DOMworld model in ODD

This is a formalODD implementation of the DomWorld model(Hemelrijk, 1998)

Overview: General Description

What is the research question?

The DomWorld model (Hemelrijk, 1998) was proposed as an alternative model for explaining how different hierarchies can form in ape-troupes. It put forward the idea that the hierarchies were the aggregate result of dominance interactions. This model demonstrates how a hierarchy can form without a system-level equation guiding the actions of the monkeys, but rather as a result of the actions of individuals.

How would you categorize the role of the model?

Explanation : Establishing a possible causal chain from a set-up to its consequences in terms of the mechanisms in a simulation.

For whom is the model designed?

The model was initially designed for primatologists.

What is the purpose of the model?

The purpose of the model is to explain and illustrate how hierarchies can occur as an aggregate result of discrete dominance interactions taken by monkeys in a group of monkeys.

Overview: Entities, state variables, and scales

Entities

The entities in this model are: male, female

The entity male has colour blue and shape square of size 3 and it describes a male monkey, in this model males are the stronger sex

Entity male has the attributes

Press enter to add attribute to male

The entity female has colour red and shape circle of size 3 and it describes a female monkey, in this model females are the weaker sex

Entity female has the attributes

Press enter to add attribute to female

Common Attributes of all Entities

The common entity attributes are:

The attribute IdleTime is numerical. The attribute describes the position of the monkey in the queue

The attribute Dominance is numerical range from 0.1 to 9999. The attribute describes the strength of a monkey

The attribute StepDom is numerical. The attribute describes aggression of monkeys

The attribute interaction-count is numerical. The attribute describes variable to track number of fights a monkey has been in

Networks

The networks in this model are:

Environment entities

The environment entities in this model are:

Environment Attributes

The environment attributes in this model are:

Synthetic Attributes

The synthetic attributes are:

Model Attributes

The model attributes are:

The attribute PopulationSize is numerical. The attribute describes the number of monkeys

The attribute InteractionDecay is numerical. The attribute describes variable used for decrementing the waiting time of monkeys

The attribute MaxView is numerical. The attribute describes max length of vision-sector

The attribute VisionAngle is numerical. The attribute describes angle of vision-sector

The attribute NearView is numerical. The attribute describes distance where monkeys are comfortable with seeing other monkeys

The attribute initDomMale is numerical. The attribute describes male initial strength

The attribute initDomFemale is numerical. The attribute describes female initial strength

The attribute StepDomMale is numerical. The attribute describes male aggression

The attribute StepDomFemale is numerical. The attribute describes female aggression

The attribute SearchAngle is numerical. The attribute describes how far the monkeys turn when they can't see other monkeys

The attribute PersonalSpace is numerical. The attribute describes how close other monkeys can get before an attack is considered

The attribute percentWomen is numerical. The attribute describes the number of female apes as a share of the total population

The attribute fleeDistance is numerical. The attribute describes the distance defeated monkeys run after losing a fight

Synthetic Model Attributes

The synthetic model attributes are:

Overview: Process overview and scheduling

Scheduling

1. Perform the action observe with the entity ActiveAgent of type any entity is the lowest by IdleTime from any entity

2. Perform the action reduce-IdleTime with press ctrl space if you want to add context

3. Perform the action colour-change-female with press ctrl space if you want to add context

4. Perform the action colour-change-male with press ctrl space if you want to add context

Action colour-change-male describes the update of the colour of males

It can be used of entity male of type entity male, performing the following actions

The synthetic attribute maxDom is defined as collect Dominance using max. It describes max dominance

set colour of male to blue scaled by Dominance of male in range from (maxDom * 2) to 0

Action colour-change-female describes the update of the colour of females

It can be used of entity female of type entity female, performing the following actions

The synthetic attribute maxDom is defined as collect Dominance of using max. It describes the highest dominance of the monkeys

set colour of female to red scaled by Dominance of female in range from (maxDom * 2) to 0

Action observe describes check to see if there are any other monkeys around, where other monkeys are and then what to do and then what to do based on this

It can be used of entity self of type any entity, performing the following actions

The attribute IdleTime of self is set to a random value between 0 and 1

The synthetic attribute visibleMonkeys is defined as select PopulationSize elements from any entity at in sector in front of agent with angle VisionAngle and length MaxView. It describes the visible monkeys

The synthetic attribute number-of-visible-monkeys is defined as collect visibleMonkeys using count. It describes the number of visible monkeys

when number-of-visible-monkeys = 0, then the following activities take place.

when a random value between 0 and 1 > 0.5, then the following activities take place.

self turns left by SearchAngle degrees

otherwise

self turns right by SearchAngle degrees

otherwise

the entity nearestMonkey of type any entity is the lowest by distance from self from indices of visibleMonkeys

The synthetic attribute nearestDist is defined as distance from self to nearestMonkey. It describes the distance to the nearest other monkey

when nearestDist > PersonalSpace, then the following activities take place.

when nearestDist > NearView, then the following activities take place.

self turns to face nearestMonkey

Move ahead for a distance of 1 pixels.

otherwise

Move ahead for a distance of 1 pixels.

otherwise

Perform the interaction consider-attack with self and nearestMonkey

Interaction consider-attack describes a “mental battle” that determines whether the monkey fights or not

The interaction involves a aggressor of type any entity (first partner) and a defender of type any entity (second partner), together performing the following activities.

The synthetic attribute result is defined as calculate using attack-calculation with aggressor and defender endcalc. It describes relative dominance of the monkeys

when result > a random value between 0 and 1, then the following activities take place.

Perform the interaction attack with aggressor and defender

Calculation attack-calculation describes whether to attack applicable to

aggroMonkey of type any entity

defenseMonkey of type any entity

The synthetic attribute relDom is defined as Dominance of aggroMonkey / (Dominance of aggroMonkey + Dominance of defenseMonkey). It describes the relative dominance of the attacker monkey

returns relDom

Interaction attack describes a monkey attacking another monkey

The interaction involves a attacker of type any entity (first partner) and a victim of type any entity (second partner), together performing the following activities.

The synthetic attribute results is defined as calculate using attack-calculation with attacker and victim endcalc. It describes relative dominance of attacker

The attribute interaction-count of attacker is incremented by 1

Perform the action reduce-IdleTime with select PopulationSize elements from any entity at within radius of agent within radius NearView

when results < a random value between 0 and 1, then the following activities take place.

The synthetic attribute update is defined as 0 - (results * StepDom of attacker). It describes update value for attacker loss

The attribute Dominance of attacker is incremented by update

Attribute Dominance of victim decreases by the amount of update

Perform the interaction chase with victim and attacker

Perform the interaction flee with attacker and victim

otherwise

The synthetic attribute update is defined as (1 - results) * StepDom of attacker. It describes update value for attacker win

The attribute Dominance of attacker is incremented by update

Attribute Dominance of victim decreases by the amount of update

Perform the interaction chase with attacker and victim

Perform the interaction flee with victim and attacker

Interaction chase describes winner monkey chasing loser monkey

The interaction involves a winner of type any entity (first partner) and a loser of type any entity (second partner), together performing the following activities.

winner turns to face loser

Move ahead for a distance of 1 pixels.

when 0.5 > a random value between 0 and 1, then the following activities take place.

winner turns left by 45 / 2 degrees

otherwise

winner turns right by 45 / 2 degrees

Interaction flee describes <write description here>

The interaction involves a loser of type any entity (first partner) and a winner of type any entity (second partner), together performing the following activities.

loser turns to face winner

Move ahead for a distance of fleeDistance pixels.

when 0.5 > a random value between 0 and 1, then the following activities take place.

loser turns left by 180 + (45 / 2) degrees

otherwise

loser turns right by 180 + (45 / 2) degrees

Action reduce-IdleTime describes the reduction of idle time

It can be used of entity ape of type any entity, performing the following actions

The attribute IdleTime of ape is set to (1 - InteractionDecay) * IdleTime of ape

Design Concepts

Rationales

Interaction

interaction consider-attack

interaction attack

interaction chase

interaction flee

Stochasticity

attribute IdleTime is initialized with stochasticity

code observe uses stochasticity

code consider-attack uses stochasticity

code attack uses stochasticity

code flee uses stochasticity

code chase uses stochasticity

Details: Input

<press enter and describe the model input. press enter to get new line>

Details: Submodels

Details: Manual Experiments

Initialize entities

The initial amount of male is PopulationSize - PopulationSize * percentWomen

Entities male are on initialisation distributed within MaxView units from the center

Initialization of male attributes:

male has no attributes.

Initialize common attributes

The initial value of attribute Dominance is initDomMale

The initial value of attribute StepDom is StepDomMale

The initial amount of female is PopulationSize * percentWomen

Entities female are on initialisation distributed within MaxView units from the center

Initialization of female attributes:

female has no attributes.

Initialize common attributes

The initial value of attribute Dominance is initDomFemale

The initial value of attribute StepDom is StepDomFemale

Initialize common attributes

The initial value of attribute IdleTime is a random value between 0 and 1

The initial value of attribute interaction-count is 0

Initialize model attributes

The initial value of attribute PopulationSize is 10 with the option to select a value between 1 and 40 with granularity 1

The initial value of attribute InteractionDecay is 0.9

The initial value of attribute MaxView is 50 with the option to select a value between 10 and 100 with granularity 1

The initial value of attribute VisionAngle is 120

The initial value of attribute NearView is 24

The initial value of attribute initDomMale is 16 with the option to select a value between 1 and 20 with granularity 1

The initial value of attribute initDomFemale is 8 with the option to select a value between 1 and 20 with granularity 1

The initial value of attribute StepDomMale is 1 with the option to select a value between 0 and 1 with granularity 0.1

The initial value of attribute StepDomFemale is 0.8 with the option to select a value between 0 and 1 with granularity 0.1

The initial value of attribute SearchAngle is 120 with the option to select a value between 0 and 360 with granularity 1

The initial value of attribute PersonalSpace is 2 with the option to select a value between 1 and 24 with granularity 1

The initial value of attribute percentWomen is 0.5 with the option to select a value between 0 and 1 with granularity 0.1

The initial value of attribute fleeDistance is 2 with the option to select a value between 1 and 5 with granularity 10

Visualization of Data in Manual Experiments

Press enter to add data for visualization

Appearance

The size of the world for the simulation is 100

In the simulation the pixel size is 3

The world should wrap horizontally true and vertically true

The simulation uses the background colour green

Simulation end

Any of the following conditions end the simulation:

press enter to add end condition