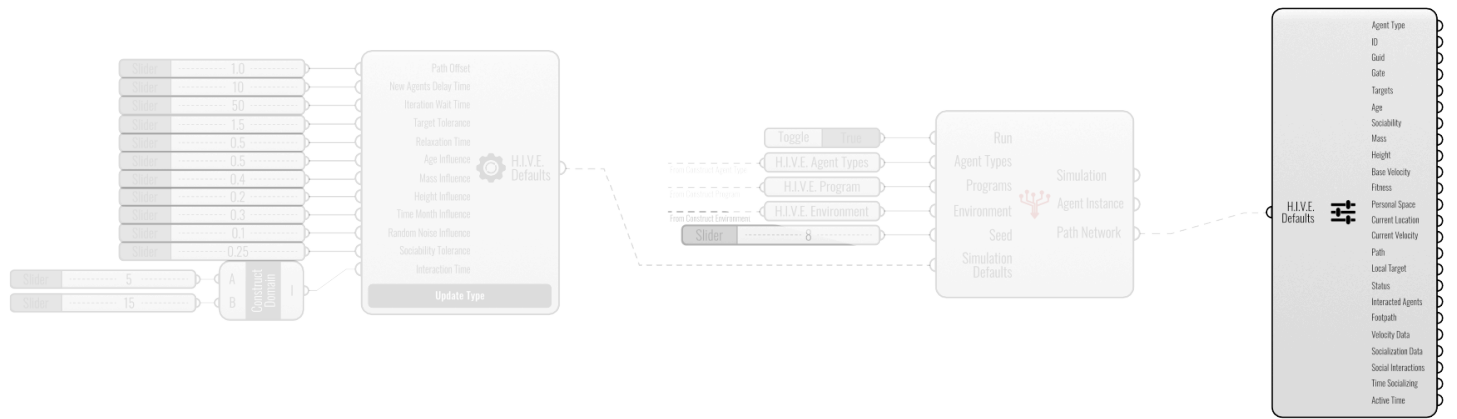
6 Seed

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



Agent Instance Deconstructor

User Input Data ■ H.I.V.E. Output Data ■
H.I.V.E. Input Data ■ Native Output Data ■



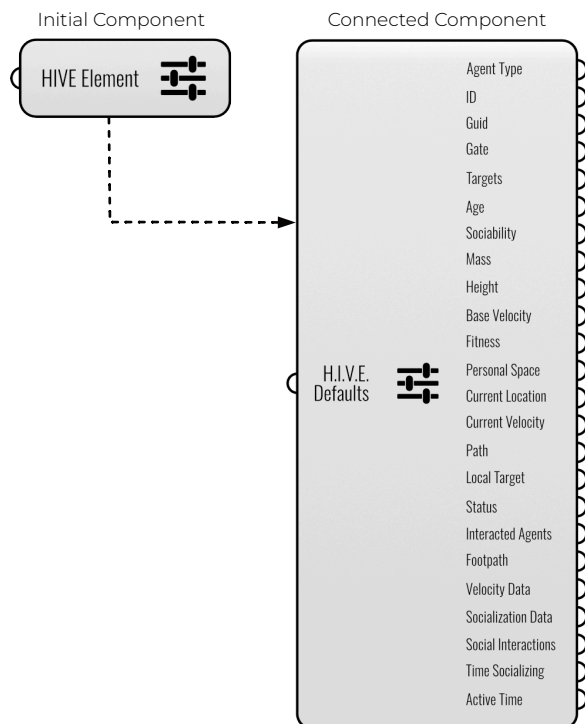
Inputs

1 H.I.V.E. Element

The compiled H.I.V.E. 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 ID

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

2 Guid

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

3 Gate

The H.I.V.E. compiled program from which this agent instance will spawn from.

4 Targets

The H.I.V.E. compiled program(s) this agent instance will visit during the simulation.

5 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.

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 Mass

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

8 Height

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

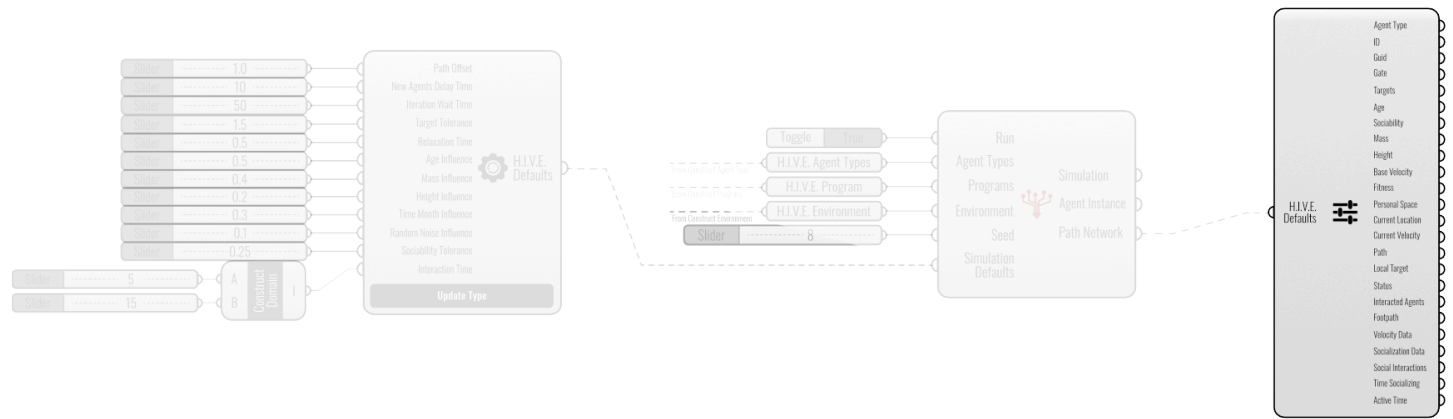
9 Base Velocity

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



Agent Instance Deconstructor

User Input Data ■ H.I.V.E. Output Data ■
H.I.V.E. Input Data ■ Native Output Data ■



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 Current Location

The agent's current x,y,z location at the active iteration.

13 Current Velocity

The agent's current velocity vector at the active iteration.

14 Path

A series of point locations defining the agent's local destinations which have yet to be reached. For complete movements, see the 'Footpath' output.

15 Local Target

The agent's next sub-target within its complete journey

16 Status

The agent's current status at the active iteration, such as "Moving" or "Socializing".

17 Interacted Agents

The complete list of other H.I.V.E. agent instances that this agent instance interacted with during the simulation.

18 Footpath

The complete travel path, in points, that this agent instance had during the simulation.

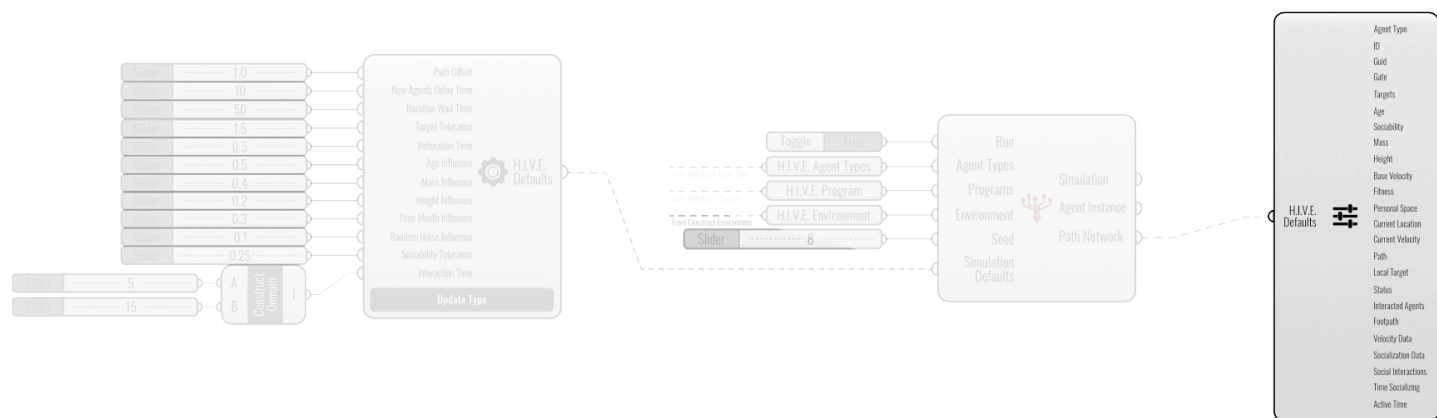
19 Velocity Data

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



Agent Instance Deconstructor

User Input Data ■ H.I.V.E. Output Data ■
H.I.V.E. Input Data ■ Native Output Data ■



20 Socializing Data

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

21 Social Interactions

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

22 Time Socializing

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

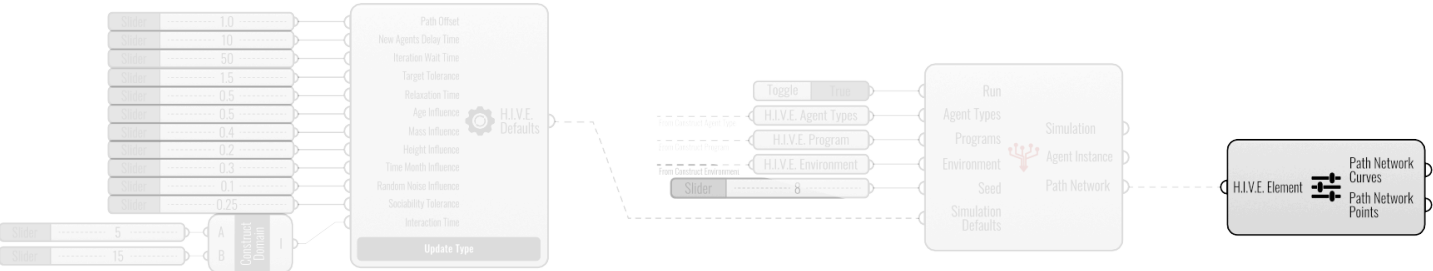
23 Active Time

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



Path Network Deconstructor

User Input Data H.I.V.E. Output Data
H.I.V.E. Input Data Native Output Data



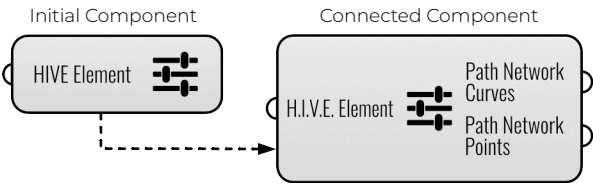
Inputs

1 H.I.V.E. Element

The compiled H.I.V.E. 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.

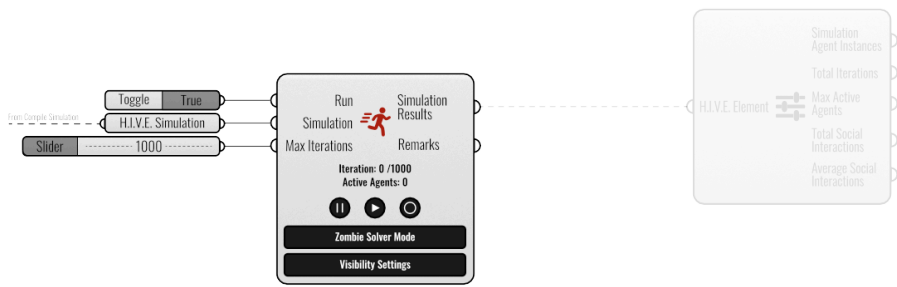
2 Path Network Points

The points which describe the final network node connections in the simulation, used to plan routes.



Run Simulation Component

User Input Data  H.I.V.E. Output Data 
H.I.V.E. 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 H.I.V.E. 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 H.I.V.E. 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 which control the visualization of the simulation, including the dot size of the agent in Rhinospace and their display color while moving and socializing. See the visibility settings panel below.

Display Settings

Moving Agent Color 

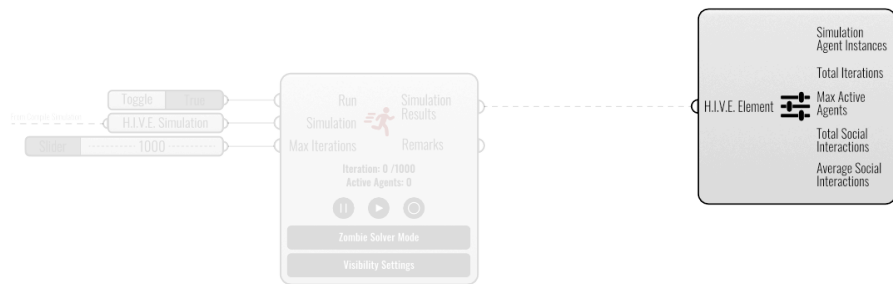
Socializing Agent Color 

Agent Size



Simulation Results Deconstructor

User Input Data  H.I.V.E. Output Data 
H.I.V.E. Input Data  Native Output Data 



Inputs

1 H.I.V.E. Element

The compiled H.I.V.E. simulation results class to deconstruct.

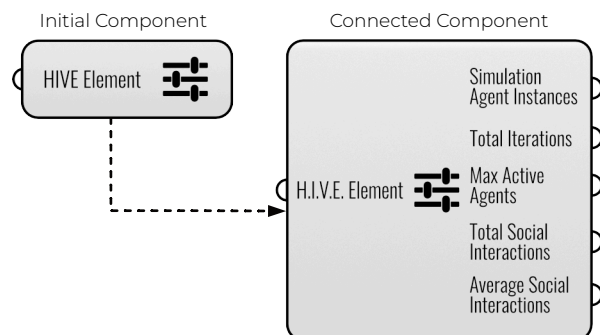
Outputs

1 Simulation Agent Instances

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

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.



2 Total Iterations

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

3 Max Active Agents

The maximum number of agents which were actively engaging in the simulation at one time.

4 Total Social Interactions

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

