USC Ground Truth Documentation

August 14, 2018

Contents

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:

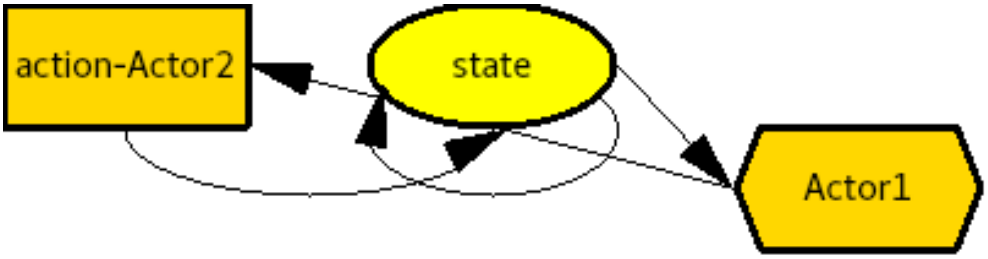

Figure 1: Simple influence diagram

- 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.
- 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

2.2 Actor's alive

Type: Boolean

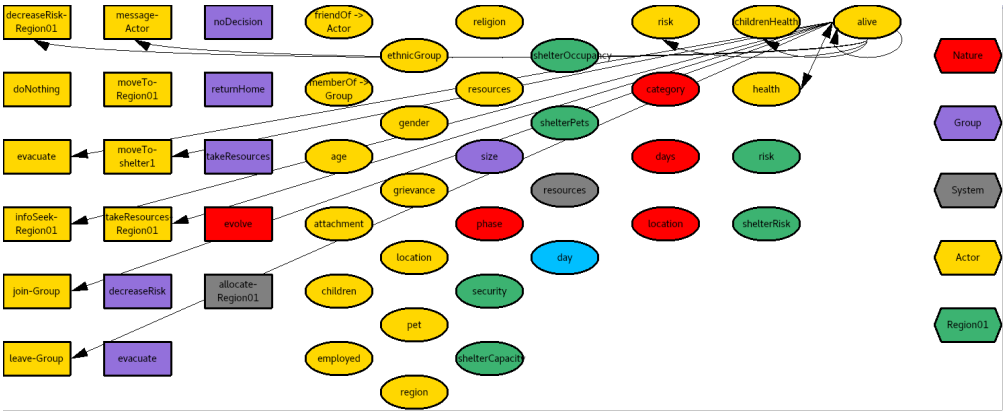

Figure 2: Ground Truth subgraph for Actor's alive

2.2.1 Default change in Actor's alive

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**

2.4 Actor's category

Type: Integer

2.5 Actor's center

Type: String

Values: **Region01**, **none**

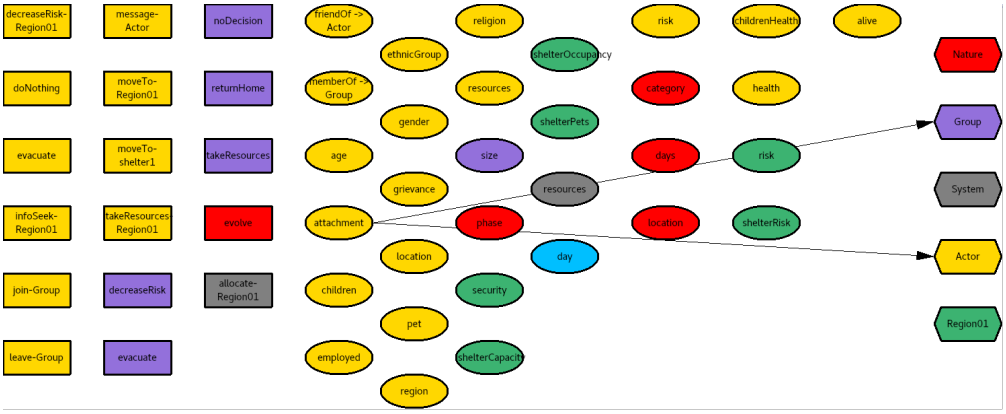

Figure 3: Ground Truth subgraph for Actor's attachment

2.6 Actor's children

Number of children

Type: Real

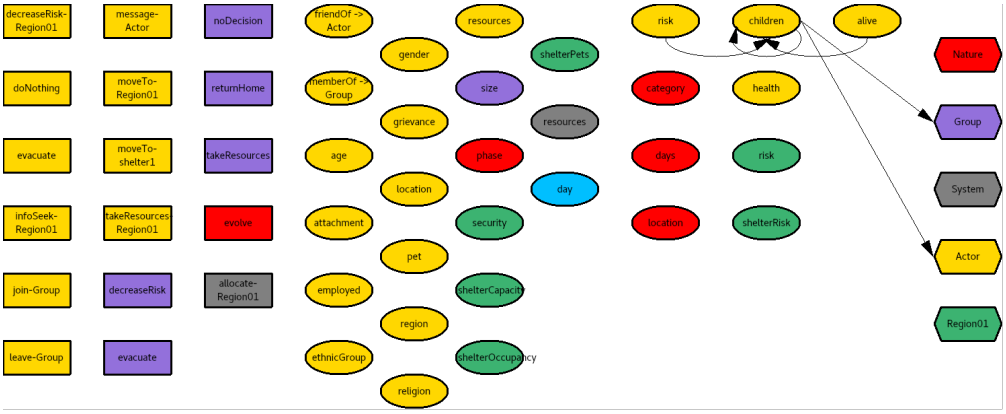

Figure 4: Ground Truth subgraph for Actor's children

2.7 Actor's childrenHealth

Current level of children's physical wellbeing

Type: Real

2.7.1 Default change in Actor's childrenHealth

IF **Actor's alive**
THEN IF **Actor's risk**$'$>0.20
THEN IF **Actor's risk**$'$>0.40
THEN IF **Actor's risk**$'$>0.60
THEN IF **Actor's risk**$'$>0.80
THEN
80%: **Actor's childrenHealth**$'$←60%·**Actor's childrenHealth**

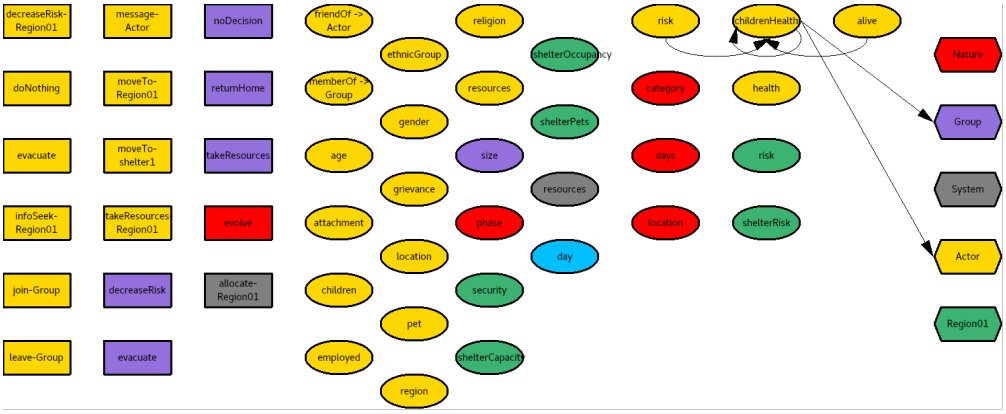

Figure 5: Ground Truth subgraph for Actor's childrenHealth

20%: **Actor's childrenHealth**′←60%·**Actor's childrenHealth**+0.24
ELSE
60%: **Actor's childrenHealth**′←60%·**Actor's childrenHealth**
40%: **Actor's childrenHealth**′←60%·**Actor's childrenHealth**+0.24
ELSE
40%: **Actor's childrenHealth**′←60%·**Actor's childrenHealth**
60%: **Actor's childrenHealth**′←60%·**Actor's childrenHealth**+0.24
ELSE
20%: **Actor's childrenHealth**′←60%·**Actor's childrenHealth**
80%: **Actor's childrenHealth**′←60%·**Actor's childrenHealth**+0.24
ELSE **Actor's childrenHealth**′←60%·**Actor's childrenHealth**+0.24
ELSE **Actor's childrenHealth**′←0.00

2.8 Actor's employed

Has a full-time job

Type: Boolean

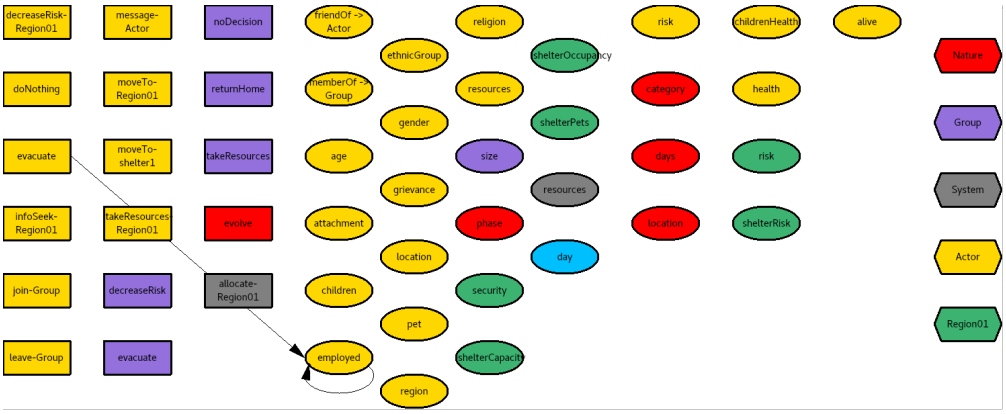

Figure 6: Ground Truth subgraph for Actor's employed

2.8.1 Effect of Actor-evacuate on Actor's employed

Actor's employed′←**Actor's employed**

2.9 Actor's ethnicGroup

Ethnicity of actor

Type: String

Values: **majority**, **minority**

2.10 Actor's gender

Type: String

Values: **female**, **male**

2.11 Actor's grievance

Current level of grievance felt toward system

Type: Real

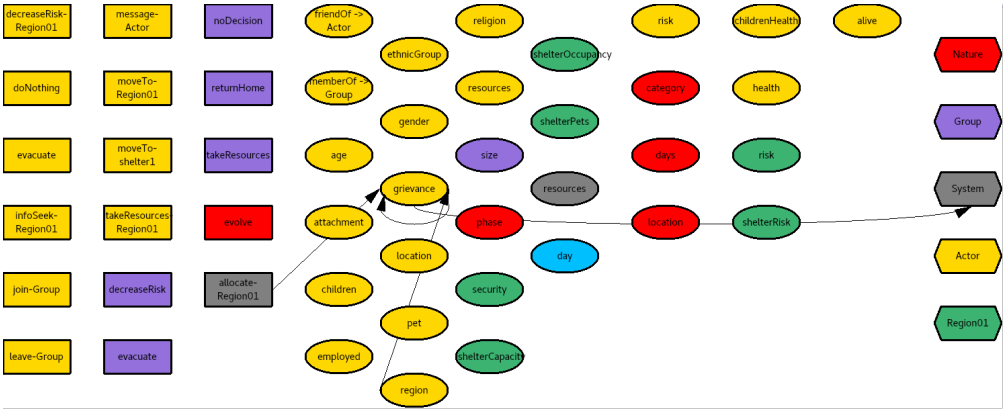

Figure 7: Ground Truth subgraph for Actor's grievance

2.11.1 Effect of System-allocate-Region01 on Actor's grievance

IF **Actor's region**=**Region01**
THEN **Actor's grievance**$'$←80%·**Actor's grievance**
ELSE **Actor's grievance**$'$←80%·**Actor's grievance**+0.20

2.12 Actor's health

Current level of physical wellbeing

Type: Real

2.12.1 Default change in Actor's health

IF **Actor's alive**
THEN IF **Actor's risk**$'$>0.20
THEN IF **Actor's risk**$'$>0.40
THEN IF **Actor's risk**$'$>0.60
THEN IF **Actor's risk**$'$>0.80

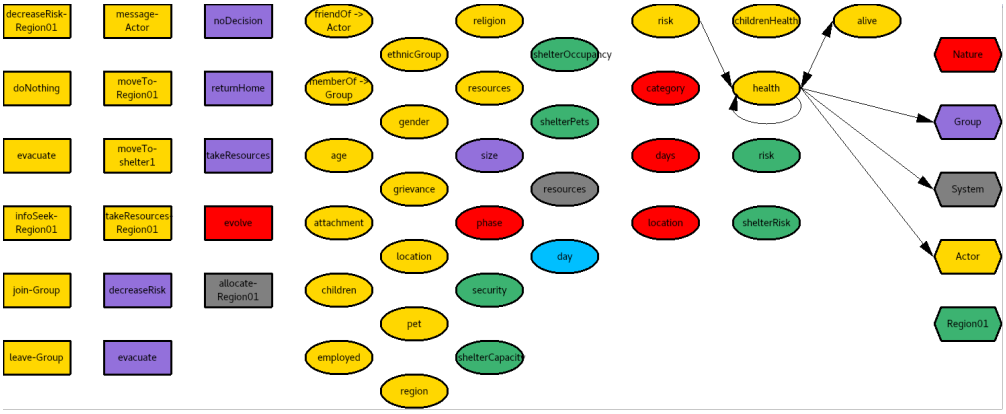

Figure 8: Ground Truth subgraph for Actor's health

THEN
80%: **Actor's health**′←60%·**Actor's health**
20%: **Actor's health**′←60%·**Actor's health**+0.24
ELSE
60%: **Actor's health**′←60%·**Actor's health**
40%: **Actor's health**′←60%·**Actor's health**+0.24
ELSE
40%: **Actor's health**′←60%·**Actor's health**
60%: **Actor's health**′←60%·**Actor's health**+0.24
ELSE
20%: **Actor's health**′←60%·**Actor's health**
80%: **Actor's health**′←60%·**Actor's health**+0.24
ELSE **Actor's health**′←60%·**Actor's health**+0.24
ELSE **Actor's health**′←0.00

2.13 Actor's location

Current location

Type: String

Values: Region01, **evacuated**, **shelter1**

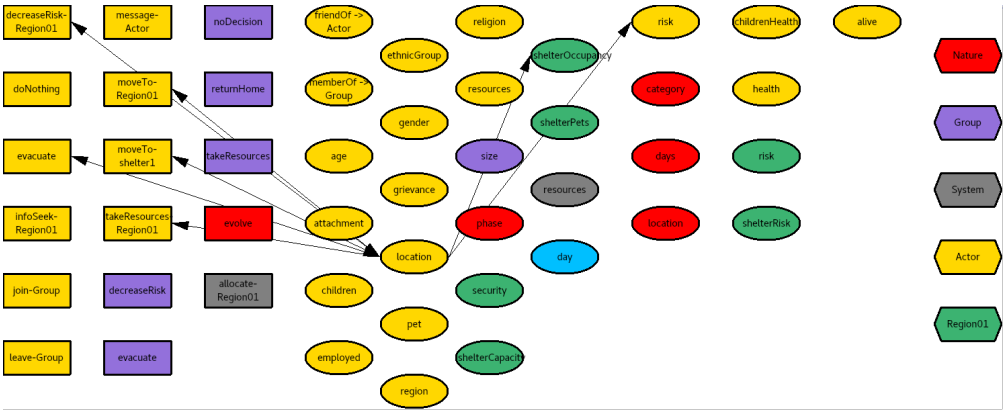

Figure 9: Ground Truth subgraph for Actor's location

2.13.1 Effect of Actor-evacuate on Actor's location

Actor's location′←evacuated

2.13.2 Effect of Actor-moveTo-Region01 on Actor's location

Actor's location′←Region01

2.13.3 Effect of Actor-moveTo-shelter1 on Actor's location

Actor's location′←shelter1

2.14 Actor's perceivedHealth

Type: Real

2.15 Actor's perceivedKids

Type: Real

2.16 Actor's pet

Owns a pet

Type: Boolean

2.17 Actor's phase

Type: String

Values: active, **approaching**, **none**

2.18 Actor's region

Region of residence

Type: String

Values: Region01

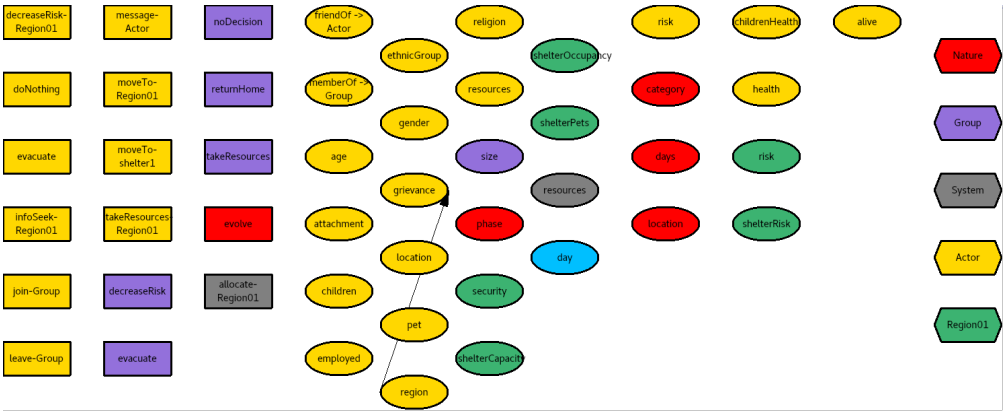

Figure 10: Ground Truth subgraph for Actor's region

2.19 Actor's religion

Religious affiliation of actor

Type: String

Values: **majority**, **minority**, **none**

2.20 Actor's resources

Material resources (wealth) currently owned

Type: Real

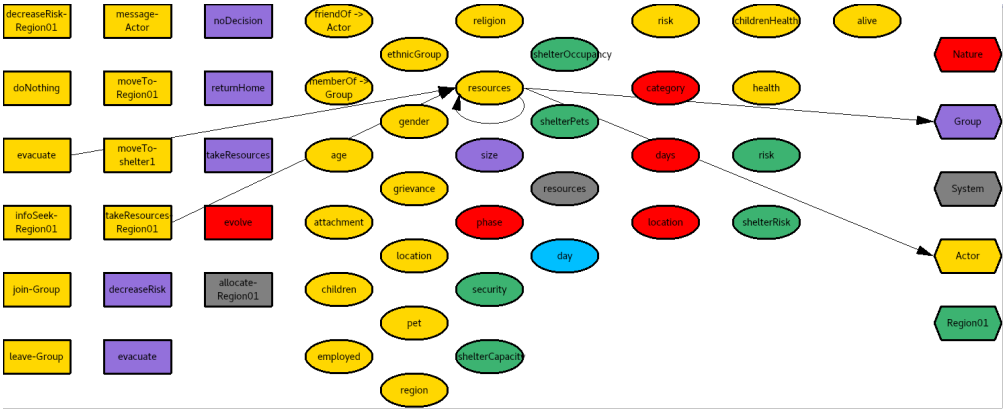

Figure 11: Ground Truth subgraph for Actor's resources

2.20.1 Effect of Actor-evacuate on Actor's resources

IF **Actor's resources**>0.40
THEN **Actor's resources**$'\leftarrow$**Actor's resources**-0.40
ELSE **Actor's resources**$'\leftarrow 0.00$

2.20.2 Effect of Actor-takeResources-Region01 on Actor's resources

Actor's resources$'\leftarrow$**Actor's resources**$+1.00$

2.21 Actor's risk

Current level of risk from hurricane

Type: Real

2.21.1 Effect of Actor-takeResources-Region01 on Actor's risk

IF **Nature's phase**$=$**none**
THEN **Actor's risk**$'\leftarrow 20\%\cdot$**Actor's risk**$+0.80$
ELSE **Actor's risk**$'\leftarrow 80\%\cdot$**Actor's risk**$+0.20$

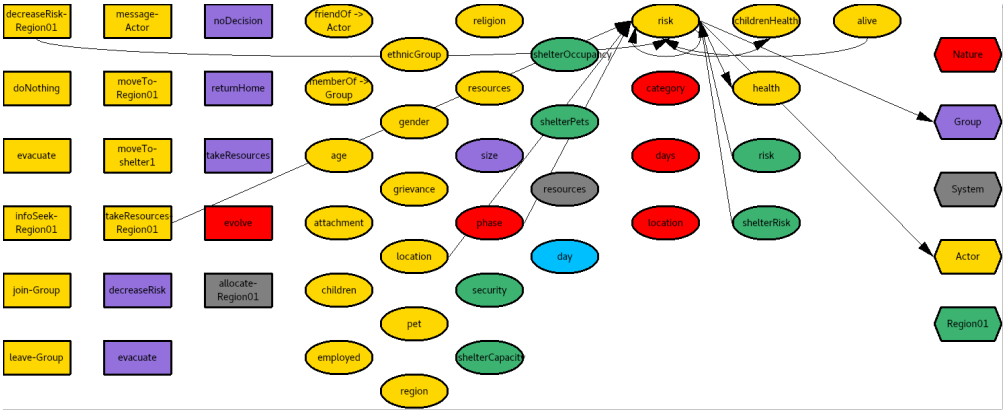

Figure 12: Ground Truth subgraph for Actor's risk

2.21.2 Default change in Actor's risk

IF **Actor's alive**
THEN IF **Actor's location**$'$=**shelter1**
THEN **Actor's risk**$'$←**Region01's shelterRisk**
ELSE IF **Actor's location**$'$=**evacuated**
THEN **Actor's risk**$'$←10%·**Actor's risk**
ELSE **Actor's risk**$'$←**Region01's risk**
ELSE **Actor's risk**$'$←0.00

2.21.3 Effect of Actor-decreaseRisk-Region01 on Actor's risk

Actor's risk$'$←80%·**Actor's risk**+0.20

2.22 Group's size

Type: Integer

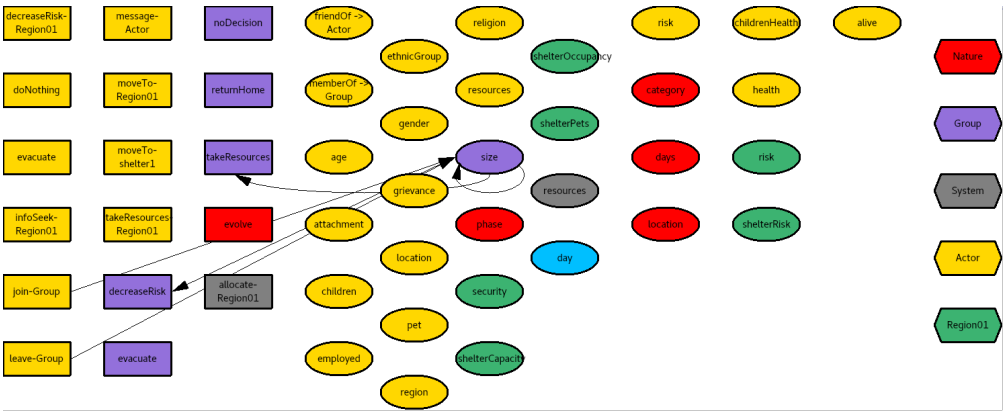

Figure 13: Ground Truth subgraph for Group's size

2.22.1 Effect of Actor-join-Group on Group's size

Group's size$'$←**Group's size**+1

2.22.2 Effect of Actor-leave-Group on Group's size

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

2.23 Nature's category

Type: Integer

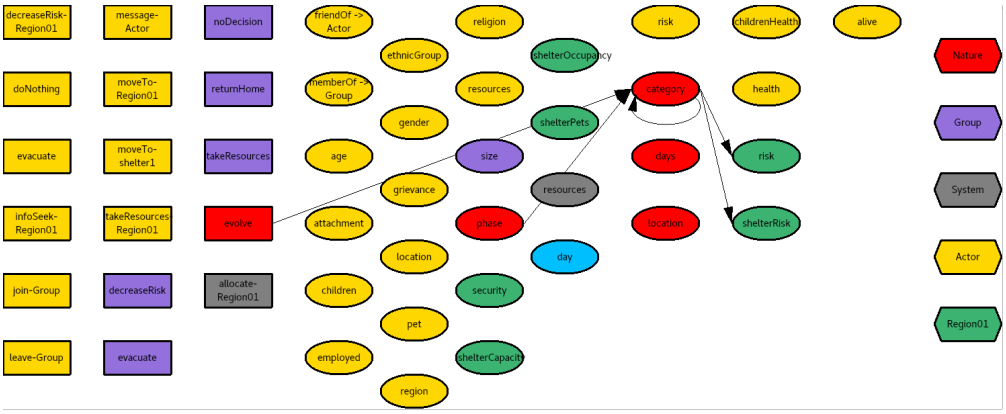

Figure 14: Ground Truth subgraph for Nature's category

2.23.1 Effect of Nature-evolve on Nature's category

IF **Nature's phase**$'$=**approaching**
THEN IF **Nature's category**$=0$
THEN
20%: **Nature's category**$'\leftarrow 1$
20%: **Nature's category**$'\leftarrow 2$
20%: **Nature's category**$'\leftarrow 5$
20%: **Nature's category**$'\leftarrow 3$
20%: **Nature's category**$'\leftarrow 4$
ELSE IF **Nature's category**$=1$
THEN
80%: **Nature's category**$'\leftarrow$**Nature's category**
20%: **Nature's category**$'\leftarrow 2$
ELSE IF **Nature's category**$=5$
THEN
80%: **Nature's category**$'\leftarrow$**Nature's category**
20%: **Nature's category**$'\leftarrow 4$
ELSE
80%: **Nature's category**$'\leftarrow$**Nature's category**
10%: **Nature's category**$'\leftarrow$**Nature's category**-1
10%: **Nature's category**$'\leftarrow$**Nature's category**$+1$
ELSE IF **Nature's phase**$'$=**active**
THEN **Nature's category**$'\leftarrow$**Nature's category**
ELSE **Nature's category**$'\leftarrow 0$

2.24 Nature's days

Type: Integer

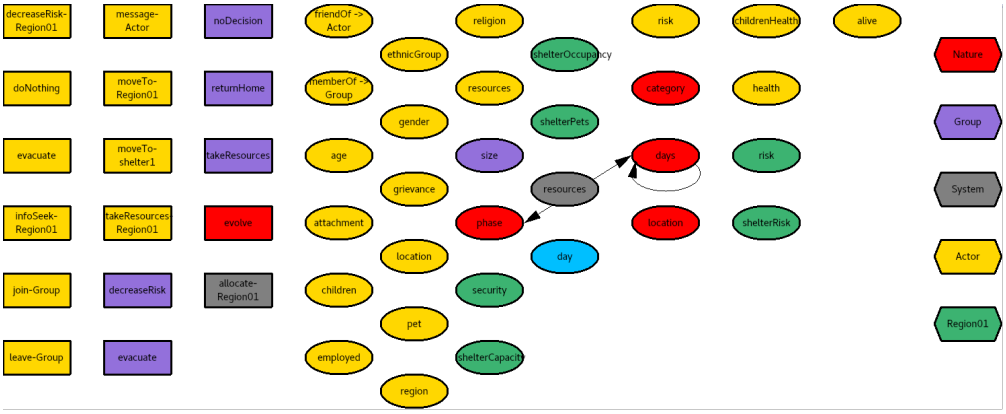

Figure 15: Ground Truth subgraph for Nature's days

2.24.1 Default change in Nature's days

IF **Nature's phase**=**Nature's phase**′
THEN **Nature's days**′←**Nature's days**+1
ELSE **Nature's days**′←0

2.25 Nature's location

Type: String

Values: Region01, **none**

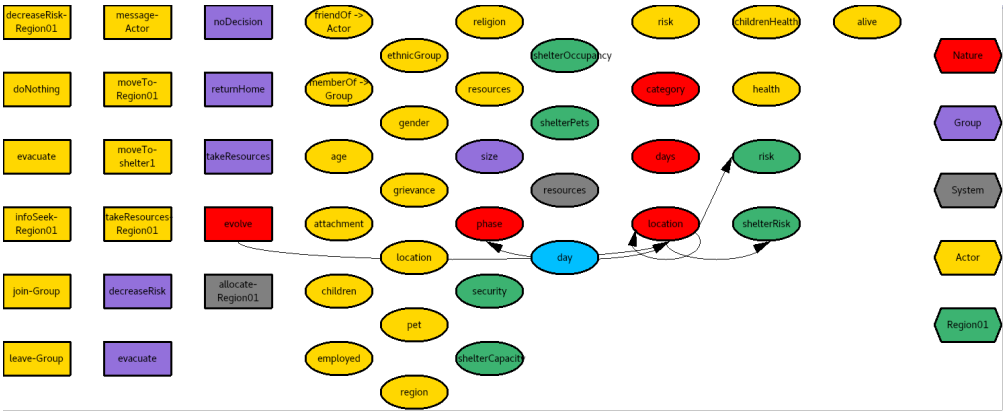

Figure 16: Ground Truth subgraph for Nature's location

2.25.1 Effect of Nature-evolve on Nature's location

IF **Nature's phase**′=**approaching**
THEN IF **Nature's location**=**none**
THEN **Nature's location**′←**Region01**
ELSE **Nature's location**′←**Nature's location**
ELSE IF **Nature's phase**′=**active**
THEN IF **Nature's location**=**Region01**
THEN

40%: **Nature's location**′←**none**
20%: **Nature's location**′←**Region01**
ELSE **Nature's location**′←**Nature's location**
ELSE **Nature's location**′←**none**

2.26 Nature's phase

Type: String

Values: **active**, **approaching**, **none**

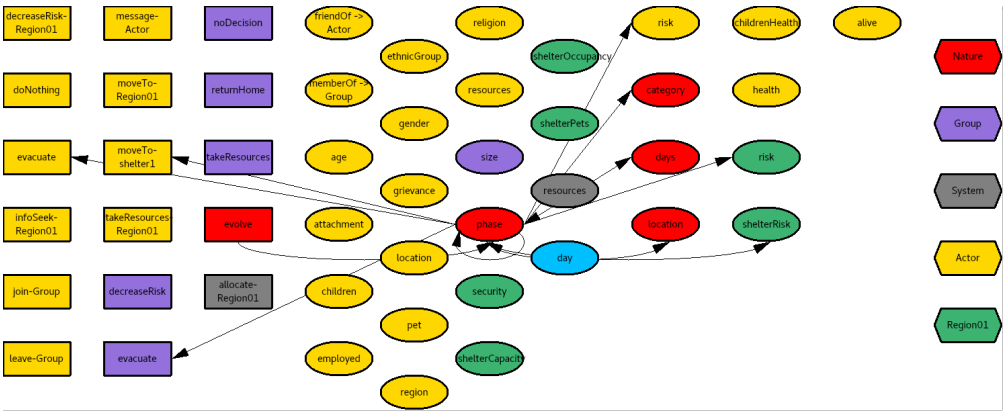

Figure 17: Ground Truth subgraph for Nature's phase

2.26.1 Effect of Nature-evolve on Nature's phase

IF **Nature's phase**=**none**
THEN IF **Nature's days**>5
THEN
60%: **Nature's phase**′←**Nature's phase**
40%: **Nature's phase**′←**approaching**
ELSE **Nature's phase**′←**Nature's phase**
ELSE IF **Nature's phase**=**approaching**
THEN IF **Nature's days**>5
THEN
60%: **Nature's phase**′←**Nature's phase**
40%: **Nature's phase**′←**active**
ELSE **Nature's phase**′←**Nature's phase**
ELSE IF **Nature's location**=**none**
THEN **Nature's phase**′←**none**
ELSE **Nature's phase**′←**Nature's phase**

2.27 Region01's risk

Type: Real

2.27.1 Effect of Actor-decreaseRisk-Region01 on Region01's risk

Region01's risk′←80%·**Region01's risk**

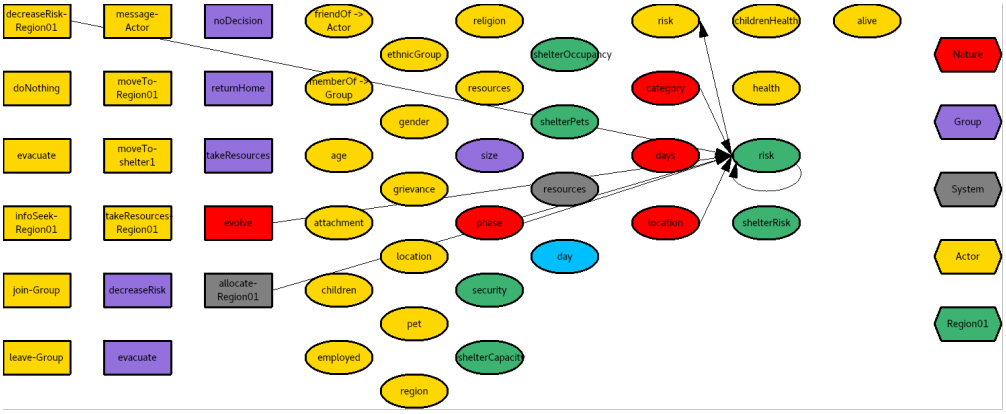

Figure 18: Ground Truth subgraph for Region01's risk

2.27.2 Effect of Nature-evolve on Region01's risk

IF **Nature's phase**$'$=**active**
THEN IF **Nature's location**$'$=**Region01**
THEN IF **Nature's category**=4
THEN **Region01's risk**$'$←60%·**Region01's risk**+0.40
ELSE IF **Nature's category**=3
THEN **Region01's risk**$'$←70%·**Region01's risk**+0.30
ELSE IF **Nature's category**=2
THEN **Region01's risk**$'$←80%·**Region01's risk**+0.20
ELSE IF **Nature's category**=1
THEN **Region01's risk**$'$←90%·**Region01's risk**+0.10
ELSE **Region01's risk**$'$←0%·**Region01's risk**+1.00
ELSE **Region01's risk**$'$←**Region01's risk**
ELSE **Region01's risk**$'$←80%·**Region01's risk**

2.27.3 Effect of System-allocate-Region01 on Region01's risk

Region01's risk$'$←90%·**Region01's risk**

2.28 Region01's security

Type: Real

2.29 Region01's shelterCapacity

Type: Integer

2.30 Region01's shelterOccupancy

Type: Integer

2.30.1 Effect of Actor-evacuate on Region01's shelterOccupancy

IF **Actor's location**=**shelter1**
THEN **Region01's shelterOccupancy**$'$←**Region01's shelterOccupancy**−1
ELSE **Region01's shelterOccupancy**$'$←**Region01's shelterOccupancy**

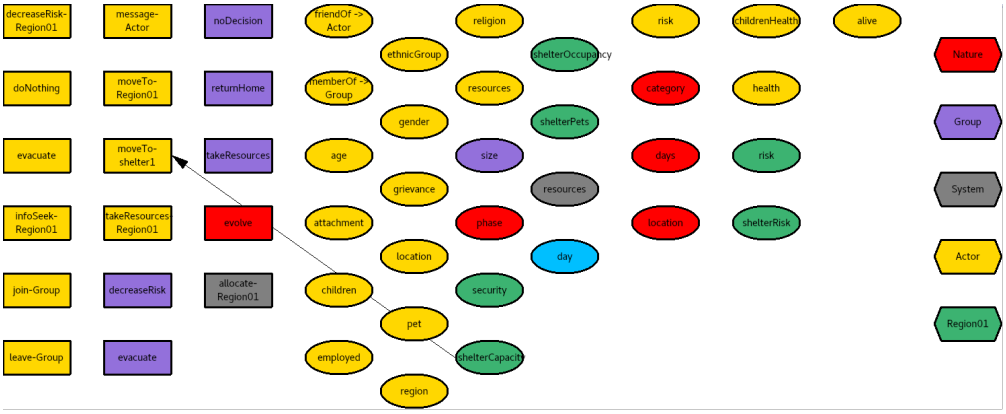

Figure 19: Ground Truth subgraph for Region01's shelterCapacity

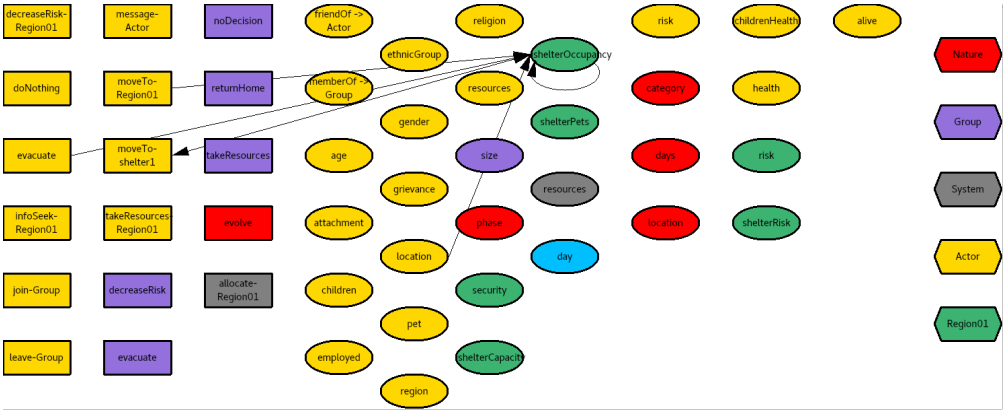

Figure 20: Ground Truth subgraph for Region01's shelterOccupancy

2.30.2 Effect of Actor-moveTo-Region01 on Region01's shelterOccupancy

IF **Actor's location**=**shelter1**
THEN **Region01's shelterOccupancy**$'$←**Region01's shelterOccupancy**−1
ELSE **Region01's shelterOccupancy**$'$←**Region01's shelterOccupancy**

2.30.3 Effect of Actor-moveTo-shelter1 on Region01's shelterOccupancy

Region01's shelterOccupancy$'$←**Region01's shelterOccupancy**+1

2.31 Region01's shelterPets

Type: Boolean

2.32 Region01's shelterRisk

Type: Real

2.32.1 Effect of Nature-evolve on Region01's shelterRisk

IF **Nature's phase**$'$=**active**
THEN IF **Nature's location**$'$=**Region01**

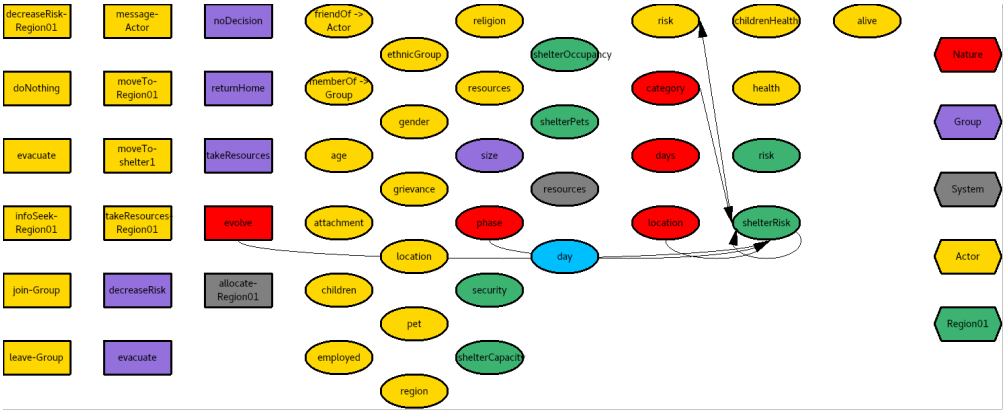

Figure 21: Ground Truth subgraph for Region01's shelterRisk

THEN IF **Nature's category**=5
THEN **Region01's shelterRisk**′←20%·**Region01's shelterRisk**+0.80
ELSE IF **Nature's category**=4
THEN **Region01's shelterRisk**′←40%·**Region01's shelterRisk**+0.60
ELSE IF **Nature's category**=3
THEN **Region01's shelterRisk**′←60%·**Region01's shelterRisk**+0.40
ELSE IF **Nature's category**=2
THEN **Region01's shelterRisk**′←80%·**Region01's shelterRisk**+0.20
ELSE IF **Nature's category**=1
THEN **Region01's shelterRisk**′←**Region01's shelterRisk**
ELSE **Region01's shelterRisk**′←**Region01's shelterRisk**
ELSE **Region01's shelterRisk**′←**Region01's shelterRisk**
ELSE **Region01's shelterRisk**′←80%·**Region01's shelterRisk**

2.33 System's resources

Type: Integer

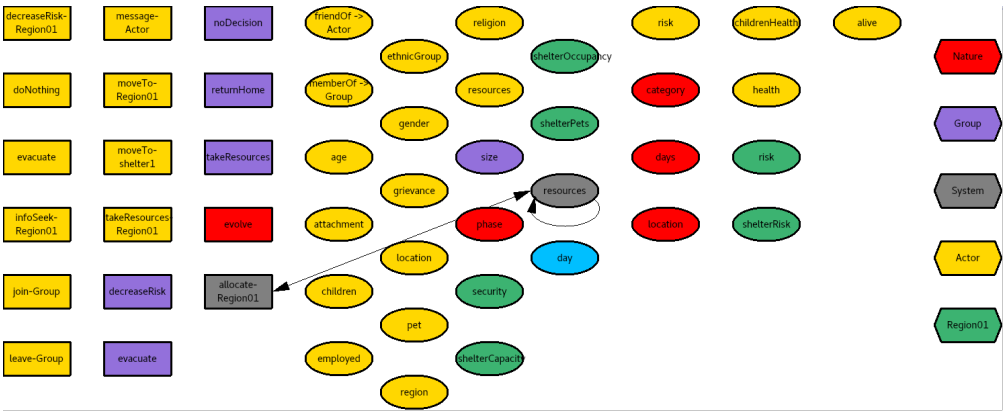

Figure 22: Ground Truth subgraph for System's resources

2.33.1 Effect of System-allocate-Region01 on System's resources

System's resources′←**System's resources**−5

2.34 day

Type: Integer

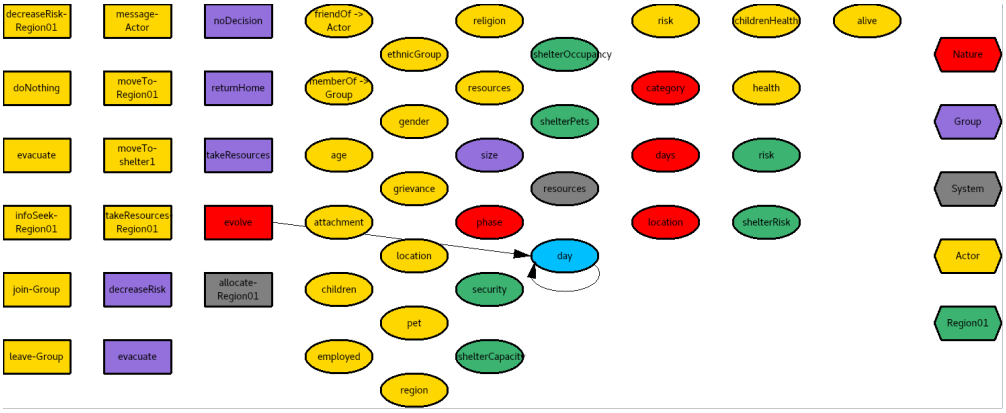

Figure 23: Ground Truth subgraph for day

2.34.1 Effect of Nature-evolve on day

day$'$←**day**+1

3 Relations

3.1 Actor friendOf Actor

Type: Boolean

3.2 Actor memberOf Group

Type: Boolean

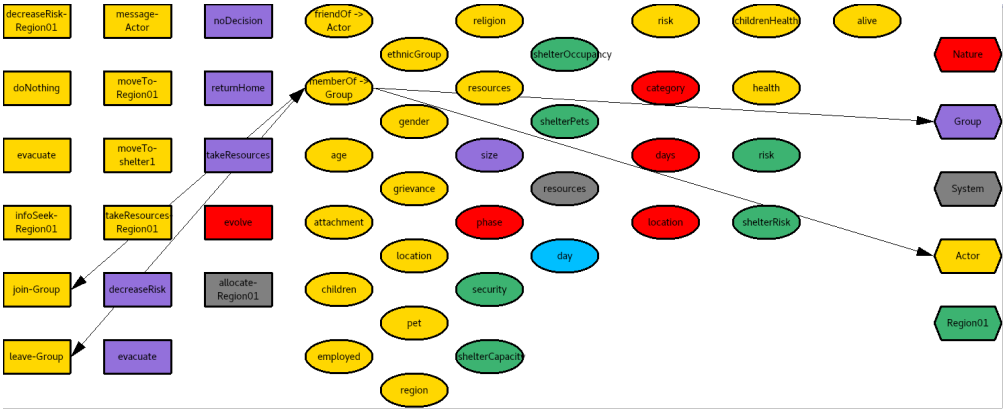

Figure 24: Ground Truth subgraph for Actor memberOf -> Group

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

Actor memberOf Group$'$←**true**

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

Actor memberOf Group′←false

4 Actions

4.1 Nature evolve

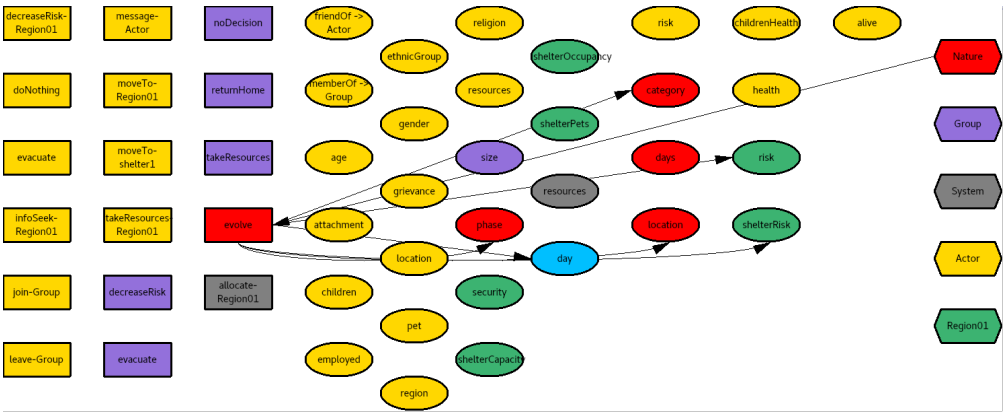

Figure 25: Ground Truth subgraph for Nature-evolve

4.1.1 Effect on Nature's category of Nature evolve

IF **Nature's phase′**=**approaching**
THEN IF **Nature's category**=0
THEN
20%: **Nature's category′**←1
20%: **Nature's category′**←2
20%: **Nature's category′**←5
20%: **Nature's category′**←3
20%: **Nature's category′**←4
ELSE IF **Nature's category**=1
THEN
80%: **Nature's category′**←**Nature's category**
20%: **Nature's category′**←2
ELSE IF **Nature's category**=5
THEN
80%: **Nature's category′**←**Nature's category**
20%: **Nature's category′**←4
ELSE
80%: **Nature's category′**←**Nature's category**
10%: **Nature's category′**←**Nature's category**−1
10%: **Nature's category′**←**Nature's category**+1
ELSE IF **Nature's phase′**=**active**
THEN **Nature's category′**←**Nature's category**
ELSE **Nature's category′**←0

4.1.2 Effect on Nature's location of Nature evolve

IF **Nature's phase′**=**approaching**
  THEN IF **Nature's location**=**none**
    THEN **Nature's location′**←**Region01**
    ELSE **Nature's location′**←**Nature's location**
  ELSE IF **Nature's phase′**=**active**
    THEN IF **Nature's location**=**Region01**
      THEN
        40%: **Nature's location′**←**none**
        20%: **Nature's location′**←**Region01**
      ELSE **Nature's location′**←**Nature's location**
    ELSE **Nature's location′**←**none**

4.1.3 Effect on Nature's phase of Nature evolve

IF **Nature's phase**=**none**
  THEN IF **Nature's days**>5
    THEN
      60%: **Nature's phase′**←**Nature's phase**
      40%: **Nature's phase′**←**approaching**
    ELSE **Nature's phase′**←**Nature's phase**
  ELSE IF **Nature's phase**=**approaching**
    THEN IF **Nature's days**>5
      THEN
        60%: **Nature's phase′**←**Nature's phase**
        40%: **Nature's phase′**←**active**
      ELSE **Nature's phase′**←**Nature's phase**
    ELSE IF **Nature's location**=**none**
      THEN **Nature's phase′**←**none**
      ELSE **Nature's phase′**←**Nature's phase**

4.1.4 Effect on Region01's risk of Nature evolve

IF **Nature's phase′**=**active**
  THEN IF **Nature's location′**=**Region01**
    THEN IF **Nature's category**=4
      THEN **Region01's risk′**←60%·**Region01's risk**+0.40
      ELSE IF **Nature's category**=3
        THEN **Region01's risk′**←70%·**Region01's risk**+0.30
        ELSE IF **Nature's category**=2
          THEN **Region01's risk′**←80%·**Region01's risk**+0.20
          ELSE IF **Nature's category**=1
            THEN **Region01's risk′**←90%·**Region01's risk**+0.10
            ELSE **Region01's risk′**←0%·**Region01's risk**+1.00
    ELSE **Region01's risk′**←**Region01's risk**
  ELSE **Region01's risk′**←80%·**Region01's risk**

4.1.5 Effect on Region01's shelterRisk of Nature evolve

IF **Nature's phase′**=**active**
  THEN IF **Nature's location′**=**Region01**
    THEN IF **Nature's category**=5
      THEN **Region01's shelterRisk′**←20%·**Region01's shelterRisk**+0.80
      ELSE IF **Nature's category**=4

THEN **Region01's shelterRisk**′←40%·**Region01's shelterRisk**+0.60
ELSE IF **Nature's category**=3
THEN **Region01's shelterRisk**′←60%·**Region01's shelterRisk**+0.40
ELSE IF **Nature's category**=2
THEN **Region01's shelterRisk**′←80%·**Region01's shelterRisk**+0.20
ELSE IF **Nature's category**=1
THEN **Region01's shelterRisk**′←**Region01's shelterRisk**
ELSE **Region01's shelterRisk**′←**Region01's shelterRisk**
ELSE **Region01's shelterRisk**′←**Region01's shelterRisk**
ELSE **Region01's shelterRisk**′←80%·**Region01's shelterRisk**

4.1.6 Effect on day of Nature evolve

day′←**day**+1

4.2 Group decreaseRisk

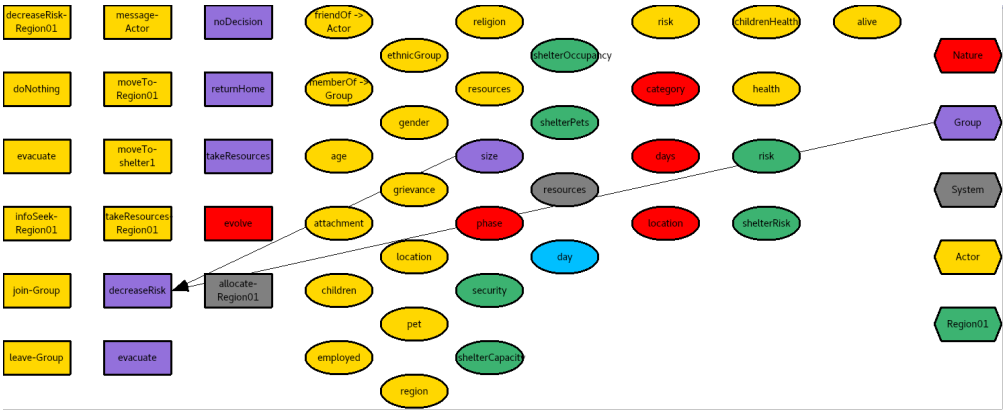

Figure 26: Ground Truth subgraph for Group-decreaseRisk

4.2.1 Applicability of Group decreaseRisk

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

4.3 Group evacuate

4.3.1 Applicability of Group evacuate

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

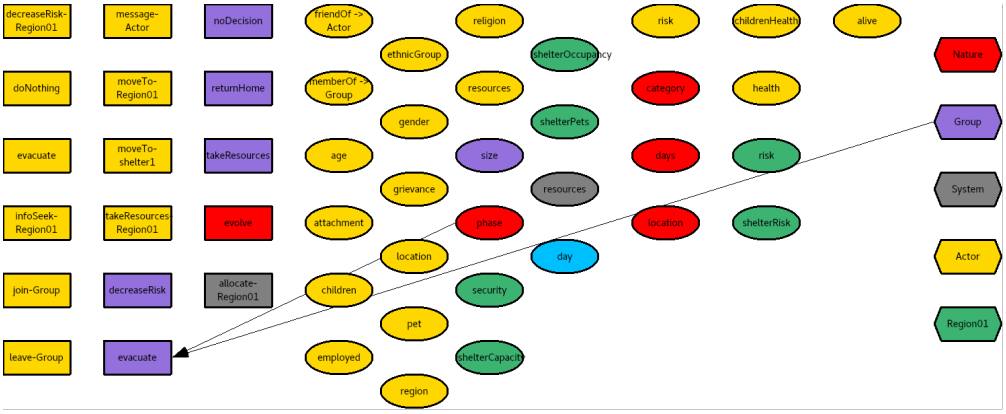

Figure 27: Ground Truth subgraph for Group-evacuate

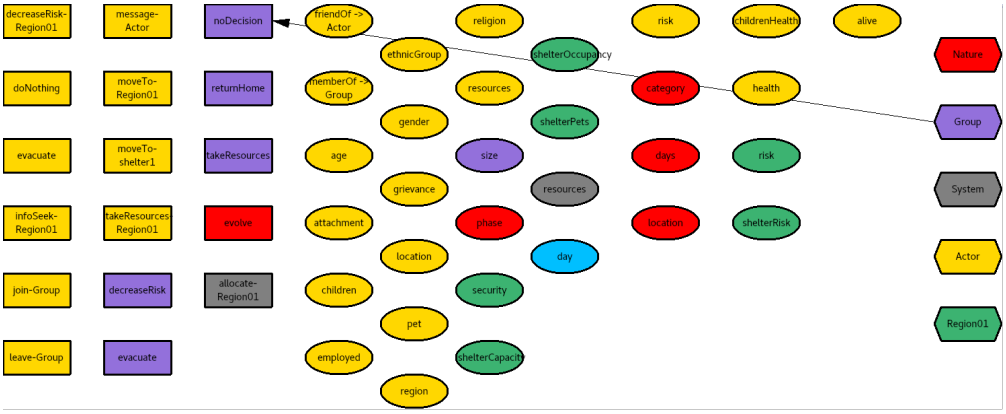

Figure 28: Ground Truth subgraph for Group-noDecision

4.4 Group noDecision

4.5 Group returnHome

4.6 Group takeResources

4.6.1 Applicability of Group takeResources

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

4.7 System allocate Region01

4.7.1 Applicability of System allocate Region01

IF **System's resources**>5
THEN **true**
ELSE **false**

4.7.2 Effect on Actor's grievance of System allocate Region01

IF **Actor's region**$=$**Region01**
THEN **Actor's grievance**$'\leftarrow 80\%\cdot$**Actor's grievance**

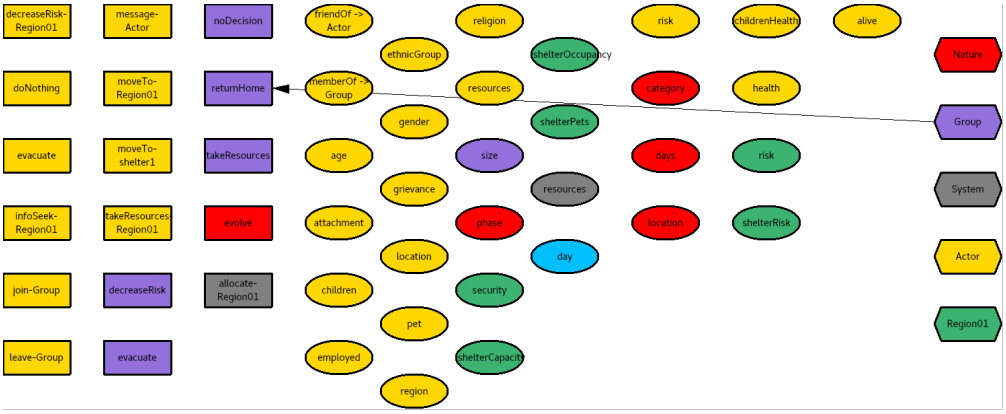

Figure 29: Ground Truth subgraph for Group-returnHome

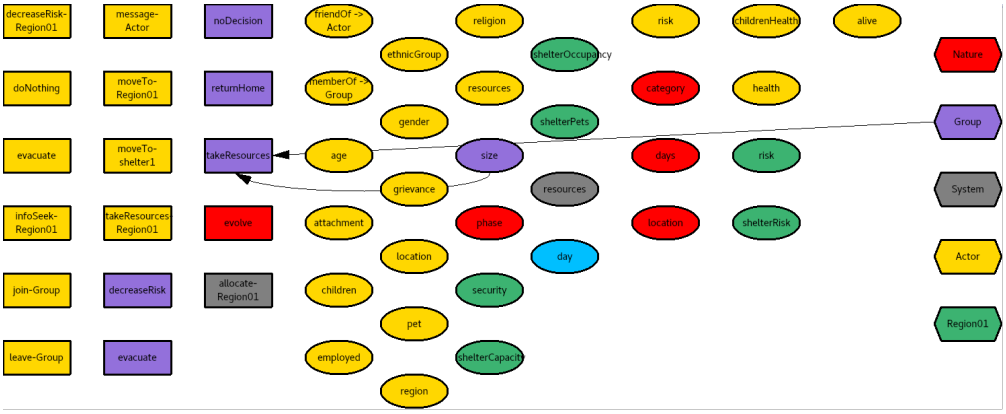

Figure 30: Ground Truth subgraph for Group-takeResources

ELSE **Actor's grievance**$'\leftarrow 80\%\cdot$**Actor's grievance**$+0.20$

4.7.3 Effect on Region01's risk of System allocate Region01

Region01's risk$'\leftarrow 90\%\cdot$**Region01's risk**

4.7.4 Effect on System's resources of System allocate Region01

System's resources$'\leftarrow$**System's resources**-5

4.8 Actor decreaseRisk Region01

4.8.1 Applicability of Actor decreaseRisk Region01

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

4.8.2 Effect on Actor's risk of Actor decreaseRisk Region01

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

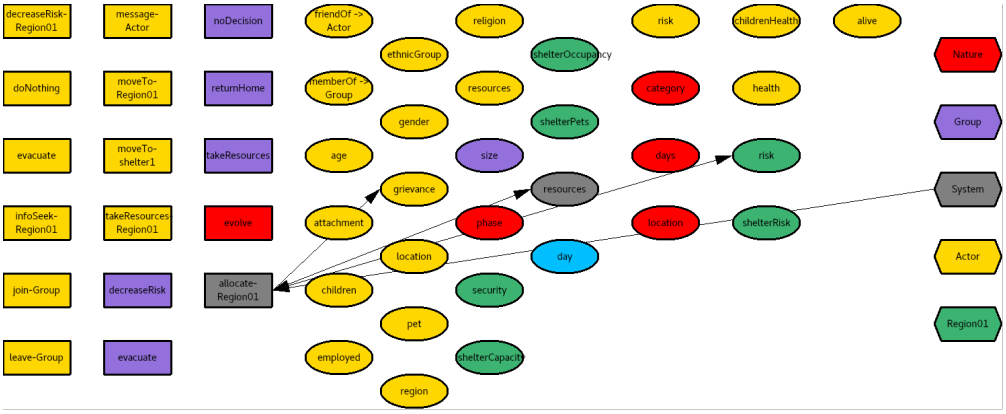

Figure 31: Ground Truth subgraph for System-allocate-Region01

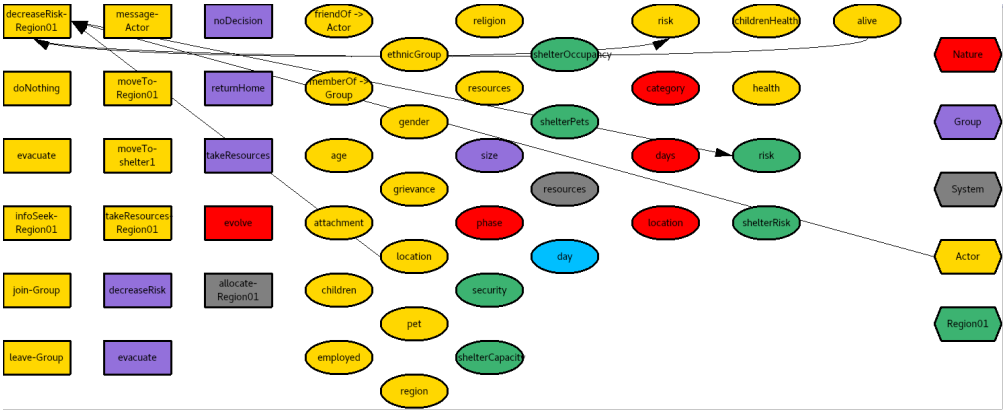

Figure 32: Ground Truth subgraph for Actor-decreaseRisk-Region01

4.8.3 Effect on Region01's risk of Actor decreaseRisk Region01

Region01's risk$'$$\leftarrow$80%$\cdot$**Region01's risk**

4.9 Actor doNothing

4.10 Actor evacuate

4.10.1 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**

4.10.2 Effect on Actor's employed of Actor evacuate

Actor's employed$'$$\leftarrow$**Actor's employed**

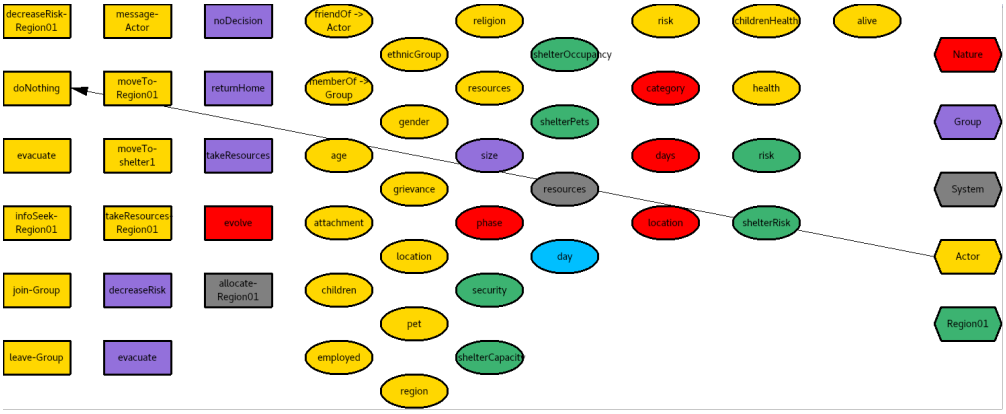

Figure 33: Ground Truth subgraph for Actor-doNothing

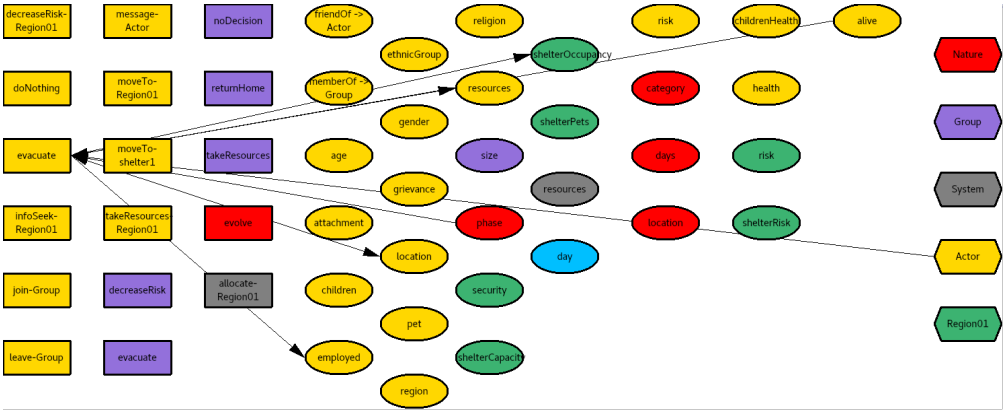

Figure 34: Ground Truth subgraph for Actor-evacuate

4.10.3 Effect on Actor's location of Actor evacuate

Actor's location$'\leftarrow$**evacuated**

4.10.4 Effect on Actor's resources of Actor evacuate

IF **Actor's resources**>0.40
THEN **Actor's resources**$'\leftarrow$**Actor's resources**-0.40
ELSE **Actor's resources**$'\leftarrow 0.00$

4.10.5 Effect on Region01's shelterOccupancy of Actor evacuate

IF **Actor's location**$=$**shelter1**
THEN **Region01's shelterOccupancy**$'\leftarrow$**Region01's shelterOccupancy**-1
ELSE **Region01's shelterOccupancy**$'\leftarrow$**Region01's shelterOccupancy**

4.11 Actor infoSeek Region01

4.11.1 Applicability of Actor infoSeek Region01

IF **Actor's alive**
THEN **true**
ELSE **false**

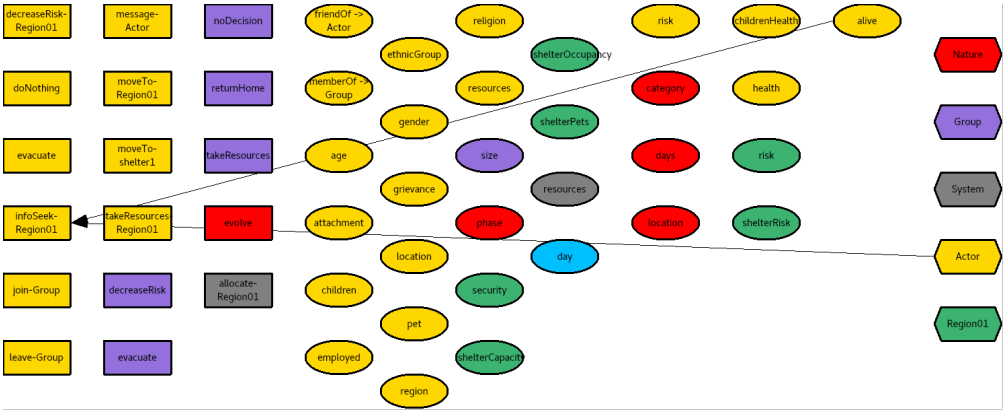

Figure 35: Ground Truth subgraph for Actor-infoSeek-Region01

4.12 Actor join Group

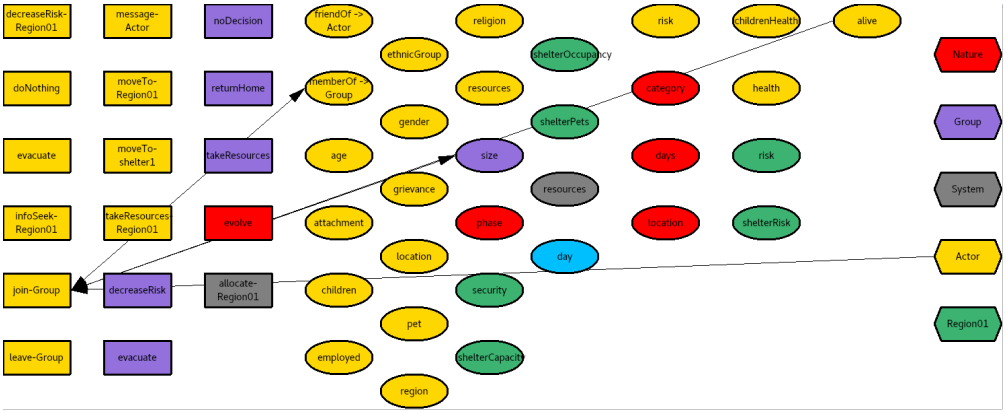

Figure 36: Ground Truth subgraph for Actor-join-Group

4.12.1 Applicability of Actor join Group

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

4.12.2 Effect on Actor memberOf Group of Actor join Group

Actor memberOf Group$'$**←true**

4.12.3 Effect on Group's size of Actor join Group

Group's size$'$**←Group's size**+1

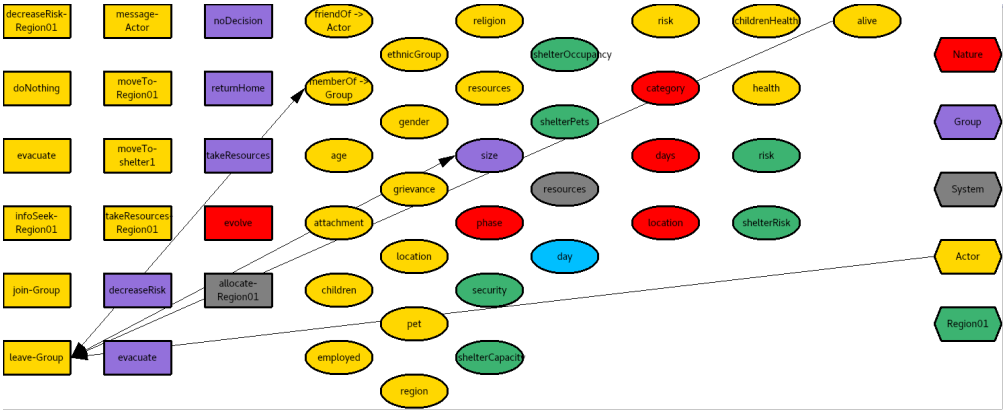

Figure 37: Ground Truth subgraph for Actor-leave-Group

4.13 Actor leave Group

4.13.1 Applicability of Actor leave Group

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

4.13.2 Effect on Actor memberOf Group of Actor leave Group

Actor memberOf Group$'\leftarrow$**false**

4.13.3 Effect on Group's size of Actor leave Group

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

4.14 Actor message Actor

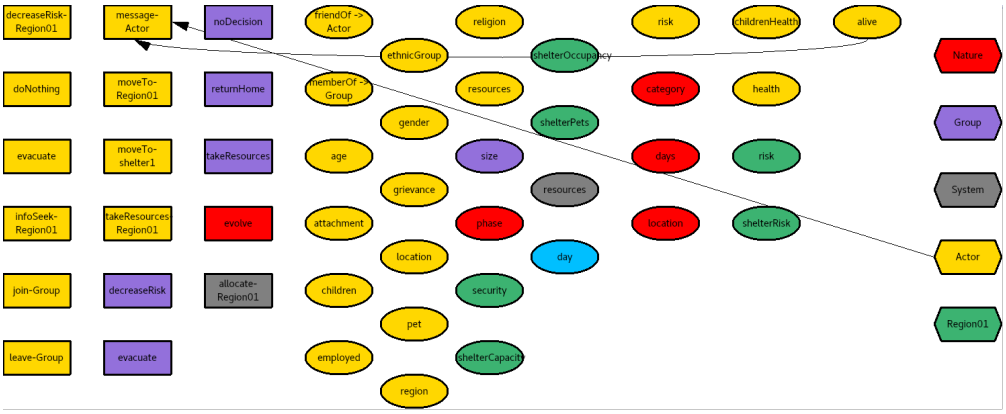

Figure 38: Ground Truth subgraph for Actor-message-Actor

4.14.1 Applicability of Actor message Actor

IF **Actor's alive**
THEN **true**
ELSE **false**

4.15 Actor moveTo Region01

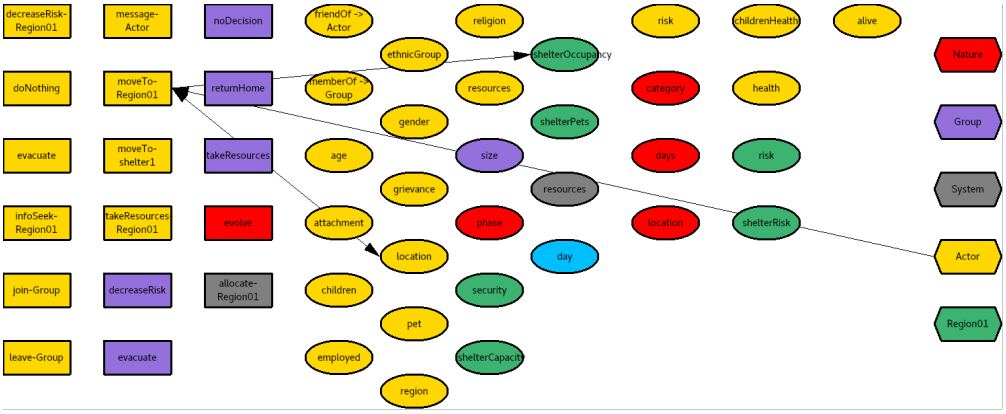

Figure 39: Ground Truth subgraph for Actor-moveTo-Region01

4.15.1 Applicability of Actor moveTo Region01

IF **Actor's location**=**evacuated**or **shelter1**
THEN **true**
ELSE **false**

4.15.2 Effect on Actor's location of Actor moveTo Region01

Actor's location$'\leftarrow$**Region01**

4.15.3 Effect on Region01's shelterOccupancy of Actor moveTo Region01

IF **Actor's location**=**shelter1**
THEN **Region01's shelterOccupancy**$'\leftarrow$**Region01's shelterOccupancy**-1
ELSE **Region01's shelterOccupancy**$'\leftarrow$**Region01's shelterOccupancy**

4.16 Actor moveTo shelter1

4.16.1 Applicability of Actor moveTo shelter1

IF **Region01's shelterCapacity-Region01's shelterOccupancy**>0
THEN IF **Nature's phase**=**none**
THEN **false**
ELSE IF **Actor's alive**
THEN IF **Actor's location**=**shelter1**
THEN **false**
ELSE **true**
ELSE **false**
ELSE **false**

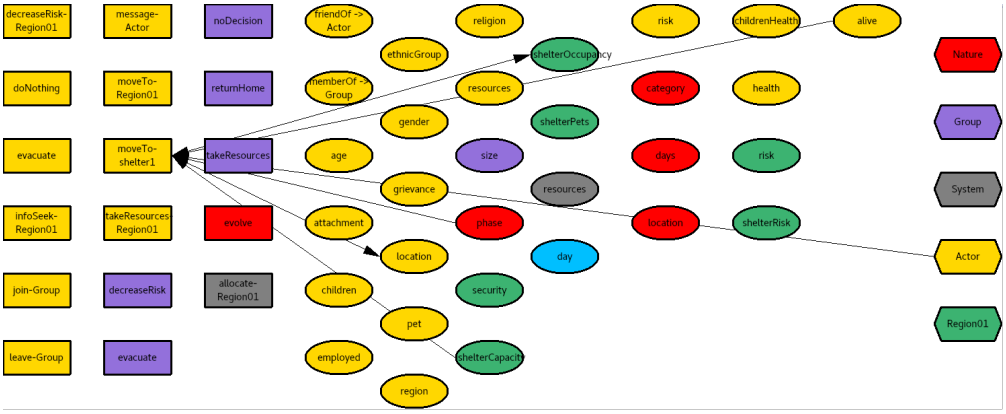

Figure 40: Ground Truth subgraph for Actor-moveTo-shelter1

4.16.2 Effect on Actor's location of Actor moveTo shelter1

Actor's location$'$←**shelter1**

4.16.3 Effect on Region01's shelterOccupancy of Actor moveTo shelter1

Region01's shelterOccupancy$'$←**Region01's shelterOccupancy**+1

4.17 Actor takeResources Region01

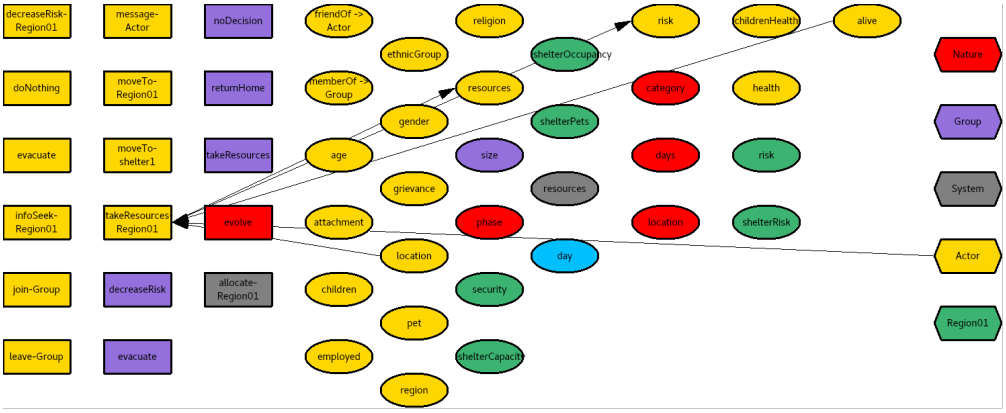

Figure 41: Ground Truth subgraph for Actor-takeResources-Region01

4.17.1 Applicability of Actor takeResources Region01

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

4.17.2 Effect on Actor's resources of Actor takeResources Region01

Actor's resources$'$←**Actor's resources**+1.00

4.17.3 Effect on Actor's risk of Actor takeResources Region01

IF **Nature's phase**=**none**
THEN **Actor's risk**′←20%·**Actor's risk**+0.80
ELSE **Actor's risk**′←80%·**Actor's risk**+0.20

5 Expected Reward

5.1 Group's Reward

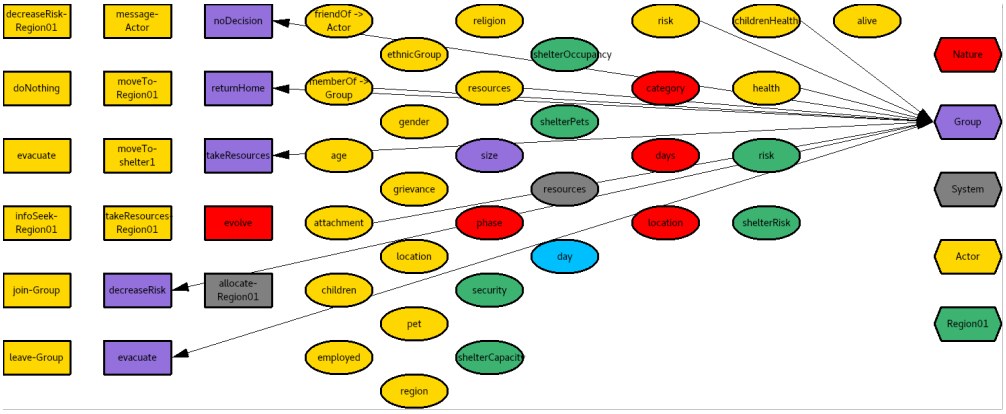

Figure 42: Ground Truth subgraph for Group

IF **Actor's risk**>0.60
THEN IF **Actor's attachment**=**anxious**
THEN R←10%·**Actor memberOf Group**+40%·**Actor's childrenHealth**+60%·**Actor's health**+20%·**Actor's resources**
ELSE IF **Actor's attachment**=**avoidant**
THEN R←-10%·**Actor memberOf Group**+40%·**Actor's childrenHealth**+60%·**Actor's health**+20%·**Actor's resources**
ELSE R←40%·**Actor's childrenHealth**+60%·**Actor's health**+20%·**Actor's resources**
ELSE R←40%·**Actor's childrenHealth**+60%·**Actor's health**+20%·**Actor's resources**

5.2 Actor's Reward

IF **Actor's risk**>0.60
THEN IF **Actor's attachment**=**anxious**
THEN R←10%·**Actor memberOf Group**+40%·**Actor's childrenHealth**+60%·**Actor's health**+20%·**Actor's resources**
ELSE IF **Actor's attachment**=**avoidant**
THEN R←-10%·**Actor memberOf Group**+40%·**Actor's childrenHealth**+60%·**Actor's health**+20%·**Actor's resources**
ELSE R←40%·**Actor's childrenHealth**+60%·**Actor's health**+20%·**Actor's resources**
ELSE R←40%·**Actor's childrenHealth**+60%·**Actor's health**+20%·**Actor's resources**

Figure 43: Ground Truth subgraph for Actor