Package 'Waypoint'

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Title Convert, Validate, Format and Print Geographic Coordinates and
Waypoints

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Description Convert, validate, format and elegantly print geographic coordinates and waypoints
(paired latitude and longitude values) in decimal degrees, degrees and minutes, and degrees,
minutes and seconds using high performance C++ code to enable rapid conversion and formatting
of large coordinate and waypoint datasets.

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Description

Convert, validate, format and elegantly print geographic coordinates and waypoints (paired latitude and longitude values) in decimal degrees, degrees and minutes, and degrees, minutes and seconds using high performance C++ code to enable rapid conversion and formatting of large coordinate and waypoint datasets.

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| convert | *Convert the Format of "coords" and "waypoints" Objects* |

Description

Convert the format of objects of class "coords" or "waypoints" between (i) decimal degrees, (ii) degrees and minutes, and (iii) degrees, minutes and seconds.

Usage

```
convert(x, ...)

## S3 method for class 'coords'
convert(x, fmt, ...)

## S3 method for class 'waypoints'
convert(x, fmt, ...)
```

Arguments

x	object of class "coords" created by function as_coords(), or class "waypoints" created by function as_waypoints().
...	further arguments passed to or from other methods.
fmt	integer, 1L, 2L or 3L, specifying the required coordinate format.

Details

The fmt argument should be 1L to convert to *decimal degrees*, 2L, to convert to *degrees and minutes*, and 3L to convert to *degrees, minutes and seconds*. On conversion of a "coords" object, the original argument x is modified to have a decimal point after the number of whole degrees in the case of decimal degrees, after the number of whole minutes in the case of degrees and minutes, and after the number of whole seconds in the case of degrees, minutes and seconds.

Prior to conversion, the "coords" or "waypoints" object to be converted is checked to ensure its values represent valid geographic locations as described under validate().

Value

The original argument x, an object of class "coords" or "waypoints" with values converted as described under *details* and a revised "fmt" attribute reflecting the new format.

See Also

"coords", "waypoints" and validate().

Other coordsandway: coords, waypoints

Examples

```
## Continuing example from `as_coords()`...


## Named "coords" object in degrees and minutes with
## eight values each of latitude and longitude
dm

## Convert to degrees, minutes and seconds (fmt = 3)
convert(dm, 3)

## Convert to decimal degrees (fmt = 1)
```

```
convert(dm, 1)

## Show converted values as an ordinary R numeric vector
as.numeric(dm)

###
## Continuing example from `as_waypoints()`...


## "waypoints" object in degrees, minutes and seconds
wp

## Convert to degrees and minutes (fmt = 2)
convert(wp, 2)

## Convert to decimal degrees (fmt = 1)
convert(wp, 1)

## Show converted values as an ordinary R data frame
as.data.frame(wp)

rm(dm, wp)
```

---

coords   *Geographic Coordinate Class*

Description

as_coords() creates an object of class "coords", a robust representation of a series of geographic or GPS coordinate values.

latlon()<- adds information to objects of class "coords" specifying whether individual coordinate values represent latitude or longitude.

Usage

```
as_coords(object, ...)

## Default S3 method:
as_coords(object, ..., fmt = 1L)

latlon(cd) <- value

## S3 method for class 'waypoints'
as_coords(object, which, ...)
```

Arguments

object	a numeric vector of coordinate values, optionally named, or an object of class "waypoints".
...	further arguments passed to or from other methods.
fmt	integer, 1L, 2L or 3L, specifying the required coordinate format.
cd	object of class "coords" created by function as_coords().
value	a logical vector of length 1 or length(x).
which	logical, indicating whether the as_coords() method for class "waypoints" extracts the latitude component of argument object (if TRUE), or the longitude (if FALSE).

Details

Individual values provided in a numeric vector argument object should have a decimal point after the number of whole degrees in the case of *decimal degrees*, after the number of whole minutes in the case of *degrees and minutes*, and after the number of whole seconds in the case of *degrees, minutes and seconds*.

The fmt argument should be 1L to represent decimal degrees, 2L for degrees and minutes, and 3L for degrees, minutes and seconds and is used to provide the format of values in the numeric vector argument object to be converted to class "coords".

The values of a newly created "coords" object are checked to ensure they are valid geographic locations as described under validate().

Individual coordinate values in a Coords object may be specified as representing latitude or longitude using latlon(). The value argument may either be a single value, TRUE signifying that all values are latitude, FALSE signifying that all values are longitude, or a logical vector of the same length as as the Coords object signifying whether individual values are latitude or longitude.

Value

as_cords() returns an object of class "coords", comprising a numeric vector argument with additional attributes: –

"class"	the character string "coords".
"fmt"	an integer representing the coordinate format.
"valid"	a logical vector indicating whether individual coordinate values are valid geographic locations.

The as_cords() method for class "coords" returns its numeric vector argument object modified in place, whereas the method for class 'waypoints' returns a new numeric vector.

latlon() returns its "coords" argument cd with a logical vector attribute "latlon" added or updated to reflect argument value.

See Also

attr(), attributes, and validate().

Other coordsandway: convert(), waypoints

Examples

```
## Numeric vector representing degrees and minutes, with
## the decimal point after the number of whole minutes
dm <- c(5130.4659, 4932.7726, 4806.4339, 3853.3696, 0.0000, -3706.7044, -5306.2869, -2514.4093,
        -007.6754, 1823.9137, -12246.7203, -7702.1145, 0.0000, -1217.3178, 7331.0370, -5731.1536)

## Create an unnamed "coords" object of degrees and minutes (fmt = 2)
## (Latitude and longitude unspecified)
as_coords(dm, fmt = 2)

## Name the "coords" object
names(dm) <- rep(c("Nelson's Column", "Ostravice", "Tally Ho", "Washington Monument", "Null Island",
                "Tristan da Cunha", "Mawson Peak", "Silvio Pettirossi International Airport"), 2)
dm

## Set all values to represent longitude
## ("latlon" attribute set to FALSE, length 1)
latlon(dm) <- FALSE
dm

## Set eight values each of latitude and longitude
## ("latlon" attribute set to TRUE, n=8, and FALSE, n=8)
latlon(dm) <- rep(c(TRUE, FALSE), each = 8)
dm

## Show as an ordinary R numeric vector
as.numeric(dm)

rm(dm)
```

---

  format   *Format and Print Coords or Waypoints*

Description

Format and print objects of class "coords" or "waypoints".

Usage

```
## S3 method for class 'coords'
print(x, ..., max = NULL)

## S3 method for class 'waypoints'
print(x, ..., max = NULL)

## S3 method for class 'coords'
format(x, ..., usenames = TRUE)
```

```
## S3 method for class 'waypoints'
format(x, ..., usenames = TRUE)

ll_headers(aswidth, fmt)
```

Arguments

x	object of class "coords" created by function as_coords(), or class "waypoints" created by function as_waypoints().
...	further arguments passed to or from other methods.
max	numeric or NULL, specifying the maximal number of entries to be printed. By default, when NULL, getOption("max.print") used.
usenames	logical, whether or not to include names in formatted output; default TRUE.
aswidth	character vector, used to match width of headers to formatted output.
fmt	integer, 1L, 2L or 3L, specifying the required coordinate format.

Details

The format() methods for "coords" and "waypoints" objects output elegantly formatted character vector representations of their arguments, which are used by their respective print() methods.

Prior to formatting and printing, "coords" or "waypoints" objects are checked to ensure that their "valid" attribute (in the case of a "coords" object), or "validlat" and "validlon" attributes (in the case of a "waypoints" object) are present and all TRUE i.e., valid. If these attributes are found to contain any FALSE i.e. invalid values, a warning is issued and similarly, if these attributes are missing, a warning is issued and the objects are re-validated as described under validate().

ll_headers() outputs the headings "Latitude ... Longitude" formatted to the same width as argument aswidth, adjusted for format fmt and is primarily intended for use by the print() method for class "waypoints".

Value

The format() methods for both classes "coords" and "waypoints" return a character vector, respectively of length length(x) or nrow(x), and containing values formatted in decimal degrees, degrees and minutes, or degrees, minutes and seconds as appropriate.

See Also

format(), print(), "coords" and "waypoints".

Examples

```
## Continuing example from `as_coords()`...


## Print named "coords" object in degrees and minutes,
## 'silently' using S3 print() method
dm
```

```
## Format as a fixed-width character vector,
## with names...
format(dm)

## ...or without them
format(dm, usenames = FALSE)

###
## Continuing example from `as_waypoints()`...


## Print named "waypoints" object in degrees and minutes,
## 'silently' using S3 print() method
wp

## Format as a fixed-width character vector,
## with names...
format(wp)

## ...or without them
format(wp, usenames = FALSE)

rm(dm, wp)
```

---

op-zero-length   *Operator Providing Alternative to Zero-Length Object*

Description

Infix function implementing provision of an alternative if an object has zero length.

Usage

```
x %L% y
```

Arguments

x, y   atomic vector arguments or other objects for which length() is defined.

Details

The infix function %L% may be useful in implementing if (length(x)) x else y and was inspired
by the null coalescing operator %||%.

Value

x, or if length(x) is zero, y.

See Also

%||%.

Examples

```
c4 <- letters[1:4]
c0 <- character(0)
n3 <- 1:3
n0 <- numeric(0)

c4 %L% n3
c0 %L% n3

n3 %L% c4
n0 %L% c4

rm(c4, c0, n3, n0)
```

---

review   *Review Coordinates and Waypoints Validity*

Description

Review validity of elements of "coords" and "waypoints" objects.

Usage

```
review(x, ...)

## S3 method for class 'coords'
review(x, ..., show_n = 20L)

## S3 method for class 'waypoints'
review(x, ..., show_n = 20L)
```

Arguments

x	object of class "coords" created by function as_coords(), or class "waypoints" created by function as_waypoints().
...	further arguments passed to or from other methods.
show_n	integer, the maximum number of invalid elements of argument x to include in the output; default 20L.

Details

review() reveals elements of "coords" and "waypoints" objects that do not conform to the criteria checked by validate(), i.e. are not valid geographic locations.

Value

The `review()` method for class `"coords"` returns a [list](#) comprising the following elements: -

allvalid	logical, whether or not all the elements of argument x are valid.
n_invalid	integer, the number of invalid elements in argument x, if any.
invalids	numeric vector including invalid elements of argument x, if any.
which_invalid	integer vector specifying which elements of argument x are invalid, if any.

The method for class `"waypoints"` returns a list of two sub-lists, each sub-list with elements as described above for the method for class `"coords"`, one each for latitude and longitude.

See Also

["coords"](#) and ["waypoints"](#).

Other validate: [validate](#)()

Examples

```
## Continuing example from `validate()`...


## Review "coords" object in degrees and minutes, having
## an erroneous first value of more than 60 minutes
review(dm)

###
## Continuing example from `validate()`...


## Review "waypoints" object in  decimal degrees, having an erroneous
## penultimate latitude absolute value greater than 90 degrees
review(wp)

rm(dm, wp)
```

---

validate	*Validate Coords or Waypoints*

Description

Validate objects of class `"coords"` or `"waypoints"` as geographic locations.

Usage

```
validate(x, ...)

## S3 method for class 'coords'
validate(x, ...)

## S3 method for class 'waypoints'
validate(x, ...)
```

Arguments

x	object of class "coords" created by function as_coords(), or class "waypoints" created by function as_waypoints().
...	further arguments passed to or from other methods.

Details

Individual coordinate values within "coords" or "waypoints" objects are checked to ensure they represent valid geographic locations.

To be valid, the absolute values of coordinates in degrees must not exceed 180°, or 90° if degrees of latitude and, similarly, the absolute values of the minutes and seconds components, where given, must not exceed 60. Otherwise, a warning will be issued and the "valid" attribute in the case of a "coords" object, or "validlat" and "validlon" attributes in the case of a "waypoints" object will be set to FALSE for any non-compliant coordinate values.

Value

validate() returns its argument with logical vector attribute "valid", or attributes "validlat" and "validlon" updated as appropriate for "coords" and' "waypoints" objects respectively.

See Also

"coords" and "waypoints".

Other validate: review()

Examples

```
## Continuing example from `as_coords()`...


## Validate "coords" object in degrees and minutes
validate(dm)

## Deliberately change the first coordinate
## to a value greater than 60 minutes
dm[1] <- 5160.4659

validate(dm)
```

```
## Examine "valid" attribute of dm
attr(dm, "valid")

###
## Continuing second example from `as_waypoints()`...


## Validate "waypoints" object in decimal degrees

validate(wp)

## Deliberately change the penultimate latitude
## to an absolute value greater than 90 degrees
wp$lat[7] <- -93.104781

validate(wp)

## Examine "validlat" attribute of wp
attr(wp, "validlat")

rm(dm, wp)
```

---

waypoints	*Geographic Waypoint Class*

Description

as_waypoints() creates an object of class "waypoints", a robust representation of a series of geographic or GPS waypoints of paired latitude and longitude values.

Usage

```
as_waypoints(object, ...)

## Default S3 method:
as_waypoints(object, ..., fmt = 1L)
```

Arguments

object	a data frame with each row representing a waypoint, comprising at least two numeric columns containing values of latitude and longitude, and optionally a character column of waypoint names (see *Details*).
...	further arguments passed to or from other methods.
fmt	integer, 1L, 2L or 3L, specifying the required coordinate format.

Details

Data frame argument `object` should have `numeric` vector latitude and longitude columns with individual values having a decimal point after the number of whole degrees in the case of *decimal degrees*, after the number of whole minutes in the case of *degrees and minutes*, and after the number of whole seconds in the case of *degrees, minutes and seconds*. These should be the first two columns of the data frame, or the second and third columns if the first column contains waypoints names (see below). Alternative columns may be specified for the latitude and longitude by setting `"llcols"` as a length 2 `integer` vector attribute of `object` indicating their positions in the data frame.

The `fmt` argument should be `1L` to represent decimal degrees, `2L` for degrees and minutes, and `3L` for degrees, minutes and seconds and is used to provide the format of values in data frame argument `object` to be converted to class `"waypoints"`.

If the waypoints have names, these should be included in a "Name" column of data frame argument `object`, by default immediately before (on the left-hand side of) the latitude and longitude columns. An alternative column for waypoint names may be specified by setting an `integer` [attribute](#) named "namescol" indicating its position in `object`, while setting this attribute to NA supresses printing of waypoint names. If neither a "Name" column nor a `"namescol"` attribute is present in `object`, [row.names](#) are used for waypoint names.

The latitude and longitude values of a newly created `"waypoints"` object are checked to ensure they are valid geographic locations as described under [validate](#)().

Value

An object of classes `"waypoints"` and `"data.frame"`, comprising the original data frame argument `object`, with additional attributes: –

`"class"`	the `character` string `"waypoints"`.
`"fmt"`	an `integer` indicating the coordinate format.
`"namescol"`	an `integer` indicating the position of a waypoint names column, if present.
`"llcols"`	a length 2 `integer` vector indicating the positions of latitude and longitude columns.
`"validlat"` and `"validlon"`	
	`logical` vectors indicating whether individual latitude and longitude values are valid geographic locations.

See Also

[attr](#)(), [data.frame](#)(), and [validate](#)().

Other coordsandway: [convert](#)(), [coords](#)

Examples

```
## Dataframe representing waypoint names, and latitude and longitude values
## in degrees, minutes and seconds
wp1 <- data.frame(
  name = c("Nelson's Column", "Ostravice", "Tally Ho", "Washington Monument", "Null Island",
           "Tristan da Cunha", "Mawson Peak", "Silvio Pettirossi International Airport"),
  lat = c(513027.95, 493246.36, 480626.04, 385322.18, 0, -370642.26, -530617.21, -251424.56),
```

```
    lon = c(-00740.53, 182354.82, -1224643.22, -770206.87, 0, -121719.07, 733102.22, -573109.21)
)

## Create "waypoints" object of degrees, minutes and seconds (fmt = 3)
as_waypoints(wp1, fmt = 3)

## Show as an ordinary R data frame
as.data.frame(wp1)


###

## Dataframe representing unnamed latitude and longitude
## values in decimal degrees
wp2 <- data.frame(
    lat = c(51.507765, 49.54621, 48.107232, 38.889494, 0, -37.11174, -53.104781, -25.240156),
    lon = c(-0.127924, 18.398562, -122.778671, -77.035242, 0, -12.28863, 73.517283, -57.519227)
)

## Create unnamed "waypoints" object of decimal degrees (default fmt = 1)
as_waypoints(wp2)

## Add waypoint names as row.names
row.names(wp2) <-
    c("Nelson's Column", "Ostravice", "Tally Ho", "Washington Monument", "Null Island",
      "Tristan da Cunha", "Mawson Peak", "Silvio Pettirossi International Airport")

wp2

## Show as an ordinary R data frame
as.data.frame(wp2)

rm(wp1, wp2)
```

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