**Package ‘NetLogoR’**

October 19, 2021

**Title**  Build and Run Spatially Explicit Agent-Based Models

**Description**  Build and run spatially explicit agent-based models using only the R platform. 'NetLogoR' follows the same framework as the 'NetLogo' software (Wilensky, 1999 <http://ccl.northwestern.edu/netlogo/>) and is a translation in R of the structure and functions of 'NetLogo'. 'NetLogoR' provides new R classes to define model agents and functions to implement spatially explicit agent-based models in the R environment. This package allows benefiting of the fast and easy coding phase from the highly developed 'NetLogo' framework, coupled with the versatility, power and massive resources of the R software.

Examples of three models (Ants <http://ccl.northwestern.edu/netlogo/models/Ants>, Butterfly (Railsback and Grimm, 2012) and Wolf-Sheep-Predation <http://ccl.northwestern.edu/netlogo/models/WolfSheepPredation>) written using 'NetLogoR' are available. The 'NetLogo' code of the original version of these models is provided alongside.

A programming guide inspired from the 'NetLogo' Programming Guide (<https://ccl.northwestern.edu/netlogo/docs/programming.html>) and a dictionary of 'NetLogo' primitives (<https://ccl.northwestern.edu/netlogo/docs/dictionary.html>) equivalences are also available.

NOTE: To increment 'time', these functions can use a for loop or can be integrated with a discrete event simulator, such as 'SpaDES' (<https://cran.r-project.org/package=SpaDES>).

The suggested package 'fastshp' can be installed with 'install.packages("fastshp", repos = "https://rforge.net", type = "source")'.


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**Imports**  abind, car, CircStats, data.table, grDevices, Hmisc,
matrixStats, methods, plyr, quickPlot (>= 0.1.2), sp,
SpaDES.tools, stats, rgeos

Suggests fastshp, knitr, magrittr, microbenchmark, rmarkdown, sf,
SpaDES.core, testthat

AdditionalRepositories https://rforge.net

BugReports https://github.com/PredictiveEcology/NetLogoR/issues

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VignetteBuilder knitr, rmarkdown

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'worldNLR-classes-methods.R' 'agentMatrix-Class-methods.R'
'agentset-functions.R' 'function-arguments.R'
'patch-functions.R' 'plot.R' 'world-functions.R' 'quickPlot.R'
'spades-functions.R' 'turtle-functions.R'

NeedsCompilation no

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The suggested package `fastshp` can be installed with `install.packages("fastshp",repos = "https://rforge.net",type = "source")`. The examples included with the package, are located in the R package "examples" folder, which can be found at `system.file(package = "NetLogoR","examples")`. The 3 specific R examples can be opened here: `file.edit(file.path(system.file(package = "NetLogoR","examples"),"Ants","Ants.R"))`, `file.edit(file.path(system.file(package = "NetLogoR","examples"),"Butterfly","Butterfly-1.R"))`, or `file.edit(file.path(system.file(package = "NetLogoR","examples"),"Wolf-Sheep-Predation","Wolf-Sheep-Predation.R"))`.

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See Also

Useful links:

- [https://netlogor.predictiveecology.org](https://netlogor.predictiveecology.org)
- [https://github.com/PredictiveEcology/NetLogoR/](https://github.com/PredictiveEcology/NetLogoR/)
- [https://groups.google.com/g/netlogor](https://groups.google.com/g/netlogor)

---

**==,agentMatrix,character-method**

*Relational Operators*

**Description**

Binary operators which allow the comparison of values in an `agentMatrix`. 
Usage

```r
## S4 method for signature 'agentMatrix,character'
e1 == e2

## S4 method for signature 'agentMatrix,numeric'
e1 == e2
```

Arguments

- `e1`: An `agentMatrix` object.
- `e2`: Atomic vector, symbol, call, or other object for which methods have been written.

Value

A logical vector indicating the result of the element by element comparison.

---

`agentClasses-class` 

*A meta class for agentMatrix and SpatialPointsDataFrame*

Description

Both these types can be used by NetLogoR to describe turtle agents.

Author(s)

Eliot McIntire

---

`agentMatrix` 

*Create a new agentMatrix object*

Description

This is a fast alternative to the `SpatialPointsDataFrame`. It is meant to replace that functionality, though there are not as many methods (yet). The object is primarily a numeric matrix. Any character column passed to ... will be converted to a numeric, using `as.factor` internally, and stored as a numeric. Methods using this class will automatically convert character queries to the correct numeric alternative.

Usage

```r
agentMatrix(..., coords)

# S4 method for signature 'matrix'
agentMatrix(..., coords)

# S4 method for signature 'missing'
agentMatrix(..., coords)
```
agentMatrix-class

Arguments

... Vectors, a data.frame, or a matrix of extra columns to add to the coordinates, or a SpatialPointsDataFrame.
coords A matrix with 2 columns representing x and y coordinates

Value

An agentMatrix object

Author(s)

Eliot McIntire

See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#clear-turtles

Examples

newAgent <- agentMatrix(
    coords = cbind(pxcor = c(1, 2, 5), pycor = c(3, 4, 6)),
    char = letters[c(1, 2, 6)],
    nums2 = c(4.5, 2.6, 2343),
    char2 = LETTERS[c(4, 24, 3)],
    nums = 5:7)

w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
    data = runif(25))
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
Examples

newAgent <- new("agentMatrix",
    coords = cbind(pxcor = c(1, 2, 5), pycor = c(3, 4, 6)),
    char = letters[c(1, 2, 6)],
    nums2 = c(4.5, 2.6, 2343),
    char2 = LETTERS[c(4, 24, 3)],
    nums = 5:7)

# compare speeds -- about 5x faster
if(require(microbenchmark)) {
    microbenchmark(times = 499,
        spdf = {SpatialPointsDataFrame(
            coords = cbind(pxcor = c(1, 2, 5), pycor = c(3, 4, 6)),
            data = data.frame(
                char = letters[c(1, 2, 6)],
                nums2 = c(4.5, 2.6, 2343),
                char2 = LETTERS[c(4, 24, 3)],
                nums = 5:7))},
        agentMat = {agentMatrix(
            coords = cbind(pxcor = c(1, 2, 5),
                pycor = c(3, 4, 6)),
            char = letters[c(1, 2, 6)],
            nums2 = c(4.5, 2.6, 2343),
            char2 = LETTERS[c(4, 24, 3)],
            nums = 5:7)}},
        agentMatDirect = {new("agentMatrix",
            coords = cbind(pxcor = c(1, 2, 5),
                pycor = c(3, 4, 6)),
            char = letters[c(1, 2, 6)],
            nums2 = c(4.5, 2.6, 2343),
            char2 = LETTERS[c(4, 24, 3)],
            nums = 5:7)})
    }

bk

Move backward

Description

Move the turtles backward of their headings’ directions.

Usage

bk(turtles, dist, world, torus = FALSE, out = TRUE)

## S4 method for signature 'agentMatrix,numeric'
bk(turtles, dist, world, torus = FALSE, out = TRUE)
Arguments

- **turtles**: AgentMatrix object representing the moving agents.
- **dist**: Numeric. Vector of distances to move. Must be of length 1 or of length turtles.
- **world**: WorldMatrix or worldArray object.
- **torus**: Logical to determine if the world is wrapped. Default is torus = FALSE.
- **out**: Logical. Determine if a turtle should move when torus = FALSE and its ending position will be outside of the world’s extent. Default is out = TRUE.

Details

If torus = FALSE and out = TRUE, world does not need to be provided.

If a distance to move leads a turtle outside of the world’s extent and torus = TRUE, the turtle is relocated on the other side of the world, inside its extent; if torus = FALSE and out = TRUE, the turtle moves past the world’s extent; if torus = FALSE and out = FALSE, the turtle does not move at all. In the event that a turtle does not move, its previous coordinates are still updated with its position before running bk() (i.e., its current position).

If a given dist value is negative, then the turtle moves forward.

The turtles’ headings are not affected by the function (i.e., the turtles do not face backward).

Value

AgentMatrix representing the turtles with updated coordinates and updated data for their previous coordinates prevX and prevY.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#back
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#jump

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
                   data = runif(25))
t1 <- createOTurtles(n = 10, world = w1)
plot(w1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)
t1 <- fd(turtles = t1, dist = 2)
```
canMove

Can the turtles move?

Description

Report TRUE if a turtle can move the given distance without leaving the world’s extent, report FALSE otherwise.

Usage

canMove(world, turtles, dist)

## S4 method for signature 'worldNLR,agentMatrix,numeric'
canMove(world, turtles, dist)

Arguments

world  
WorldMatrix or worldArray object.

 turtles  
AgentMatrix object representing the moving agents.

dist  
Numeric. Vector of distances to move. Must be of length 1 or of length turtles.

Value

Logical. Vector of length turtles.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#can-move
cbind

**Examples**

```r
e1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
t1 <- createTurtles(n = 10, world = w1)
canMove(world = w1, turtles = t1, dist = 1:10)
```

---

### cbind

**Combine R Objects by Rows or Columns**

**Description**

Take a sequence of `agentMatrix` arguments and combine by columns or rows, respectively. This will take the coordinates of the first argument and remove the coordinates of the second object.

**Usage**

```r
## S3 method for class 'agentMatrix'
cbind(..., deparse.level)
```

```r
## S3 method for class 'agentMatrix'
rbind(..., deparse.level = 1)
```

**Arguments**

- `...` Two `agentMatrix` objects.
- `deparse.level` See `cbind`.

**Value**

An `agentMatrix` object.

---

### cellFromPxcorPycor

**Cells numbers from patches coordinates**

**Description**

Report the cells numbers as defined for a `Raster*` object given the patches coordinates `pxcor` and `pycor`.

**Usage**

```r
cellFromPxcorPycor(world, pxcor, pycor)
```

```r
## S4 method for signature 'worldNLR,numeric,numeric'
cellFromPxcorPycor(world, pxcor, pycor)
```
clearPatches

Arguments

world  WorldMatrix or worldArray object.
pxcor  Integer. Vector of patches pxcor coordinates. Must be of length 1 or of the same
       length as pycor.
pycor  Integer. Vector of patches pycor coordinates. Must be of length 1 or of the same
       length as pxcor.

Value

Numeric. Vector of cells number.

Author(s)

Sarah Bauduin

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
cellFromPxcorPycor(world = w1, pxcor = 0, pycor = 9)
cellFromPxcorPycor(world = w1, pxcor = c(0, 1, 2), pycor = 0)

Description

Reset all patches values to NA.

Usage

clearPatches(world)

## S4 method for signature 'worldMatrix'
clearPatches(world)

## S4 method for signature 'worldArray'
clearPatches(world)

Arguments

world  WorldMatrix or worldArray object.

Value

WorldMatrix object with NA values for all patches.
coordinates, agentMatrix-method

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#clear-patches

Examples

```r
w1 <- createWorld()
w1 <- NLset(world = w1, agents = patches(w1), val = runif(NLcount(patches(w1))))
w1Val <- of(world = w1, agents = patches(w1))
summary(w1Val)

w1 <- clearPatches(w1)
w1Val <- of(world = w1, agents = patches(w1))
summary(w1Val)
```

coordinates, agentMatrix-method

Set spatial coordinates

Description
Set spatial coordinates

Usage
```r
## S4 method for signature 'agentMatrix'
coordinates(obj, ...)
```

Arguments

- **obj**
  - an AgentMatrix object

- **...**
  - additional arguments that may be used by particular methods

Value
usually an object of class SpatialPointsDataFrame; if the coordinates set cover the full set of variables in object, an object of class SpatialPoints is returned. See coordinates.
createOTurtles  
Create ordered turtles

Description
Create n turtles at the center of the world with their headings evenly distributed.

Usage
createOTurtles(n, world, breed, color)

## S4 method for signature 'numeric'
createOTurtles(n, world, breed, color)

Arguments
n  
Integer.

world  
WorldMatrix or worldArray object.

breed  
Character. Vector of breed names. Must be of length 1 or of length n. If missing, breed = "turtle" for all turtles.

color  
Character. Vector of color names. Must be of length n. If missing, colors are assigned using the function rainbow(n).

Details
The identity of the turtles is defined by their who number. This numbering starts at 0 and increments by 1.
The coordinates from the previous time step are stored in prevX and prevY. The initial values are NA.

Value
AgentMatrix object of length n with data for the turtles being: xcor, ycor, who, heading, prevX, prevY, breed, and color.

Author(s)
Sarah Bauduin and Eliot McIntire

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#create-ordered-turtles
createTurtles

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
data = runif(25))
t1 <- createOTurtles(n = 10, world = w1)
plot(w1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)

```r
> t1 <- fd(turtles = t1, dist = 1)
> points(t1, col = of(agents = t1, var = "color"), pch = 16)
```

createTurtles

Create turtles

Description

Create n moving agents with a set of defined variables.

Usage

```r
createTurtles(n, coords, world, heading, breed, color)
```

## S4 method for signature 'numeric,matrix,missing'
```r
createTurtles(n, coords, world, heading, breed, color)
```

## S4 method for signature 'numeric,missing,ANY'
```r
createTurtles(n, coords, world, heading, breed, color)
```

Arguments

- **n**: Integer.
- **coords**: Matrix (ncol = 2) with the first column xcor and the second column ycor representing the turtles initial locations. nrow(coords) must be equal to 1 or to n. Given coordinates must be inside the world’s extent. If missing, turtles are put in the center of the world.
- **world**: WorldMatrix or worldArray object.
- **heading**: Numeric. Vector of values between 0 and 360. Must be of length 1 or of length n. If missing, a random heading is assigned to each turtle.
- **breed**: Character. Vector of breed names. Must be of length 1 or of length n. If missing, breed = "turtle" for all turtles.
- **color**: Character. Vector of color names. Must be of length n. If missing, colors are assigned using the function rainbow(n).
createWorld

Create a world

Details

If coords is provided, world must not be provided.

The identity of the turtles is defined by their who number. This numbering starts at 0 and increments by 1.

The coordinates from the previous time step are stored in prevX and prevY. The initial values are NA.

Value

AgentMatrix object of length n with data for the turtles being: xcor, ycor, who, heading, prevX, prevY, breed, and color.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#create-turtles

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = runif(25))
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
plot(w1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)
createWorld

Usage
createWorld(minPxcor, maxPxcor, minPycor, maxPycor, data = NA)

## S4 method for signature 'numeric,numeric,numeric,numeric,ANY'
createWorld(minPxcor, maxPxcor, minPycor, maxPycor, data = NA)

## S4 method for signature 'missing,missing,missing,missing,missing'
createWorld()

Arguments
minPxcor  Integer. Minimum pxcor for the patches (world's left border).
maxPxcor  Integer. Maximum pxcor for the patches (world's right border).
minPycor  Integer. Minimum pycor for the patches (world's bottom border).
maxPycor  Integer. Maximum pycor for the patches (world's top border).
data      Vector of length 1 or length (maxPxcor -minPxcor + 1) * (maxPycor -minPycor + 1). Default is NA.

Details
If data is provided, values are assigned by rows.
If no parameters value are provided, default values are: minPxcor = -16, maxPxcor = 16, minPycor = -16, and maxPycor = 16.
See help("worldMatrix-class") for more details on the worldMatrix class.

Value
WorldMatrix object composed of (maxPxcor -minPxcor + 1) * (maxPycor -minPycor + 1) patches (i.e., matrix cells).

Author(s)
Sarah Bauduin, Eliot McIntire, and Alex Chubaty

References

Examples
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = 1:25)
plot(w1)
Description
Kill selected turtles.

Usage
\[
die(turtles, who)
\]

Arguments
- **turtles**  AgentMatrix object representing the moving agents.
- **who**  Integer. Vector of the who numbers for the selected turtles.

Details
The who numbers of the remaining turtles are unchanged.

Value
AgentMatrix representing the turtles with the selected ones removed.

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#die

Examples
\[
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
t1 <- createTurtles(n = 10, world = w1)
NLcount(t1)
t1 <- die(turtles = t1, who = c(2, 3, 4))
NLcount(t1)
\]
diffuse

Description

Each patch gives an equal share of a portion of its value to its neighbor patches.

Usage

diffuse(world, pVar, share, nNeighbors, torus = FALSE)

## S4 method for signature 'worldMatrix,missing,numeric,numeric'
diffuse(world, share, nNeighbors, torus)

## S4 method for signature 'worldArray,character,numeric,numeric'
diffuse(world, pVar, share, nNeighbors, torus = FALSE)

Arguments

- **world**: WorldMatrix or worldArray object.
- **pVar**: Character. If the world is a worldArray object, pVar is the name of the layer to use to define the patches values. pVar must not be provided if the world is a worldMatrix object.
- **share**: Numeric. Value between 0 and 1 representing the portion of the patches values to be diffused among the neighbors.
- **nNeighbors**: Integer: 4 or 8. Represents the number of neighbor patches considered.
- **torus**: Logical to determine if the world is wrapped. Default is torus = FALSE.

Details

What is given is lost for the patches.

If torus = TRUE, all patches have nNeighbors patches around them, which some may be on the other sides of the world. If torus = FALSE, patches located on the edges of the world have less than nNeighbors patches around them. However, each neighbor still gets 1/4 or 1/8 of the shared amount and the diffusing patch keeps the leftover.

Value

WorldMatrix or worldArray object with patches values updated.

Author(s)

Sarah Bauduin
References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#diffuse
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#diffuse4

Examples
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
                   data = sample(1:3, size = 25, replace = TRUE))
plot(w1)
# Diffuse 50% of each patch value to its 8 neighbors
w2 <- diffuse(world = w1, share = 0.5, nNeighbors = 8)
plot(w2)

---

downhill

**downhill**

Move downhill

Description
Move the turtles to their neighboring patch with the lowest value.

Usage
downhill(world, pVar, turtles, nNeighbors, torus = FALSE)

## S4 method for signature 'worldMatrix,missing,agentMatrix,numeric'
downhill(world, turtles, nNeighbors, torus)

## S4 method for signature 'worldArray,character,agentMatrix,numeric'
downhill(world, pVar, turtles, nNeighbors, torus = FALSE)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>world</td>
<td>WorldMatrix or worldArray object.</td>
</tr>
<tr>
<td>pVar</td>
<td>Character. If the world is a worldArray object, pVar is the name of the layer to use to define the patches values. pVar must not be provided if the world is a worldMatrix object.</td>
</tr>
<tr>
<td>turtles</td>
<td>AgentMatrix object representing the moving agents.</td>
</tr>
<tr>
<td>nNeighbors</td>
<td>Integer: 4 or 8. Represents the number of neighbor patches considered.</td>
</tr>
<tr>
<td>torus</td>
<td>Logical to determine if the world is wrapped. Default is torus = FALSE.</td>
</tr>
</tbody>
</table>
**Details**

If no neighboring patch has a smaller value than the patch where the turtle is currently located on, the turtle stays on this patch. It still moves to the patch center if it was not already on it.

If there are multiple neighboring patches with the same lowest value, the turtle chooses one patch randomly.

If a turtle is located on a patch on the edge of the world and torus = FALSE, it has fewer neighboring patches as options to move than nNeighbors; if torus = TRUE, the turtle can move on the other side of the world to move downhill and its choice of neighboring patches is always equals to nNeighbors.

**Value**

AgentMatrix representing the turtles with updated coordinates and updated data for their heading values and previous coordinates prevX and prevY.

**Author(s)**

Sarah Bauduin

**References**


**See Also**

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#downhill

**Examples**

```r
w1 <- createWorld(minPxcor = 1, maxPxcor = 10, minPycor = 1, maxPycor = 10, data = runif(100))
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
plot(w1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)

t1 <- downhill(world = w1, turtles = t1, nNeighbors = 8)
points(t1, col = of(agents = t1, var = "color"), pch = 16)
```
Description

Report the amount by which the turtles' coordinates xcor would change if the turtles were to move forward the given distances with their current headings.

Usage

\[ dx(turtles, \text{dist} = 1) \]

## S4 method for signature 'agentMatrix, numeric'
\[ dx(turtles, \text{dist} = 1) \]

## S4 method for signature 'agentMatrix, missing'
\[ dx(turtles) \]

Arguments

turtles AgentMatrix object representing the moving agents.
dist Numeric. Vector of distances the turtles would have to move forward to compute the increment values. Must be of length 1 or of length turtles. The default value is \( \text{dist} = 1 \).

Details

Report the sine of the turtles' heading multiplied by the dist values. Heading 0 is north and angles are calculated in degrees in a clockwise manner.

Value

Numeric. Vector of length turtles.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#dxy
Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
t1 <- createOTurtles(world = w1, n = 10)
dx(turtles = t1)
```

**Description**

Report the amount by which the turtles' coordinates ycor would change if the turtles were to move forward the given distances with their current headings.

**Usage**

```r
dy(turtles, dist = 1)
```

## S4 method for signature 'agentMatrix,numeric'

```r
dy(turtles, dist = 1)
```

## S4 method for signature 'agentMatrix,missing'

```r
dy(turtles)
```

**Arguments**

- `turtles` AgentMatrix object representing the moving agents.
- `dist` Numeric. Vector of distances the turtles would have to move forward to compute the increment values. Must be of length 1 or of length `turtles`. The default value is `dist = 1`.

**Details**

Report the cosine of the turtles' heading multiplied by the `dist` values. Heading 0 is north and angles are calculated in degrees in a clockwise manner.

**Value**

Numeric. Vector of length `turtles`.

**Author(s)**

Sarah Bauduin

**References**

### extent,worldNLR-method

**Bounding box and extent methods for NetLogoR classes**

#### Description

Same as `bbox` and `extent`.

#### Usage

```r
## S4 method for signature 'worldNLR'
extent(x, ...)
```

```r
## S4 method for signature 'agentMatrix'
extent(x, ...)

.bboxCoords(coords)
```

```r
## S4 method for signature 'agentMatrix'
bbox(obj)

bbox(obj) <- value
```

```r
## S4 replacement method for signature 'agentMatrix,matrix'
bbox(obj) <- value
```

```r
## S4 method for signature 'worldNLR'
bbox(obj)
```

#### Arguments

- `x`  
  Raster* or Extent object, a matrix, a bbox, or a vector of four numbers
- `...`  
  Additional arguments. When `x` is a single number representing 'xmin', you can pass three additional numbers (xmax, ymin, ymax)  
  When `x` is a Raster* object, you can pass four additional arguments to crop the extent: `r1`, `r2`, `c1`, `c2`, representing the first and last row and column number
 coords  xy coordinates for all cells, e.g., produced by \texttt{raster::coordinates}.

 obj  object deriving from class "Spatial", or one of classes: "Line", "Lines", "Polygon" or "Polygons", or ANY, which requires \texttt{obj} to be an array with at least two columns.

 value  2x2 matrix representing the bounding box. See \texttt{bbox}.

**Value**

\texttt{bbox} returns a two-column matrix; the first column has the minimum, the second the maximum values; rows represent the spatial dimensions. \texttt{extent} returns an extent object.

two-column matrix; the first column has the minimum, the second the maximum values; rows represent the spatial dimensions. See \texttt{bbox}.

---

**face** 

*Face something*

---

**Description**

Set the turtles' heading towards agents2.

**Usage**

\texttt{face(turtles, agents2, world, torus = FALSE)}

```
## S4 method for signature 'agentMatrix,matrix'
face(turtles, agents2, world, torus = FALSE)
```

**Arguments**

- **turtles**  AgentMatrix object representing the moving agents.
- **agents2**  Matrix (\texttt{ncol = 2}) with the first column \texttt{pxcor} and the second column \texttt{pycor} representing the patches coordinates, or AgentMatrix object representing the moving agents, or Matrix (\texttt{ncol = 2}) with the first column \texttt{x} and the second column \texttt{y} representing locations coordinates.
- **world**  WorldMatrix or \texttt{worldArray} object.
- **torus**  Logical to determine if the \texttt{world} is wrapped. Default is \texttt{torus = FALSE}.

**Details**

The number of agents/locations in \texttt{agents2} must be equal to 1 or to the length of \texttt{turtles}.

If \texttt{torus = FALSE}, \texttt{world} does not need to be provided.

If \texttt{torus = TRUE} and the distance from one \texttt{turtles} to its corresponding agent/location \texttt{agents2} is smaller around the sides of the \texttt{world} than across it, then the direction to the agent/location \texttt{agents2} going around the sides of the \texttt{world} is given to the \texttt{turtle}.

If a turtle is facing its own location, its heading does not change.
Value

AgentMatrix representing the turtles with updated headings.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#face
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#facexy

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
                   data = runif(25))
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
plot(w1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)

t1 <- face(turtles = t1, agents2 = cbind(x = 0, y = 0))
t1 <- fd(turtles = t1, dist = 0.5)
points(t1, col = of(agents = t1, var = "color"), pch = 16)

---

fd

Move forward

Description

Move the turtles forward with their headings as directions.

Usage

fd(turtles, dist, world, torus = FALSE, out = TRUE)

## S4 method for signature 'agentMatrix,numeric'
fd(turtles, dist, world, torus = FALSE, out = TRUE)
Arguments

- **turtles**: AgentMatrix object representing the moving agents.
- **dist**: Numeric. Vector of distances to move. Must be of length 1 or of length turtles.
- **world**: WorldMatrix or worldArray object.
- **torus**: Logical to determine if the world is wrapped. Default is torus = FALSE.
- **out**: Logical. Determine if a turtle should move when torus = FALSE and its ending position will be outside of the world’s extent. Default is out = TRUE.

Details

If torus = FALSE and out = TRUE, world does not need to be provided.

If a distance to move leads a turtle outside of the world’s extent and torus = TRUE, the turtle is relocated on the other side of the world, inside its extent; if torus = FALSE and out = TRUE, the turtle moves past the world’s extent; if torus = FALSE and out = FALSE, the turtle does not move at all. In the event that a turtle does not move, its previous coordinates are still updated with its position before running fd() (i.e., its current position).

If a given dist value is negative, then the turtle moves backward.

Value

AgentMatrix representing the turtles with updated coordinates and updated data for their previous coordinates prevX and prevY.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#forward
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#jump

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = runif(25))
t1 <- createOTurtles(n = 10, world = w1)
plot(w1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)

fd(turtles = t1, dist = 1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)
```
hatch

Hatch new turtles

Description
Create new turtles from parent turtles.

Usage
hatch(turtles, who, n, breed)

## S4 method for signature 'agentMatrix,numeric,numeric'
hatch(turtles, who, n, breed)

Arguments
- **turtles**: AgentMatrix object representing the moving agents.
- **who**: Integer. Vector of the who numbers for the selected turtles.
- **n**: Integer. Vector of length 1 or of length who. Number of new turtles to create for each parent.
- **breed**: Character. One breed name. If missing, the created turtles are of the same breed as their parent turtle.

Details
The parent turtle must be contained in the turtles.
The created turtles inherit of all the data from the parent turtle, except for the breed if specified otherwise, and for the who numbers. The who" numbers of the turtles created take on following the highest who number among the turtles.
All new hatched turtles are placed at the end of the agentMatrix object.

Value
AgentMatrix representing the turtles with the new hatched ones.

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#hatch
home

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
t1 <- createTurtles(n = 10, world = w1)
NLcount(t1)
t1 <- hatch(turtles = t1, who = 0, n = 2)
NLcount(t1)
```

home

Return home

Description

Move the turtles back home.

Usage

```r
home(world, turtles, home)
```

## S4 method for signature 'worldNLR,agentMatrix,character'

```r
home(world, turtles, home)
```

Arguments

- **world**: WorldMatrix or worldArray object.
- **turtles**: AgentMatrix object representing the moving agents.
- **home**: Character. Can take one of the following options to define where to relocate the turtles:
  - `home = "home0"` will place the turtles at the location \( x = 0, y = 0 \).
  - `home = "center"` will place the turtles at the center of the world.
  - `home = "pCorner"` will place the turtles at the center of the patch located in the left bottom corner of the world.
  - `home = "corner"` will place the turtles at the left bottom corner of the world.

Value

AgentMatrix representing the turtles with updated coordinates and updated data for their previous coordinates prevX and prevY.

Author(s)

Sarah Bauduin

References

See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#home

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = runif(25))
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
plot(w1)
points(t1, col = "black", pch = 16)

t1 <- home(world = w1, turtles = t1, home = "pCorner")
points(t1, col = "red", pch = 16)
```

---

inCone Agents in cone

Description

Report the agents within the "cone of vision" in front of each one of the turtles.

Usage

```r
inCone(turtles, radius, angle, agents, world, torus = FALSE)
```

## S4 method for signature 'agentMatrix,numeric,numeric,matrix'
inCone(turtles, radius, angle, agents, world, torus = FALSE)

Arguments

- `turtles`: AgentMatrix object representing the moving agents.
- `radius`: Numeric. Vector of distances from turtles to locate agents. Must be of length 1 or of length turtles.
- `angle`: Numeric. Vector of angles to define the size of the cone of vision for the turtles. The cone of vision is defined between the direction of their headings minus angle / 2 to the direction of their headings plus angle / 2. Must be of length 1 or of length turtles.
- `agents`: Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
- `world`: WorldMatrix or worldArray object.
- `torus`: Logical to determine if the world is wrapped. Default is torus = FALSE.
Details
agents are reported if there are within radius distance of the turtle and their direction from the
turtle is within [-angle,+ angle] of the turtle’s heading.
Distances to patches are calculated to their center.
If torus = FALSE, world does not need to be provided.
If torus = TRUE, the radius distances are calculated around the sides of the world to select agents.

Value
Matrix (ncol = 3) with the first column pxcor and the second column pycor representing the
coordinates of the patches among agents2 within the cone of vision of each of the turtles which
are represented by the id column, if agents are patches, or
Matrix (ncol = 2) with the first column who representing the who numbers of the turtles among
agents2 within the cone of vision of each of the turtles which are represented by the id column,
if agents are turtles.

Author(s)
Sarah Bauduin

References
Learning and Computer-Based Modeling, Northwestern University. Evanston, IL.

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#in-cone

Examples
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
p1 <- inCone(turtles = t1, radius = 2, agents = patches(w1), angle = 90)
t2 <- inCone(turtles = turtle(t1, who = 0), radius = 2, angle = 90, agents = t1)
initialize,agentMatrix-method

*Initialize for agentMatrix Class*

**Description**

To create a new agentMatrix object.

**Usage**

```r
## S4 method for signature 'agentMatrix'
initialize(.Object = "agentMatrix", coords, ..., levelsAM)
```

**Arguments**

- `.Object` An object: see the “Initialize Methods” section.
- `coords` 2 column matrix of coordinates
- `...` arguments to specify properties of the new object, to be passed to `initialize()`.
- `levelsAM` A list with named character vectors. Each name should match with elements in `...`, and each character vector should be the length of unique elements in the `...` element.

**Value**

An agentMatrix object.

---

**inRadius**

*Agents in radius*

**Description**

Report the patches or turtles among `agents2` within given distances of each of the agents. Currently, this function multiplies `radius` by 1.0000001 so that the response of `inRadius` is inclusive.

**Usage**

```r
inRadius(agents, radius, agents2, world, torus = FALSE)
```

```r
## S4 method for signature 'matrix,numeric,matrix'
inRadius(agents, radius, agents2, world, torus = FALSE)
```
Arguments

- **agents**
  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

- **radius**
  Numeric. Vector of distances from agents to locate agents2. Must be of length 1 or of length agents.

- **agents2**
  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

- **world**
  WorldMatrix or worldArray object.

- **torus**
  Logical to determine if the world is wrapped. Default is torus = FALSE.

Details

Distances from/to patches are calculated from/to their center.

- If torus = FALSE, world does not need to be provided.
- If torus = TRUE, the radius distances are calculated around the sides of the world to select agents2.

Value

Matrix (ncol = 3) with the first column pxcor and the second column pycor representing the coordinates of the patches among agents2 within radius distances for each agents which are represented by the id column, if agents2 are patches, or

Matrix (ncol = 2) with the first column who representing the who numbers of the turtles among agents2 within radius distances for each agents which are represented by the id column, if agents2 are turtles.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#in-radius

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
p1 <- inRadius(agents = patch(w1, 0, 0), radius = 2, agents2 = patches(w1))
t2 <- inRadius(agents = patch(w1, 0, 0), radius = 2, agents2 = t1)
```
p2 <- inRadius(agents = t1, radius = 2, agents2 = patches(w1))
t3 <- inRadius(agents = turtle(t1, who = 0), radius = 2, agents2 = t1)

.. code-block:: r

   inspect

Inspect turtles

Description

Display all variables values for the selected individuals among the turtles.

Usage

inspect(turtles, who)

## S4 method for signature 'agentMatrix,numeric'
inspect(turtles, who)

Arguments

turtles AgentMatrix object representing the moving agents.

who Integer. Vector of the who numbers for the selected turtles.

Value

Dataframe (nrow = length(who)) of the variables of the selected individuals among the turtles.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#inspect

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
t1 <- createOTurtles(world = w1, n = 10)
inspect(turtles = t1, who = c(2, 3))
isNLclass

Description

Report TRUE if the agents is of the class tested, report FALSE otherwise.

Usage

isNLclass(agents, class)

## S4 method for signature 'matrix,character'
isNLclass(agents, class)

Arguments

agents       Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
class       Character. Can take one of the following options to define the class: "agent", "agentset", "patch", "patchset", "turtle" or "turtleset".

Details

Careful! The class tested does not correspond to actual R classes.

agents is "patch" if it is a matrix (ncol = 2) with the first column pxcor and the second column pycor with only one row. agents is "patcheset" if the matrix has more than one row.

agents is "turtle" if it is an agentMatrix containing only one turtle. agents is "turtleset" if the agentMatrix contains more than one turtle.

agents is "agent" if it is either "patch" or "turtle". agents is "agentset" if it is either "patcheset" or "turtleset".

Value

Logical. TRUE if agents is of the class tested.

Author(s)

Sarah Bauduin

References

layoutCircle

Description

Relocate the turtles on a circle centered on the world.

Usage

layoutCircle(world, turtles, radius, torus = FALSE)

# S4 method for signature 'worldNLRI,agentMatrix,numeric'
layoutCircle(world, turtles, radius, torus = FALSE)

Arguments

world WorldMatrix or worldArray object.
turtles AgentMatrix object representing the moving agents.
radius Numeric. Radius of the circle.
torus Logical to determine if the world is wrapped. Default is torus = FALSE.

Details

The turtles point outwards.

If the radius value leads turtles outside of the world's extent and torus = TRUE, they are relo-
cated on the other sides of the world, inside its extent; if torus = FALSE, the turtles are located
past the world's extent.

Value

AgentMatrix representing the turtles with updated coordinates and updated data for their heading
values and previous coordinates prevX and prevY.
Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#layout-circle

Examples
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9,
data = runif(100))
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
plot(w1)
points(t1, col = "black", pch = 16)

t1 <- layoutCircle(world = w1, turtles = t1, radius = 3)
points(t1, col = "red", pch = 16)

left

Description
Rotate the turtles’s headings to the left of angle degrees.

Usage
left(turtles, angle)

## S4 method for signature 'agentMatrix,numeric'
left(turtles, angle)

Arguments
turtles AgentMatrix object representing the moving agents.
angle Numeric. Vector of angles in degrees by which to rotate the turtles’ headings. Must be of length 1 or of length turtles.

Details
If a given angle value is negative, then the turtle rotates to the right.
maxNof

Value
AgentMatrix representing the turtles with updated heading values.

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#left

Examples
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
t1 <- createTurtles(n = 10, world = w1)
of(agents = t1, var = "heading")
t1 <- left(turtles = t1, angle = 180)
of(agents = t1, var = "heading")

maxNof N agents with maximum

Description
Report the n patches or turtles among agents which have their variable among the maximum values.

Usage
maxNof(agents, n, world, var)

## S4 method for signature 'matrix,numeric,worldMatrix,missing'
maxNof(agents, n, world)

## S4 method for signature 'matrix,numeric,worldArray,character'
maxNof(agents, n, world, var)

## S4 method for signature 'agentMatrix,numeric,missing,character'
maxNof(agents, n, var)
maxNof

Arguments

agents Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
n Integer.
world WorldMatrix or worldArray object.
var Character. The name of the selected agents variable. If agents are patches and the world is a worldMatrix object, var must not be provided. If agents are patches and the world is a worldArray object, var is the name of the layer to use to define the patches values. If agents are turtles, var is one of the turtles’ variable and can be equal to xcor, ycor, any of the variables created when turtles were created, as well as any variable created using turtlesOwn().

Details

world must not be provided if agents are turtles.

If there is a tie that would make the number of returned patches or turtles larger than n, it is broken randomly.

Value

Matrix (ncol = 2, nrow = n) with the first column pxcor and the second column pycor representing the coordinates of the n patches among the agents which have their variable values among the maximum values among the agents, or AgentMatrix of length n representing the turtles among the agents which have their var values among the maximum values among the agents.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#max-n-of

Examples

# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = sample(1:10, size = 25, replace = TRUE))
plot(w1)
p1 <- maxNof(agents = patches(w1), n = 6, world = w1)
# Turtles
```r
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10),
                heading = sample(1:5, size = 10, replace = TRUE))
t2 <- maxNof(agents = t1, n = 5, var = "heading")
```

## maxOneOf

### Description

Report one patch or one turtle among agents which has its variable equals to the maximum value.

### Usage

```r
maxOneOf(agents, world, var)
```

### Arguments

- **agents**
  - Matrix (ncol = 2) with the first column `pxcor` and the second column `pycor` representing the patches coordinates, or `AgentMatrix` object representing the moving agents.

- **world**
  - `WorldMatrix` or `worldArray` object.

- **var**
  - Character. The name of the selected agents variable. If agents are patches and the world is a `worldMatrix` object, `var` must not be provided. If agents are patches and the world is a `worldArray` object, `var` is the name of the layer to use to define the patches values. If agents are turtles, `var` is one of the turtles’ variable and can be equal to `xcor`, `ycor`, any of the variables created when turtles were created, as well as any variable created using `turtlesOwn()`.

### Details

- `world` must not be provided if agents are turtles.
- If there are several patches or turtles among agents with their variable equal to the maximum value, one is chosen randomly. To access to all patches or turtles among agents which have their variable equal to the maximum value, use `withMax()`.
**maxPxcor**

**Value**

Matrix (ncol = 2, nrow = 1) with the first column `pxcor` and the second column `pycor` representing the coordinates of the patch (or of one of the patches) among the agents which has its variable equals to the maximum value among the agents, or `AgentMatrix` of length 1 representing the turtle (or one of the turtles) among the agents which has its variable `var` equals to the maximum value among the agents.

**Author(s)**

Sarah Bauduin

**References**


**See Also**

[https://ccl.northwestern.edu/netlogo/docs/dictionary.html#max-one-of](https://ccl.northwestern.edu/netlogo/docs/dictionary.html#max-one-of)

**Examples**

```r
# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
                  data = sample(1:5, size = 25, replace = TRUE))
plot(w1)
p1 <- maxOneOf(agents = patches(w1), world = w1)

# Turtles
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10),
                    heading = sample(1:3, size = 10, replace= TRUE))
t2 <- maxOneOf(agents = t1, var = “heading”)
```

<table>
<thead>
<tr>
<th>maxPxcor</th>
<th>Maximum pxcor</th>
</tr>
</thead>
</table>

**Description**

Report the patches maximum `pxcor` in the `world`.

**Usage**

```
maxPxcor(world)
```

```r
## S4 method for signature 'worldNLR'
```

```r
maxPxcor(world)
```
Arguments
  world  WorldMatrix or worldArray object.

Value
  Integer.

Author(s)
  Sarah Bauduin

References

See Also
  https://ccl.northwestern.edu/netlogo/docs/dictionary.html#max-pcor

Examples
  w1 <- createWorld()
  maxPxcor(w1)

---

maxPycor  Maximum pycor

Description
  Report the patches maximum pycor in the world.

Usage
  maxPycor(world)

  ## S4 method for signature 'worldNLR'
  maxPycor(world)

Arguments
  world  WorldMatrix or worldArray object.

Value
  Integer.
**minNof**

**Author(s)**
Sarah Bauduin

**References**

**See Also**
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#max-pcor

**Examples**

```r
w1 <- createWorld()
maxPycor(w1)
```

---

**Description**

Report the \( n \) patches or turtles among agents which have their variable among the minimum values.

**Usage**

```r
minNof(agents, n, world, var)
```

---

**Arguments**

- **agents**  
  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

- **n**  
  Integer.

- **world**  
  WorldMatrix or worldArray object.
Character. The name of the selected agents variable. If agents are patches and the world is a `worldMatrix` object, `var` must not be provided. If agents are patches and the world is a `worldArray` object, `var` is the name of the layer to use to define the patches values. If agents are turtles, `var` is one of the turtles’ variable and can be equal to `xcor`, `ycor`, any of the variables created when turtles were created, as well as any variable created using `turtlesOwn()`.

**Details**

`world` must not be provided if agents are turtles.

If there is a tie that would make the number of returned patches or turtles larger than `n`, it is broken randomly.

**Value**

- Matrix `(ncol = 2, nrow = n)` with the first column `pxcor` and the second column `pycor` representing the coordinates of the `n` patches among the agents which have their variable values among the minimum values among the agents, or
- `AgentMatrix` of length `n` representing the turtles among the agents which have their `var` values among the minimum values among the agents.

**Author(s)**

Sarah Bauduin

**References**


**See Also**

[https://ccl.northwestern.edu/netlogo/docs/dictionary.html#min-n-of](https://ccl.northwestern.edu/netlogo/docs/dictionary.html#min-n-of)

**Examples**

```r
# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
                   data = sample(1:10, size = 25, replace = TRUE))
plot(w1)
p1 <- minNof(agents = patches(w1), n = 6, world = w1)

# Turtles
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10),
                    heading = sample(1:5, size = 10, replace = TRUE))
t2 <- minNof(agents = t1, n = 5, var = "heading")
```
**Description**

Report one patch or one turtle among agents which has its variable equals to the minimum value.

**Usage**

```r
minOneOf(agents, world, var)
## S4 method for signature 'matrix,worldMatrix,missing'
minOneOf(agents, world)
## S4 method for signature 'matrix,worldArray,character'
minOneOf(agents, world, var)
## S4 method for signature 'agentMatrix,missing,character'
minOneOf(agents, var)
```

**Arguments**

- **agents**
  - Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or
  - AgentMatrix object representing the moving agents.
- **world**
  - WorldMatrix or worldArray object.
- **var**
  - Character. The name of the selected agents variable. If agents are patches and the world is a worldMatrix object, var must not be provided. If agents are patches and the world is a worldArray object, var is the name of the layer to use to define the patches values. If agents are turtles, var is one of the turtles’ variable and can be equal to xcor, ycor, any of the variables created when turtles were created, as well as any variable created using turtlesOwn().

**Details**

world must not be provided if agents are turtles.

If there are several patches or turtles among agents with their variable equal to the minimum value, one is chosen randomly. To access to all patches or turtles among agents which have their variable equal to the minimum value, use withMin().

**Value**

Matrix (ncol = 2, nrow = 1) with the first column pxcor and the second column pycor representing the coordinates of the patch (or of one of the patches) among the agents which has its variable equals to the minimum value among the agents, or
AgentMatrix of length 1 representing the turtle (or one of the turtles) among the agents which has its variable var equals to the minimum value among the agents.

**Author(s)**

Sarah Bauduin

**References**


**See Also**

[https://ccl.northwestern.edu/netlogo/docs/dictionary.html#min-one-of](https://ccl.northwestern.edu/netlogo/docs/dictionary.html#min-one-of)

**Examples**

```r
# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
data = sample(1:5, size = 25, replace = TRUE))
plot(w1)
p1 <- minOneOf(agents = patches(w1), world = w1)

# Turtles
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10),
heading = sample(1:3, size = 10, replace = TRUE))
t2 <- minOneOf(agents = t1, var = "heading")
```

---

**minPxcor**  
**Minimum pxcor**

**Description**

Report the patches minimum pxcor in the world.

**Usage**

```r
minPxcor(world)
```

```r
## S4 method for signature 'worldNLR'
minPxcor(world)
```

**Arguments**

- **world**  
  WorldMatrix or worldArray object.
**minPycor**

**Value**

Integer.

**Author(s)**

Sarah Bauduin

**References**


**See Also**

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#min-pcor

**Examples**

```r
w1 <- createWorld()
minPycor(w1)
```

---

**minPycor**  
Minimum pycor

**Description**

Report the patches minimum pycor in the world.

**Usage**

```r
minPycor(world)
```

```r
## S4 method for signature 'worldNLR'
minPycor(world)
```

**Arguments**

- `world`  
  WorldMatrix or worldArray object.

**Value**

Integer.

**Author(s)**

Sarah Bauduin
References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#min-pcor

Examples

```r
w1 <- createWorld()
minPycor(w1)
```

```
moveTo

Move to

Description

Move the turtles to the agents’ locations.

Usage

moveTo(turtles, agents)

## S4 method for signature 'agentMatrix,matrix'
moveTo(turtles, agents)

Arguments

- **turtles**: AgentMatrix object representing the moving agents.
- **agents**: Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

Details

- The number of agents must be equal to 1 or to length turtles.
- The turtle’s headings are not affected with this function.
- If a turtle is moving to a patch location, it will be located at the patch center.

Value

AgentMatrix representing the turtles with updated coordinates and updated data for their previous coordinates prevX and prevY.
neighbors

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#move-to

Examples
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9,
data = runif(100))
t1 <- createTurtles(n = 5, coords = randomXYcor(w1, n = 5))plot(w1)points(t1, col = "black", pch = 16)

t1 <- moveTo(turtles = t1, agents = turtle(t1, who = 0))points(t1, col = "red", pch = 16)

t1 <- moveTo(turtles = t1, agents = patch(w1, 9, 9))points(t1, col = "blue", pch = 16)

neighbors    Neighbors patches

Description
Report the coordinates of the neighbors patches around the agents.

Usage
neighbors(world, agents, nNeighbors, torus = FALSE)

## S4 method for signature 'worldNLR, matrix, numeric'
neighbors(world, agents, nNeighbors, torus = FALSE)

Arguments

world    WorldMatrix or worldArray object.
agents    Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
nNeighbors  
Integer: 4 or 8. Represents the number of neighbor patches considered.

torus  
Logical to determine if the world is wrapped. Default is torus = FALSE.

Details
The patch around which the neighbors are identified, or the patch where the turtle is located on around which the neighbors are identified, is not returned.

If torus = FALSE, agents located on the edges of the world have less than nNeighbors patches around them. If torus = TRUE, all agents located on the edges of the world have nNeighbors patches around them, which some may be on the other sides of the world.

Value
Matrix (ncol = 3) with the first column pxcor and the second column pycor representing the coordinates of the neighbors patches around the agents and the third column id representing the id of the agents in the order provided.

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#neighbors

Examples
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
neighbors(world = w1, agents = patch(w1, c(0,9), c(0,7)), nNeighbors = 8)
t1 <- createTurtles(n = 3, coords = randomXYcor(w1, n = 3))
neighbors(world = w1, agents = t1, nNeighbors = 4)

NLall

All agents?

Description
Report TRUE if all agents have their variable equal to a given value, report FALSE otherwise.
Usage

NLall(agents, world, var, val)

## S4 method for signature 'matrix,worldMatrix,missing'
NLall(agents, world, val)

## S4 method for signature 'matrix,worldArray,character'
NLall(agents, world, var, val)

## S4 method for signature 'agentMatrix,missing,character'
NLall(agents, var, val)

Arguments

gamma | Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
gamma | WorldMatrix or worldArray object.
var | Character. The name of the selected agents variable. If agents are patches and the world is a worldMatrix object, var must not be provided. If agents are patches and the world is a worldArray object, var is the name of the layer to use to define the patches values. If agents are turtles, var is one of the turtles' variable and can be equal to xcor, ycor, any of the variables created when turtles were created, as well as any variable created using turtlesOwn().
val | Numeric or character. Vector of any length.

Details

world must not be provided if agents are turtles.

Value

Logical. TRUE if all the agents have their variable equal to val, FALSE otherwise.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#all
Examples

# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = runif(25))
NLall(agents = patches(w1), world = w1, val = 5)

w2 <- w1
NLset(world = w1, agents = patches(w1), val = 5)
NLall(agents = patches(w2), world = w2, val = 5)

# Turtles
t1 <- createTurtles(n = 5, coords = cbind(xcor = 1, ycor = 1), heading = c(1, 2, 2, 1, 2))
NLall(agents = t1, var = "xcor", val = 1)
NLall(agents = t1, var = "heading", val = 2)

NLany

Any agents?

Description

Report TRUE if agents is non empty, report FALSE otherwise.

Usage

NLany(agents)

## S4 method for signature 'matrix'
NLany(agents)

Arguments

agents

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or
AgentMatrix object representing the moving agents.

Value

Logical. TRUE if there is at least one patch or one turtle in the agents, FALSE otherwise.

Author(s)

Sarah Bauduin

References

NLcount

See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#any

Examples

# Patches
w1 <- createWorld(minPxCor = 0, maxPxCor = 4, minPycor = 0, maxPycor = 4)
p1 <- noPatches()
p2 <- patch(w1, 0, 0)
NLany(p1)
NLany(p2)

# Turtles
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
t2 <- noTurtles()
NLany(t1)
NLany(t2)

---

<table>
<thead>
<tr>
<th>NLcount</th>
<th>Count agents</th>
</tr>
</thead>
</table>

Description

Report the number of patches or turtles inside agents.

Usage

NLcount(agents)

## S4 method for signature 'matrix'
NLcount(agents)

Arguments

agents Matrix (ncol = 2) with the first column pxCor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

Value

Integer.

Author(s)

Sarah Bauduin
References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#count

Examples

# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
p1 <- patches(w1)
NLcount(p1) # 25 patches

# Turtles
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
NLcount(t1) # 10 turtles

---

**NLdist**

*Distances between agents*

Description

Report the distances between agents and agents2.

Usage

NLdist(agents, agents2, world, torus = FALSE, allPairs = FALSE)

## S4 method for signature 'matrix,matrix'
NLdist(agents, agents2, world, torus = FALSE, allPairs = FALSE)

Arguments

agents  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

agents2  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents, or Matrix (ncol = 2) with the first column x and the second column y representing locations coordinates.

world  WorldMatrix or worldArray object.
torus Logical to determine if the world is wrapped. Default is torus = FALSE.

allPairs Logical. Only relevant if the number of agents/locations in agents and in agents2 are the same. If allPairs = FALSE, the distance between each agents with the corresponding agents2 is returned. If allPairs = TRUE, a full distance matrix is returned. Default is allPairs = FALSE.

Details
Distances from/to a patch are measured from/to its center.

If torus = FALSE, world does not need to be provided.

If torus = TRUE, a distance around the sides of the world is reported only if smaller than the one across the world.

Value
Numeric. Vector of distances between agents and agents2 if agents and/or agents2 contained one agent/location, or if agents and agents2 contained the same number of agents/locations and allPairs = FALSE, or

Matrix of distances between agents (rows) and agents2 (columns) if agents and agents2 are of different lengths, or of same length and allPairs = TRUE.

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#distance
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#distancexy

Examples
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
NLdist(agents = patch(w1, 0, 0), agents2 = patch(w1, c(1, 9), c(1, 9)))
NLdist(agents = patch(w1, 0, 0), agents2 = patch(w1, c(1, 9), c(1, 9)),
world = w1, torus = TRUE)
t1 <- createTurtles(n = 2, coords = randomXYcor(w1, n = 2))
NLdist(agents = t1, agents2 = patch(w1, c(1,9), c(1,9)), allPairs = TRUE)
**NLset**  
*Set an agents variable*

**Description**

Assign values to the agents for the selected variables.

**Usage**

```r
NLset(world, turtles, agents, var, val)
```

```r
## S4 method for signature 'missing,agentMatrix,agentMatrix,character'
NLset(turtles, agents, var, val)
```

```r
## S4 method for signature 'worldMatrix,missing,matrix,missing'
NLset(world, agents, val)
```

```r
## S4 method for signature 'worldArray,missing,matrix,character'
NLset(world, agents, var, val)
```

**Arguments**

- `world`  
  WorldMatrix or worldArray object.

- `turtles`  
  AgentMatrix object representing the moving agents.

- `agents`  
  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

- `var`  
  Character. Vector of the names of the selected agents variables. If agents are patches and the world is a worldMatrix object, var must not be provided. If agents are patches and the world is a worldArray object, var is the name of the layers to use to define the patches values. If agents are turtles, var is some of the turtles' variable and can be any of the variables created when turtles were created, as well as any variable created with turtlesOwn().

- `val`  
  Numeric or character. Vector of length 1 or length NLcount(agents) if length(var) == 1, or Matrix or Dataframe (ncol = length(var), nrow = NLcount(agents)). Columns must be in the same order as var.

**Details**

If agents are patches, world must be provided and turtles must not be provided. If agents are turtles, turtles must be provided and world must not be provided.
**Value**

WorldMatrix or worldArray object with the values `val` assigned to the patches variables `var` for the agents, or

AgentMatrix representing the turtles with the values `val` assigned to the variables `var` for the agents.

**Author(s)**

Sarah Bauduin

**References**


**See Also**

[https://ccl.northwestern.edu/netlogo/docs/dictionary.html#set](https://ccl.northwestern.edu/netlogo/docs/dictionary.html#set)

**Examples**

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
w1 <- NLset(world = w1, agents = patches(w1), val = 1)
# Set the patch[0,4] to 0
w1 <- NLset(world = w1, agents = patch(w1, 0, 4), val = 0)
of(world = w1, agents = patches(w1))

t1 <- createTurtles(n = 3, world = w1, heading = 0)
# Set the heading of turtle 0 to 180
t2 <- NLset(turtles = t1, agents = turtle(t1, who = 0), var = "heading", val = 180)
of(agents = t2, var = "heading") # c(180, 0, 0)
```

**Description**

Report the patches or the turtles among agents which have their variable equals to specific values.
Usage

NLwith(agents, world, var, val)

## S4 method for signature 'matrix,worldMatrix,missing'
NLwith(agents, world, val)

## S4 method for signature 'matrix,worldArray,character'
NLwith(agents, world, var, val)

## S4 method for signature 'agentMatrix,missing,character'
NLwith(agents, var, val)

Arguments

agents  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
world   WorldMatrix or worldArray object.
var     Character. The name of the selected agents variable. If agents are patches and the world is a worldMatrix object, var must not be provided. If agents are patches and the world is a worldArray object, var is the name of the layer to use to define the patches values. If agents are turtles, var is one of the turtles’ variable and can be equal to xcor, ycor, any of the variables created when turtles were created, as well as any variable created using turtlesOwn().
val     Numeric or character. Vector of any length.

Details

world must not be provided if agents are turtles.
This is equivalent in R to subsetting.
val can include NA.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the coordinates of the patches among the agents which have their variable equals to any val, or AgentMatrix representing the turtles among the agents which have their variable var equals to any val.

Author(s)

Sarah Bauduin

References

See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#with

Examples

# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
data = sample(1:5, size = 25, replace = TRUE))
plot(w1)
p2 <- NLwith(agents = patches(w1), world = w1, val = 2)

# Turtles
t1 <- createTurtles(n = 5, coords = randomXYcor(w1, n = 5),
breed = c("sheep", "sheep", "wolf", "sheep", "sheperd"))
t2 <- NLwith(agents = t1, var = "breed", val = "sheep")
t3 <- NLwith(agents = t1, var = "breed", val = c("sheep", "wolf"))

NLworldIndex

WorldMatrix indices from vector indices

Description

Convert vector indices or Raster* cell numbers into worldMatrix indices.

Usage

NLworldIndex(world, cellNum)

## S4 method for signature 'worldMatrix,numeric'
NLworldIndex(world, cellNum)

Arguments

world       WorldMatrix or worldArray object.
cellNum     Integer. Vector of cells number.

Value

Numeric. Vector of worldMatrix indices.

Author(s)

Eliot McIntire
Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9, data = 1:100)
w1Ras <- world2raster(w1)
index <- 24
pxpy <- PxcorPycorFromCell(world = w1, cellNum = index)

rasValue <- as.integer(unname(w1Ras[index]))
# Not correct index:
identical(w1[index], rasValue)
# Correct index
identical(w1[NLworldIndex(w1, index)], rasValue)
```

---

n0f  

N random agents

Description

Report n patches or turtles randomly selected among agents.

Usage

```r
n0f(agents, n)
```

Arguments

- **agents** Matrix (`ncol = 2`) with the first column `pxcor` and the second column `pycor` representing the patches coordinates, or
  Matrix (`ncol = 3`) with the first column "pxcor" and the second column "pycor" representing the patches coordinates and the third column `id`, or
  AgentMatrix object representing the moving agents, or
  Matrix (`ncol = 2`) with the first column `whoTurtles` and the second column `id`.

- **n** Integer. Number of patches or turtles to select from agents.

Details

`n` must be less or equal the number of patches or turtles in `agents`.

If `agents` is a matrix with `ncol = 3`, the selection of `n` random patches is done per individual "id". The order of the patches coordinates returned follow the order of "id". If `agents` is a matrix (`ncol = 2`) with columns `whoTurtles` and `id`, the selection of `n` random turtles (defined by their `whoTurtles`) is done per individual "id". The order of the who numbers returned follow the order of "id".
Value
Matrix (ncol = 2, nrow = n) with the first column pxcor and the second column pycor representing the coordinates of the selected patches from agents, or
Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the coordinates of the selected patches from agents, n per individual "id", or
AgentMatrix (nrow = n) representing the turtles selected from agents,
Integer. Vector of who numbers for the selected turtles from agents, n per individual "id".

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#n-of

Examples
# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
pSelect <- nOf(agents = patches(w1), n = 5)

# Turtles
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
tSelect <- nOf(agents = t1, n = 2)
Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#no-patches

Examples
p1 <- noPatches()
NLcount(p1)

---

**noTurtles**  
*No turtles*

Description
Report an empty turtle agentset.

Usage
noTurtles()

Value
AgentMatrix with the turtle variables defined as when using createTurtles() but with 0 turtle.

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#no-turtles
Examples

t1 <- noTurtles()
NLcount(t1)

Description

These are required to create plotting methods to work with quickPlot.

Usage

## S4 method for signature 'worldArray'
numLayers(x)

## S4 method for signature 'agentMatrix'
.plotGrob(
  grobToPlot,
  col = NULL,
  real = FALSE,
  size = unit(5, "points"),
  minv,
  maxv,
  legend = TRUE,
  legendText = NULL,
  length = NULL,
  gp = gpar(),
  gpText = gpar(),
  pch = 19,
  speedup = 1,
  name = character(),
  vp = list(),
  ...
)

## S4 method for signature 'worldArray'
layerNames(object)

## S4 method for signature 'worldArray,.quickPlotGrob'
.identifyGrobToPlot(toPlot, sGrob, takeFromPlotObj)
Arguments

x A .quickPlotObjects object or list of these.
grobToPlot Raster*, SpatialLines*, SpatialPoints*, or SpatialPolygons* object.
col Currently only used for the legend of a Raster* object.
real Logical indicating whether the data are real numbers (i.e., as opposed to integer or factor).
size The size of the SpatialPoints.
minv The minimum value on a Raster*. Required because not all Rasters have this defined internally.
maxv The maximum value on a Raster*. Required because not all Rasters have this defined internally.
legend Logical indicating whether a legend should be drawn. Default TRUE.
legendText Vector of values to use for legend value labels. Defaults to NULL which results in a pretty numeric representation. If Raster* has a Raster Attribute Table (rat; see raster package), this will be used by default. Currently, only a single vector is accepted.
length Numeric.
gp grid parameters, usually the output of a call to gpar.
gpText gpar object for legend label text.
pch Point character for SpatialPoints, as par.
speedup Numeric. The factor by which the number of vertices in SpatialPolygons and SpatialLines* will be subsampled. The vertices are already subsampled by default to make plotting faster.
name Character string of name of object being plotted.
vp whole viewport tree of quickPlotGrob
... Additional arguments. None currently implemented.
object A Raster*, SpatialPoints*, SpatialLines*, or SpatialPolygons* object; or list of these.
toPlot The object to plot. Should be a single layer if from a multi-layer object such as a RasterStack.
sGrob quickPlot grob object
takeFromPlotObj Logical. Should the data come from the argument passed into Plot (TRUE), or from the (.quickPlotEnv) (FALSE).
of

Values of an agents variable

Description

Report the agents values for the requested variable.

Usage

of(world, agents, var)

## S4 method for signature 'missing,agentMatrix,character'
of(agents, var)

## S4 method for signature 'worldMatrix,matrix,missing'
of(world, agents)

## S4 method for signature 'worldArray,matrix,character'
of(world, agents, var)

Arguments

world WorldMatrix or worldArray object.
agents Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
var Character. Vector of the names of the selected agents variables. If agents are patches and the world is a worldMatrix object, var must not be provided. If agents are patches and the world is a worldArray object, var is the name of the layers to use to define the patches values. If agents are turtles, var is some of the turtles' variable and can be any of the variables created when turtles were created, as well as any variable created with turtlesOwn().

Details

world must be provided only if agents are patches.

Value

Vector of values for the agents if one variable is requested. The class depends of the variable class. The order of the vector follows the order of the agents, or

Matrix or Dataframe (ncol = length(var), nrow = NLcount(agents)) if more than one variable is requested. The row order follows the order of the agents.

Author(s)

Sarah Bauduin
References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#of

Examples

# Patches
w1 <- createWorld(minPxcor = 0, maxXcor = 4, minYcor = 0, maxYcor = 4,
data = 1:25)
of(world = w1, agents = patch(w1, c(0, 0), c(4, 0)))

# Turtles
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
of(agents = t1, var = "heading")

oneOf

One random agent

Description

Report one patch or turtle randomly selected among agents.

Usage

oneOf(agents)

## S4 method for signature 'matrix'
oneOf(agents)

Arguments

agents Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or Matrix (ncol = 3) with the first column "pxcor and the second column pycor representing the patches coordinates and the third column id, or AgentMatrix object representing the moving agents, or Matrix (ncol = 2) with the first column whoTurtles and the second column id.
Details

If `agents` is a matrix with `ncol = 3`, the selection of one random patch is done per individual `id`. The order of the patches coordinates returned follow the order of `id`. If `agents` is a matrix (`ncol = 2`) with columns `whoTurtles` and `id`, the selection of one random turtle (defined by their `whoTurtles`) is done per individual `id`. The order of the `who` numbers returned follow the order of `id`.

Value

Matrix (`ncol = 2`, `nrow = 1`) with the first column `pxcor` and the second column `pycor` representing the coordinates of the selected patch from `agents`, or

Matrix (`ncol = 2`) with the first column `pxcor` and the second column `pycor` representing the coordinates of the selected patches from `agents`, one per individual `id`, or

AgentMatrix object representing the turtle selected from `agents`, or

Integer. Vector of `who` numbers for the selected turtles from `agents`, one per individual `id`.

Author(s)

Sarah Bauduain

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#one-of

Examples

# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
pSelect <- oneOf(agents = patches(w1))

# Turtles
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
tSelect <- oneOf(agents = t1)
other

Description

Report an agent set of the agents except specific ones.

Usage

other(agents, except)

## S4 method for signature 'matrix,matrix'
other(agents, except)

Arguments

agents    Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

except    Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

Details

Both agents and except must be of the same class (e.g., both patches or both turtles).

Warning: this function removes turtles only based on similar who numbers and breed names.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches in agents without the ones in except, or AgentMatrix representing the turtles in agents without the ones in except.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#other
Examples

# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
p1 <- other(agents = patches(w1), except = patch(w1, 0, 0))
NLcount(p1) # 99 patches

# Turtles
t1 <- createTurtles(n = 10, coords = cbind(xcor = 0, ycor = 0))
t2 <- other(agents = t1, except = turtle(t1, who = 0))
NLcount(t2) # 9 turtles

patch

<table>
<thead>
<tr>
<th>Patches coordinates</th>
</tr>
</thead>
</table>

Description

Report the coordinates of the patches at the given [x,y] locations.

Usage

patch(world, x, y, duplicate = FALSE, torus = FALSE, out = FALSE)

## S4 method for signature 'worldNLR,numeric,numeric'
patch(world, x, y, duplicate = FALSE, torus = FALSE, out = FALSE)

Arguments

- **world**: WorldMatrix or worldArray object.
- **x**: Numeric. Vector of x coordinates. Must be of same length as y.
- **y**: Numeric. Vector of y coordinates. Must be of same length as x.
- **duplicate**: Logical. If more than one location [x,y] fall into the same patch and duplicate == TRUE, the patch coordinates are returned the number of times the locations. If duplicate == FALSE, the patch coordinates are only returned once. Default is duplicate == FALSE.
- **torus**: Logical to determine if the world is wrapped. Default is torus = FALSE.
- **out**: Logical. If out = FALSE, no patch coordinates are returned for patches outside of the world’s extent, if out = TRUE, NA are returned. Default is out = FALSE.

Details

If a location [x,y] is outside the world’s extent and torus = FALSE and out = FALSE, no patch coordinates are returned; if torus = FALSE and out = TRUE, NA are returned; if torus = TRUE, the patch coordinates from a wrapped world are returned.
Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates at \([x, y]\).

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#patch

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
patch(world = w1, x = c(0, 9.1, 8.9, 5, 5.3), y = c(0, 0, -0.1, 12.4, 12.4))
patch(world = w1, x = c(0, 9.1, 8.9, 5, 5.3), y = c(0, 0, -0.1, 12.4, 12.4),
  duplicate = TRUE)
patch(world = w1, x = c(0, 9.1, 8.9, 5, 5.3), y = c(0, 0, -0.1, 12.4, 12.4),
  torus = TRUE)
patch(world = w1, x = c(0, 9.1, 8.9, 5, 5.3), y = c(0, 0, -0.1, 12.4, 12.4),
  torus = TRUE, duplicate = TRUE)
```

---

**patchAhead**

### Patches ahead

**Description**

Report the coordinates of the patches at the given distances of the turtles in the direction of their headings.

**Usage**

```r
patchAhead(world, turtles, dist, torus = FALSE)
```

## S4 method for signature 'worldNLR,agentMatrix,numeric'

```
patchAhead(world, turtles, dist, torus = FALSE)
```
Arguments

world  WorldMatrix or worldArray object.
turtles  AgentMatrix object representing the moving agents.
dist  Numeric. Vector of distances from the turtles. dist must be of length 1 or of length turtles.
torus  Logical to determine if the world is wrapped. Default is torus = FALSE.

Details

If torus = FALSE and the patch at distance dist of a turtle is outside the world’s extent, NA are returned for the patch coordinates. If torus = TRUE, the patch coordinates from a wrapped world are returned.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the coordinates of the patches at the distances dist and turtles’s headings directions of turtles. The order of the patches follows the order of the turtles.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#patch-ahead

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
patchAhead(world = w1, turtles = t1, dist = 1)
patchAt

Description

Report the coordinates of the patches at \((dx, dy)\) distances of the agents.

Usage

\[
\text{patchAt(\text{world}, \text{agents}, dx, dy, torus = FALSE)}
\]

## S4 method for signature 'worldNLR,matrix,numeric,numeric'
\[
\text{patchAt(\text{world}, \text{agents}, dx, dy, torus = FALSE)}
\]

Arguments

- **world**: WorldMatrix or worldArray object.
- **agents**: Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
- **dx**: Numeric. Vector of distances to the east (right) from the agents. If \(dx\) is negative, the distance to the west (left) is computed. \(dx\) must be of length 1 or of the same length as number of patches or turtles in agents.
- **dy**: Numeric. Vector of distances to the north (up) from the agents. If \(dy\) is negative, the distance to the south is computed (down). \(dy\) must be of length 1 or of the same length as number of patches or turtles in agents.
- **torus**: Logical to determine if the world is wrapped. Default is \(torus = \text{FALSE}\).

Details

If the patch at distance \((dx, dy)\) of an agent is outside of the world's extent and \(torus = \text{FALSE}\), NA are returned for the patch coordinates; if \(torus = \text{TRUE}\), the patch coordinates from a wrapped world are returned.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the coordinates of the patches at \((dx, dy)\) distances of the agents. The order of the patches follows the order of the agents.

Author(s)

Sarah Bauduin
**patchDistDir**

**References**


**See Also**

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#patch-at
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#at-points

**Examples**

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
patchCorner <- patchAt(world = w1, agents = patch(w1, 0, 0), dx = 1, dy = 1)
t1 <- createTurtles(n = 1, coords = cbind(xcor = 0, ycor = 0))
patchCorner <- patchAt(world = w1, agents = t1, dx = 1, dy = 1)
```

---

**patchDistDir**  
**Patches at given distances and directions**

**Description**

Report the coordinates of the patches at the given distances and directions from the agents.

**Usage**

```r
patchDistDir(world, agents, dist, angle, torus = FALSE)
```

**Arguments**

- `world`: WorldMatrix or worldArray object.
- `agents`: Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
- `dist`: Numeric. Vector of distances from the agents. Must be of length 1 or of the same length as the number of agents.
- `angle`: Numeric. Absolute directions from the agents. angle must be of length 1 or of the same length as the number of agents. Angles are in degrees with 0 being North.
- `torus`: Logical to determine if the world is wrapped. Default is torus = FALSE.
Details

If `torus = FALSE` and the patch at distance `dist` and direction `angle` of an agent is outside the world’s extent, NA are returned for the patch coordinates. If `torus = TRUE`, the patch coordinates from a wrapped world are returned.

If agents are turtles, their headings are not taken into account; the given directions `angle` are used. To find a patch at certain distance from a turtle using the turtle’s heading, look at `patchAhead()`, `patchLeft()` or `patchRight()`.

Value

Matrix (ncol = 2) with the first column `pxcor` and the second column `pycor` representing the coordinates of the patches at the distances `dist` and directions `angle` of agents. The order of the patches follows the order of the agents.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#patch-at-heading-and-distance

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
p1 <- patchDistDir(world = w1, agents = patch(w1, 0, 0), dist = 1, angle = 45)
t1 <- createTurtles(n = 1, coords = cbind(xcor = 0, ycor = 0), heading = 315)
p2 <- patchDistDir(world = w1, agents = t1, dist = 1, angle = 45)
```

patches

All the patches in a world

Description

Report the coordinates of all the patches in the world.

Usage

patches(world)

# S4 method for signature 'worldNLR'
patches(world)
Arguments

world WorldMatrix or worldArray object.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates. The order of the patches follows the order of the cells numbers as defined for a Raster* object.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#patches

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
allPatches <- patches(world = w1)
NLcount(allPatches) # 100 patches

Description

Report the coordinates of the patches under the turtles locations.

Usage

patchHere(world, turtles)

## S4 method for signature 'worldNLr,agentMatrix'
patchHere(world, turtles)

Arguments

world WorldMatrix or worldArray object.
turtles AgentMatrix object representing the moving agents.
Details

If a turtle is located outside of the world’s extent, NA are returned for the patch coordinates.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the coordinates of the patches at the turtles location. The order of the patches follows the order of the turtles.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#patch-here

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
patchHere(world = w1, turtles = t1)
Arguments

world  WorldMatrix or worldArray object.
turtles  AgentMatrix object representing the moving agents.
dist  Numeric. Vector of distances from the turtles. dist must be of length 1 or of length turtles.
angle  Numeric. Vector of angles in degrees by which the turtle’s headings should rotate to locate the patches. Must be of length 1 or of length turtles.
torus  Logical to determine if the world is wrapped. Default is torus = FALSE.

Details

If a given dist value is negative, then the turtle would look backward. If a given angle value is negative, then the turtle would look to the right.

If torus = FALSE and the patch at distance dist of a turtle and angle degrees to the left of its heading is outside the world’s extent, NA are returned for the patch coordinates. If torus = TRUE, the patch coordinates from a wrapped world are returned.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the coordinates of the patches at dist distances of the turtles and angle to the left of their headings. The order of the patches follows the order of the turtles.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#patch-lr-and-ahead

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
t1 <- createTurtles(n = 1, coords = cbind(xcor = 2, ycor = 2), heading = 90)
patchLeft(world = w1, turtles = t1, dist = 2, angle = 90)
Description

Report the coordinates of the patches at the given distances of the turtles and given angle right of their headings.

Usage

patchRight(world, turtles, dist, angle, torus = FALSE)

## S4 method for signature 'worldNLR,agentMatrix,numeric,numeric'
patchRight(world, turtles, dist, angle, torus = FALSE)

Arguments

world  
AgentMatrix or worldArray object.
turtles  
AgentMatrix object representing the moving agents.
dist  
Numeric. Vector of distances from the turtles. dist must be of length 1 or of length turtles.
angle  
Numeric. Vector of angles in degrees by which the turtle's headings should rotate to locate the patches. Must be of length 1 or of length turtles.
torus  
Logical to determine if the world is wrapped. Default is torus = FALSE.

Details

If a given dist value is negative, then the turtle would look backward. If a given angle value is negative, then the turtle would look to the left.

If torus = FALSE and the patch at distance dist of a turtle and angle degrees to the right of its heading is outside the world's extent, NA are returned for the patch coordinates. If torus = TRUE, the patch coordinates from a wrapped world are returned.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the coordinates of the patches at dist distances of the turtles and angle to the right of their headings. The order of the patches follows the order of the turtles.

Author(s)

Sarah Bauduin

References

patchSet

See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#patch-lr-and-ahead

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
t1 <- createTurtles(n = 1, coords = cbind(xcor = 2, ycor = 2), heading = 90)
patchRight(world = w1, turtles = t1, dist = 2, angle = 90)

patchSet  Patch set

Description

Report the patch coordinates of all the unique patches contained in the inputs.

Usage

patchSet(...)  

## S4 method for signature 'matrix'
patchSet(...)  

Arguments

...  Matrices (ncol = 2) of patches coordinates with the first column pxcor and the second column pycor.

Details

Duplicate patches among the inputs are removed in the returned matrix.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates.

Author(s)

Sarah Bauduin

References

**See Also**

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#patch-set

**Examples**

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
p1 <- patchAt(world = w1, agents = patch(w1, c(0,1,2), c(0,0,0)), dx = 1, dy = 1)
p2 <- patchDistDir(world = w1, agents = patch(w1, 0, 0), dist = 1, angle = 45)
p3 <- patch(world = w1, x = 4.3, y = 8)
p4 <- patchSet(p1, p2, p3)
```

---

<table>
<thead>
<tr>
<th>pExist</th>
<th>Do the patches exist?</th>
</tr>
</thead>
</table>

**Description**

Report TRUE if a patch exists inside the `world`'s extent, report FALSE otherwise.

**Usage**

```r
pExist(world, pxcor, pycor)
```

```r
## S4 method for signature 'worldNLR,numeric,numeric'
pExist(world, pxcor, pycor)
```

**Arguments**

- `world` WorldMatrix or worldArray object.
- `pxcor` Integer. Vector of patches `pxcor` coordinates. Must be of length 1 or of the same length as `pycor`.
- `pycor` Integer. Vector of patches `pycor` coordinates. Must be of length 1 or of the same length as `pxcor`.

**Value**

Logical.

**Author(s)**

Sarah Bauduin

**References**

See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#member

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
pExist(world = w1, pxcor = -1, pycor = 2)
```

Description

These pass to plot, as a matrix of points (`agentMatrix`), as a raster (`worldMatrix`), or a rasterStack (`worldArray`). They can be modified.

Usage

```r
## S3 method for class 'agentMatrix'
plot(x, ...)

## S3 method for class 'worldMatrix'
plot(x, ...)

## S3 method for class 'worldArray'
plot(x, ...)

## S3 method for class 'agentMatrix'
points(x, ...)
```

Arguments

- `x` an `agentMatrix`, `worldMatrix` or `worldArray` object
- `...` arguments passed to plot methods for matrix (`agentMatrix`) or raster (`world*`)

Value

none; invoked for side-effect of generating a plot.
Examples

# agentMatrix
newAgent <- new("agentMatrix",
  coords = cbind(pxcor = c(1, 2, 5), pycor = c(3, 4, 6)),
  char = letters[c(1, 2, 6)],
  nums2 = c(4.5, 2.6, 2343),
  char2 = LETTERS[c(4, 24, 3)],
  nums = 5:7)
plot(newAgent)

## worldMatrix
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9, data = 1:100)
plot(w1)

## worldArray
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = 1:25)
w2 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = 25:1)
w3 <- stackWorlds(w1, w2)
plot(w3)

# agentMatrix
newAgent <- new("agentMatrix",
  coords = cbind(pxcor = c(1, 2, 5), pycor = c(3, 4, 6)),
  char = letters[c(1, 2, 6)],
  nums2 = c(4.5, 2.6, 2343),
  char2 = LETTERS[c(4, 24, 3)],
  nums = 5:7)
points(newAgent)

PxcorPycorFromCell  Patches coordinates from cells numbers

Description

Report the patches coordinates pxcor and pycor given the cells numbers as defined for a Raster* object.

Usage

PxcorPycorFromCell(world, cellNum)

## S4 method for signature 'worldNLR,numeric'
PxcorPycorFromCell(world, cellNum)

Arguments

world  WorldMatrix or worldArray object.
cellNum  Integer. Vector of cells number.
randomPxcor

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor in the order of the given cellNum.

Author(s)

Sarah Bauduin

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
cellNum <- cellFromPxcorPycor(world = w1, pxcor = 0, pycor = 9)
PxcorPycorFromCell(world = w1, cellNum = cellNum)
cellNum <- cellFromPxcorPycor(world = w1, pxcor = c(0, 1, 2), pycor = 0)
PxcorPycorFromCell(world = w1, cellNum = cellNum)

randomPxcor  Random pxcor

Description

Report n random pxcor coordinates within the world’s extent.

Usage

randomPxcor(world, n)

## S4 method for signature 'worldNLR,numeric'
randomPxcor(world, n)

Arguments

world       WorldMatrix or worldArray object.
n            Integer.

Value

Integer. Vector of length n of pxcor coordinates.

Author(s)

Sarah Bauduin

References

randomPycor

See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#random-pcor

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
pxcor <- randomPxcor(world = w1, n = 10)
```

Description

Report \( n \) random pycor coordinates within the world's extent.

Usage

```r
randomPycor(world, n)
```

## S4 method for signature 'worldNLR,numeric'

```r
randomPycor(world, n)
```

Arguments

- `world`: WorldMatrix or worldArray object.
- `n`: Integer.

Value

Integer. Vector of length \( n \) of pycor coordinates.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#random-pcor
Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
pycor <- randomPycor(world = w1, n = 10)

randomXcor

---

**randomXcor**  **Random xcor**

Description

Report n random xcor coordinates within the world’s extent.

Usage

randomXcor(world, n)

## S4 method for signature 'worldNLR,numeric'
randomXcor(world, n)

Arguments

- world: WorldMatrix or worldArray object.
- n: Integer.

Value

Numeric. Vector of length n of xcor coordinates.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#random-cor
randomXYcor

Random turtles coordinates

Description
Report n random xcor and ycor coordinates within the world’s extent.

Usage
randomXYcor(world, n)

Arguments
world WorldMatrix or worldArray object.
n Integer.

Value
Matrix (ncol = 2, nrow = n) with the first column xcor and the second column ycor.

Examples
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
               data = runif(25))
t1 <- createTurtles(n = 10, coords = cbind(xcor = randomXcor(world = w1, n = 10),
               ycor = randomYcor(world = w1, n = 10)))
plot(w1)
points(t1, col = of(agents = t1, var = “color”), pch = 16)
randomYcor

randomYcor  Random ycor

Description

Report n random ycor coordinates within the world's extent.

Usage

randomYcor(world, n)

## S4 method for signature 'worldNLR,numeric'
randomYcor(world, n)

Arguments

world  WorldMatrix or worldArray object.

n  Integer.

Value

Numeric. Vector of length n of ycor coordinates.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#random-cor

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
data = runif(25))
t1 <- createTurtles(n = 10, coords = cbind(xcor = randomXcor(world = w1, n = 10),
ycor = randomYcor(world = w1, n = 10)))
plot(w1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)
raster2world

Convert a Raster object into a worldMatrix or worldArray object

Description

Convert a RasterLayer object into a worldMatrix object or a RasterStack object into a worldArray object.

Usage

raster2world(raster)

## S4 method for signature 'RasterLayer'
raster2world(raster)

## S4 method for signature 'RasterStack'
raster2world(raster)

Arguments

raster 
RasterLayer or RasterStack object.

Details

See help("worldMatrix-class") or help("worldArray-class") for more details on the classes. The number of rows and columns, as well as the cell values of the raster are kept the same. However, to match the coordinates system and resolution of a worldMatrix or worldArray, the grid is shifted by a 1/2 cell to have round coordinate values at the center of the patches and patch size is equal to (1,1). The bottom left corner cell coordinates of the worldMatrix or worldArray will be (pxcor = 0, pycor = 0).

Value

WorldMatrix or worldArray object depending on the input raster. Patches value are retained from the raster.

Author(s)

Sarah Bauduin

Examples

r1 <- raster(extent(c(0, 10, 0, 10)), nrows = 10, ncols = 10)
r1[]<-runif(100)
w1 <- raster2world(r1)
plot(r1)
plot(w1)
right

Rotate to the right

Description

Rotate the turtles's headings to the right of angle degrees.

Usage

right(turtles, angle)

## S4 method for signature 'agentMatrix,numeric'
right(turtles, angle)

Arguments

turtlesAgentMatrix object representing the moving agents.
angleNumeric. Vector of angles in degrees by which to rotate the turtles' headings. Must be of length 1 or of length turtles.

Details

If a given angle value is negative, then the turtle rotates to the left.

Value

AgentMatrix representing the turtles with updated heading values.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#right
Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
t1 <- createTurtles(n = 10, world = w1)
of(agents = t1, var = "heading")
t1 <- right(turtles = t1, angle = 180)
of(agents = t1, var = "heading")
```

---

**setXY**

### Set turtles' locations

**Description**

Set the turtles xcor and ycor coordinates.

**Usage**

```r
setXY(turtles, xcor, ycor, world, torus = FALSE)
```

### S4 method for signature 'agentMatrix,numeric,numeric,missing,ANY'

```r
setXY(turtles, xcor, ycor, torus)
```

### S4 method for signature 'agentMatrix,numeric,numeric,worldNLR,logical'

```r
setXY(turtles, xcor, ycor, world, torus = FALSE)
```

**Arguments**

- **turtles**  
  AgentMatrix object representing the moving agents.
- **xcor**  
  Numeric. Vector of x coordinates. Must be of length 1 or of length turtles.
- **ycor**  
  Numeric. Vector of y coordinates. Must be of length 1 or of length turtles.
- **world**  
  WorldMatrix or worldArray object.
- **torus**  
  Logical to determine if the world is wrapped. Default is torus = FALSE.

**Details**

world must be provided only if torus = TRUE.

If the given coordinates [xcor,ycor] are located outside of the world's extent and torus = TRUE, then the coordinates assigned to the turtle are the ones from a wrapped word; if torus = FALSE, the turtle is located outside of the world's extent with the given coordinates.

**Value**

AgentMatrix representing the turtles with updated coordinates and updated data for their previous coordinates prevX and prevY.
show,agentMatrix-method

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#setxy

Examples
```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9,
data = runif(100))
t1 <- createTurtles(n = 5, coords = randomXYcor(w1, n = 5))
plot(w1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)

r1 <- setXY(turtles = t1, xcor = 1:5, ycor = 1:5)
points(r1, col = of(agents = r1, var = "color"), pch = 16)
```

---

**show,agentMatrix-method**

*Key base R functions for agentMatrix class*

**Description**

Slight modifications from the default versions.

**Usage**

```r
## S4 method for signature 'agentMatrix'
show(object)

## S4 method for signature 'agentMatrix'
length(x)

## S4 method for signature 'agentMatrix'
nrow(x)

## S3 method for class 'agentMatrix'
head(x, n = 6L, ...)  

## S3 method for class 'agentMatrix'
tail(x, n = 6L, ...)
```
Arguments

object  An agentMatrix object.
x      An agentMatrix object
n      an integer vector of length up to dim(x) (or 1, for non-dimensioned objects).
... arguments to be passed to or from other methods (currently, none used).

Value

show returns an invisible NULL. length returns a non-negative integer of length 1, except for vectors of more than $2^{31} - 1$ elements, when it returns a double. nrow returns an integer of length 1 or NULL.

An agentMatrix object, like x, but generally smaller.

---

show,worldArray-method

Key base R functions for worldNLR classes

Description

Slight modifications from the default versions.

Usage

```r
## S4 method for signature 'worldArray'
show(object)
```

```r
## S4 method for signature 'worldMatrix'
show(object)
```

Arguments

object  An agentMatrix object.

---

sortOn  Sort agents

Description

Return the agents sorted according to their value.
sortOn

Usage

sortOn(agents, world, var)

## S4 method for signature 'matrix,worldMatrix,missing'
sortOn(agents, world)

## S4 method for signature 'matrix,worldArray,character'
sortOn(agents, world, var)

## S4 method for signature 'agentMatrix,missing,character'
sortOn(agents, var)

Arguments

agents  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
world   WorldMatrix or worldArray object.
var     Character. The name of the selected agents variable. If agents are patches and the world is a worldMatrix object, var must not be provided. If agents are patches and the world is a worldArray object, var is the name of the layer to use to define the patches values. If agents are turtles, var is one of the turtles' variable and can be equal to xcor, ycor, any of the variables created when turtles were created, as well as any variable created using turtlesOwn().

Details

world must not be provided if agents are turtles.

The sorting of the agents is done in a increasing order.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the coordinates of the patches sorted according to their values, if agents are patches, or AgentMatrix representing the turtles sorted according to their var values, if agents are turtles.

Author(s)

Sarah Bauduin

References

spdf2turtles

From SpatialPointsDataFrame to agentMatrix

Description

Convert a SpatialPointsDataFrame object into an agentMatrix object.

Usage

spdf2turtles(spdf)

## S4 method for signature 'SpatialPointsDataFrame'
spdf2turtles(spdf)

Arguments

spdf SpatialPointsDataFrame object representing moving agents.

Details

If the spdf does not contain the variables created with createTurtles(), these variables will be created with the default values as in createTurtles().

Value

AgentMatrix object representing the moving agents (coordinates and data) as contained in spdf.

Author(s)

Sarah Bauduin
Examples

```r
sp1 <- SpatialPointsDataFrame(coords = cbind(x = c(1, 2, 3), y = c(1, 2, 3)),
                               data = cbind.data.frame(age = c(0, 0, 3),
                                                      sex = c("F", "F", "M")))
t1 <- spdf2turtles(spdf = sp1)
```

---

**sprou**  
_Sprout new turtles_

**Description**

Create n new turtles on specific patches.

**Usage**

```r
sprout(n, patches, breed, heading, color, turtles)
```

## S4 method for signature 'numeric, matrix'

```r
sprout(n, patches, breed, heading, color, turtles)
```

**Arguments**

- **n**: Integer. Vector of length 1 or of length the number of patches. Number of new turtles to create on each patch.
- **patches**: Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates.
- **breed**: Character. Vector of breed names. Must be of length 1 or of length the number of patches. If missing, breed = turtle for all the sprouted turtles.
- **heading**: Numeric. Vector of values between 0 and 360. Must be of length 1 or of length the number of patches. If missing, a random heading is assigned to each sprouted turtle.
- **color**: Character. Vector of color names. Must be of length 1, of length the number of patches or of length `sum(n)`. If missing, colors are assigned using the function `rainbow(n)`.
- **turtles**: AgentMatrix object representing the moving agents.

**Details**

nrow(patches) must be equal to 1 or to n.

If turtles is provided, the new turtles are added to the turtles when returned. The who numbers of the sprouted turtles therefore follow the ones from the turtles. All new sprouted turtles are placed at the end of the agentMatrix object. If no turtles is provided, a new agentMatrix is created and the who numbers start at 0.

If turtles is provided and had additional variables created with `turtlesOwn()`, NA is given for these variables for the new sprouted turtles.
Value

AgentMatrix including the new sprouted turtles.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#sprout

Examples

t1 <- sprout(patches = cbind(pxcor = 2, pycor = 2), n = 3)
t2 <- sprout(patches = cbind(pxcor = 3, pycor = 3), n = 3, turtles = t1)

stackWorlds

Description

Stack multiple worldMatrix into a worldArray.

Usage

stackWorlds(...)

## S4 method for signature 'worldMatrix'
stackWorlds(...)

Arguments

... worldMatrix objects. If passed as unnamed objects, then the function will attempt to use their object names as layer names. Alternatively, to be more reliable, these can be passed as named arguments. See examples.

Details

The worldMatrix objects must all have the same extents.
**Value**

worldArray object.

**Author(s)**

Sarah Bauduin

**Examples**

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = 1:25)
w2 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = 25:1)
w3 <- stackWorlds(w1, w2)
plot(w3)

# pass named arguments to specify a different name than the object name
w4 <- stackWorlds(layer1 = w1, layer2 = w2)
```

---

**Description**

Compute the difference between headings.

**Usage**

```r
subHeadings(angle1, angle2, range360 = FALSE)
```

---

**Arguments**

- `angle1`: AgentMatrix object representing the moving agents, or Numeric. Vector of angles.
- `angle2`: AgentMatrix object representing the moving agents, or Numeric. Vector of angles.
range360 Logical. If range360 = TRUE, returned values are between 0 and 360 degrees; if range360 = FALSE, returned values are between -180 and 180 degrees. Default is range360 = FALSE.

Details

This function does the opposite as the one in NetLogo where angle1 is the target heading. angle1 and angle2 must be of the same length or if different, one of them must be of length 1. Positive values mean clockwise rotations, negative value mean counterclockwise rotations.

Value

Numeric. Vector of the smallest angles in degrees by which angle1 could be rotated to produce angle2 (i.e., the target heading).

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#subtract-headings

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
t1 <- createOTurtles(n = 10, world = w1)
subHeadings(angle1 = t1, angle2 = 0)
### tExist

#### Usage

```r
tExist(turtles, who, breed)
```

#### Arguments

- **turtles**  
  AgentMatrix object representing the moving agents.
- **who**  
  Integer. Vector of the who numbers for the selected turtles.
- **breed**  
  Characters. Vector of breed names for the selected turtles. If missing, there is no distinction based upon breed.

#### Value

Logical. Vector of TRUE or FALSE if the who numbers with any of the breed, if provided, exist or not inside the turtles.

#### Author(s)

Sarah Bauduin

#### References


#### See Also

[https://ccl.northwestern.edu/netlogo/docs/dictionary.html#member](https://ccl.northwestern.edu/netlogo/docs/dictionary.html#member)

#### Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10),
  breed = c(rep("sheep", 5), rep("wolf", 5)))
tExist(turtles = t1, who = 3, breed = "sheep")
tExist(turtles = t1, who = 9, breed = "sheep")
tExist(turtles = t1, who = 9, breed = c("sheep", "wolf"))
tExist(turtles = t1, who = c(3, 9))
```
Towards

Directions towards

Description

Report the directions of each agents towards each corresponding agents2.

Usage

towards(agents, agents2, world, torus = FALSE)

## S4 method for signature 'matrix,matrix'
towards(agents, agents2, world, torus = FALSE)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>agents</td>
<td>Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.</td>
</tr>
<tr>
<td>agents2</td>
<td>Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents, or Matrix (ncol = 2) with the first column x and the second column y representing locations coordinates.</td>
</tr>
<tr>
<td>world</td>
<td>WorldMatrix or worldArray object.</td>
</tr>
<tr>
<td>torus</td>
<td>Logical to determine if the world is wrapped. Default is torus = FALSE.</td>
</tr>
</tbody>
</table>

Details

agents and agents2 must have the same number of agents/locations or if different, one of them must have only one agent/location. If agents and agents2 have the same number of agents/locations, the directions are calculated for each pair agents[i] and agents2[i] and not for each agents towards every single agents2.

If torus = FALSE, world does not need to be provided.

If torus = TRUE and the distance from one agents to its corresponding agents2 is smaller around the sides of the world than across it, then the direction to agents2 going around the sides of the world is returned.

The direction from a patch to its location returns 0; the direction from a turtle to its location returns the turtle’s heading.

Value

Numeric. Vector of angles in degrees of length equal to the largest number of agents/locations between agents and agents2.
turtle

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#towards
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#towardsxy

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4)
towards(agents = patches(w1), agents2 = cbind(x = 0, y = 0))
t1 <- createTurtles(n = 10, world = w1)
towards(agents = t1, agents2 = cbind(x = 0, y = 0))
```

turtle

Select turtles

Description

Report the individuals among turtles based on their who numbers and breed.

Usage

```
turtle(turtles, who, breed)
```

## S4 method for signature 'agentMatrix,numeric,missing'
turtle(turtles, who)

## S4 method for signature 'agentMatrix,numeric,character'
turtle(turtles, who, breed)

Arguments

- **turtles**: AgentMatrix object representing the moving agents.
- **who**: Integer. Vector of the who numbers for the selected turtles.
- **breed**: Characters. Vector of breed names for the selected turtles. If missing, there is no distinction based upon breed.
Details

If no turtle matches the given who numbers, with potentially one of the given breed, inside turtles, then an empty agentMatrix is returned.

If there are duplicates who numbers among the turtles, the first matching turtle with the requested who number is returned.

Value

AgentMatrix of the selected turtles sorted in the order of the who numbers requested. If breed was provided, the turtles selected are of one of the breed.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#turtle

Examples

w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
t2 <- turtle(t1, who = 2)

---

### turtles2spdf

*From agentMatrix to SpatialPointsDataFrame*

**Description**

Convert an agentMatrix object into a SpatialPointsDataFrame object.

**Usage**

```r
turtles2spdf(turtles)
```

```r
## S4 method for signature 'agentMatrix'
turtles2spdf(turtles)
```
**Arguments**

- **turtles**  
  AgentMatrix object representing the moving agents.

**Value**

SpatialPointsDataFrame object representing the moving agents (coordinates and data) as contained in turtles.

**Author(s)**

Sarah Bauduin

**Examples**

```r
  t1 <- createTurtles(n = 10, coords = cbind(xcor = 1:10, ycor = 1:10))
  sp1 <- turtles2spdf(turtles = t1)
```

**Description**

Report the individuals among turtles that are located on the patches at \((dx, dy)\) distances of the agents.

**Usage**

```r
  turtlesAt(world, turtles, agents, dx, dy, breed, torus = FALSE)
```

## S4 method for signature 'worldNLR,agentMatrix,matrix,numeric,numeric,missing'

```r
  turtlesAt(world, turtles, agents, dx, dy, torus)
```

## S4 method for signature 'worldNLR,agentMatrix,matrix,numeric,numeric,character'

```r
  turtlesAt(world, turtles, agents, dx, dy, breed, torus = FALSE)
```

**Arguments**

- **world**  
  WorldMatrix or worldArray object.

- **turtles**  
  AgentMatrix object representing the moving agents.

- **agents**  
  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.
dx  Numeric. Vector of distances to the east (right) from the agents. If dx is negative, the distance to the west (left) is computed. dx must be of length 1 or of the same length as number of patches or turtles in agents.

dy  Numeric. Vector of distances to the north (up) from the agents. If dy is negative, the distance to the south is computed (down). dy must be of length 1 or of the same length as number of patches or turtles in agents.

breed  Characters. Vector of breed names for the selected turtles. If missing, there is no distinction based upon breed.

torus  Logical to determine if the world is wrapped. Default is torus = FALSE.

Details
If the patch at distance (dx,dy) of an agent is outside of the world’s extent and torus = FALSE, no turtle is returned; if torus = TRUE, the turtle located on the patch whose coordinates are defined from the wrapped world is returned.

Value
AgentMatrix representing the individuals among turtles of any of the given breed, if specified, which are located on the patches at (dx,dy) distances of the agents.

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#turtles-at
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#at-points

Examples
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
t1 <- createTurtles(n = 10, coords = cbind(xcor = 0:9, ycor = 0:9),
breed = c(rep("sheep", 5), rep("wolf", 5)))
t2 <- turtlesAt(world = w1, turtles = t1, agents = turtle(t1, who = 0),
    dx = 1, dy = 1)
t3 <- turtlesAt(world = w1, turtles = t1,
    agents = patch(w1, c(3,4,5), c(3,4,5)), dx = 1, dy = 1,
    breed = "sheep")
turtleSet  

Create a turtle agentset

Description

Report a turtle agentset containing all unique turtles provided in the inputs.

Usage

turtleSet(...)

## S4 method for signature 'agentMatrix'
turtleSet(...)  

Arguments

...  

AgentMatrix objects representing the moving agents.

Details

Duplicated turtles are identified based only on their who numbers. The turtle chosen for a who number is the first one given in the inputs. To keep all turtles from the inputs, use NLset() to reassign who numbers in some of the inputs, prior using turtleSet(), to avoid turtles with duplicated who numbers.

Value

AgentMatrix object containing all the unique turtles.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#turtle-set
Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9)
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10), breed = "sheep")
t2 <- createTurtles(n = 2, coords = randomXYcor(w1, n = 2), breed = "wolf")
t2 <- NLset(turtles = t2, agents = t2, var = "who", val = c(10, 11))
t3 <- createTurtles(n = 1, coords = randomXYcor(w1, n = 1), breed = "sheperd")
t3 <- NLset(turtles = t3, agents = t3, var = "who", val = 12)
t4 <- turtleSet(t1, t2, t3)
```

---

`turtlesOn`  
*Turtles on*

Description

Report the individuals among turtles that are on the same patches as the agents.

Usage

`turtlesOn(world, turtles, agents, breed, simplify = TRUE)`

```r
### S4 method for signature 'worldNLR,agentMatrix,matrix,missing'
turtlesOn(world, turtles, agents, simplify)
```

```r
### S4 method for signature 'worldNLR,agentMatrix,matrix,character'
turtlesOn(world, turtles, agents, breed, simplify = TRUE)
```

Arguments

- `world` *WorldMatrix or worldArray object.*
- `turtles` *AgentMatrix object representing the moving agents.*
- `agents` *Matrix (ncol = 2) with the first column `pxcor` and the second column `pycor` representing the patches coordinates, or AgentMatrix object representing the moving agents.*
- `breed` *Characters. Vector of breed names for the selected turtles. If missing, there is no distinction based upon breed.*
- `simplify` *Logical. If `simplify = TRUE`, all turtles on the same patches as any agents are returned; if `simplify = FALSE`, the turtles are evaluated for each agents's patches individually.*

Details

The agents must be located inside the `world`'s extent.
Value

AgentMatrix representing any individuals from turtles of any of the given breed, if specified, located on the same patches as any of the agents, if simplify = TRUE, or Matrix (ncol = 2) with the first column whoTurtles and the second column id showing which turtles are on the same patches as which agents represented by id, if simplify = FALSE. id represents and follows the order of the agents. id does not represent the who numbers of the agents if agents are turtles.

Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#turtles-on

Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9,
data = runif(100))
t1 <- createTurtles(n = 500, coords = randomXYcor(w1, n = 500))
plot(w1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)

t2 <- turtlesOn(world = w1, turtles = t1, agents = patch(w1, 2, 2))
```

turtlesOwn

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a new variable for the turtles.</td>
</tr>
</tbody>
</table>

Usage

turtlesOwn(turtles, tVar, tVal)

## S4 method for signature 'agentMatrix,character,missing'
turtlesOwn(turtles, tVar)

## S4 method for signature 'agentMatrix,character,ANY'
turtlesOwn(turtles, tVar, tVal)
**Arguments**

- **turtles**
  AgentMatrix object representing the moving agents.
- **tVar**
  Character. the name of the turtles variable to create.
- **tVal**
  Vector representing the values of tVar. Must be of length 1 or of length turtles. If missing, NA is given.

**Value**

AgentMatrix representing the turtles with the new variable tVar added.

**Author(s)**

Sarah Bauduin

**References**


**See Also**

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#turtles-own

**Examples**

```r
  t1 <- createTurtles(n = 5, coords = cbind(xcor = 0, ycor = 0))
  t1 <- turtlesOwn(turtles = t1, tVar = "sex", tVal = c("F", "F", "F", "M", "M"))
```

---

**updateList**

*Update elements of a named list with elements of a second named list*

**Description**

Merge two named list based on their named entries. Where any element matches in both lists, the value from the second list is used in the updated list. Subelements are not examined and are simply replaced. If one list is empty, then it returns the other one, unchanged.

**Usage**

```r
  updateList(x, y)
```

```r
  ## S4 method for signature 'list,list'
  updateList(x, y)

  ## S4 method for signature `'\'NULL\',list'`
```
updateList(x, y)
## S4 method for signature 'list,`NULL`
updateList(x, y)
## S4 method for signature `NULL`,`NULL`
updateList(x, y)

Arguments

x, y  a named list

Value

A named list, with elements sorted by name. The values of matching elements in list y replace the values in list x.

Author(s)

Alex Chubaty

Examples

L1 <- list(a = "hst", b = NA_character_, c = 43)
L2 <- list(a = "gst", c = 42, d = list(letters))
updateList(L1, L2)

updateList(L1, NULL)
updateList(NULL, L2)
updateList(NULL, NULL)  # should return empty list

Description

Move uphill

Usage

uphill(world, pVar, turtles, nNeighbors, torus = FALSE)
## S4 method for signature 'worldMatrix,missing,agentMatrix,numeric'
uphill(world, turtles, nNeighbors, torus)
## S4 method for signature 'worldArray,character,agentMatrix,numeric'
uphill(world, pVar, turtles, nNeighbors, torus = FALSE)
Arguments

world  WorldMatrix or worldArray object.
pVar  Character. If the world is a worldArray object, pVar is the name of the layer to use to define the patches values. pVar must not be provided if the world is a worldMatrix object.
turtles  AgentMatrix object representing the moving agents.
nNeighbors  Integer: 4 or 8. Represents the number of neighbor patches considered.
torus  Logical to determine if the world is wrapped. Default is torus = FALSE.

Details

If no neighboring patch has a larger value than the patch where the turtle is currently located on, the turtle stays on this patch. It still moves to the patch center if it was not already on it.

If there are multiple neighboring patches with the same highest value, the turtle chooses one patch randomly.

If a turtle is located on a patch on the edge of the world and torus = FALSE, it has fewer neighboring patches as options to move than nNeighbors; if torus = TRUE, the turtle can move on the other side of the world to move uphill and its choice of neighboring patches is always equals to nNeighbors.

Value

AgentMatrix representing the turtles with updated coordinates and updated data for their heading values and previous coordinates prevX and prevY.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#uphill

Examples

w1 <- createWorld(minPxcor = 1, maxPxcor = 10, minPycor = 1, maxPycor = 10, data = runif(100))
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10))
plot(w1)
points(t1, col = of(agents = t1, var = "color"), pch = 16)

t1 <- uphill(world = w1, turtles = t1, nNeighbors = 8)
points(t1, col = of(agents = t1, var = "color"), pch = 16)
withMax

| withMax | Agents with maximum |

**Description**

Report the patches or turtles among agents which have their variable equals to the maximum value.

**Usage**

```r
withMax(agents, world, var)
```

## S4 method for signature 'matrix,worldMatrix,missing'

```r
withMax(agents, world)
```

## S4 method for signature 'matrix,worldArray,character'

```r
withMax(agents, world, var)
```

## S4 method for signature 'agentMatrix,missing,character'

```r
withMax(agents, var)
```

**Arguments**

- **agents**
  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

- **world**
  WorldMatrix or worldArray object.

- **var**
  Character. The name of the selected agents variable. If agents are patches and the world is a worldMatrix object, var must not be provided. If agents are patches and the world is a worldArray object, var is the name of the layer to use to define the patches values. If agents are turtles, var is one of the turtles’ variable and can be equal to xcor, ycor, any of the variables created when turtles were created, as well as any variable created using turtlesOwn().

**Details**

world must not be provided if agents are turtles.

**Value**

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the coordinates of the patches among the agents which have their variable equal to the maximum value among the agents, or AgentMatrix representing the turtles among the agents which have their variable var equal to the maximum value among the agents.
Author(s)
Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#with-max

Examples

# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4,
    data = sample(1:5, size = 25, replace = TRUE))
plot(w1)
p1 <- withMax(agents = patches(w1), world = w1)

# Turtles
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10),
    heading = sample(1:3, size = 10, replace = TRUE))
t2 <- withMax(agents = t1, var = "heading")

withMin

Agents with minimum

Description
Report the patches or turtles among agents which have their variable equals to the minimum value.

Usage

withMin(agents, world, var)

## S4 method for signature 'matrix,worldMatrix,missing'
withMin(agents, world)

## S4 method for signature 'matrix,worldArray,character'
withMin(agents, world, var)

## S4 method for signature 'agentMatrix,missing,character'
withMin(agents, var)
Arguments

agents  Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the patches coordinates, or AgentMatrix object representing the moving agents.

world  WorldMatrix or worldArray object.

var  Character. The name of the selected agents variable. If agents are patches and the world is a worldMatrix object, var must not be provided. If agents are patches and the world is a worldArray object, var is the name of the layer to use to define the patches values. If agents are turtles, var is one of the turtles’ variable and can be equal to xcor, ycor, any of the variables created when turtles were created, as well as any variable created using turtlesOwn().

Details

world must not be provided if agents are turtles.

Value

Matrix (ncol = 2) with the first column pxcor and the second column pycor representing the coordinates of the patches among the agents which have their variable equal to the minimum value among the agents, or AgentMatrix representing the turtles among the agents which have their variable var equal to the minimum value among the agents.

Author(s)

Sarah Bauduin

References


See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#with-min

Examples

# Patches
w1 <- createWorld(minPxcor = 0, maxPxcor = 4, minPycor = 0, maxPycor = 4, data = sample(1:5, size = 25, replace = TRUE))
plot(w1)
p1 <- withMin(agents = patches(w1), world = w1)

# Turtles
t1 <- createTurtles(n = 10, coords = randomXYcor(w1, n = 10),
                   heading = sample(1:3, size = 10, replace = TRUE))
`world2raster <- withMin(agents = t1, var = "heading")`

### world2raster

Convert a `worldMatrix` or `worldArray` object into a Raster* object

#### Description

Convert a `worldMatrix` object into a RasterLayer object or a `worldArray` object into a RasterStack object

#### Usage

```r
world2raster(world)
```

```r
## S4 method for signature 'worldMatrix'
world2raster(world)
```

```r
## S4 method for signature 'worldArray'
world2raster(world)
```

#### Arguments

- `world` WorldMatrix or worldArray object.

#### Details

The Raster* returned has the same extent and resolution as the world with round coordinates at the center of the cells and coordinates x.5 at the edges of the cells.

#### Value

RasterLayer or RasterStack object depending on the input world. Patches value are retained from the world.

#### Author(s)

Sarah Bauduin

#### Examples

```r
w1 <- createWorld(minPxcor = 0, maxPxcor = 9, minPycor = 0, maxPycor = 9, data = runif(100))
r1 <- world2raster(w1)
plot(r1)
```
The worldArray class

Description

This is an s4 class extension of array. It is a collection of several worldMatrix objects with the same extent (i.e., same values for all their slots) stacked together. It is used to keep more than one value per patch.

Author(s)

Sarah Bauduin, Eliot McIntire, and Alex Chubaty

See Also

worldMatrix

worldHeight

Description

Report the height of the world in patch number.

Usage

worldHeight(world)

## S4 method for signature 'worldNLR'
worldHeight(world)

Arguments

world WorldMatrix or worldArray object.

Value

Integer.

Author(s)

Sarah Bauduin

References

See Also
https://ccl.northwestern.edu/netlogo/docs/dictionary.html#world-dim

Examples

```r
w1 <- createWorld()
worldHeight(w1)
```

Description

This is an s4 class extension of matrix with 7 additional slots. A worldMatrix object can be viewed as a grid composed of squared patches (i.e., matrix cells). Patches have two spatial coordinates pxcor and pycor, representing the location of their center. pxcor and pycor are always integer and increment by 1. pxcor increases as you move right and pycor increases as you move up. pxcor and pycor can be negative if there are patches to the left or below the patch [pxcor = 0, pycor = 0].

Details

The first four slots of the worldMatrix are: minPxcor, maxPxcor, minPycor, maxPycor which represent the minimum and maximum patches coordinates in the worldMatrix. The slot extent is similar to a Raster* extent. Because pxcor and pycor represent the spatial location at the center of the patches and the resolution of them is 1, the extent of the worldMatrix is equal to xmin = minPxcor -0.5, xmax = maxPxcor + 0.5, ymin = minPycor -0.5, and ymax = maxPycor + 0.5. The number of patches in a worldMatrix is equal to ((maxPxcor -minPxcor) + 1) * ((maxPycor -minPycor) + 1). The slot res is equal to 1 as it is the spatial resolution of the patches. The last slot pCoords is a matrix representing the patches coordinates of all the matrix cells in the order of cells in a Raster* (i.e., by rows).

Careful: The methods [] and [] <- retrieve or assign values for the patches in the given order of the patches coordinates provided. When no patches coordinates are provided, the values retrieved or assigned is done in the order of the cell numbers as defined in in Raster* objects (i.e., by rows).

Author(s)

Sarah Bauduin, Eliot McIntire, and Alex Chubaty

References

The `worldNLR` class is the union of the `worldMatrix` and `worldArray` classes. Mostly used for building function purposes.

**Author(s)**
Sarah Bauduin, and Eliot McIntire

**worldWidth**

Report the width of the world in patch number.

**Usage**

```r
worldWidth(world)
```

**Arguments**

- `world`  
  WorldMatrix or worldArray object.

**Value**

Integer.

**Author(s)**
Sarah Bauduin

**References**

wrap

Wrap coordinates or pixels in a torus-like fashion

Description

Generally for model development purposes.

Usage

wrap(obj, bounds, withHeading)

## S4 method for signature 'matrix,Extent,missing'
wrap(obj, bounds)

## S4 method for signature 'SpatialPoints,ANY,missing'
wrap(obj, bounds)

## S4 method for signature 'matrix,Raster,missing'
wrap(obj, bounds)

## S4 method for signature 'matrix,Raster,missing'
wrap(obj, bounds)

## S4 method for signature 'matrix,matrix,missing'
wrap(obj, bounds)

## S4 method for signature 'SpatialPointsDataFrame,Extent,logical'
wrap(obj, bounds, withHeading)

## S4 method for signature 'SpatialPointsDataFrame,Raster,logical'
wrap(obj, bounds, withHeading)

## S4 method for signature 'SpatialPointsDataFrame,matrix,logical'
wrap(obj, bounds, withHeading)

See Also

https://ccl.northwestern.edu/netlogo/docs/dictionary.html#world-dim

Examples

w1 <- createWorld()
worldWidth(w1)
Arguments

obj A SpatialPoints* object, or matrix of coordinates.

bounds Either a Raster*, Extent, or bbox object defining bounds to wrap around.

withHeading Logical. If TRUE, then the previous points must be wrapped also so that the subsequent heading calculation will work. Default FALSE. See details.

Details

If withHeading used, then obj must be a SpatialPointsDataFrame that contains two columns, x1 and y1, with the immediately previous agent locations.

Value

Same class as obj, but with coordinates updated to reflect the wrapping.

Author(s)

Eliot McIntire

Examples

library(quickPlot)
library(raster)

xrange <- yrange <- c(-50, 50)
hab <- raster(extent(c(xrange, yrange)))
hab[] <- 0

# initialize agents
N <- 10

# previous points
x1 <- rep(0, N)
y1 <- rep(0, N)
# initial points
starts <- cbind(x = stats::runif(N, xrange[1], xrange[2]),
y = stats::runif(N, yrange[1], yrange[2]))

# create the agent object
agent <- SpatialPointsDataFrame(coords = starts, data = data.frame(x1, y1))

ln <- rlnorm(N, 1, 0.02) # log normal step length
sd <- 50 # could be specified globally in params

if (interactive()) {
clearPlot()
Plot(hab, zero.color = "white", axes = "L")
}
if (requireNamespace("SpaDES.tools")) {
for (i in 1:10) {
agent <- SpaDES.tools::crw(agent = agent,
    extent = extent(hab), stepLength = ln,
    stddev = sd, lonlat = FALSE, torus = TRUE)
if (interactive()) Plot(agent, addTo = "hab", axes = TRUE)
}

[ Extract or Replace Parts of an Object ]

Description

Operators acting on vectors, matrices, arrays and lists to extract or replace parts.

Usage

```r
## S4 method for signature 'worldMatrix,numeric,numeric,ANY'
x[i, j, ..., drop = TRUE]

## S4 method for signature 'worldMatrix,missing,missing,ANY'
x[i, j, ..., drop = TRUE]

## S4 replacement method for signature 'worldMatrix,numeric,numeric,ANY'
x[i, j] <- value

## S4 replacement method for signature 'worldMatrix,missing,missing,ANY'
x[i, j] <- value

## S4 method for signature 'worldArray,numeric,numeric,ANY'
x[i, j, ..., drop = TRUE]

## S4 method for signature 'worldArray,missing,missing,ANY'
x[i, j, ..., drop = TRUE]

## S4 replacement method for signature 'worldArray,numeric,numeric,matrix'
x[i, j] <- value

## S4 replacement method for signature 'worldArray,missing,missing,matrix'
x[i, j] <- value

## S4 method for signature 'agentMatrix,numeric,numeric,ANY'
x[i, j, ..., drop = TRUE]

## S4 method for signature 'agentMatrix,logical,missing,ANY'
x[i, j, ..., drop = TRUE]
```
## Arguments

- **x**
  - A `agentMatrix` object from which to extract element(s) or in which to replace element(s).

- **i**
  - Indices specifying elements to extract or replace.

- **j**
  - see **i**.
... other named arguments
drop not implemented
value Any R object
name A literal character string or a name (possibly backtick quoted).

Value
An agentMatrix when full row(s), full column(s) or element(s) at specific row(s) and column(s) is/are extracted.

Note
Extract methods for agentMatrix class will generally maintain the agentMatrix class. This means that there will still be coordinates, character columns represented as numerics etc. $ is for extracting the raw columns and does not maintain the agentMatrix class. [] will extract all values, and result in a data.frame with the correct character and numeric columns.

[[ Subsetting for worldArray class

Description
These function similarly to [[ for RasterStack objects.

Usage
## S4 method for signature 'worldArray,ANY,ANY'
x[[i]]

## S4 replacement method for signature 'worldArray,ANY,ANY'
x[[i]] <- value

## S4 method for signature 'worldArray'
x$name

Arguments
x A worldArray object.
i Index number or layer name specifying a subset of layer(s) from the worldArray.
value A replacement worldMatrix layer for one of the current layers in the worldArray.
name Layer name, normally without back ticks, unless has symbols.
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