



H.I.V.E. Documentation

Cellular Autonomia Simulation

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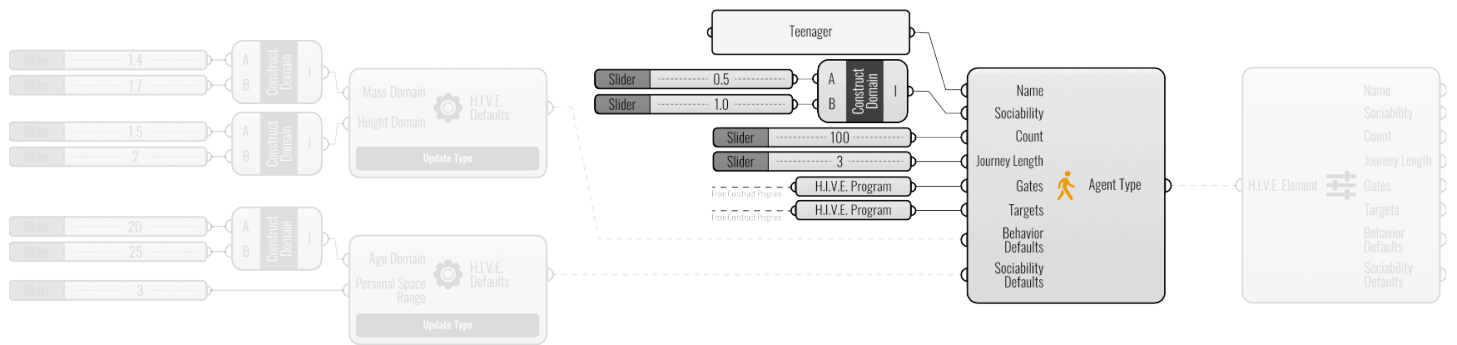
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Construct Agent Type Component

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.

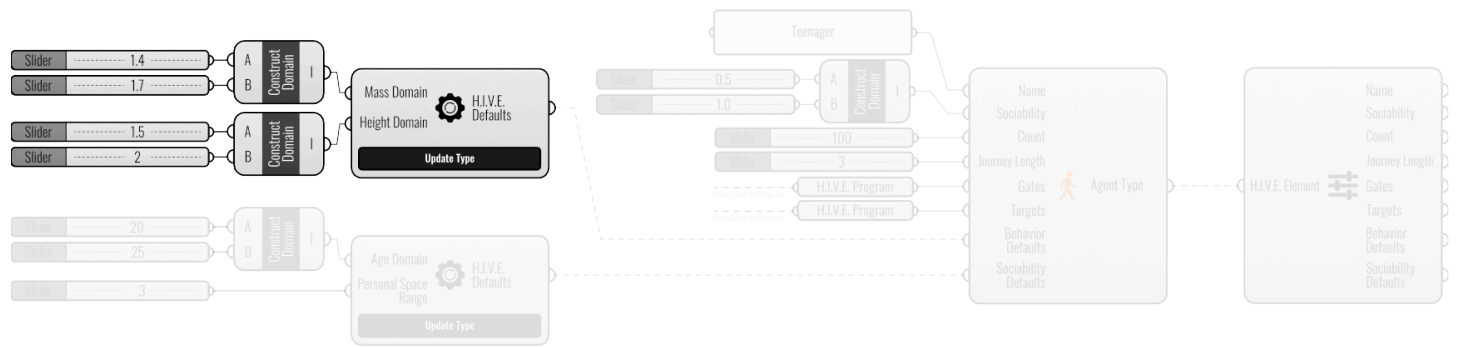
8 Sociability Defaults

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.

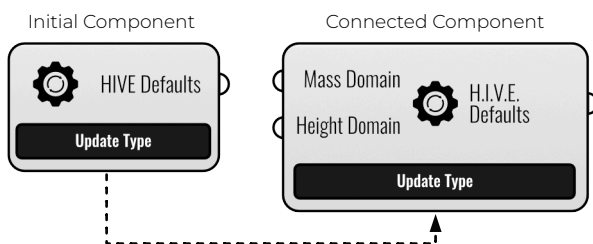
Outputs

1 H.I.V.E. Defaults

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

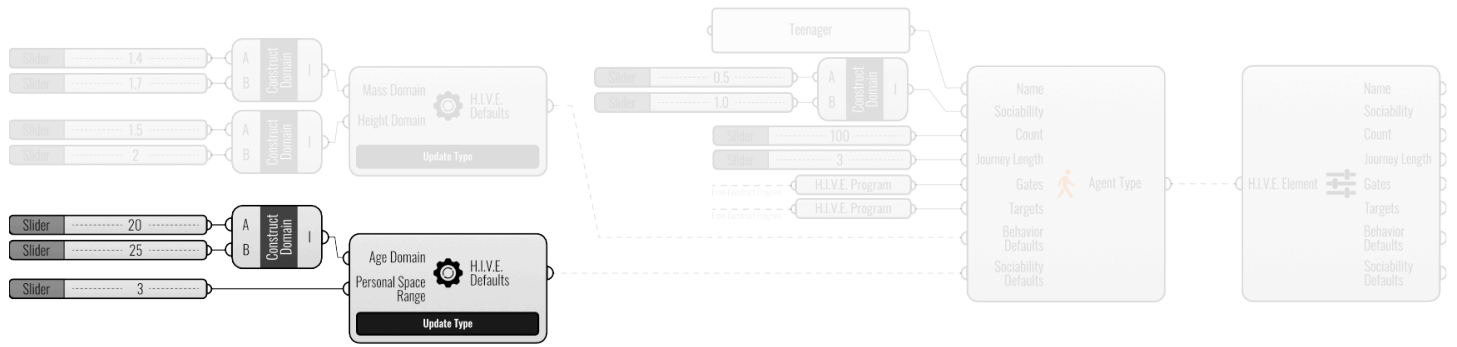
Note:

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

The agent type's age. This will affect its movement patterns and social behaviors during the simulation.

2 Personal Space Range

The agent type's personal radius. If another agent enters this radius, there is a chance the two will socialize.

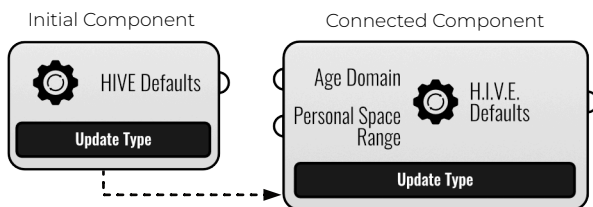
Outputs

1 H.I.V.E. Defaults

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

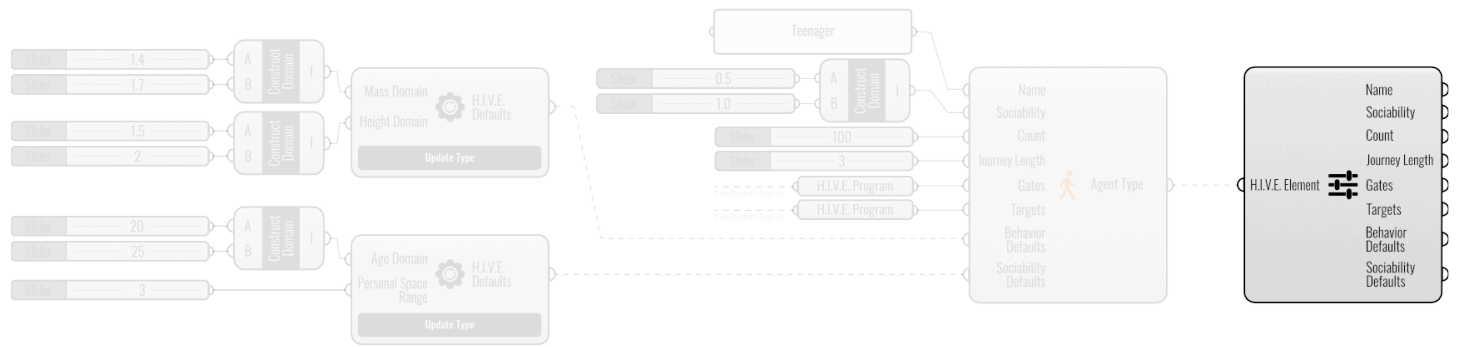
Note:

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 Component

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



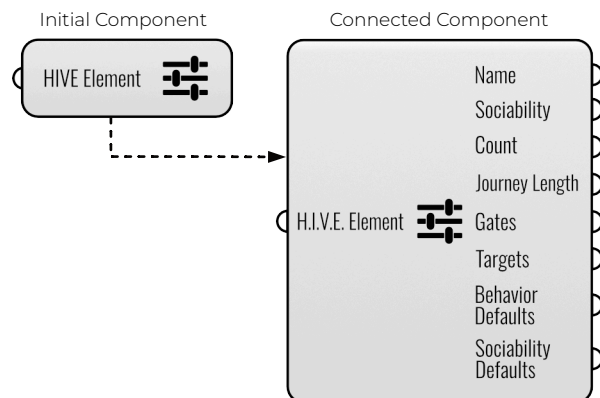
Inputs

1 H.I.V.E. Element

The compiled H.I.V.E. 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 value from 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 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.

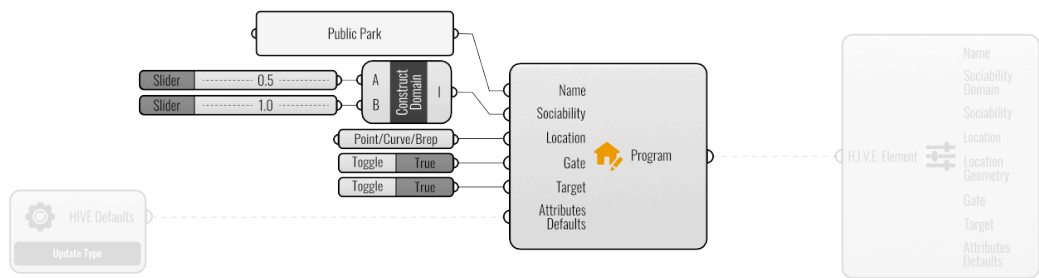
8 Sociability Defaults

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), curve(s), or brep(s) which represent the location or zone of this program. If input is a brep, please sure that it intersects the Environment surface.

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

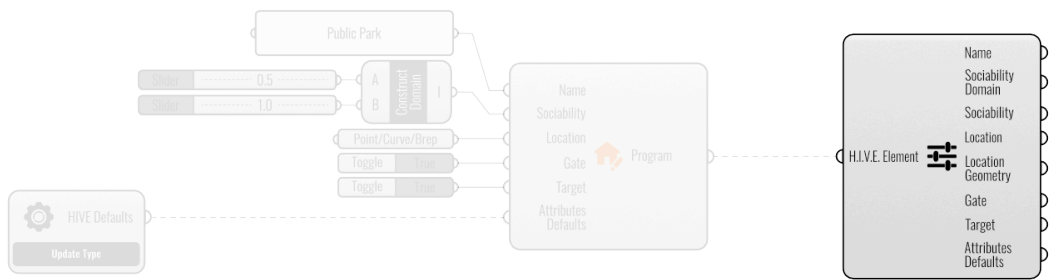
1 Program

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

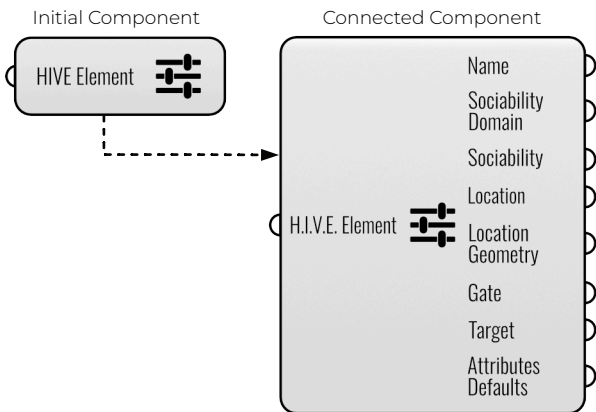


Inputs

- 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.



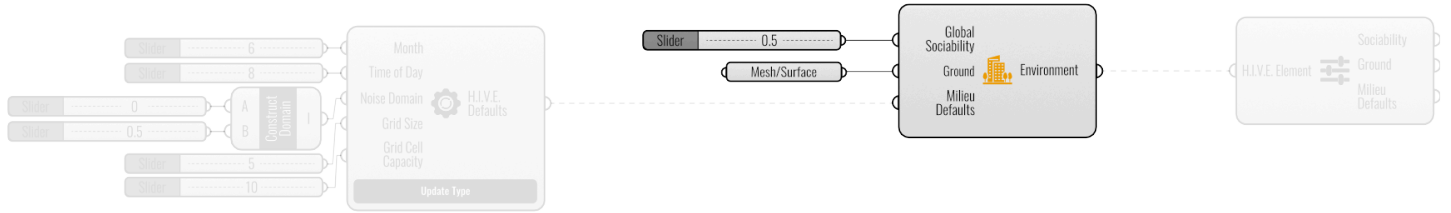
Outputs

- 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 center point which represents the program location.
- 5 Location Geometry
The curve or brep which represents the whole program boundary, if provided. This output will be empty if points were provided as the program's location.
- 6 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 Ground

A mesh or surface geometry which represents the area which agents will use to travel during the simulation. Ground can be modeled in 2D or 3D.

3 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

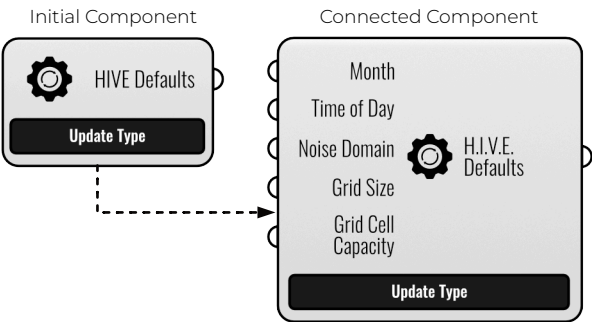
- 1 Month
- The month in which the simulation takes place. This will affect the agents' social and movement behaviors. This is a range from 1-12 where January = 1 and December = 12.
- 2 Time of Day
- The time of day in which the simulation takes place. This will affect the agents' socialization and movement. 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. This is a range from 0 to 1, where very quiet = 0 and very noisy = 1.
- 4 Grid Size
- This defines the resolution of the ground grid, affecting spatial accuracy and agent movement.
- 5 Grid Cell Capacity
- This defines the number of agents who can share one grid cell at any given iteration. Beyond this number, the cell has reached capacity and cannot accept more agents.

Outputs

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

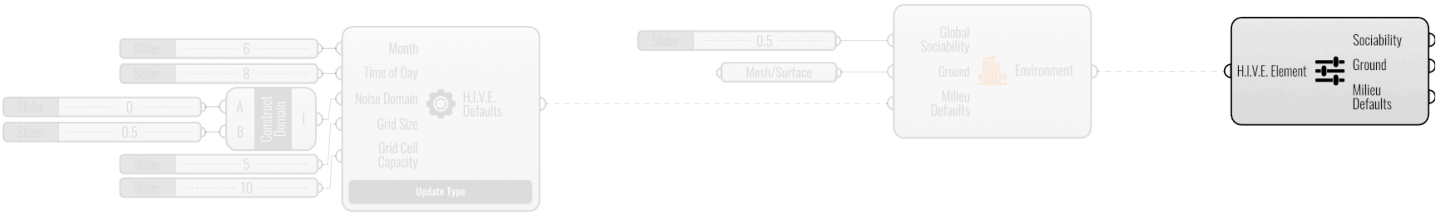
Note:

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.



Environment Deconstructor

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



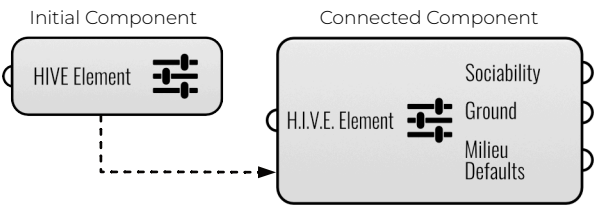
Inputs

1 H.I.V.E. Element

The compiled H.I.V.E. 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 Ground

A mesh or surface geometry which represents the area which agents will use to travel during the simulation. Ground can be modeled in 2D or 3D.

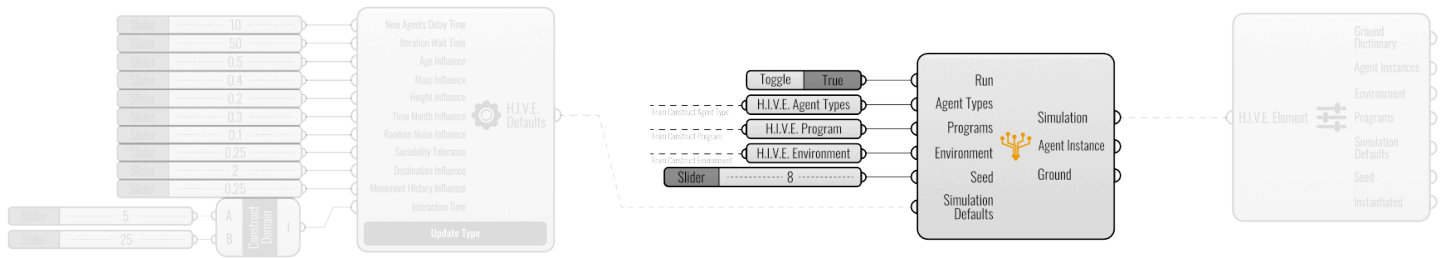
3 Milieu Defaults

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 agent types 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 across different iterations of the same simulation..

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.

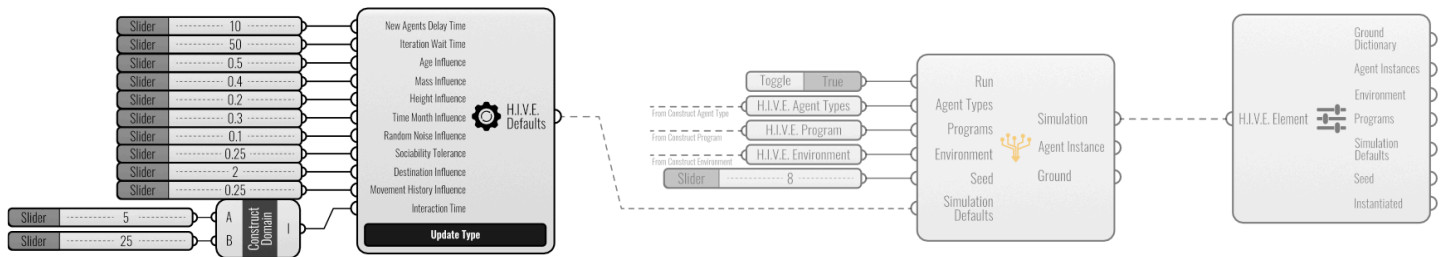
3 Ground

The final geometry which represents the area which agents will use to travel during the simulation.



Simulation Defaults Override

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



Inputs

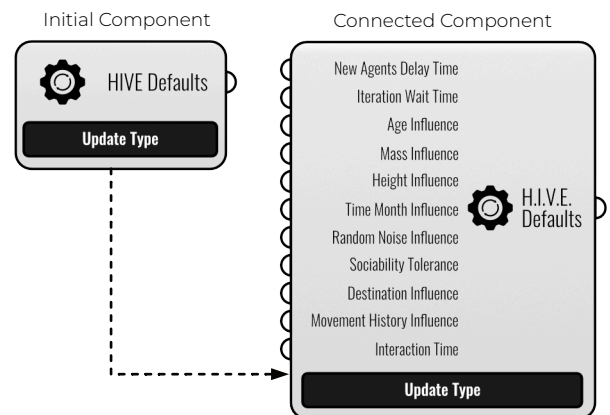
- 1 **New Agents Delay Time**
An integer that sets the interval (in iterations) for spawning new agents.
- 2 **Iteration Wait Time**
A duration in milliseconds that sets the delay between iterations. A minimum of 50ms is recommended for smooth Grasshopper performance.
- 3 **Age Influence**
A number from 0.0 to 1.0 which describes how strongly an agent's age will affect its behavior during the simulation.
- 4 **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.
- 5 **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.
- 6 **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.
- 7 **Random Noise Influence**
A number from 0.0 to 1.0 which describes how strongly the environment's noise will affect agent behavior.
- 8 **Sociability Tolerance**
A value from 0.0 to 1.0 representing the maximum allowed difference in sociability for agents to interact.
- 9 **Destination Influence**
A number from 0.0 to 1.0 which describes how directly an agent is likely to move towards its target destination.
- 10 **Movement History Influence**
A number from 0.0 to 1.0 which describes how likely an agent is to prioritize visiting new cells rather than previously visited ones.
- 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.

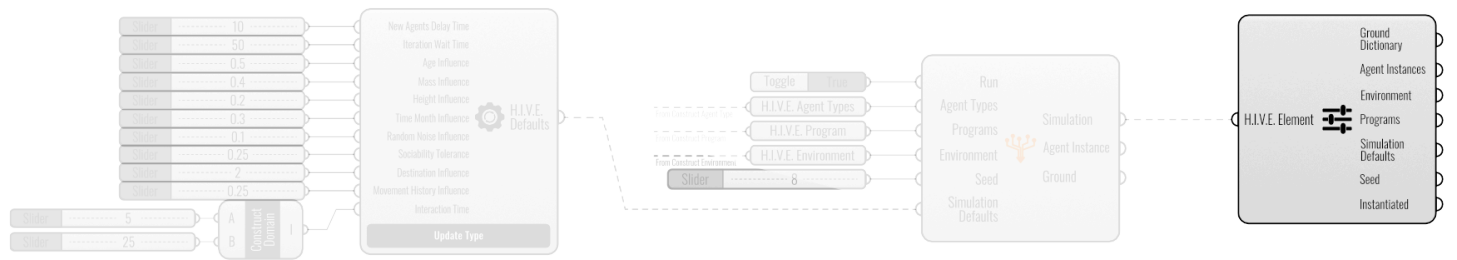
Note:

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 ■



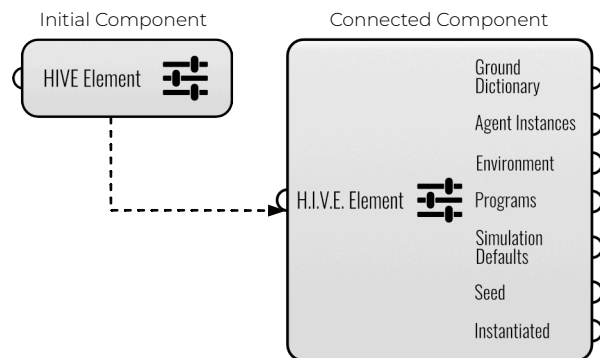
Inputs

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 Ground Dictionary

A list of H.I.V.E. classes which describe each cell of the ground of the cellular automata simulation.

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.

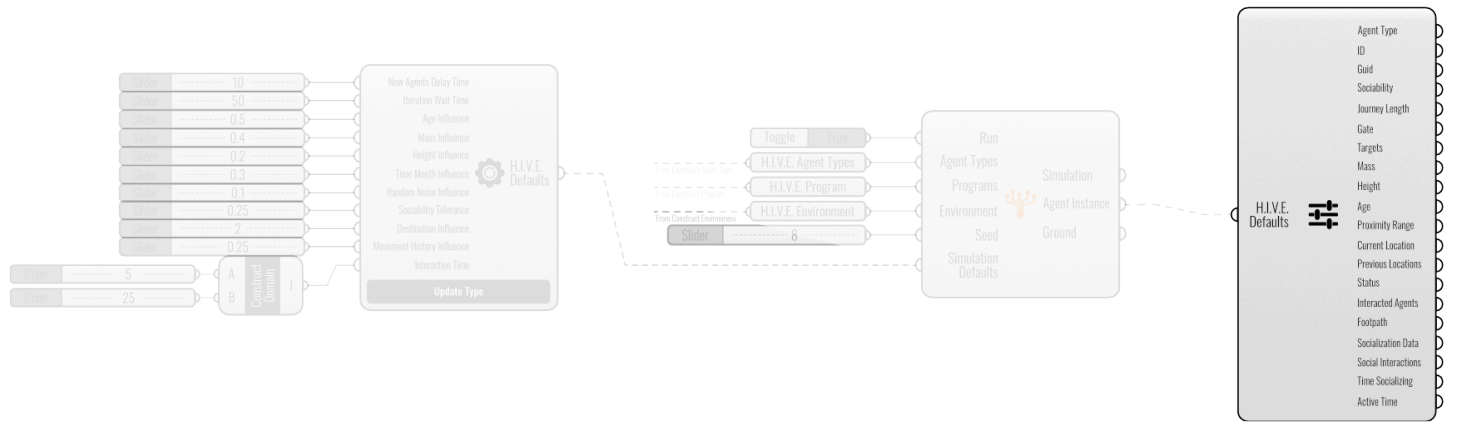
6 Seed

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..



Agent Instance Deconstructor

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



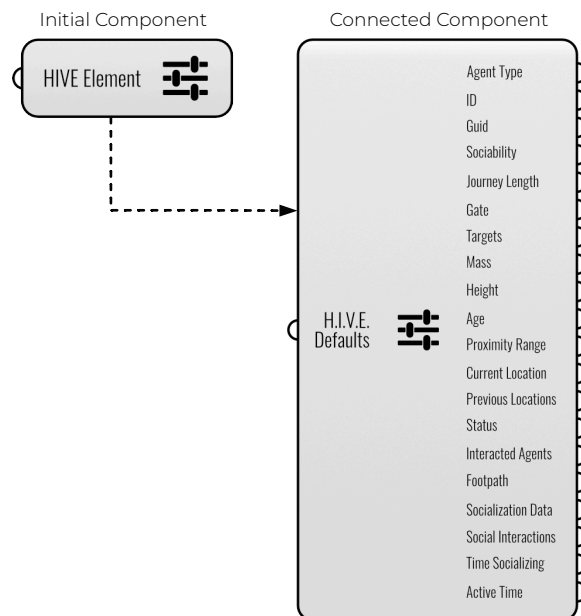
Inputs

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 Sociability

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

4 Journey Length

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

5 Gate

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

6 Targets

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

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.

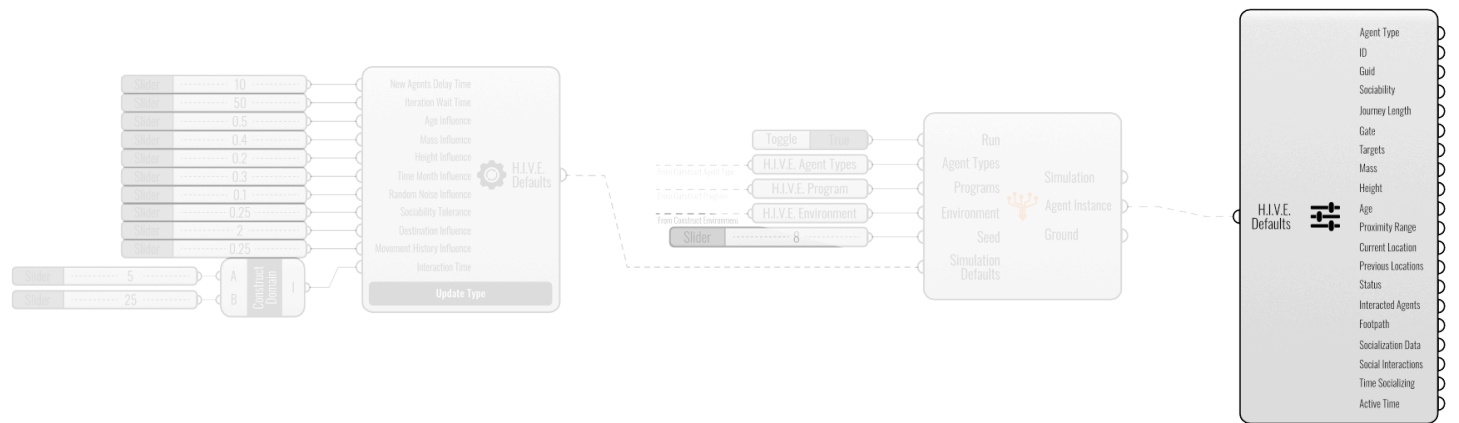
9 Age

The agent's age, which affects its movement and social behaviors during the simulation.



Agent Instance Deconstructor

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



10 Proximity Range

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 proximity range domain.

11 Current Location

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

12 Previous Locations

A series of indicies denoting the agent's previously visited cells during the simulation.

13 Status

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

14 Interacted Agents

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

15 Footpath

The actual travel path, in x,y,z points, that this agent instance had during the simulation.

16 Socializing Data

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

17 Social Interactions

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

18 Time Socializing

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

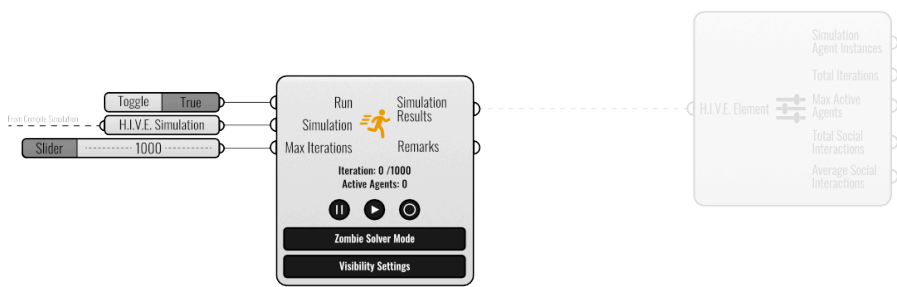
19 Active Time

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



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 

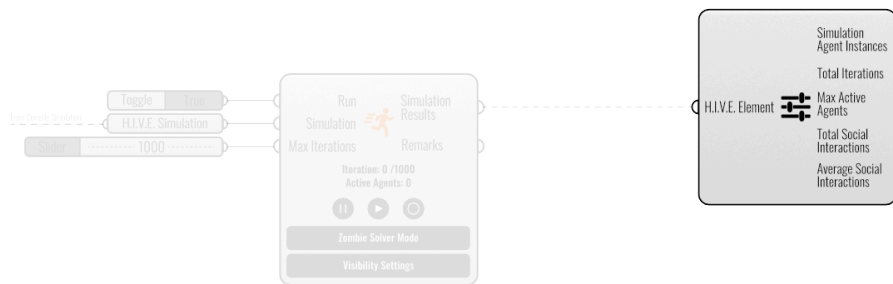
Socializing Agent Color 

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.

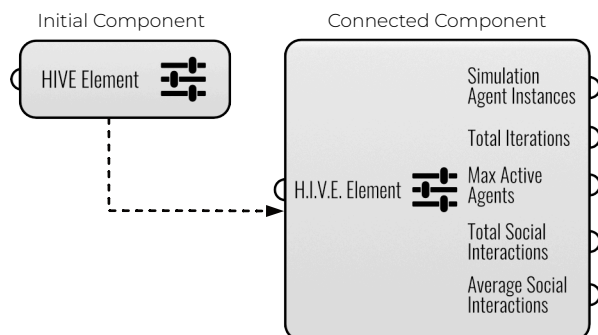
Outputs

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.

