

# USC Ground Truth Documentation

October 9, 2018

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# 1 Background

We use influence diagrams as the underlying graph structure for our ground truth. Here is a simple influence diagram for a simulation of two actors, showing the three types of nodes and some possible links (always directed) among them:

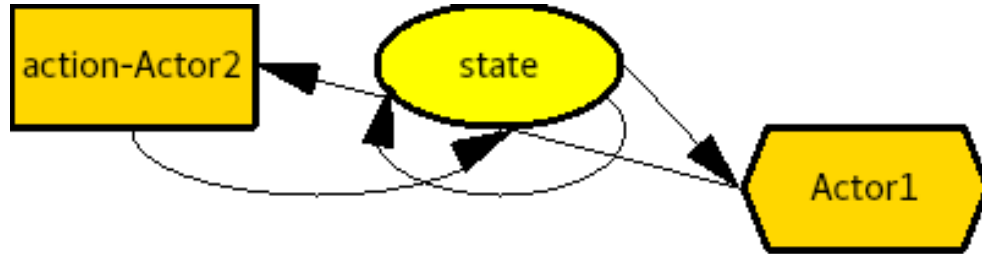


Figure 1: Simple influence diagram

- Rectangular nodes are possible actions for a particular agent (“Actor 1”, indicated by color) representing a potential behavior. They are labeled with a verb (“action”) and an optional object of the verb (“Actor2”). An action node has a binary value, indicating whether or not the action was chosen.
- Oval nodes are state variables. Their value is potentially a probability distribution over a domain of possible values. All true state variables will be certain (i.e., 100% probability for a single value), but agents’ perceptions of the true state will often be uncertain.
- Hexagonal nodes are utility or reward nodes. They represent an expected value computation by the agent (“Actor1”). The node’s value is a table with each row corresponding to a possible action choice and its expected utility.
- Links from action nodes to state nodes specify an effect that the action has on the value of the state. In the following specifications of these effects, a variable name followed by a ‘ will denote the value of the variable after the action is performed.
- Links from one state node to another specify an influence that the value of the first state node has on the effect of at least one action on the second state node.
- Links from a state node to an agent’s utility node specify that the state node is an input to the expected value calculation performed by that agent. There is a real-valued weight from  $(0,1]$  on each link specifying the priority of that variable’s influence on that agent’s reward calculation (higher values mean higher priority).
- Links from utility nodes to action nodes indicate that the expected value calculation then determines whether or not that action is chosen. In the simulations described here, we use a strict maximization, so that the action choice is deterministic (i.e., the action with the highest expected value is performed, with ties broken by a pre-determined fixed order).
- Therefore, in the above simple ground truth, whether or not “Actor1” chooses to do “action” to “Actor2” influences the subsequent value of the variable “state” (link from rectangle to oval). The subsequent value of “state” also depends on its prior value (link from oval to itself). “Actor1”’s expected value of doing “action” to “Actor2” is a function of the value of “state” (link from oval to hexagon), and this expected value influences whether or not “Actor1” chooses to do so (link from hexagon to rectangle).

Any real values (e.g., initial values of variables, conditional probability table values, reward weights) will be drawn from either a set  $\{0, 0.5, 1\}$  or  $\{0, 0.2, 0.4, 0.6, 0.8, 1\}$ , depending on the appropriate granularity needed.

## 2 State

### 2.1 Actor's age

**Type:** Integer

psychsim/domains/groundtruth/actor.py:66

### 2.2 Actor's alive

**Type:** Boolean

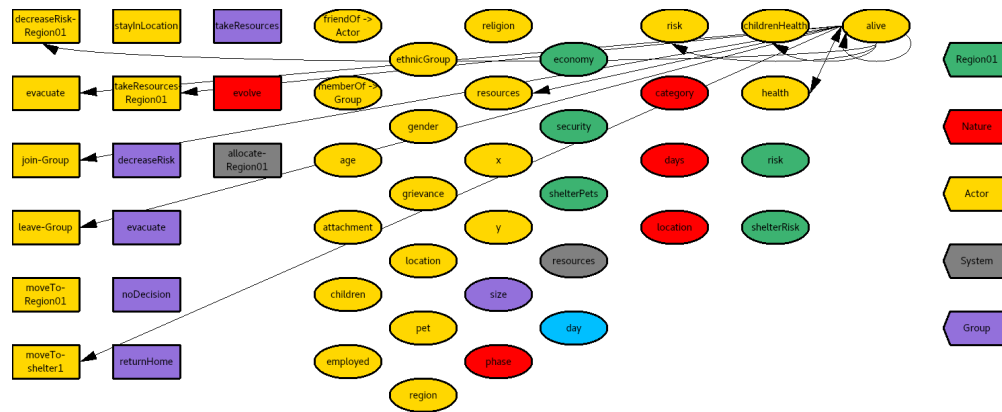


Figure 2: Ground Truth subgraph for Actor's alive

psychsim/domains/groundtruth/actor.py:190

#### 2.2.1 Default change in Actor's alive

psychsim/domains/groundtruth/actor.py:464

**IF Actor's alive**

**THEN : IF Actor's health' > 0.01**

**THEN : Actor's alive' ← true**

**ELSE : Actor's alive' ← false**

**ELSE : Actor's alive' ← Actor's alive**

### 2.3 Actor's attachment

Attachment style

**Type:** String

**Values:** anxious, avoidant, secure

psychsim/domains/groundtruth/actor.py:101

### 2.4 Actor's category

**Type:** Integer

psychsim/domains/groundtruth/actor.py:648

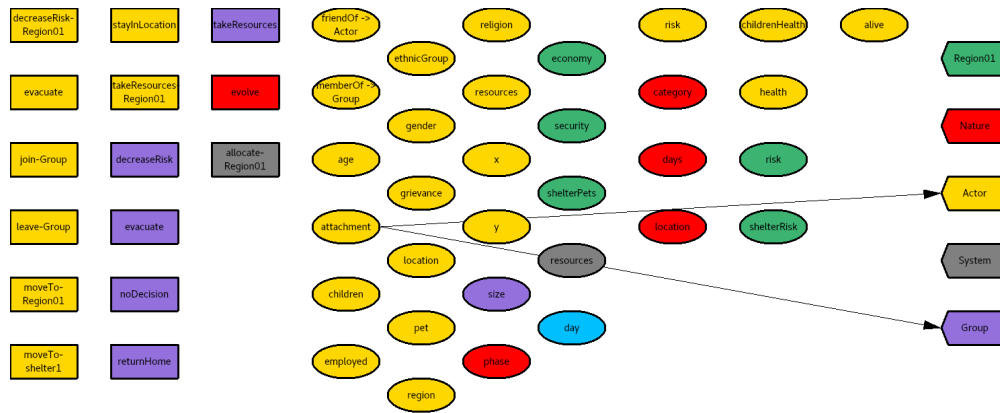


Figure 3: Ground Truth subgraph for Actor's attachment

## 2.5 Actor's center

**Type:** String

**Values:** Region01, none

psychsim/domains/groundtruth/actor.py:643

## 2.6 Actor's children

Number of children

**Type:** Real

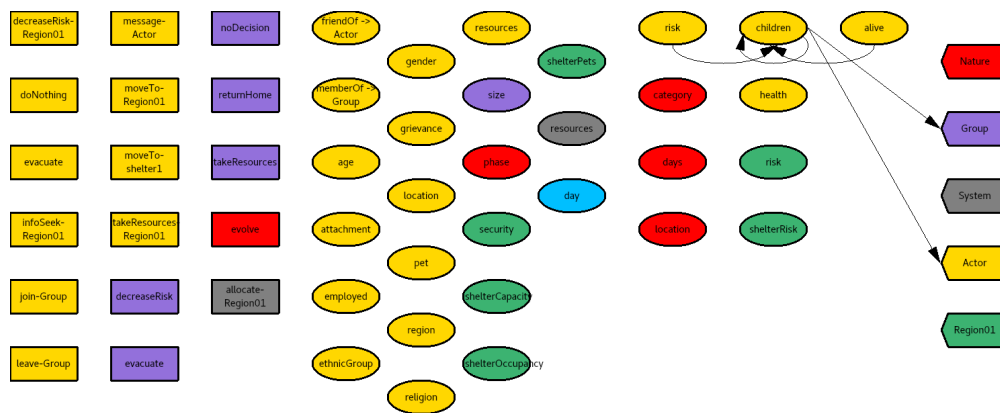


Figure 4: Ground Truth subgraph for Actor's children

psychsim/domains/groundtruth/actor.py:75

## 2.7 Actor's childrenHealth

Current level of children's physical wellbeing

**Type:** Real

psychsim/domains/groundtruth/actor.py:212

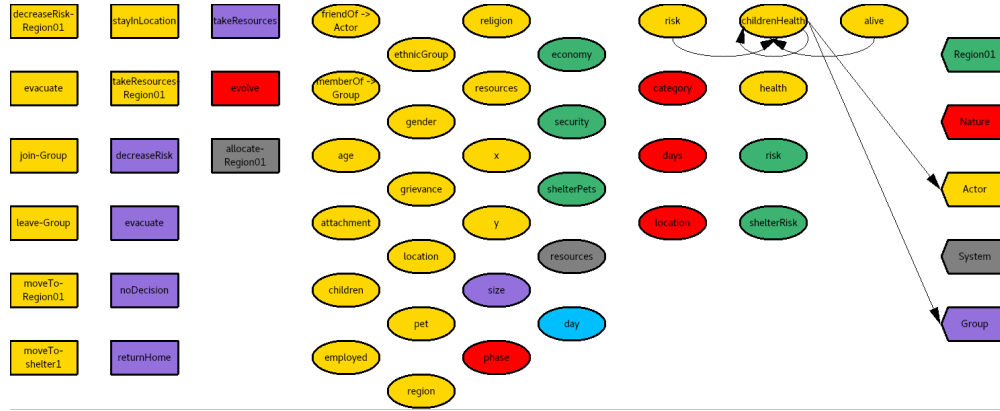


Figure 5: Ground Truth subgraph for Actor's childrenHealth

### 2.7.1 Default change in Actor's childrenHealth

psychsim/domains/groundtruth/actor.py:455

IF Actor's alive

THEN : IF Actor's risk' ∈

[0,0.2]: Actor's childrenHealth' ← 60%·Actor's childrenHealth+0.24

(0.2,0.4]:

20%: Actor's childrenHealth' ← 60%·Actor's childrenHealth

80%: Actor's childrenHealth' ← 60%·Actor's childrenHealth+0.24

(0.4,0.6]:

40%: Actor's childrenHealth' ← 60%·Actor's childrenHealth

60%: Actor's childrenHealth' ← 60%·Actor's childrenHealth+0.24

(0.6,0.8]:

60%: Actor's childrenHealth' ← 60%·Actor's childrenHealth

40%: Actor's childrenHealth' ← 60%·Actor's childrenHealth+0.24

(0.8,1.0]:

80%: Actor's childrenHealth' ← 60%·Actor's childrenHealth

19%: Actor's childrenHealth' ← 60%·Actor's childrenHealth+0.24

(1.0,1]:

100%: Actor's childrenHealth' ← 60%·Actor's childrenHealth

0%: Actor's childrenHealth' ← 60%·Actor's childrenHealth+0.24

ELSE : Actor's childrenHealth' ← 0.00

## 2.8 Actor's days

Type: Integer

psychsim/domains/groundtruth/actor.py:638

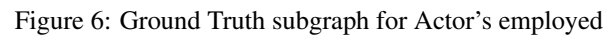
## 2.9 Actor's employed

Has a full-time job

Type: Boolean

psychsim/domains/groundtruth/actor.py:83





## psychsim/domains/groundtruth/actor.py:39

## psychsim/domains/groundtruth/actor.py:58

Figure 7: Ground Truth subgraph for Actor’s grievance

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### 2.12.1 Effect of System-allocate-Region01 on Actor's grievance

psychsim/domains/groundtruth/system.py:55

IF Actor's region=Region01

THEN : Actor's grievance'  $\leftarrow 80\% \cdot \text{Actor's grievance}$

ELSE : Actor's grievance'  $\leftarrow 80\% \cdot \text{Actor's grievance} + 0.20$

### 2.13 Actor's health

Current level of physical wellbeing

Type: Real

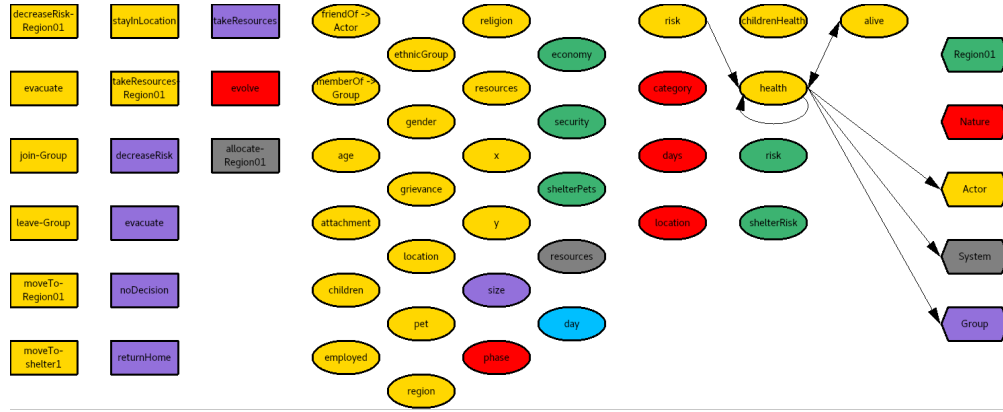


Figure 8: Ground Truth subgraph for Actor's health

psychsim/domains/groundtruth/actor.py:194

### 2.13.1 Default change in Actor's health

psychsim/domains/groundtruth/actor.py:442

IF Actor's alive

THEN : IF Actor's risk'  $\in$

[0,0.2]: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health} + 0.24$

(0.2,0.4]:

20%: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health}$

80%: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health} + 0.24$

(0.4,0.6]:

40%: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health}$

60%: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health} + 0.24$

(0.6,0.8]:

60%: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health}$

40%: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health} + 0.24$

(0.8,1.0]:

80%: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health}$

19%: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health} + 0.24$

(1.0,1]:

100%: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health}$

0%: Actor's health'  $\leftarrow 60\% \cdot \text{Actor's health} + 0.24$

ELSE : Actor's health'  $\leftarrow 0.00$



## 2.17 Actor's pet

Owns a pet

**Type:** Boolean

psychsim/domains/groundtruth/actor.py:88

## 2.18 Actor's phase

**Type:** String

**Values:** active, approaching, none

psychsim/domains/groundtruth/actor.py:634

## 2.19 Actor's region

Region of residence

**Type:** String

**Values:** Region01

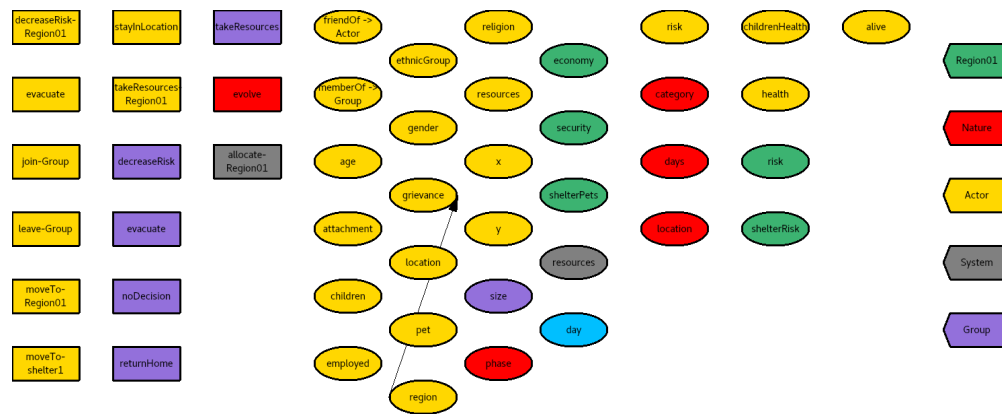


Figure 10: Ground Truth subgraph for Actor's region

psychsim/domains/groundtruth/actor.py:150

## 2.20 Actor's religion

Religious affiliation of actor

**Type:** String

**Values:** majority, minority, none

psychsim/domains/groundtruth/actor.py:47

## 2.21 Actor's resources

Material resources (wealth) currently owned

**Type:** Real

psychsim/domains/groundtruth/actor.py:216

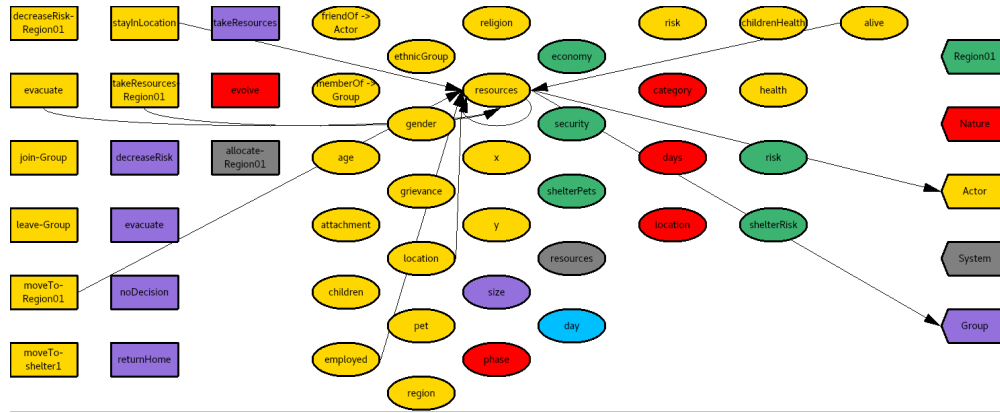


Figure 11: Ground Truth subgraph for Actor's resources

### 2.21.1 Effect of Actor-evacuate on Actor's resources

```
psychsim/domains/groundtruth/actor.py:501
IF Actor's resources>0.20
    THEN : Actor's resources' ← Actor's resources - 0.20
    ELSE : Actor's resources' ← 0.00
```

### 2.21.2 Effect of Actor-moveTo-Region01 on Actor's resources

```
psychsim/domains/groundtruth/actor.py:493
IF Actor's alive
    THEN : IF Actor's employed
        THEN : Actor's resources' ← 80%·Actor's resources + 0.20
        ELSE : Actor's resources' ← Actor's resources
    ELSE : Actor's resources' ← Actor's resources
```

### 2.21.3 Effect of Actor-stayInLocation on Actor's resources

```
psychsim/domains/groundtruth/actor.py:482
IF Actor's alive
    THEN : IF Actor's employed
        THEN : IF Actor's location={ 'evacuated', 'Region01' }
            THEN : Actor's resources' ← 80%·Actor's resources + 0.20
            ELSE : Actor's resources' ← Actor's resources
        ELSE : Actor's resources' ← Actor's resources
    ELSE : Actor's resources' ← Actor's resources
```

### 2.21.4 Effect of Actor-takeResources-Region01 on Actor's resources

```
psychsim/domains/groundtruth/actor.py:544
Actor's resources' ← 80%·Actor's resources + 0.20
```

## 2.22 Actor's risk

Current level of risk from hurricane

Type: Real

```
psychsim/domains/groundtruth/actor.py:236
```

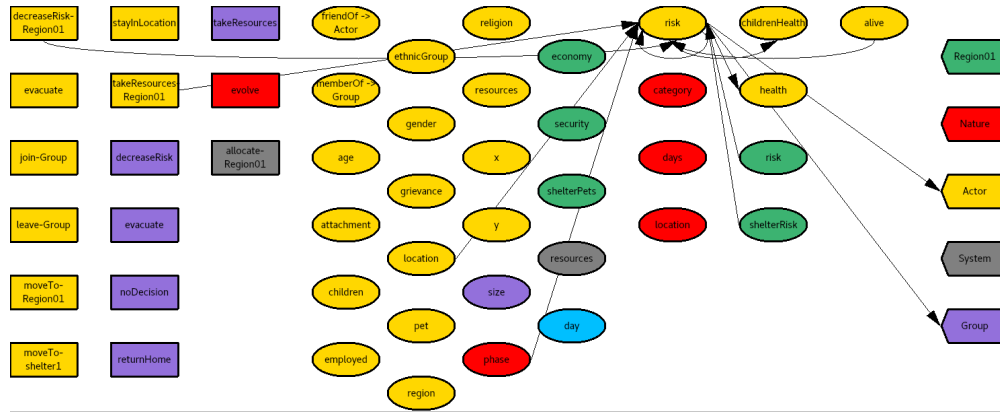


Figure 12: Ground Truth subgraph for Actor's risk

### 2.22.1 Effect of Actor-decreaseRisk-Region01 on Actor's risk

psychsim/domains/groundtruth/actor.py:526  
**Actor's risk'**  $\leftarrow 80\% \cdot \text{Actor's risk} + 0.20$

### 2.22.2 Effect of Actor-takeResources-Region01 on Actor's risk

psychsim/domains/groundtruth/actor.py:551  
**IF Nature's phase=none**  
    **THEN :** **Actor's risk'**  $\leftarrow 19\% \cdot \text{Actor's risk} + 0.80$   
    **ELSE :** **Actor's risk'**  $\leftarrow 40\% \cdot \text{Actor's risk} + 0.60$

### 2.22.3 Default change in Actor's risk

psychsim/domains/groundtruth/actor.py:429  
**IF Actor's alive**  
    **THEN :** **IF Actor's location'=shelter1**  
        **THEN :** **Actor's risk'**  $\leftarrow \text{Region01's shelterRisk}$   
        **ELSE :** **IF Actor's location'=evacuated**  
            **THEN :** **Actor's risk'**  $\leftarrow 9\% \cdot \text{Actor's risk}$   
            **ELSE :** **Actor's risk'**  $\leftarrow \text{Region01's risk}$   
    **ELSE :** **Actor's risk'**  $\leftarrow 0.00$

## 2.23 Actor's x

Representation of residence's longitude

**Type:** Real

psychsim/domains/groundtruth/actor.py:161

## 2.24 Actor's y

Representation of residence's latitude

**Type:** Real

psychsim/domains/groundtruth/actor.py:163

## 2.25 Group's size

Type: Integer

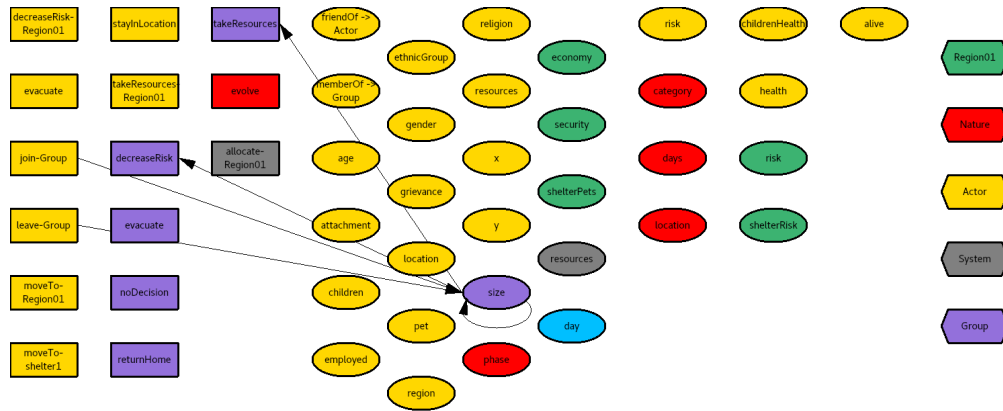


Figure 13: Ground Truth subgraph for Group's size

psychsim/domains/groundtruth/group.py:24

### 2.25.1 Effect of Actor-join-Group on Group's size

psychsim/domains/groundtruth/group.py:113

$\text{Group's size}' \leftarrow \text{Group's size} + 1$

### 2.25.2 Effect of Actor-leave-Group on Group's size

psychsim/domains/groundtruth/group.py:124

$\text{Group's size}' \leftarrow \text{Group's size} - 1$

## 2.26 Nature's category

Type: Integer

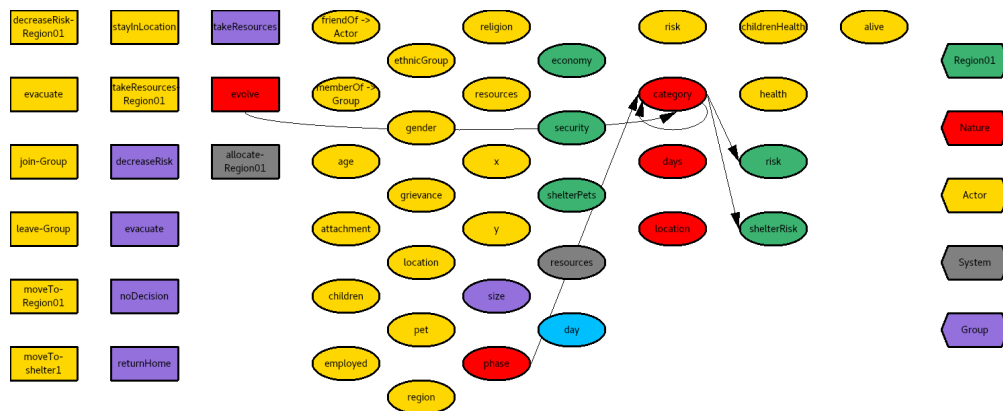


Figure 14: Ground Truth subgraph for Nature's category

psychsim/domains/groundtruth/nature.py:26

### 2.26.1 Effect of Nature-evolve on Nature's category

psychsim/domains/groundtruth/nature.py:80

IF Nature's phase'

= approaching: IF Nature's category=0

THEN :

20%: Nature's category'  $\leftarrow$  1

20%: Nature's category'  $\leftarrow$  2

20%: Nature's category'  $\leftarrow$  3

20%: Nature's category'  $\leftarrow$  4

20%: Nature's category'  $\leftarrow$  5

ELSE : IF Nature's category=1

THEN :

60%: Nature's category'  $\leftarrow$  Nature's category

40%: Nature's category'  $\leftarrow$  2

ELSE : IF Nature's category=5

THEN :

40%: Nature's category'  $\leftarrow$  4

60%: Nature's category'  $\leftarrow$  Nature's category

ELSE :

20%: Nature's category'  $\leftarrow$  Nature's category - 1

60%: Nature's category'  $\leftarrow$  Nature's category

20%: Nature's category'  $\leftarrow$  Nature's category + 1

= active: Nature's category'  $\leftarrow$  Nature's category

= none: Nature's category'  $\leftarrow$  0

### 2.27 Nature's days

Type: Integer

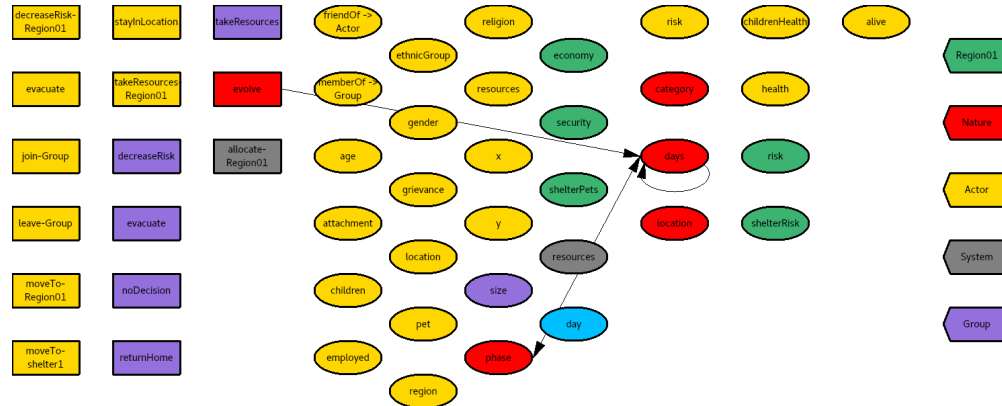


Figure 15: Ground Truth subgraph for Nature's days

psychsim/domains/groundtruth/nature.py:18

### 2.27.1 Effect of Nature-evolve on Nature's days

psychsim/domains/groundtruth/nature.py:54

IF Nature's phase=Nature's phase'

THEN : Nature's days'  $\leftarrow$  Nature's days + 1

ELSE : Nature's days'  $\leftarrow$  0



## 2.28 Nature's location

Type: String

Values: Region01, none

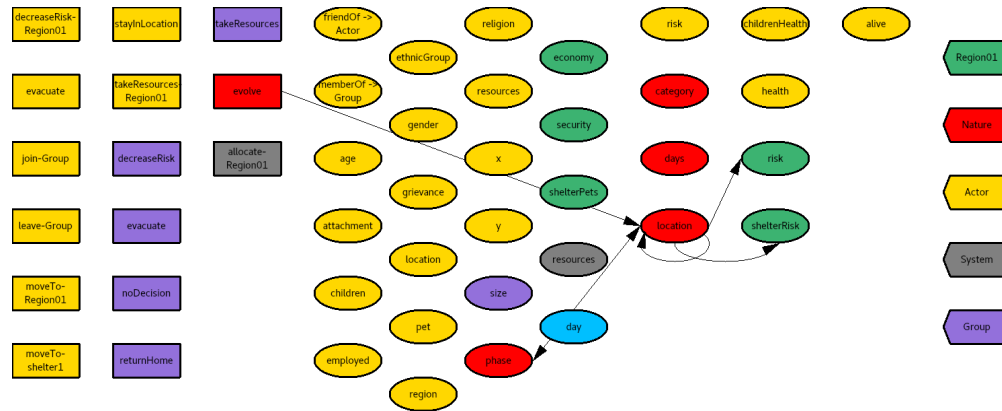


Figure 16: Ground Truth subgraph for Nature's location

psychsim/domains/groundtruth/nature.py:23

### 2.28.1 Effect of Nature-evolve on Nature's location

psychsim/domains/groundtruth/nature.py:111

IF Nature's phase'

= approaching: IF Nature's location=none  
 THEN : Nature's location' ← Region01  
 ELSE : Nature's location' ← Nature's location  
 = active: IF Nature's location  
 OTHERWISE : Nature's location' ← Nature's location  
 = Region01: Nature's location' ← none  
 = none: Nature's location' ← none

## 2.29 Nature's phase

Type: String

Values: active, approaching, none

psychsim/domains/groundtruth/nature.py:16

### 2.29.1 Effect of Nature-evolve on Nature's phase

psychsim/domains/groundtruth/nature.py:49

IF Nature's phase

= none: IF Nature's days>1  
 THEN :  
 80%: Nature's phase' ← approaching  
 19%: Nature's phase' ← none  
 ELSE : Nature's phase' ← none  
 = approaching: IF Nature's days>1

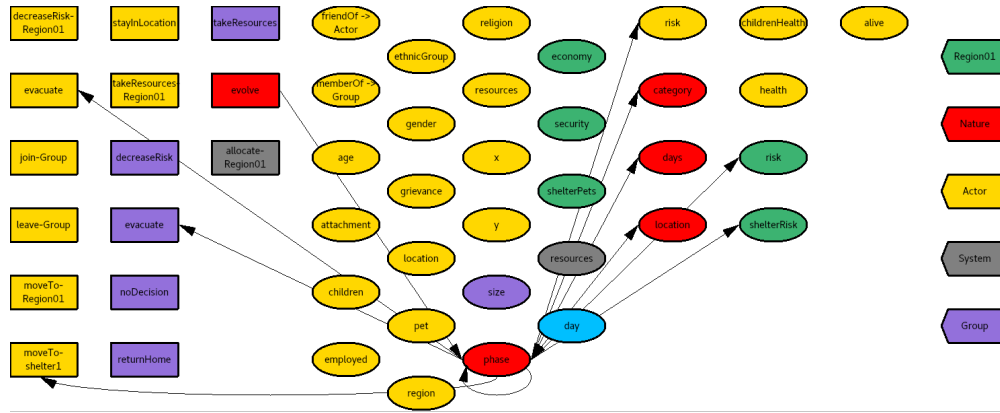


Figure 17: Ground Truth subgraph for Nature's phase

THEN :  
 80%: Nature's phase' ← active  
 19%: Nature's phase' ← approaching  
 ELSE : Nature's phase' ← approaching  
 OTHERWISE : IF Nature's location=none  
 THEN : Nature's phase' ← none  
 ELSE : Nature's phase' ← active

### 2.30 Region01's economy

Current economic level of region

Type: Real

psychsim/domains/groundtruth/region.py:77

### 2.31 Region01's risk

Level of risk from hurricane

Type: Real

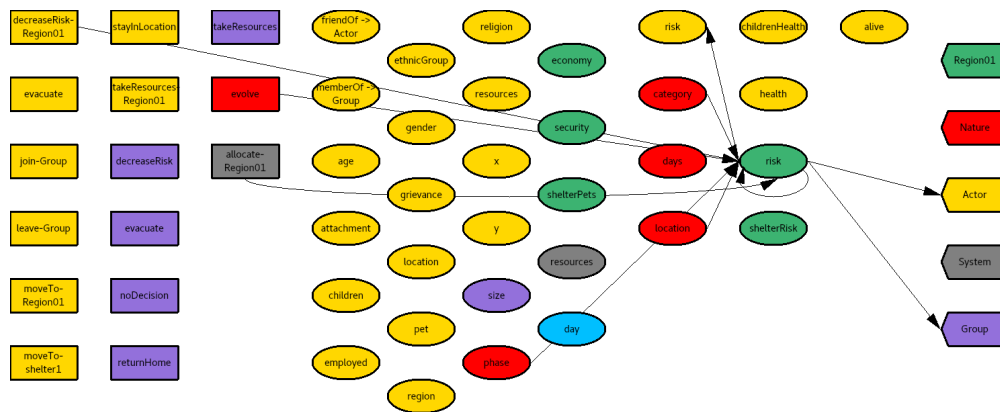


Figure 18: Ground Truth subgraph for Region01's risk

psychsim/domains/groundtruth/region.py:51

### 2.31.1 Effect of Actor-decreaseRisk-Region01 on Region01's risk

psychsim/domains/groundtruth/actor.py:521

**Region01's risk'**  $\leftarrow 80\% \cdot \text{Region01's risk}$

### 2.31.2 Effect of Nature-evolve on Region01's risk

psychsim/domains/groundtruth/nature.py:129

**IF Nature's phase'** = active

**THEN :** **IF Nature's location'**

**OTHERWISE :** **Region01's risk'**  $\leftarrow 80\% \cdot \text{Region01's risk}$   
        = **Region01:** **IF Nature's category**

            = **1:** **Region01's risk'**  $\leftarrow 80\% \cdot \text{Region01's risk} + 0.20$

            = **2:** **Region01's risk'**  $\leftarrow 60\% \cdot \text{Region01's risk} + 0.40$

            = **3:** **Region01's risk'**  $\leftarrow 39\% \cdot \text{Region01's risk} + 0.60$

            = **4:** **Region01's risk'**  $\leftarrow 19\% \cdot \text{Region01's risk} + 0.80$

            = **5:** **Region01's risk'**  $\leftarrow 0\% \cdot \text{Region01's risk} + 1.00$

**ELSE :** **Region01's risk'**  $\leftarrow 80\% \cdot \text{Region01's risk}$

### 2.31.3 Effect of System-allocate-Region01 on Region01's risk

psychsim/domains/groundtruth/system.py:43

**Region01's risk'**  $\leftarrow 80\% \cdot \text{Region01's risk}$

## 2.32 Region01's security

Level of law enforcement in region

**Type:** Real

psychsim/domains/groundtruth/region.py:64

## 2.33 Region01's shelterPets

**Type:** Boolean

psychsim/domains/groundtruth/region.py:88

## 2.34 Region01's shelterRisk

**Type:** Real

psychsim/domains/groundtruth/region.py:82

### 2.34.1 Effect of Nature-evolve on Region01's shelterRisk

psychsim/domains/groundtruth/nature.py:144

**IF Nature's phase'** = active

**THEN :** **IF Nature's location'** = **Region01**

**THEN :** **IF Nature's category**

            = **1:** **Region01's shelterRisk'**  $\leftarrow \text{Region01's shelterRisk}$

            = **2:** **Region01's shelterRisk'**  $\leftarrow 80\% \cdot \text{Region01's shelterRisk} + 0.20$

            = **3:** **Region01's shelterRisk'**  $\leftarrow 60\% \cdot \text{Region01's shelterRisk} + 0.40$

            = **4:** **Region01's shelterRisk'**  $\leftarrow 39\% \cdot \text{Region01's shelterRisk} + 0.60$

            = **5:** **Region01's shelterRisk'**  $\leftarrow 19\% \cdot \text{Region01's shelterRisk} + 0.80$

**ELSE :** **Region01's shelterRisk'**  $\leftarrow \text{Region01's shelterRisk}$

**ELSE :** **Region01's shelterRisk'**  $\leftarrow 80\% \cdot \text{Region01's shelterRisk}$

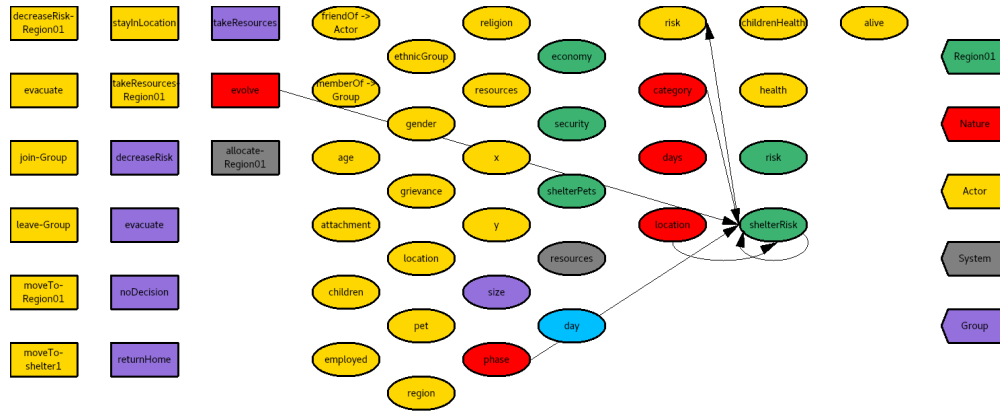


Figure 19: Ground Truth subgraph for Region01's shelterRisk

## 2.35 System's resources

**Type:** Integer

psychsim/domains/groundtruth/system.py:20

## 2.36 day

**Type:** Integer

psychsim/domains/groundtruth/\_\_main\_\_.py:710

### 2.36.1 Effect of Nature-evolve on day

psychsim/domains/groundtruth/nature.py:149  
 $\text{day}' \leftarrow \text{day} + 1$

## 3 Relations

### 3.1 Actor friendOf Actor

{'codePtr': True}

**Type:** Boolean

### 3.2 Actor memberOf Group

{'codePtr': True}

**Type:** Boolean

#### 3.2.1 Effect of Actor-join-Group on Actor memberOf Group

$\text{Actor memberOf Group}' \leftarrow \text{true}$

#### 3.2.2 Effect of Actor-leave-Group on Actor memberOf Group

$\text{Actor memberOf Group}' \leftarrow \text{false}$

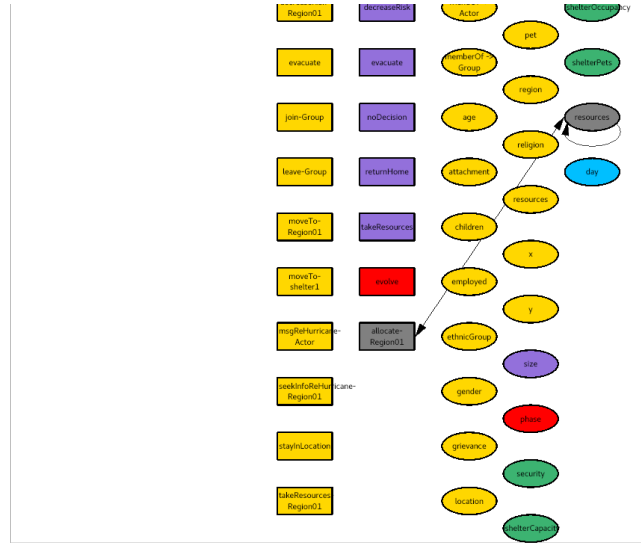


Figure 20: Ground Truth subgraph for System's resources

## 4 Actions

### 4.1 Nature evolve

#### 4.1.1 Effect on Nature's category of Nature evolve

IF Nature's phase'

= approaching: IF Nature's category=0

THEN :

20%: Nature's category'  $\leftarrow$  1

20%: Nature's category'  $\leftarrow$  2

20%: Nature's category'  $\leftarrow$  3

20%: Nature's category'  $\leftarrow$  4

20%: Nature's category'  $\leftarrow$  5

ELSE : IF Nature's category=1

THEN :

60%: Nature's category'  $\leftarrow$  Nature's category

40%: Nature's category'  $\leftarrow$  2

ELSE : IF Nature's category=5

THEN :

40%: Nature's category'  $\leftarrow$  4

60%: Nature's category'  $\leftarrow$  Nature's category

ELSE :

20%: Nature's category'  $\leftarrow$  Nature's category - 1

60%: Nature's category'  $\leftarrow$  Nature's category

20%: Nature's category'  $\leftarrow$  Nature's category + 1

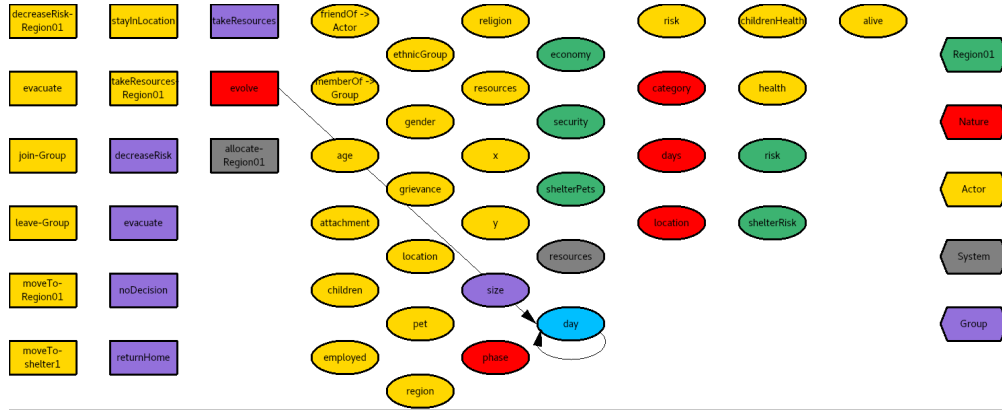


Figure 21: Ground Truth subgraph for day

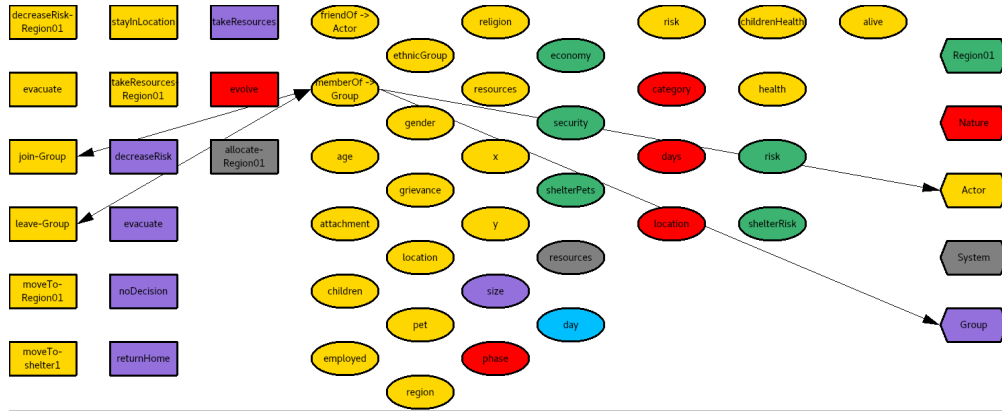


Figure 22: Ground Truth subgraph for Actor memberOf -> Group

= active: Nature's category'  $\leftarrow$  Nature's category  
 = none: Nature's category'  $\leftarrow$  0

#### 4.1.2 Effect on Nature's days of Nature evolve

IF Nature's phase=Nature's phase'  
 THEN : Nature's days'  $\leftarrow$  Nature's days+1  
 ELSE : Nature's days'  $\leftarrow$  0

#### 4.1.3 Effect on Nature's location of Nature evolve

IF Nature's phase'  
 = approaching: IF Nature's location=none  
 THEN : Nature's location'  $\leftarrow$  Region01  
 ELSE : Nature's location'  $\leftarrow$  Nature's location  
 = active: IF Nature's location  
 OTHERWISE : Nature's location'  $\leftarrow$  Nature's location  
 = Region01: Nature's location'  $\leftarrow$  none  
 = none: Nature's location'  $\leftarrow$  none

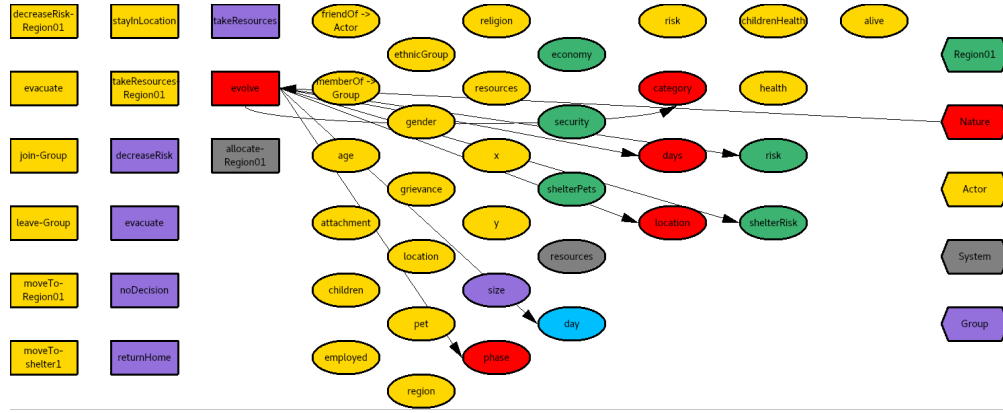


Figure 23: Ground Truth subgraph for Nature-evolve

#### 4.1.4 Effect on Nature's phase of Nature evolve

IF Nature's phase

= none: IF Nature's days > 1

THEN :

80%: Nature's phase'  $\leftarrow$  approaching

19%: Nature's phase'  $\leftarrow$  none

ELSE : Nature's phase'  $\leftarrow$  none

= approaching: IF Nature's days > 1

THEN :

80%: Nature's phase'  $\leftarrow$  active

19%: Nature's phase'  $\leftarrow$  approaching

ELSE : Nature's phase'  $\leftarrow$  approaching

OTHERWISE : IF Nature's location = none

THEN : Nature's phase'  $\leftarrow$  none

ELSE : Nature's phase'  $\leftarrow$  active

#### 4.1.5 Effect on Region01's risk of Nature evolve

IF Nature's phase' = active

THEN : IF Nature's location'

OTHERWISE : Region01's risk'  $\leftarrow$  80% · Region01's risk

= Region01: IF Nature's category

= 1: Region01's risk'  $\leftarrow$  80% · Region01's risk + 0.20

= 2: Region01's risk'  $\leftarrow$  60% · Region01's risk + 0.40

= 3: Region01's risk'  $\leftarrow$  39% · Region01's risk + 0.60

= 4: Region01's risk'  $\leftarrow$  19% · Region01's risk + 0.80

= 5: Region01's risk'  $\leftarrow$  0% · Region01's risk + 1.00

ELSE : Region01's risk'  $\leftarrow$  80% · Region01's risk

#### 4.1.6 Effect on Region01's shelterRisk of Nature evolve

IF Nature's phase' = active

THEN : IF Nature's location' = Region01

THEN : IF Nature's category

= 1: Region01's shelterRisk'  $\leftarrow$  Region01's shelterRisk

= 2: Region01's shelterRisk'  $\leftarrow$  80% · Region01's shelterRisk + 0.20

= 3: Region01's shelterRisk'  $\leftarrow$  60% · Region01's shelterRisk + 0.40

= 4: **Region01's shelterRisk'**  $\leftarrow 39\% \cdot \text{Region01's shelterRisk} + 0.60$   
 = 5: **Region01's shelterRisk'**  $\leftarrow 19\% \cdot \text{Region01's shelterRisk} + 0.80$   
 ELSE : **Region01's shelterRisk'**  $\leftarrow \text{Region01's shelterRisk}$   
 ELSE : **Region01's shelterRisk'**  $\leftarrow 80\% \cdot \text{Region01's shelterRisk}$

#### 4.1.7 Effect on day of Nature evolve

**day'**  $\leftarrow \text{day} + 1$

## 4.2 Actor decreaseRisk Region01

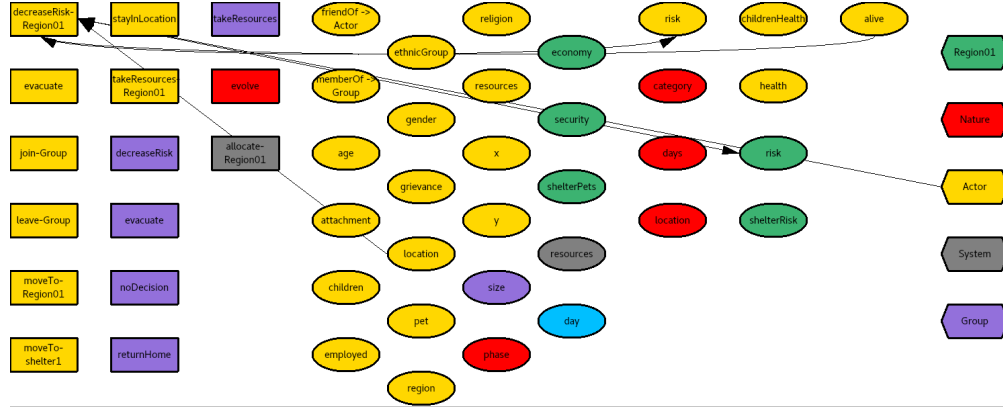


Figure 24: Ground Truth subgraph for Actor-decreaseRisk-Region01

### 4.2.1 Applicability of Actor decreaseRisk Region01

IF Actor's location=Region01  
 THEN : IF Actor's alive  
 THEN : true  
 ELSE : false  
 ELSE : false

### 4.2.2 Effect on Actor's risk of Actor decreaseRisk Region01

**Actor's risk'**  $\leftarrow 80\% \cdot \text{Actor's risk} + 0.20$

### 4.2.3 Effect on Region01's risk of Actor decreaseRisk Region01

**Region01's risk'**  $\leftarrow 80\% \cdot \text{Region01's risk}$

## 4.3 Actor evacuate

### 4.3.1 Applicability of Actor evacuate

IF Nature's phase=none  
 THEN : false  
 ELSE : IF Actor's location=evacuated  
 THEN : false  
 ELSE : IF Actor's alive  
 THEN : true  
 ELSE : false



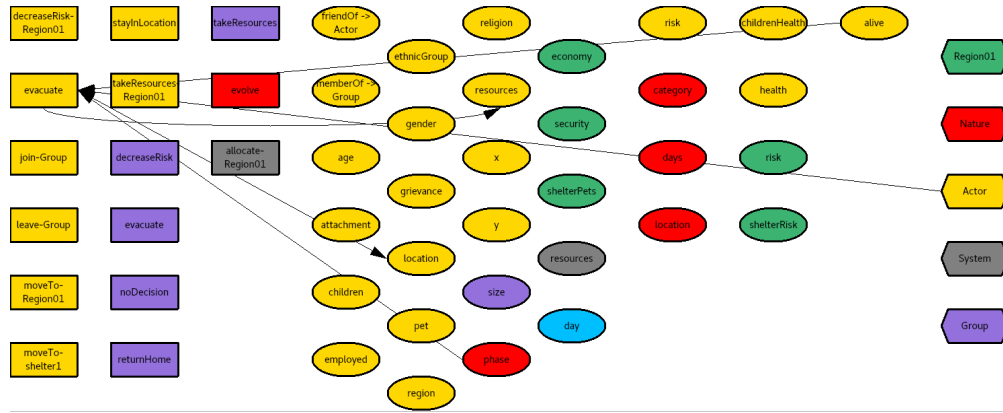


Figure 25: Ground Truth subgraph for Actor-evacuate

#### 4.3.2 Effect on Actor's location of Actor evacuate

Actor's location'  $\leftarrow$  evacuated

#### 4.3.3 Effect on Actor's resources of Actor evacuate

IF Actor's resources  $> 0.20$   
 THEN : Actor's resources'  $\leftarrow$  Actor's resources  $- 0.20$   
 ELSE : Actor's resources'  $\leftarrow 0.00$

#### 4.4 Actor join Group

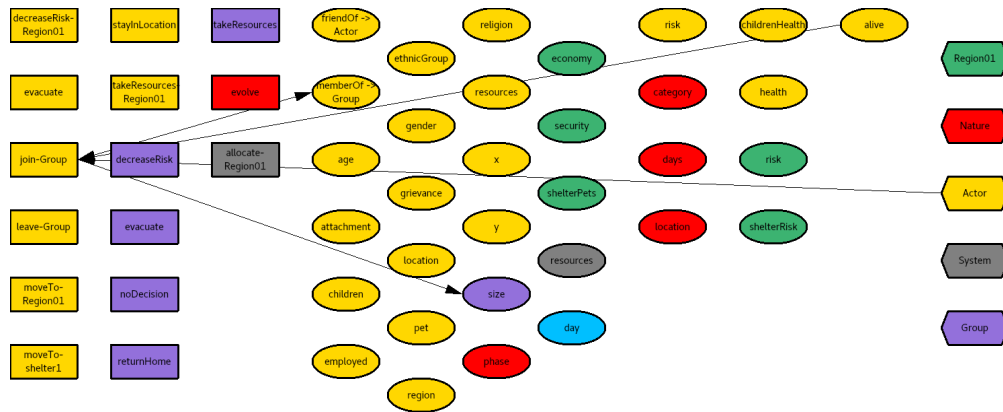


Figure 26: Ground Truth subgraph for Actor-join-Group

##### 4.4.1 Applicability of Actor join Group

IF Actor's alive  
 THEN : IF Actor memberOf Group  
 THEN : false  
 ELSE : true  
 ELSE : false

#### 4.4.2 Effect on Actor memberOf Group of Actor join Group

Actor memberOf Group'  $\leftarrow$  true

#### 4.4.3 Effect on Group's size of Actor join Group

Group's size'  $\leftarrow$  Group's size+1

### 4.5 Actor leave Group

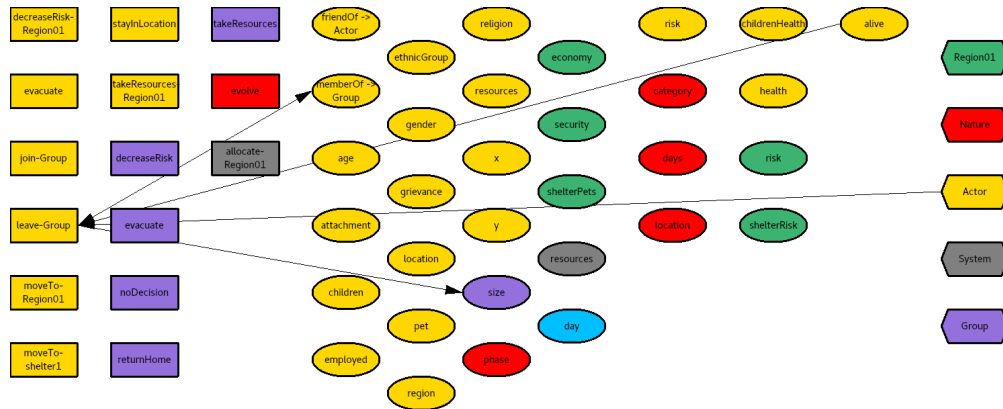


Figure 27: Ground Truth subgraph for Actor-leave-Group

#### 4.5.1 Applicability of Actor leave Group

IF Actor's alive

THEN : IF Actor memberOf Group

THEN : true

ELSE : false

ELSE : false

#### 4.5.2 Effect on Actor memberOf Group of Actor leave Group

Actor memberOf Group'  $\leftarrow$  false

#### 4.5.3 Effect on Group's size of Actor leave Group

Group's size'  $\leftarrow$  Group's size-1

### 4.6 Actor moveTo Region01

#### 4.6.1 Applicability of Actor moveTo Region01

IF Actor's location={ 'shelter1', 'evacuated' }

THEN : true

ELSE : false

#### 4.6.2 Effect on Actor's location of Actor moveTo Region01

Actor's location'  $\leftarrow$  Region01

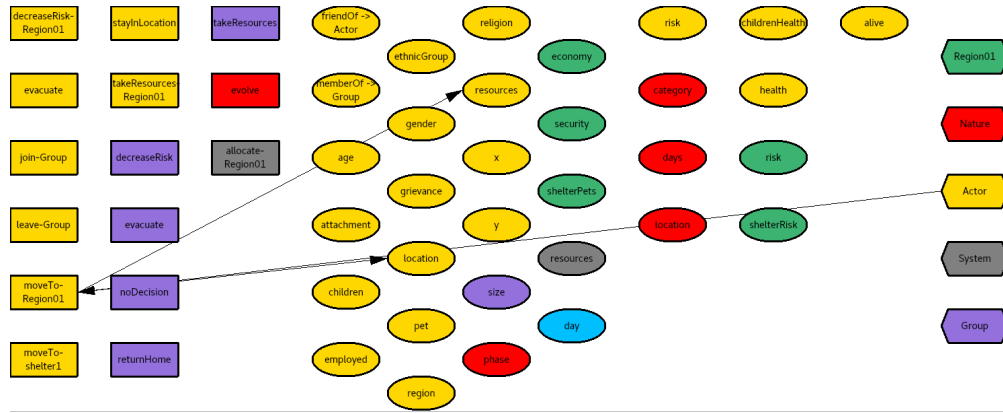


Figure 28: Ground Truth subgraph for Actor-moveTo-Region01

#### 4.6.3 Effect on Actor's resources of Actor moveTo Region01

IF Actor's alive

THEN : IF Actor's employed

THEN :  $\text{Actor's resources}' \leftarrow 80\% \cdot \text{Actor's resources} + 0.20$

ELSE :  $\text{Actor's resources}' \leftarrow \text{Actor's resources}$

ELSE :  $\text{Actor's resources}' \leftarrow \text{Actor's resources}$

#### 4.7 Actor moveTo shelter1

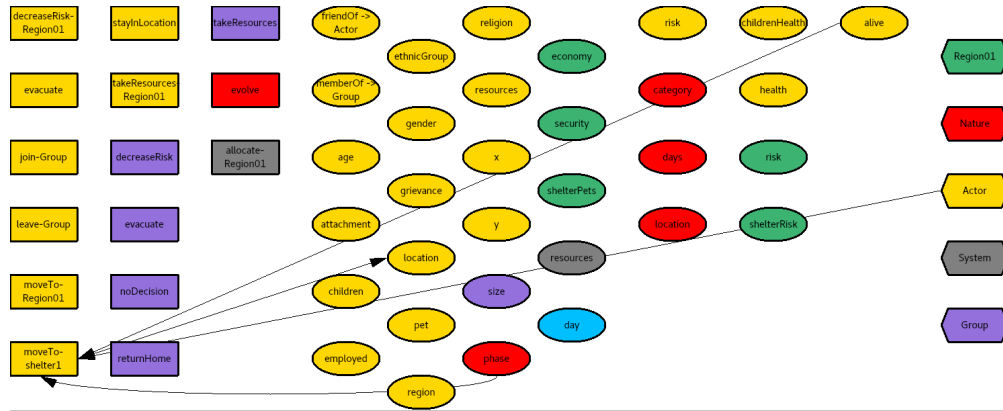


Figure 29: Ground Truth subgraph for Actor-moveTo-shelter1

##### 4.7.1 Applicability of Actor moveTo shelter1

IF Nature's phase=none

THEN : false

ELSE : IF Actor's alive

THEN : IF Actor's location=shelter1

THEN : false

ELSE : true

ELSE : false

#### 4.7.2 Effect on Actor's location of Actor moveTo shelter1

Actor's location'  $\leftarrow$  shelter1

### 4.8 Actor stayInLocation

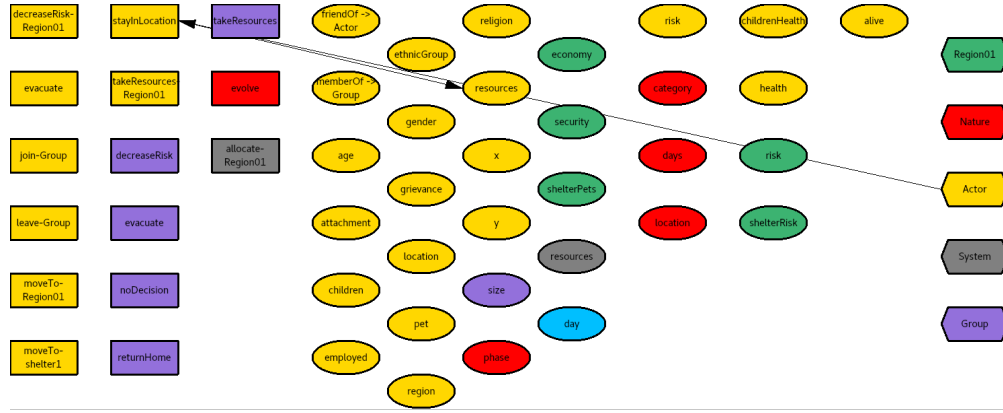


Figure 30: Ground Truth subgraph for Actor-stayInLocation

#### 4.8.1 Effect on Actor's resources of Actor stayInLocation

IF Actor's alive

THEN : IF Actor's employed

THEN : IF Actor's location={ 'evacuated', 'Region01' }

THEN : Actor's resources'  $\leftarrow$  80%·Actor's resources+0.20

ELSE : Actor's resources'  $\leftarrow$  Actor's resources

ELSE : Actor's resources'  $\leftarrow$  Actor's resources

ELSE : Actor's resources'  $\leftarrow$  Actor's resources

### 4.9 Actor takeResources Region01

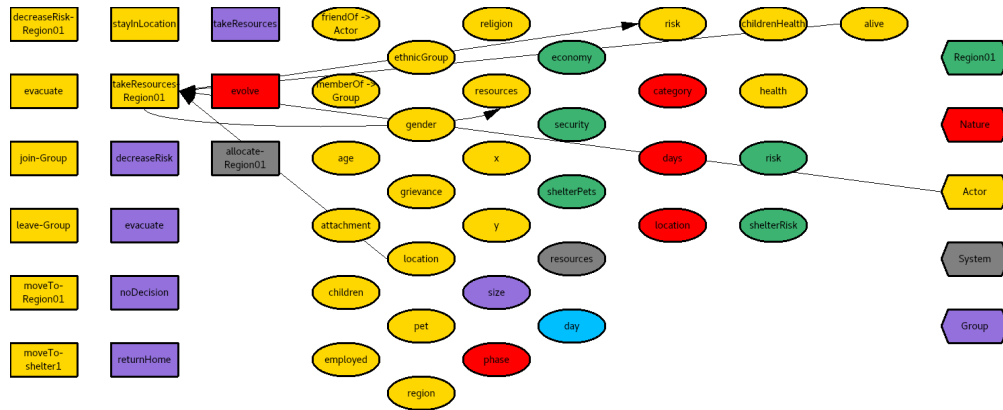


Figure 31: Ground Truth subgraph for Actor-takeResources-Region01

#### 4.9.1 Applicability of Actor takeResources Region01

IF Actor's location=Region01

THEN : IF Actor's alive

THEN : true

ELSE : false

ELSE : false

#### 4.9.2 Effect on Actor's resources of Actor takeResources Region01

Actor's resources'  $\leftarrow 80\% \cdot \text{Actor's resources} + 0.20$

#### 4.9.3 Effect on Actor's risk of Actor takeResources Region01

IF Nature's phase=none

THEN : Actor's risk'  $\leftarrow 19\% \cdot \text{Actor's risk} + 0.80$

ELSE : Actor's risk'  $\leftarrow 40\% \cdot \text{Actor's risk} + 0.60$

### 4.10 System allocate Region01

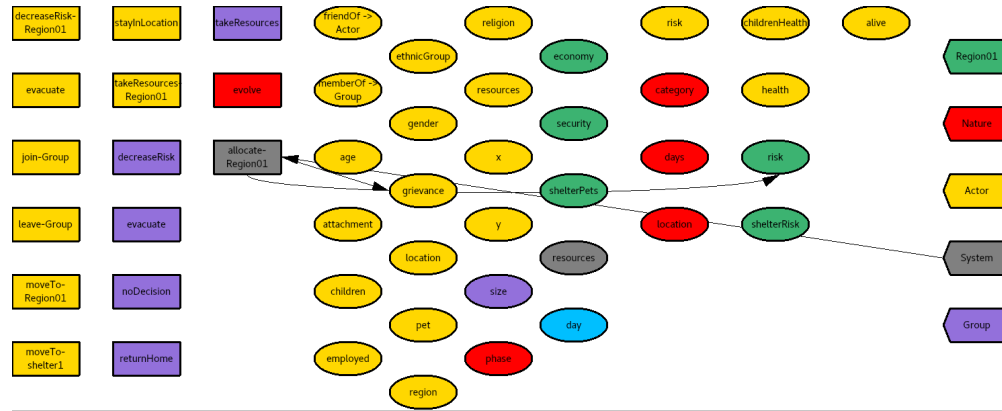


Figure 32: Ground Truth subgraph for System-allocate-Region01

#### 4.10.1 Effect on Actor's grievance of System allocate Region01

IF Actor's region=Region01

THEN : Actor's grievance'  $\leftarrow 80\% \cdot \text{Actor's grievance}$

ELSE : Actor's grievance'  $\leftarrow 80\% \cdot \text{Actor's grievance} + 0.20$

#### 4.10.2 Effect on Region01's risk of System allocate Region01

Region01's risk'  $\leftarrow 80\% \cdot \text{Region01's risk}$

### 4.11 Group decreaseRisk

#### 4.11.1 Applicability of Group decreaseRisk

IF Group's size > 0

THEN : true

ELSE : false

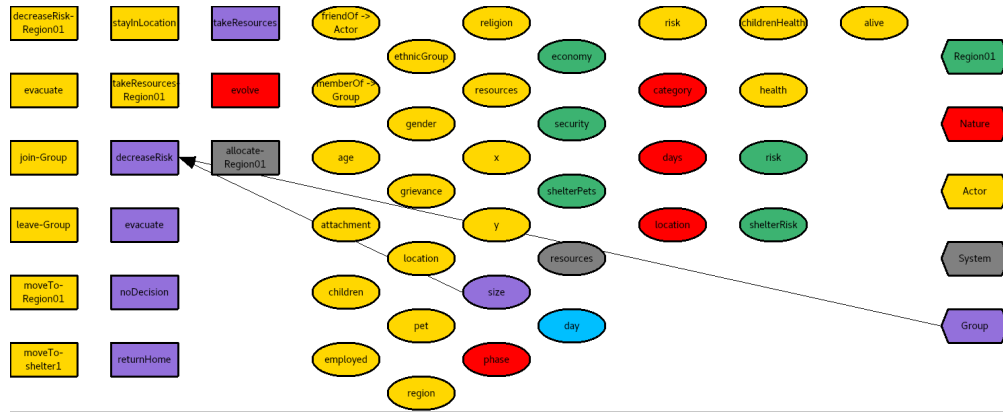


Figure 33: Ground Truth subgraph for Group-decreaseRisk

## 4.12 Group evacuate

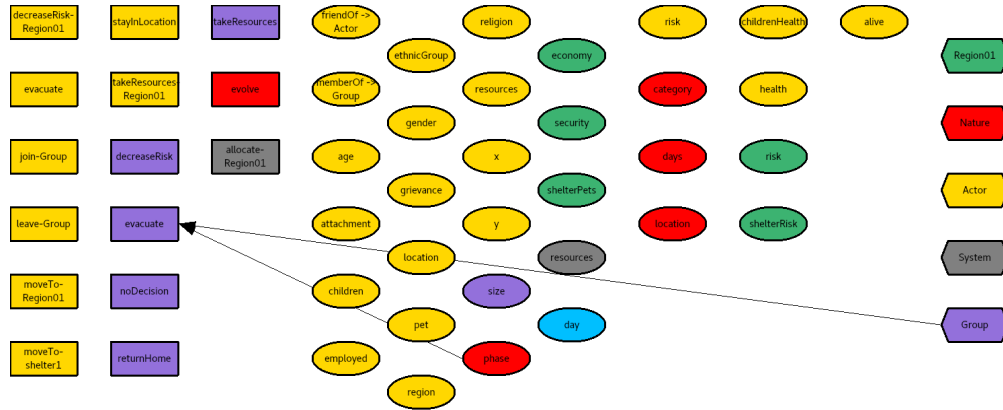


Figure 34: Ground Truth subgraph for Group-evacuate

### 4.12.1 Applicability of Group evacuate

IF Nature's phase=none  
 THEN : false  
 ELSE : true

### 4.13 Group noDecision

### 4.14 Group returnHome

### 4.15 Group takeResources

#### 4.15.1 Applicability of Group takeResources

IF Group's size>0  
 THEN : true  
 ELSE : false

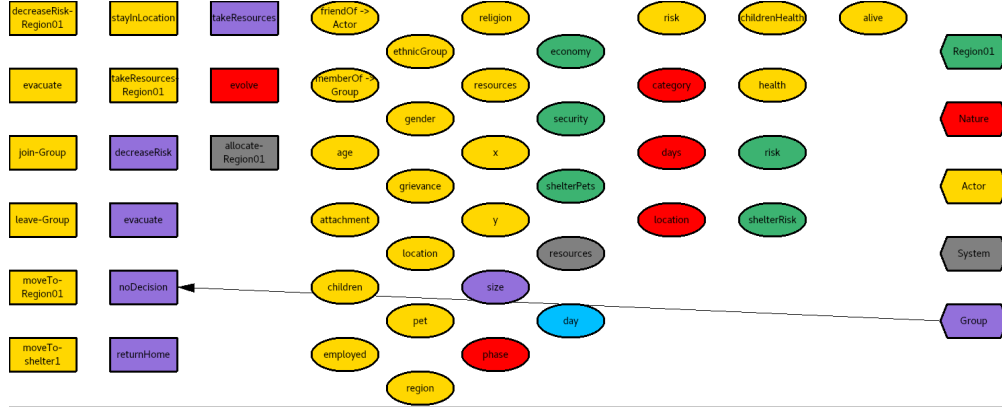


Figure 35: Ground Truth subgraph for Group-noDecision

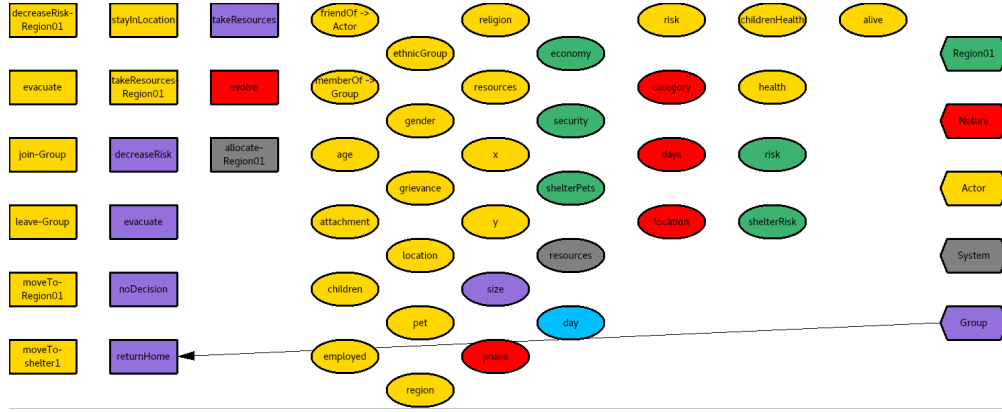


Figure 36: Ground Truth subgraph for Group-returnHome

## 5 Expected Reward

### 5.1 Actor's Reward

IF Actor's risk > 0.60

THEN : IF Actor's attachment = anxious

THEN :  $R \leftarrow 20\% \cdot \text{Actor memberOf Group} + 40\% \cdot \text{Actor's childrenHealth} + 60\% \cdot \text{Actor's health} + 20\% \cdot \text{Actor's resources} + -60\% \cdot \text{Region01's risk}$

ELSE : IF Actor's attachment = avoidant

THEN :  $R \leftarrow -20\% \cdot \text{Actor memberOf Group} + 40\% \cdot \text{Actor's childrenHealth} + 60\% \cdot \text{Actor's health} + 20\% \cdot \text{Actor's resources} + -60\% \cdot \text{Region01's risk}$

ELSE :  $R \leftarrow 40\% \cdot \text{Actor's childrenHealth} + 60\% \cdot \text{Actor's health} + 20\% \cdot \text{Actor's resources} + -60\% \cdot \text{Region01's risk}$

ELSE :  $R \leftarrow 40\% \cdot \text{Actor's childrenHealth} + 60\% \cdot \text{Actor's health} + 20\% \cdot \text{Actor's resources} + -60\% \cdot \text{Region01's risk}$

### 5.2 Group's Reward

IF Actor's risk > 0.60

THEN : IF Actor's attachment = anxious

THEN :  $R \leftarrow 20\% \cdot \text{Actor memberOf Group} + 40\% \cdot \text{Actor's childrenHealth} + 60\% \cdot \text{Actor's health} + 20\% \cdot \text{Actor's resources} + -60\% \cdot \text{Region01's risk}$

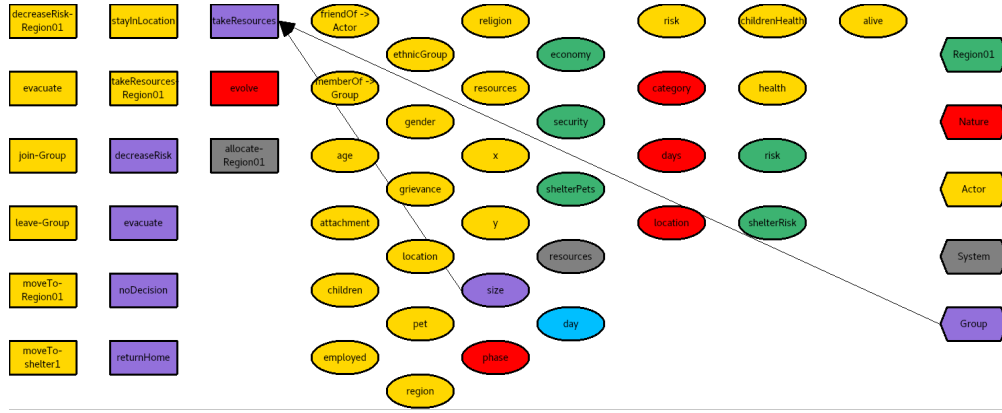


Figure 37: Ground Truth subgraph for Group-takeResources

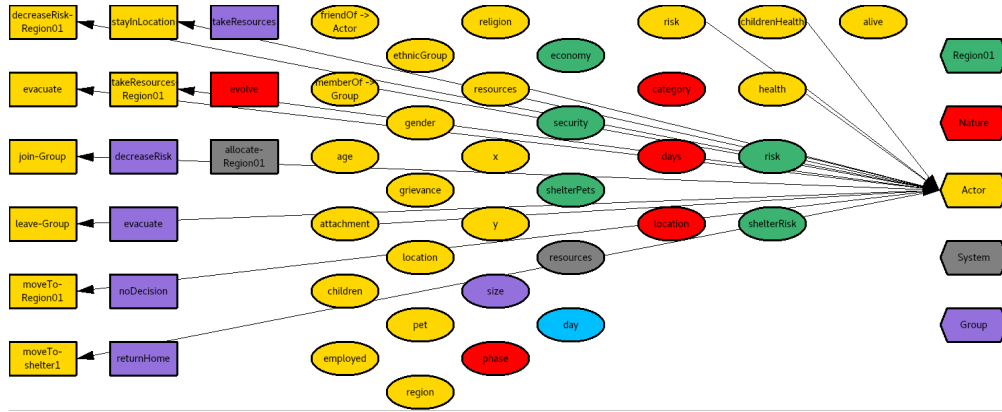


Figure 38: Ground Truth subgraph for Actor

ELSE : IF Actor's attachment=avoidant  
 THEN :  $R \leftarrow -20\% \cdot \text{Actor memberOf Group} + 40\% \cdot \text{Actor's childrenHealth} + 60\% \cdot \text{Actor's health} + 20\% \cdot \text{Actor's resources} + -60\% \cdot \text{Region01's risk}$   
 ELSE :  $R \leftarrow 40\% \cdot \text{Actor's childrenHealth} + 60\% \cdot \text{Actor's health} + 20\% \cdot \text{Actor's resources} + -60\% \cdot \text{Region01's risk}$   
 ELSE :  $R \leftarrow 40\% \cdot \text{Actor's childrenHealth} + 60\% \cdot \text{Actor's health} + 20\% \cdot \text{Actor's resources} + -60\% \cdot \text{Region01's risk}$



