The Move package

an R package for animal movement data

currently developed by
Bart Kranstauber, Kamran Safi, and Marco Smolla

Max Planck Institute for Ornithology
Vogelwarte Radolfzell

Marco Smolla
2012-06-18

What is the MOVE package?

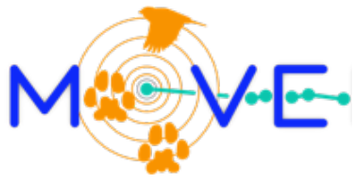
open source R package

developed for Movebank database and Movebank data

available on **r-forge** (r-forge.r-project.org)

will be available on **CRAN** when finishing beta phase

Max Planck Institute for Ornithology
Vogelwarte Radolfzell



How to use the MOVE package?

import movement data

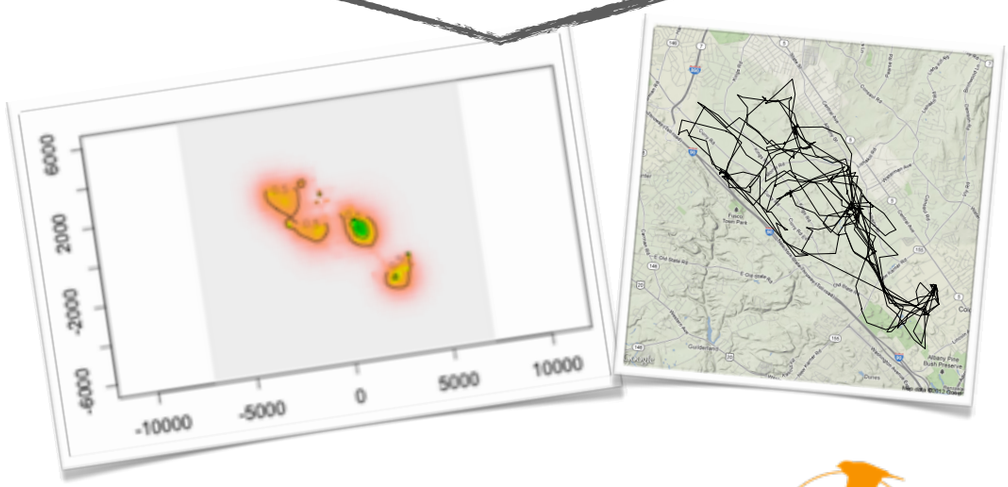
(e.g. from GPS, ARGOS, etc. logger)

analyze individual or a group of animals

(e.g. travel distance, average speed, individual differences, **utilization distribution**, etc.)

visualize movement data

(plot **the utilization distribution**, and/or add the track/s and contour lines)



Max Planck Institute for Ornithology
Vogelwarte Radolfzell

Who can use MOVE?

everyone, it's open source

especially interesting for

-(computational) ecology

-conservation

Max Planck Institute for Ornithology
Vogelwarte Radolfzell

What is the structure of the MOVE package?

main files

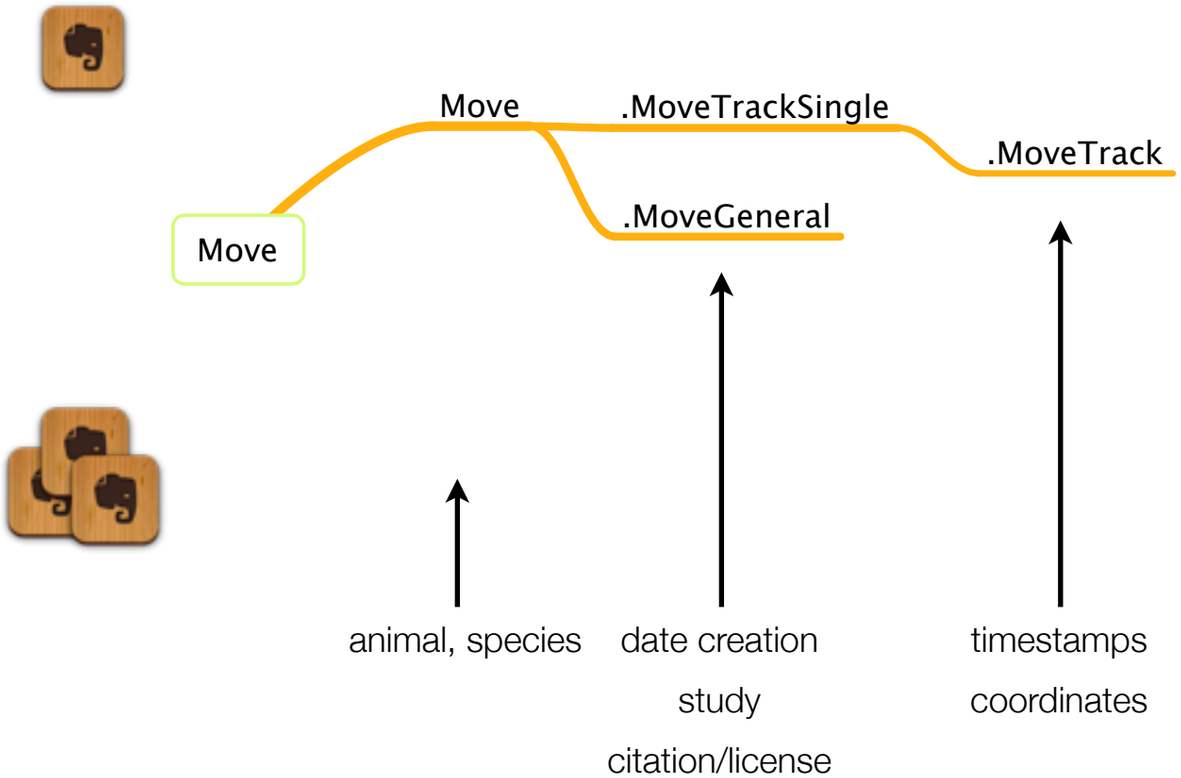
store and process study information, location, timestamps, etc.	classMove.R	classMoveStack.R
raster calculation and dynamic Brownian Bridge	classDBBMM.R	classDBMvar.R
access Movebank database from within R	WebImport.R	
earth movers distance	emd.R	

Max Planck Institute for Ornithology
Vogelwarte Radolfzell

What is the structure of the MOVE package?

object classes

Move classes	*DBBMM classes*

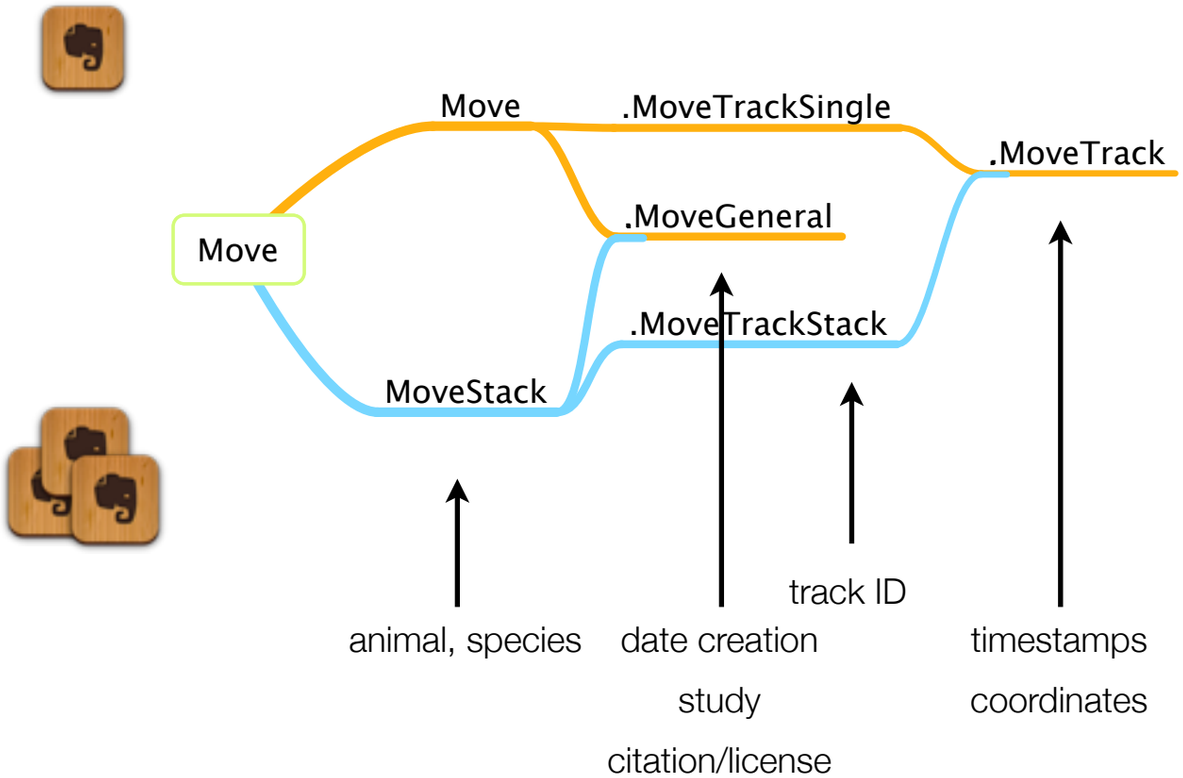


Max Planck Institute for Ornithology
Vogelwarte Radolfzell

What is the structure of the MOVE package?

object classes

Move classes	*DBBMM classes*

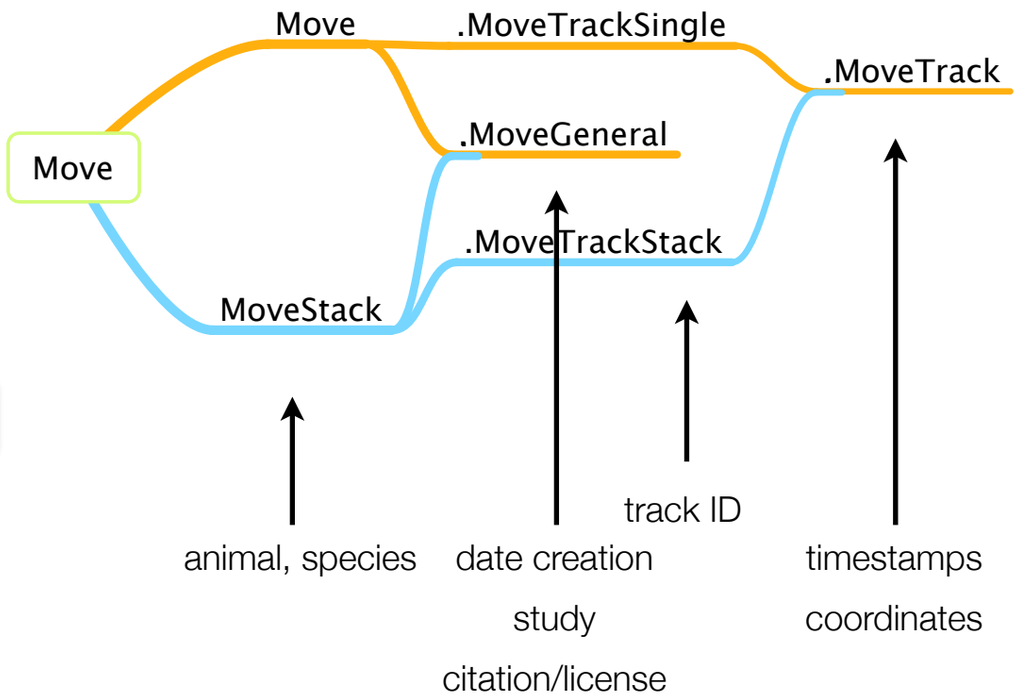


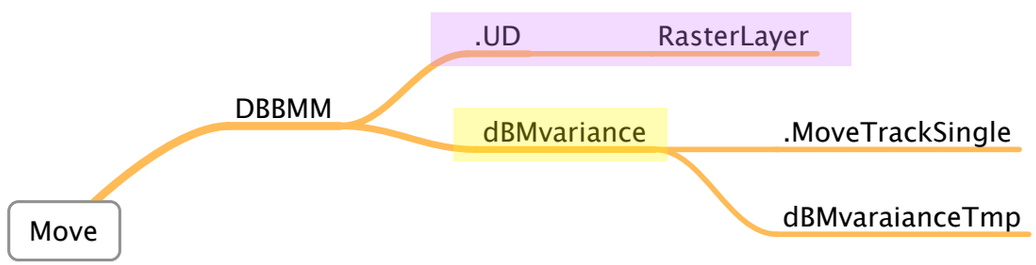
Max Planck Institute for Ornithology
Vogelwarte Radolfzell

What is the structure of the MOVE package?

object classes

Move classes	*DBBMM classes*





stores

the raster

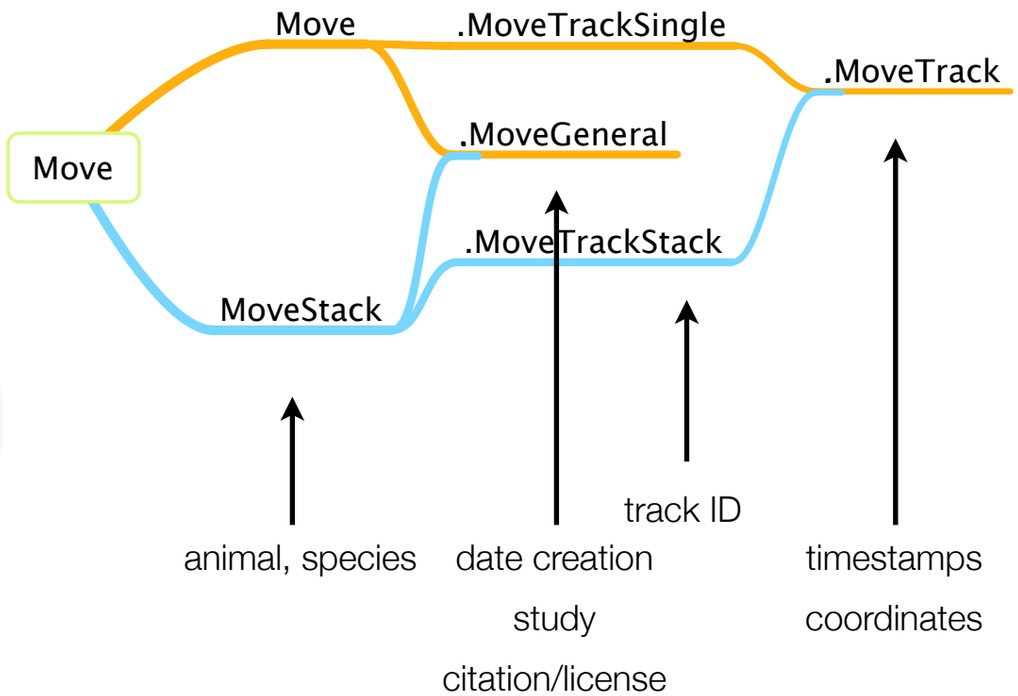
brownian bridge varaince

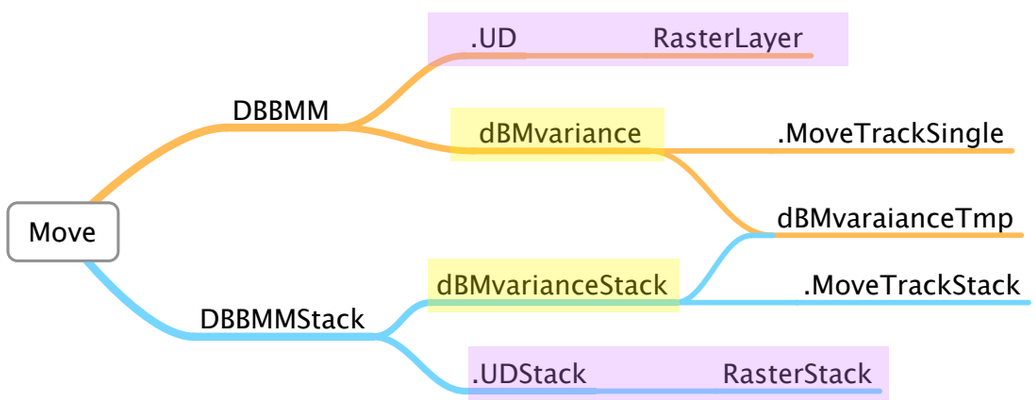
Max Planck Institute for Ornithology
Vogelwarte Radolfzell

What is the structure of the MOVE package?

object classes

Move classes	*DBBMM classes*



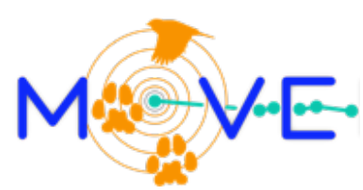


stores

the raster

brownian bridge variance

Max Planck Institute for Ornithology
Vogelwarte Radolfzell



Which functions are in the MOVE package?

functions


individuals


groups (stack)

Move class related

import

```
move(x, tz, proj)
```

```
data <- move(x="leroy_fisher_LaPoint.csv", proj=CRS("+proj=longlat"), tz="GMT")
```

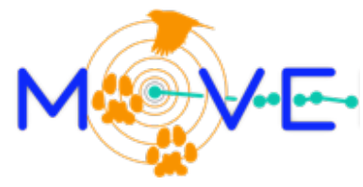
```
move(x, y, time, data, tz, proj)
```

```
file <- read.csv(file="BCI_Ocelot_Isaac.csv", header=T, sep=",", dec=".")
data <- move(x=file$location.long, y=file$location.lat,
             time=file$timestamp, tz="GMT", data=file,proj=CRS("+proj=longlat"))
```

```
movestack(x, tz, proj)
```

```
moveStack(x="~/BCI Ocelot.csv")
```

Max Planck Institute for Ornithology
Vogelwarte Radolfzell



Which functions are in the MOVE package?

functions

individuals

groups (stack)

Move class related

analyse

`n.locs(x)`

```
[1] 89  ##number of locations
```

`time.lag(x)`

```
 [1]  3004  6751 33321 56306    16  3929   847 21144 28891  9885  4543  6810   150
[13]17106   277    91   973   ##time differences between fixes
```

`summary(x)`

```
##returns e.g: max/min/average traveled distance,
               max/average speed,
               average/variance of angles, ...
```

Max Planck Institute for Ornithology
Vogelwarte Radolfzell

Which functions are in the MOVE package?

functions

individuals

groups (stack)

Move class related

visualize

+

```
spTransform(x, CRSobject)
  data_ad <- spTransform(data_ll, center=TRUE,CRSobj="+proj=aeqd")  ##change projection
```

```
lines(x, add, ...)
  lines(data, add=T, col="black")   ##plot track as lines
```

+( )

```
plot(x, add, google, maptype, ...)
  plot(test, google=T, maptype="satellite", col="white")   ##plot track, e.g. on a map
```

Max Planck Institute for Ornithology
Vogelwarte Radolfzell

Demo

Which functions are in the MOVE package?

functions

individuals

groups (stack)

DBBMM class related

create

+

```
brownian.bridge.dyn(object,raster=1,dimSize=10, location.error=23, margin=11,
time.step=NULL, window.size=31, ext=0.25, ...)
```

Move	missing	missing	use default values
Move	numeric	missing	set cell size
Move	missing	numeric	cell size largest dimension
Move	RasterLayer	missing	use a raster

for MoveStacks a RasterLayer is calculated, that includes all tracks

Max Planck Institute for Ornithology
Vogelwarte Radolfzell

Which functions are in the MOVE package?

functions

individuals

groups (stack)

DBBMM class related

visualize

+( )

```
plot(x, y, google)
```

```
plot(x=dbbmm, y=data, google=TRUE)
lines(testtest,add=T,col="black")  ##plot the raster values an add a track
```

```
contour(x, add, ...)
```

```
contour(p, levels=c(.4,.9), plot=TRUE)   ##plot contour lines at vertain levels
cnt <- contour(p, levels=c(.2,.75), plot=FALSE) ##store contour as variable
```

Max Planck Institute for Ornithology
Vogelwarte Radolfzell

Which functions are in the MOVE package?

functions

individuals

groups (stack)

DBBMM class related

analyze

```
outerProbability(x, border)
    ##calculates the probabilities at the border of the raster

summary(x)
    ##returns: max/min raster values,
                raster projection,
                and raster extension
```

Max Planck Institute for Ornithology
Vogelwarte Radolfzell

Demo

Which functions are in the MOVE package?

functions

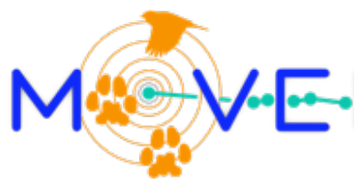
individuals

groups (stack)

browse Movebank

```
movebankLogin (username, password)
getMovebankStudies (... ,login)
searchMovebankStudies (x, login)
getMovebankStudy (study, login)
getMovebankID (study, login)
getMovebankSensors (study, login)
getMovebankSensorAttributes (study, login)
getMovebankAnimals (study, login)
getMovebankData (study, login, moveObject)
```

Max Planck Institute for Ornithology
Vogelwarte Radolfzell



Demo

Bart Kranstauber, Kamran Safi, and Marco Smolla

Max Planck Institute for Ornithology
Vogelwarte Radolfzell