

# Package ‘tlocoh.dev’

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**Type** Package

**Title** Development package for tlocoh

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**Depends** R (>= 3.0.0),sp,tlocoh

**Imports** FNN,pbapply,rgeos

**Suggests** maptools,rgdal,move,png,raster,gpclib,XML

**Description** Development package for tlocoh (i.e. functions still being developed).

**License** GPL-2

**URL** <http://tlocoh.r-forge.r-project.org>

**Roxygen** list(wrap = TRUE)

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iso2raster	<i>Convert isopleths to raster</i>
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### Description

Converts isopleths in a SpatialPolygonsDataFrame object to a RasterLayer

### Usage

```
iso2raster(polys, raster = NULL, ext = NULL, dimSize = 100,
  cell.size = NULL, sf.cell.size = 2, ll.round = TRUE, status = TRUE,
  debug = FALSE)
```

### Arguments

polys	A SpatialPolygonsDataFrame containing isopleths sorted by isopleth level (smallest to largest)
raster	A RasterStack object to be used to set the extent and resolution for the output raster.
ext	An extent object or NULL. Ignored if raster is passed.
dimSize	Numeric value used as the number of cells along the largest dimension of the data is numeric. Ignored if raster is passed.
cell.size	. Ignored if raster is passed.
sf.cell.size	. Ignored if raster is passed.
ll.round	Anchor the lower left coordinate of the raster extent to a multiple of the cell size. Ignored if raster is passed.
status	Show status messages and progress bar
debug	Show debugging info

### Details

This presumes the SPDF contains isopleths ordered from lowest level to highest. The cell values of the resulting raster will sum up to the largest isopleth leve. In order for the resulting raster to sum to 1, the 100 must be part of the input.

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lhs.iso.rast	<i>Convert isopleths to rasters</i>
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### Description

Adds rasterized version of isopleth(s) to a LoCoH-hullset object

### Usage

```
lhs.iso.rast(lhs, id = NULL, k = NULL, r = NULL, a = NULL, s = NULL,
  hs.names = NULL, sort.metric = NULL, iso.method = "pt.quantiles",
  raster = NULL, dimSize = 100, cell.size = NULL, sf.cell.size = 2,
  ll.round = TRUE, status = TRUE)
```

**Arguments**

lhs	A <a href="#">LoCoH-hullset</a> object
id	The id(s) of the hullsets to create isopleths for
k	The k value of hullsets to create isopleths for
r	The r value of hullsets to create isopleths for
a	The a value of hullsets to create isopleths for
s	The s value of hullsets to create isopleths for
hs.names	The name(s) of saved hullsets to create isopleths for
sort.metric	The name(s) of hull metric(s) used to form isopleths that rasters should be created for
iso.method	The method(s) used to define isopleths that will be converted to raster
raster	A RasterLayer object that will be used to set the extent and cell size of the rasterized isopleth
dimSize	The number of cells along the largest dimension of the track. The according raster will be calculated internally. Default is 100. Ignored if raster is passed.
cell.size	The size of each square cell in map units. Ignored if raster is passed.
sf.cell.size	The number of significant figures to use if the cell size has be computed based on dimSize. Default=2. Ignored if raster is passed.
ll.round	Whether to round the lower left coordinate to the lowest multiple of cell.size. Ignored if raster is passed. (T/F)
status	Show status messages. T/F

**Details**

This will take existing isopleths and create raster versions of them.

**Value**

A LoCoH-hullset object

**See Also**

[lhs.iso.add](#)

**Examples**

```
## Not run:
lhs <- lhs.iso.add(lhs)
lhs <- lhs.iso.rast(lhs)

## End(Not run)
```

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lhs.revisit.add	Add revisitation hull metrics to a LoCoH-hullset object
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## Description

Computes revisitation rate based on a minimum and maximum time away period

## Usage

```
lhs.revisit.add(lhs, ta.min = NULL, ta.max = NULL, ta.cuts = NULL,  
  status = TRUE)
```

## Arguments

lhs	A LoCoH-hullset object
ta.min	Minimum value(s) for time away in seconds (numeric vector)
ta.max	Maximum value(s) for time away in seconds (numeric vector)
ta.cuts	A numeric vector of time values in seconds that define the time-away intervals
status	Show status messages. T/F

## Details

ta.min and ta.max define the minimum and maximum period of time (in seconds) which must pass for another occurrence in the hull to be considered a 'revisit'. They should be the same lengths. If ta.max is NULL, no upper bound will be set

ta.cuts is an alternative way of specifying the time-away intervals. The time values in ta.cuts will serve as the values between time away intervals. For example if ta.cuts = c(1000, 4000, 7000, 10000), three time-away intervals will be examined: 1000 to 4000 seconds, 4000 to 7000 seconds, and 7000 to 10000 seconds. One way to get the values for ta.cuts is to plot the distribution of revisit times using [lhs.plot.revisit](#), and then use the [get.vals](#) function to select time values between clusters of revisit times.

## Value

A LoCoH-hullset object

## See Also

[lhs.plot.revisit](#), [get.vals](#)

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lhs.revisit.del	<i>Delete all revisitation hull metrics in a LoCoH-hullset object</i>
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**Description**

Delete all revisitation hull metrics in a LoCoH-hullset object

**Usage**

```
lhs.revisit.del(lhs, status = TRUE)
```

**Arguments**

lhs	A LoCoH-hullset object
status	Display summary, T/F

**Value**

A LoCoH-hullset object

**See Also**

[lhs.revisit.add](#)

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lhs.so.add	<i>Add hull metrics for association analysis</i>
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**Description**

Add hull metrics for association analysis

**Usage**

```
lhs.so.add(lhs, id = "all", hs2.id = "all", tbuff = 0, ivg = NULL,
  test = 0, skip.dups = TRUE, save.hso = TRUE, status = TRUE,
  piFUN = c("pIntersect", "pIntersectSat")[1])
```

**Arguments**

lhs	A <a href="#">LoCoH-hullset</a> object
id	A character vector of the hullset ids to compute metrics for. Can also be 'all'.
hs2.id	A character vector of the hullset ids to use as the comparison hullsets. Can also be 'all'.
tbuff	A temporal overlap threshold (in seconds). See details.
ivg	The intervisit gap period used to collapse intersecting hulls into discrete visits, see details
test	A two-element numeric vector containing the number of hulls in hullset 1 and hullset 2 respectively to identify intersections

<code>skip.dups</code>	Skip duplicate hulls (faster)
<code>save.hso</code>	Whether to save the hull intersection list, T/F
<code>status</code>	Show status messages. T/F
<code>piFUN</code>	The function to use to identify which pairs of hulls intersect: 'pIntersect' or 'pIntersectSat'

## Details

This function computes hull metrics for the spatially overlapping hulls from two ids. Typically this would be used when you have hullset from two individuals (i.e., two animals) and you want to see the spatial and temporal patterns of shared space use.

You can impose a temporal overlap requirement as well by passing a value for `tbuff`. Two hulls will be considered spatially overlapping only if their parent points also were recorded within `tbuff` seconds of each other. This essentially produces metrics for spatially and temporally overlapping hulls.

Hullset metrics are computed for each pair of ids. Thus if a hullset has hulls for three unique ids, each hull will have spatial overlap metrics computed for each of the other two hullsets. You can narrow which id(s) to compute metrics for, and which hullset(s) to use as the comparison, with the `id` and `hs2.id` arguments.

Up to three spatial overlap metrics are computed. `so.count` is simply the number of hulls in hullset 2 that overlap. `so.dtmmin` is the minimum amount of time (expressed in seconds) that passes between overlapping hulls. This reflects temporal partitioning of shared space - low values of `so.dtmmin` suggest the two individuals don't mind being in the same area at the same time. `so.nsv` (number of separate visits) is similar to `so.count`, but collapses overlapping hulls into discrete visits based on an intervisit gap period `ivg`. `so.nsv` is only computed if a value for `ivg` is passed.

`pIntersect` and `pIntersectSat` are two functions that identify which pairs of hulls actually intersect. Neither are terribly fast, but `pIntersect` appears to work faster than `pIntersectSat`.

## Value

A [LoCoH-hullset](#) object

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lhs.to.add	<i>Compute hull metrics for temporally overlapping hulls</i>
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## Description

Compute hull metrics for pairs of temporally overlapping hulls of separate individuals

## Usage

```
lhs.to.add(lhs, id = "all", hs2.id = "all", maxdt = "auto",
  save.hto = TRUE, status = TRUE)
```

## Arguments

lhs	A <a href="#">LoCoH-hullset</a> object
id	A character vector of the hullset ids to compute metrics for. Can also be 'all'.
hs2.id	A character vector of the hullset ids to use as the comparison hullsets. Can also be 'all'.
maxdt	The maximum difference in time (in seconds) for two hulls to be considered 'overlapping' in time. Can also be 'auto', in which case half of the smallest of the two median sampling intervals will be used.
save.hto	Whether to save the list of hull indices that temporally overlap in the hullset, T/F
status	Show status messages, T/F

## Details

This will compute hull metrics for pairs of hulls from two individuals. This only works for a LoCoH-hullset object that contains hulls from two or more individuals (id's). For each hull for individual A, for example, it will identify the hulls in individual B that temporally overlap, and compute the mean centroid distance (hull metric name = to.mcd). By default *to.mcd* is computed for all pairs of individuals, but you can specify specific pairs by passing values for *id* and *hs2.id*.

This metric is used for association analysis. You can use this metric for example to look for spatial and temporal patterns in how close individuals get to each other. Other association metrics exist for spatially overlapping hulls (see [lhs.so.add](#)).

## Value

A LoCoH-hullset object

## See Also

[lhs.so.add](#), [lhs.merge](#)

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lhs.to.stats	<i>Computes statistics on the centroid distances for time-overlapped hulls</i>
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## Description

Computes statistics on the hull-to-hull centroid distance for time-overlapped hulls, with an option to plot and overlay the distribution of centroid distances for random pairs of hulls

## Usage

```
lhs.to.stats(lhs, id1 = "all", id2 = "all", n = "all", iso.lower = NULL,
  iso.upper = NULL, iso.oz = TRUE, iso.sort.metric = "auto",
  to.comp.hist = TRUE, breaks = 20, to.mcd.outline.only = FALSE,
  lwd.outline = 3, hist.type = c("density", "counts")[1],
  col.to.mcd = "blue", col.h2h.cd = "red", title = NULL,
  title.show = TRUE, title.id.only = FALSE, title.sub.iso.enc = TRUE,
  mar = c(3, 3, if (title.show) 1.5 + (if (title.sub.iso.enc) 1.3 else 0) else
  0.5, 0.5), mgp = c(1.8, 0.5, 0), figs.per.page = 1, panel.num = NULL,
  panel.num.inside.plot = !title.show, png.dir = NULL,
```

```
png.dir.make = TRUE, png.width = 800, png.height = png.width,
png.overwrite = TRUE, png.pointsize = 12 + (png.width - 480)/80,
status = TRUE, ...)
```

## Arguments

lhs	A LoCoH-hullset object
id1	Hullset 1 id value(s). Can also be 'all'.
id2	Hullset 2 id value(s). Can also be 'all'.
n	The number of randomly selected paired hulls to use as the NULL model of no association. Can also be "all"
iso.lower	The lower level isopleth for the isopleth filter
iso.upper	The upper level isopleth for the isopleth filter
iso.oz	Apply isopleth filter to hs1 using the isopleths from hs2. T/F.
iso.sort.metric	The name of a hull metric that was used to sort hulls in the construction of the isopleths to be used as filters. If auto (default) it will pick the default sort metric used for density isopleths (i.e., area for the k-method, and number of enclosed points for the a and r methods)
to.comp.hist	Draw a histogram of the centroid distances of temporally overlapping hulls
breaks	The number of breaks in the histogram (or another valid value for breaks, see <a href="#">hist</a> ).
to.mcd.outline.only	Show the outline only of the histogram of the mean centroid distance for temporally overlapping hulls. T/F.
lwd.outline	The line width of the histogram outline (ignored if to.mcd.outline.only=F).
hist.type	The type of histogram to plot: 'density' or 'counts'.
col.to.mcd	The color of the outline of the histogram of the distribution of the centroid distances of temporally overlapping hulls.
col.h2h.cd	The color of the outline of the histogram of the distribution of the centroid distances for randomly paired hulls.
title	The title to be displayed. Character. If NULL a title will be constructed.
title.show	Whether to show the title. T/F.
title.id.only	Whether to construct the title from the id values only. T/F. Ignored if title is passed or title.show=FALSE
title.sub.iso.enc	Whether to include the isopleth filter information as the second line of the title, T/F.
mar	The plot margins. A four item numeric vector
mgp	The distance away from the edge of the plot for the 1) label, 2) tick marks, and 3) axis line. A three-item numeric vector
figs.per.page	The number of plots per page.
panel.num	A number or letter to display in the upper left hand corner of the plot when the plot will be used as part of a multi-frame graphic (as in publications). Character
panel.num.inside.plot	Whether to display panel.num inside the plot area itself, as opposed to the title area. T/F



png.dir	The directory for a PNG file (filename will be constructed automatically). Ignored if png.fn is passed
png.dir.make	Whether to create png.dir if it doesn't exist. T/F
png.width	The width of the PNG image
png.height	The height of the PNG image
png.overwrite	Whether to overwrite an existing PNG file if it exists. T/F
png.pointsize	The pointsize (in pixels) for the PNG image, equivalent to the height or width of a character in pixels (increase to make labels appear larger)
status	Display status messages. T/F
...	Additional parameters that will be passed to the <a href="#">plot</a> function

## Details

This returns a list object containing the centroid-to-centroid distances of a random selection of hulls from two individuals, which serves as a NULL model of no interaction. It can also plot the histogram of mean-centroid-distance of time-overlapped hulls with the outline of the centroid distance of random-pairs of hulls overlain on top, to visually see how close the distributions match.

It will also compute the Welch Two Sample t-test to see if the distribution for time-overlapped and randomly paired hulls have statistically significant means, and the Two-sample Kolmogorov-Smirnov test which tells you how likely the two distributions are the same.

Note that before you can use this function, the mean-centroid-distance for time-overlapped hulls must be computed using [lhs.to.add](#)

You can apply an isopleth filter by passing values for iso.lower and iso.upper. These should be the isopleth level (normally between 0 and 1) that the hull parent point must fall in to be included in the analysis. If, for example, you wanted to see whether association in the core area is significantly different from neutral interaction, you would pass iso.upper=0.5 and leave iso.lower NULL. Note that the isopleths with matching isopleth levels must already be present.

## Value

A list object

## See Also

[lhs.to.add](#), [lhs.iso.add](#)

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locoh.lhs	<i>Class for a hullsets</i>
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## Description

Class for a collection of hullsets and associated objects including hull metrics and isopleths

## Details

An object of class `locoh.lhs` is a list (S3) containing one or more sets of hulls (local MCPs) for a set of points. One hull is saved for each point if the method used to create the hulls returned at least two nearest neighbors for each point, otherwise the number of hulls might be less than the number of points. In addition to hulls (saved as a `SpatialPolygonsDataFrame`), `LoCoH-hullset` object may also contain:

- the original points and their attribute table
- an index of the points a) used to construct the hull and b) enclosed by each hull
- hull metrics
- isopleths (progressive unions of hulls) as both vector (`SpatialPolygonsDataFrame`) and raster (utilization distribution) formats.
- saved parameters for scatterplots of hull metrics.

In code examples, objects of class `locoh.lhs` are often noted by a 'lhs' suffix, and functions that are designed to work on `LoCoH-hullset` objects typically start with 'lhs'.

For a complete description of the data structure, see the vignette [T-LoCoH Data Classes](#).

## See Also

[lxy.lhs](#), [summary.locoh.lhs](#), [plot.locoh.lhs](#), [lhs.merge](#), [lhs.iso.add](#), [lhs.save](#), [lhs.exp.shp](#)

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<code>locoh.lxy</code>	<i>Class for location data</i>
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## Description

Data class for locations with associated dates, nearest neighbor info, parameters for a random walk null model, and assorted meta-data

## Details

An object of class `locoh.lxy` is a list containing a series of point locations and ancillary variables that go with those locations (e.g., time stamps, point IDs, animal IDs). These items are bundled together and 'ready to go' as inputs into `T-LoCoH` functions. The benefits of bundling all of the objects related to a set of point locations in a single list object includes:

- cleaning and error checking only has to be done once when the `lxy` object is created (e.g., with [xyt.lxy](#))
- having all of the ancillary variables together simplifies the task of passing parameters to other functions as well as saving/retrieving your work to disk
- the nearest neighbor lookup-table (which can take a long time to compute) can be reused
- locations for multiple individuals can be saved in one object

In code examples, objects of class `locoh.lxy` are often indicated by a 'lxy' suffix, and functions that are designed to work on `LoCoH-xy` objects typically start with 'lxy'.

For a complete description of the data structure, see the vignette [T-LoCoH Data Classes](#).

## See Also

[xyt.lxy](#), [lxy.proj.add](#), [lxy.repair](#), [lxy.subset](#), [lxy.merge](#), [lxy.exp.csv](#), [lxy.exp.kml](#), [lxy.exp.shp](#), [move.lxy](#)

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