

# Package ‘NlsyLinks’

November 14, 2013

**Type** Package

**Title** Utilities and kinship information for Behavior Genetics and  
Developmental research using the NLSY.

**Version** 1.216

**Date** 2013-11-14

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**Description** Utilities and kinship information for Behavior Genetics and  
Developmental research using the NLSY.

**URL** <https://r-forge.r-project.org/projects/nlsylinks/>

**Depends** R(>= 2.14.0),Matrix(>= 1.0),stats

**Imports** methods,lavaan

**Suggests** devtools,ggplot2,plyr,testit,testthat

**License** GPL

**LazyData** TRUE

**Collate** 'AceEstimate.R' 'AceLavaanGroup.R' 'AceUnivariate.R' 'CleanSemAceDataset.R'  
'ColumnUtilities.R' 'CreateAceEstimate.R' 'CreatePairLinksDoubleEntered.R'  
'CreatePairLinksDoubleEnteredWithNoOutcomes.R' 'CreatePairLinksSingleEntered.R'  
'CreateSpatialNeighbours.R' 'CreateSpatialNeighbours79Gen2.R' 'CreateSubjectTag.R'  
'DeFriesFulker.R' 'ExtraOutcomes79Doc.R' 'Links79PairDoc.R' 'Links79PairExpandedDoc.R'  
'NlsyLinks.R' 'ReadCsvNlsy79.R' 'RGroupSummary.R' 'SubjectDetails79Doc.R'  
'ValidateOutcomeDataset.R' 'ValidatePairLinks.R' 'ValidatePairLinksAreSymmetric.R'

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NlsyLinks-package	<i>Utilities and kinship information for Behavior Genetics and Developmental research using the NLSY.</i>
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## Description

Utilities and kinship information for Behavior Genetics and Developmental research using the NLSY.

## Note

This package considers both Gen1 and Gen2 subjects. "Gen1" refers to subjects in the original NLSY79 sample (<http://www.bls.gov/nls/nlsy79.htm>). "Gen2" subjects are the biological children of the Gen1 females -ie, those in the NLSY79 Children and Young Adults sample (<http://www.bls.gov/nls/nlsy79ch.htm>).

## Author(s)

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## References

This package's development was largely supported by the NIH Grant 1R01HD65865, "**NLSY Kinship Links: Reliable and Valid Sibling Identification**" (PI: Joe Rodgers). A more complete list of research articles using NLSY Kinship Links is maintained on our [repository's wiki](#).

Rodgers, Joseph Lee, & Kohler, Hans-Peter (2005). **Reformulating and simplifying the DF analysis model**. *Behavior Genetics*, 35 (2), 211-217.

Rodgers, J.L., Bard, D., Johnson, A., D'Onofrio, B., & Miller, W.B. (2008). **The Cross-Generational Mother-Daughter-Aunt-Niece Design: Establishing Validity of the MDAN Design with NLSY Fertility Variables.** *Behavior Genetics*, 38, 567-578.

D'Onofrio, B.M., Van Hulle, C.A., Waldman, I.D., Rodgers, J.L., Rathouz, P.J., & Lahey, B.B. (2007). **Causal inferences regarding prenatal alcohol exposure and childhood externalizing problems.** *Archives of General Psychiatry*, 64, 1296-1304.

Rodgers, J.L. & Doughty, D. (2000). **Genetic and environmental influences on fertility expectations and outcomes using NLSY kinship data.** In J.L. Rodgers, D. Rowe, & W.B. Miller (Eds.) *Genetic influences on fertility and sexuality*. Boston: Kluwer Academic Press.

Cleveland, H.H., Wiebe, R.P., van den Oord, E.J.C.G., & Rowe, D.C. (2000). **Behavior problems among children from different family structures: The influence of genetic self-selection.** *Child Development*, 71, 733-751.

Rodgers, J.L., Rowe, D.C., & Buster, M. (1999). **Nature, nurture, and first sexual intercourse in the USA: Fitting behavioural genetic models to NLSY kinship data.** *Journal of Biosocial Sciences*, 31.

Rodgers, J.L., Rowe, D.C., & Li, C. (1994). **Beyond nature versus nurture: DF analysis of non-shared influences on problem behaviors.** *Developmental Psychology*, 30, 374-384.

## Examples

```
library(NlsyLinks) #Load the package into the current R session.
summary(Links79Pair) #Summarize the five variables.
hist(Links79Pair$R) #Display a histogram of the Relatedness values.
table(Links79Pair$R) #Create a table of the Relatedness values for the whole sample.
```

---

Ace

*Estimates the heritability of additive traits using a single variable.*

---

## Description

An ACE model is the foundation of most Behavior Genetic research. It estimates the additive heritability (with  $a$ ), common environment (with  $c$ ) and unshared heritability/environment (with  $e$ ).

The AceUnivariate function is a wrapper that calls DeFriesFulkerMethod1 or DeFriesFulkerMethod3. Future versions will incorporate methods that use latent variable models.

## Usage

```
AceUnivariate(method=c("DeFriesFulkerMethod1","DeFriesFulkerMethod3"),
  dataSet, oName_1, oName_2, rName="R",
  manifestScale="Continuous")
```

```
DeFriesFulkerMethod1(dataSet, oName_1, oName_2,
  rName="R")
```

```
DeFriesFulkerMethod3(dataSet, oName_1, oName_2,
  rName="R")
```

## Arguments

method	The specific estimation technique.
dataSet	The data.frame that contains the two outcome variables and the relatedness coefficient (corresponding to oName_1, oName_2, and rName)
oName_1	The name of the outcome variable corresponding to the first subject in the pair. This should be a character value.
oName_2	The name of the outcome variable corresponding to the second subject in the pair. This should be a character value.
rName	The name of the relatedness coefficient for the pair (this is typically abbreviated as R). This should be a character value.
manifestScale	Currently, only <i>continuous</i> manifest/outcome variables are supported.

## Value

Currently, a list is returned with the arguments HSquared, CSquared, ESquared, and RowCount. In the future, this may be changed to an S4 class.

## Author(s)

Will Beasley

## References

Rodgers, Joseph Lee, & Kohler, Hans-Peter (2005). Reformulating and simplifying the DF analysis model. *Behavior Genetics*, 35 (2), 211-217.

## Examples

```
library(NlsyLinks) #Load the package into the current R session.
dsOutcomes <- ExtraOutcomes79
dsOutcomes$SubjectTag <- CreateSubjectTag(subjectID=dsOutcomes$SubjectID,
  generation=dsOutcomes$Generation)
dsLinks <- Links79Pair
dsLinks <- dsLinks[dsLinks$RelationshipPath=='Gen2Siblings', ] #Use only the Gen2 Siblings (ie, NLSY79-C sub)
dsDF <- CreatePairLinksDoubleEntered(outcomeDataset=dsOutcomes, linksPairDataset=dsLinks,
  outcomeNames=c("MathStandardized", "HeightZGenderAge", "WeightZGenderAge"))

estimatedAdultHeight <- DeFriesFulkerMethod3(
  dataSet=dsDF,
  oName_1="HeightZGenderAge_1",
  oName_2="HeightZGenderAge_2")
estimatedAdultHeight #ASquared and CSquared should be 0.60 and 0.10 for this rough analysis.

estimatedMath <- DeFriesFulkerMethod3(
  dataSet=dsDF,
  oName_1="MathStandardized_1",
  oName_2="MathStandardized_2")
estimatedMath #ASquared and CSquared should be 0.85 and 0.045.

class(GetDetails(estimatedMath))
summary(GetDetails(estimatedMath))
```

---

AceEstimate-class	Class "AceEstimate"
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---

### Description

A class containing information about a single univariate ACE model.

### Objects from the Class

Objects can be created by calls of the form:

```
new("AceEstimate", aSquared, cSquared, eSquared, caseCount, unity, withinBounds, details, ...)
```

### Note

The contents of the Details list depends on the underlying estimation routine. For example, when the ACE model is estimated with a DF analysis, the output is an `lm` object, because the `lm` function was used (ie, the basical general linear model). Alternatively, if the user specified the `lavaan` package should estimate that ACE model, the output is a `lavaan` object.

### Examples

```
library(NlsyLinks) #Load the package into the current R session.

showClass("AceEstimate")
est <- CreateAceEstimate(.5, .2, .3, 40)
est
print(est)
```

---

AceLavaanGroup	A simple multiple-group ACE model with the <b>lavaan</b> package.
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---

### Description

This function uses the **lavaan** package to estimate a univariate ACE model, using multiple groups. Each group has a unique value of *R* (i.e., the Relatedness coefficient).

### Usage

```
AceLavaanGroup(dsClean, estimateA=TRUE, estimateC=TRUE,
  printOutput=FALSE)
```

### Arguments

<code>dsClean</code>	The <code>data.frame</code> containing complete cases for the <i>R</i> groups to be included in the estimation.
<code>estimateA</code>	Should the <i>A</i> variance component be estimated? $A^2$ represents the proportion of variability due to a shared genetic influence.
<code>estimateC</code>	Should the <i>C</i> variance component be estimated? $C^2$ represents the proportion of variability due to a shared environmental influence.
<code>printOutput</code>	Indicates if the estimated parameters and fit statistics are printed to the console.

## Details

The variance component for  $E$  is always estimated.

## Value

An AceEstimate object.

## Note

Currently, the variables in dsClean must be named M1, M2 and R. This may not be as restrictive as it initially seems, because dsClean is intended to be produced by CleanSemAceDataset. If this is too restrictive for your uses, we'd like to hear about it (*please email wibeasley at hotmail period com*).

## Author(s)

Will Beasley

## References

The **lavaan** package is developed by Yves Rosseel at Ghent University. Two good starting points are the documentation (<http://cran.r-project.org/web/packages/lavaan/>) and his upcoming JSS paper (<http://users.ugent.be/~yrosseel/lavaan/lavaanJSSpreview.pdf>).

## See Also

Further ACE model details are discussed in our package's vignette (in the console, type `vignette("NlsyAce")`).

## Examples

```
library(NlsyLinks) #Load the package into the current R session.
dsLinks <- Links79PairExpanded #Start with the built-in data.frame in NlsyLinks
dsLinks <- dsLinks[dsLinks$RelationshipPath=='Gen2Siblings', ] #Use only Gen2 Siblings (NLSY79-C)

oName_1 <- "MathStandardized_1" #Stands for Outcome1
oName_2 <- "MathStandardized_2" #Stands for Outcome2

dsGroupSummary <- RGroupSummary(dsLinks, oName_1, oName_2)
dsClean <- CleanSemAceDataset(dsDirty=dsLinks, dsGroupSummary, oName_1, oName_2)

ace <- AceLavaanGroup(dsClean)
ace

#Should produce:
# [1] "Results of ACE estimation: [show]"
#      ASquared      CSquared      ESquared      CaseCount
#      0.6681874      0.1181227      0.2136900 8390.0000000

library(lavaan) #Load the package to access methods of the lavaan class.
GetDetails(ace)

#Examine fit stats like Chi-Squared, RMSEA, CFI, etc.
fitMeasures(GetDetails(ace)) #The function 'fitMeasures' is defined in the lavaan package.

#Examine low-level details like each group's individual parameter estimates and standard errors.
summary(GetDetails(ace))
```

```
#Extract low-level details. This may be useful when programming simulations.
inspect(GetDetails(ace), what="converged") #The lavaan package defines 'inspect'.
inspect(GetDetails(ace), what="coef")
```

---

CleanSemAceDataset	<i>Produces a cleaned dataset that works well with when using SEM to estimate a univariate ACE model.</i>
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---

## Description

This function takes a ‘GroupSummary’ data.frame (which is created by the RGroupSummary function) and returns a data.frame that is used by the Ace function.

## Usage

```
CleanSemAceDataset(dsDirty, dsGroupSummary, oName_1,
  oName_2, rName = "R")
```

## Arguments

dsDirty	This is the data.frame to be cleaned.
dsGroupSummary	The data.frame containing information about which groups should be included in the analyses. It should be created by the RGroupSummary function.
oName_1	The name of the manifest variable (in dsDirty) for the first subject in each pair.
oName_2	The name of the manifest variable (in dsDirty) for the second subject in each pair.
rName	The name of the variable (in dsDirty) indicating the pair’s relatedness coefficient.

## Details

The function takes dsDirty and produces a new data.frame with the following features:

[A] Only three existing columns are retained: O1, O2, and R. They are assigned these names.

[B] A new column called GroupID is created to reflect their group membership (which is based on the R value). These values are sequential integers, starting at 1. The group with the weakest R is 1. The group with the strongest R has the largest GroupID (this is typically the MZ twins).

[C] Any row is excluded if it has a missing data point for O1, O2, or R.

[D] The data.frame is sorted by the R value. This helps program against the multiple-group SEM API sometimes.

## Value

A data.frame with one row per subject pair. The data.frame contains the following variables (which can NOT be changed by the user through optional parameters):

R	The pair’s R value.
O1	The outcome variable for the first subject in each pair.
O2	The outcome variable for the second subject in each pair.
GroupID	Indicates the pair’s group membership.

**Author(s)**

Will Beasley

**Examples**

```
library(NlsyLinks) #Load the package into the current R session.
dsLinks <- Links79PairExpanded #Start with the built-in data.frame in NlsyLinks
dsLinks <- dsLinks[dsLinks$RelationshipPath=='Gen2Siblings', ] #Use only NLSY79-C siblings

oName_1 <- "MathStandardized_1" #Stands for Outcome1
oName_2 <- "MathStandardized_2" #Stands for Outcome2
dsGroupSummary <- RGroupSummary(dsLinks, oName_1, oName_2)

dsClean <- CleanSemAceDataset( dsDirty=dsLinks, dsGroupSummary, oName_1, oName_2, rName="R" )
summary(dsClean)

dsClean$AbsDifference <- abs(dsClean$O1 - dsClean$O2)
plot(jitter(dsClean$R), dsClean$AbsDifference, col="gray70")
```

---

ColumnUtilities	<i>A collection of functions that helps data management data.frames, particularly those derived from NLS Extracts.</i>
-----------------	--

---

**Description**

A collection of functions that helps data management data.frames, particularly those derived from NLS Extracts.

**Usage**

```
VerifyColumnExists( dataFrame, columnName )

RenameColumn( dataFrame, oldColumnName, newColumnName )

RenameNlsyColumn( dataFrame, nlsyRNumber, newColumnName )
```

**Arguments**

dataFrame	A data.frame object whose columns are to be verified or renamed.
columnName	The name of the column to verify is present in the data.frame.
nlsyRNumber	The name of the column to change.
oldColumnName	The name of the column to change.
newColumnName	The desired name of the column.

**Details**

The RNumber assigned by the NLS has a pattern. In the Nlsy79 Gen1 dataset, the names start with a 'R' or 'T' and are followed by seven digits (eg, R0000100). In the Nlsy79 Gen2 dataset, the names start with 'C' or 'Y' and are followed by seven digits (eg, C0007030, Y1994600).

In the NLS Investigator, a decimal is present in the RNumber (eg, R00001.00). When the Investigator saves the dataset as a CSV, the decimal is removed (R0000100).



**Value**

**\*IMPORTANT\*** The `RenameColumn` and `RenameNlsyColumn` functions do not use side-effects to rename the `data.frame`. Instead, it returns a new `data.frame`. In the example below, notice the assignment to `ds`: `ds <- RenameNlsyColumn(...)`.

The `VerifyColumnExists` function check that exactly one column exists with the specified `columnName`. If so, the index of the column is returned. If not, an exception is thrown.

**Author(s)**

Will Beasley

---

CreateAceEstimate	Instantiate an <a href="#">AceEstimate-class</a> object.
-------------------	--

---

**Description**

Creates an instance of the S4 class, `AceEstimate` instantiating arguments set the parameter values estimated by the ACE model.

**Usage**

```
CreateAceEstimate(aSquared, cSquared, eSquared,
  caseCount, details=list(), unityTolerance = 1e-11)
```

**Arguments**

<code>aSquared</code>	The proportion of variability due to a shared genetic influence (typically represented as $a^2$ , or sometimes $h^2$ ).
<code>cSquared</code>	The proportion of variability due to shared common environmental influence.
<code>eSquared</code>	The proportion of variability due to unexplained/residual/error influence.
<code>caseCount</code>	The number of cases used to estimate the model.
<code>unityTolerance</code>	Specifies how close the the sum of the ACE components should be to one, to be considered properly scaled to one.
<code>details</code>	A list that contains the modeling output and details.

**Details**

The contents of the `details` list depends on the underlying estimation routine. For example, when the ACE model is estimated with a DF analysis, the output is an `lm` object, because the `lm` function was used (ie, the basical general linear model). Alternatively, if the user specified the `lavaan` package should estimate that ACE model, the output is a `lavaan` object.

**Value**

An S4 object of [AceEstimate-class](#).

**Author(s)**

Will Beasley

---

CreatePairLinks	<i>Creates a pairs linking file.</i>
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---

## Description

Creates a linking file for BG designs using this file structure (e.g., DF analysis, other ACE modeling).

A DF analysis requires a double-entered file that contains the R value for the pair, and their two outcome variable values.

CreatePairLinksDoubleEnteredWithNoOutcomes is intended to be a primarily a helper function for [CreateSpatialNeighbours](#).

## Usage

```
CreatePairLinksDoubleEntered(outcomeDataset,
  linksPairDataset, outcomeNames, linksNames =
  c("ExtendedID", "R", "RelationshipPath"),
  validateOutcomeDataset = TRUE)
```

```
CreatePairLinksSingleEntered(outcomeDataset,
  linksPairDataset, outcomeNames, linksNames =
  c("ExtendedID", "R", "RelationshipPath"),
  validateOutcomeDataset = TRUE)
```

```
CreatePairLinksDoubleEnteredWithNoOutcomes(linksPairDataset,
  linksNames = c("ExtendedID", "R", "RelationshipPath"))
```

## Arguments

outcomeDataset A data frame containing the outcome variable(s)

linksPairDataset

A data frame containing the SubjectTags of each subject in the pair and their R coefficient.

outcomeNames The column names of the outcome variable(s)

linksNames The column names desired to be present in the newly created data frame. Subject1Tag and Subject2Tag are included automatically.

validateOutcomeDataset

Indicates if characteristics of the outcomeDataset should be validated.

## Author(s)

Will Beasley

## References

For more information about a DF analysis, see: Rodgers, Joseph Lee, & Kohler, Hans-Peter (2005). Reformulating and simplifying the DF analysis model. *Behavior Genetics*, 35 (2), 211-217.

**Examples**

```

dsSingleLinks <- data.frame(
  ExtendedID=c(1, 1, 1, 2),
  Subject1Tag=c(101, 101, 102, 201),
  Subject2Tag=c(102, 103, 103, 202),
  R=c(.5, .25, .25, .5),
  RelationshipPath=rep("Gen2Siblings", 4)
)
dsSingleOutcomes <- data.frame(
  SubjectTag=c(101, 102, 103, 201, 202),
  DV1=c(11, 12, 13, 41, 42),
  DV2=c(21, 22, 23, 51, 52))
dsDouble <- CreatePairLinksDoubleEntered(
  outcomeDataset=dsSingleOutcomes,
  linksPairDataset=dsSingleLinks,
  outcomeNames=c("DV1", "DV2"),
  validateOutcomeDataset=TRUE)
dsDouble #Show the 8 rows in the double-entered pair links
summary(dsDouble) #Summarize the variables

ValidatePairLinksAreSymmetric(dsDouble) #Should return TRUE.

```

---

**CreateSpatialNeighbours**

*Distances between related family members, formatted for spatial analysis.*

---

**Description**

This helper function formats the LinksPair datasets so it can be used in some types of spatial analyses. The **spdep** (Spatial Dependence) uses a sparse matrix (actually a [data.frame](#)) to represent neighbours.

**Usage**

```
CreateSpatialNeighbours(linksPairsDoubleEntered)
```

**Arguments**

**linksPairsDoubleEntered**  
A `data.frame` containing the links, preferably created by a function like [CreatePairLinksDoubleEntered](#).

**Details**

There is one row per unique pair of subjects, *respecting order*. This is different than [Links79Pair](#) and [Links79PairExpanded](#), which has one row per unique pair of subjects, *irrespective of order*. `#CreateSpatialNeighbours79Gen2` automatically creates dataset of NLSY79 Gen2 subjects (i.e., the children of the mothers in the initial NLSY79 sample).

`CreateSpatialNeighbours` accepts any paired relationships in a `data.frame`, as long as it contains the columns `Subject1Tag`, `Subject2Tag`, and `R`. See [Links79Pair](#) for more details.

**Value**

An S3 `spatial.neighbours` object to work with functions in the **spdep** package. `Subject1Tag` is renamed from. `Subject2Tag` is renamed to. `R` is renamed `weight`. The attribute `region.id` specifies each unique `SubjectTag`. The attribute `n` specifies the number of unique subjects.

**Note**

Notice the British variant of 'neighbours', to be consistent with the `spatial.neighbour` class in the `spdep` package.

**Author(s)**

Will Beasley and David Bard

**References**

Bivand, R., Pebesma, E., & Gomez-Rubio, V. (2008). *Applied Spatial Data Analysis with R*. New York: Springer. (Especially Chapter 9.) ##David, can you please give me some of the articles/books that you used this with?

**Examples**

##Need something here

---

CreateSpatialNeighbours79Gen2

*Automatically creates dataset of NLSY79 Gen2 subjects (i.e., the children of the mothers in the initial NLSY79 sample).*

---

**Description**

CreateSpatialNeighbours79Gen2 automatically creates dataset of NLSY79 Gen2 subjects (i.e., the children of the mothers in the initial NLSY79 sample).

For more information, please see [CreateSpatialNeighbours](#)

**Usage**

CreateSpatialNeighbours79Gen2()

---

CreateSubjectTag	<i>Creates a SubjectTag. This value uniquely identifies subjects, when both generations are included in the same dataset.</i>
------------------	---

---

### Description

A SubjectTag uniquely identify subjects. For Gen2 subjects, the SubjectTag is identical to their CID (ie, C00001.00 -the SubjectID assigned in the NLSY79-Children files). However for Gen1 subjects, the SubjectTag is their CaseID (ie, R00001.00), with "00" appended. This manipulation is necessary to identify subjects uniquely in inter-generational datasets. A Gen1 subject with an ID of 43 becomes 4300. The SubjectTags of her four children remain 4301, 4302, 4303, and 4304.

### Usage

```
CreateSubjectTag(subjectID, generation)
```

### Arguments

subjectID	The ID assigned by the NLSY. For Gen1 subjects, this will be their CaseID (ie, R00001.00). For Gen2 subjects, this will be their CID (ie, C00001.00).
generation	The generation of the subject. Values are either 1 or 2, representing Gen1 and Gen2. Note that this variable is not a factor (in contrast with data frames like <a href="#">Links79Pair</a> ). This dataset is supposed to mimick the dataset provided by the researcher, which typically will not have been converted to a factor.

### Details

For a fuller explanation of SubjectTag in context, see the [Links79Pair](#) dataset documentation.

### Value

A integer value under normal circumstances. An error is thrown if the vectors subjectID and generation are different lengths. If either input vector has NA values, the respective output element(s) will be NA too.

### Author(s)

Will Beasley

### See Also

[Links79Pair](#)

### Examples

```
library(NlsyLinks) #Load the package into the current R session.

#Typically these two vectors will come from a data frame.
subjectIDs <- c(71:82, 10001:10012)
generation <- c(rep(1, 12), rep(2, 12))

CreateSubjectTag(subjectIDs, generation)
```

```
#Returns 7100, ..., 8200, 10001, ..., 10012

#Use the ExtraOutcomes79 dataset, with numeric variables 'SubjectID' and 'Generation'.
ExtraOutcomes79$SubjectTag <- CreateSubjectTag(
  subjectID=ExtraOutcomes79$SubjectID,
  generation=ExtraOutcomes79$Generation
)
```

ExtraOutcomes79

*Extra outcome variables in the NLSY79*

## Description

This dataset is provided primarily to facilitate documentation examples.

Currently this dataset contains only Gen2 subjects. However, it soon will include Gen1 subjects. Code written using this dataset should NOT assume it contains only Gen2 subjects. See below for an example of filtering by generation.

## Format

A data frame with 11,495 observations on the following 6 variables. There is one row per subject.

**SubjectTag** The ID value assigned by NLS to the first subject. For Gen1 Subjects, this is their "CaseID" (ie, R00001.00). For Gen2 subjects, this is their "CID" (ie, C00001.00).

**SubjectID** The ID value assigned by NLS to the first subject. For Gen1 Subjects, this is their "CaseID" (ie, R00001.00). For Gen2 subjects, this is their "CID" (ie, C00001.00).

**Generation** The generation of the subject. Values are either 1 or 2, representing Gen1 and Gen2. Note that this variable is not a factor (in contrast with data frames like [Links79Pair](#)). This dataset is supposed to mimic the dataset provided by the researcher, which typically will not have been converted to a factor.

**AfqtRescaled2006Gaussified** Armed Forces Qualification Test Score for Gen1.

**HeightZGender** The subject's height, standardized by gender (see Details).

**HeightZGenderAge** The subject's height, standardized by gender and age (see Details).

**WeightZGender** The subject's weight, standardized by gender (see Details).

**WeightZGenderAge** The subject's weight, standardized by gender and age (see Details).

**Afi** Self-reported age of first intercourse (see Details).

**Afm** Self-reported age of first menstruation (see Details).

**MathStandardized** Standardized PIAT Math score for Gen2 (see Details).

## Author(s)

Will Beasley

## Source

Gen1 information comes from the May 15, 2010 release of the [NLSY79 sample](#). Gen2 information comes from the Sept 15, 2010 release of the [NLSY79 Children and Young Adults sample](#). Data were extracted with the NLS Investigator (<https://www.nlsinfo.org/investigator/>).

The SubjectTag variable uniquely identify subjects. For Gen2 subjects, the SubjectTag is identical to their CID (ie, C00001.00 -the SubjectID assigned in the NLSY79-Children files). However for Gen1 subjects, the SubjectTag is their CaseID (ie, R00001.00), with "00" appended. This manipulation is necessary to identify subjects uniquely in inter-generational datasets. A Gen1 subject with an ID of 43 has a SubjectTag of 4300. The SubjectTags of her four children remain 4301, 4302, 4303, and 4304.

For Gen2, an NLSY79 variable of MathStandardized is C0580100.00.

Afi, Afm, and MathStandardized values were simplified (to one value per subject) by Kelly Meredith in January 2012 using the Sept 15, 2010 release of NLSY data.

## Examples

```
library(NlsyLinks) #Load the package into the current R session.
gen2Outcomes <- subset(ExtraOutcomes79, Generation==2) #Create a dataset of only Gen2 subjects.

plot(ExtraOutcomes79)
summary(ExtraOutcomes79)

oldPar <- par(mfrow=c(3,2))
hist(ExtraOutcomes79$Generation)
hist(ExtraOutcomes79$MathStandardized)
hist(ExtraOutcomes79$HeightZGenderAge)
hist(ExtraOutcomes79$WeightZGenderAge)
hist(ExtraOutcomes79$Afi)
hist(ExtraOutcomes79$Afm)
par(oldPar)
```

---

GetDetails-methods

*A generic function for extracting the Details slot of an object.*


---

## Description

A generic function for extracting the Details slot of an AceEstimation object.

## Author(s)

Will Beasley

Links79Pair

*Kinship linking file for pairs of relatives in the NLSY79 and NLSY79 Children and Young Adults***Description**

This dataset specifies the relatedness coefficient (ie, 'R') between subjects in the same extended family. Each row represents a unique relationship pair. An extended family with  $k$  subjects will have  $k(k-1)/2$  rows. Typically, Subject1 is older while Subject2 is younger.

The dataset contains Gen1 and Gen2 subjects. "Gen1" refers to subjects in the original NLSY79 sample (<http://www.bls.gov/nls/nlsy79.htm>). "Gen2" subjects are the biological children of the Gen1 females -ie, those in the NLSY79 Children and Young Adults sample (<http://www.bls.gov/nls/nlsy79ch.htm>).

Subjects will be in the same extended family if either: [1] they are Gen1 housemates, [2] they are Gen2 siblings, [3] they are Gen2 cousins (ie, they have mothers who are Gen1 sisters in the NLSY79, [4] they are mother and child (in Gen1 and Gen2, respectively), or [5] they are aunt/uncle and niece/nephew (in Gen1 and Gen2, respectively).

The variables Subject1Tag and Subject2Tag uniquely identify subjects. For Gen2 subjects, the SubjectTag is identical to their CID (ie, C00001.00 -the SubjectID assigned in the NLSY79-Children files). However for Gen1 subjects, the SubjectTag is their CaseID (ie, R00001.00), with "00" appended. This manipulation is necessary to identify subjects uniquely in inter-generational datasets. A Gen1 subject with an ID of 43 has a SubjectTag of 4300. The SubjectTags of her four children remain 4301, 4302, 4303, and 4304.

Level 5 of RelationshipPath (ie, AuntNiece) is gender neutral. The relationship could be either Aunt-Niece, Aunt-Nephew, Uncle-Niece, or Uncle-Nephew. If there's a widely-accepted gender-neutral term, please tell me.

MZ twins have  $R=1$ . DZ twins and full-siblings have  $R=.5$ . Half-siblings have  $R=.25$ . Typical first-cousins have  $R=.125$ . Unrelated subjects have  $R=0$  (this occasionally happens for Gen1Housemates). Other R coefficients are possible. ??Joe, do you have an earlier paper that enumerates all the obscure combinations, like half-cousins or an ambiguous AuntNiece??

**Format**

A data frame with 11,075 observations on the following 5 variables. There is one row per unique pair of subjects, irrespective of order.

**ExtendedID** Identity of the extended family of the pair; it corresponds to the HHID in the NLSY79. See References below.

**Subject1Tag** Identity of the pair's first subject. See Details below.

**Subject2Tag** Identity of the pair's second subject. See Details below.

**R** The pair's Relatedness coefficient. See Details below.

**RelationshipPath** Specifies the relationship category of the pair. This variable is a factor, with levels Gen1Housemates=1, Gen2Siblings=2, Gen2Cousins=3, ParentChild=4, AuntNiece=5.

**Author(s)**

Will Beasley



## Source

Gen1 information comes from the May 15, 2010 release of the [NLSY79 sample](#). Gen2 information comes from the Sept 15, 2010 release of the [NLSY79 Children and Young Adults sample](#). Data were extracted with the NLS Investigator (<https://www.nlsinfo.org/investigator/>).

The internal version for the links is Links2011V51.

## References

The NLSY79 variable HHID (ie, R00001.49) is the source for the ExtendedID variable. This is discussed at <http://www.nlsinfo.org/nlsy79/docs/79html/79text/hhcomp.htm>. \*\* We need an introduction reference/information for 'R'/Relatedness. \*\*

## See Also

The LinksPair79 dataset contains columns necessary for a basic BG analysis. The [Links79PairExpanded](#) dataset contains further information that might be useful in more complicated BG analyses.

A tutorial that produces a similar dataset is [http://www.nlsinfo.org/childya/nlsdocs/tutorials/linking\\_mothers\\_and\\_children/linking\\_mothers\\_and\\_children\\_tutorial.html](http://www.nlsinfo.org/childya/nlsdocs/tutorials/linking_mothers_and_children/linking_mothers_and_children_tutorial.html). It provides examples in SAS, SPSS, and STATA.

The current dataset (ie, Links79Pair) can be saved as a CSV file (comma-separated file) and imported into in other programs and languages. In the R console, type the following two lines of code:

```
library(NlsyLinks); data(Links79Pair)
write.csv(Links79Pair, "C:/BGDirectory/Links79Pair.csv")
```

where "C:/BGDirectory/" is replaced by your preferred directory. Remember to use forward slashes instead of backslashes; for instance, the path "C:\BGDirectory\Links79Pair.csv" will be misinterpreted.

## Examples

```
library(NlsyLinks) #Load the package into the current R session.
summary(Links79Pair) #Summarize the five variables.
hist(Links79Pair$R) #Display a histogram of the Relatedness coefficients.
table(Links79Pair$R) #Create a table of the Relatedness coefficients for the whole sample.

#Create a dataset of only Gen2 sibs, and display the distribution of R.
gen2Siblings <- subset(Links79Pair, RelationshipPath=='Gen2Siblings')
table(gen2Siblings$R) #Create a table of the Relatedness coefficients for the Gen2 sibs.
```

---

Links79PairExpanded	<i>Kinship linking file for pairs of relatives. It builds upon the <a href="#">Links79Pair</a> dataset.</i>
---------------------	---

---

## Description

Please first read the documentation for [Links79Pair](#). That dataset contains the same pairs/rows, but only a subset of the variables/columns.

Specifies the relatedness coefficient (ie, 'R') between subjects in the same extended family. Each row represents a unique relationship pair. An extended family with  $k$  subjects will have  $k(k-1)/2$  rows. Typically, Subject1 is older while Subject2 is younger.

Currently this dataset contains only Gen2 siblings. However, it soon will be generalized to the five categories specified by the RelationshipPath variable. Code written using this dataset should NOT assume it contains only Gen2 sibling pairs. See an example of filtering the relationship category in the in [Links79Pair](#) documentation.

Please first read the documentation for [Links79Pair](#). That dataset contains the same pairs/rows, but only a subset of the variables/columns.

The specific steps to determine the R coefficient will be described in an upcoming publication. The following information may influence the decisions of an applied researcher.

A distinction is made between ‘Explicit’ and ‘Implicit’ information. Explicit information comes from survey items that directly address the subject’s relationships. For instance in 2006, surveys asked if the sibling pair share the same biological father (eg, Y19940.00 and T00020.00). Implicit information comes from items where the subject typically isn’t aware that their responses may be used to determine genetic relatedness. For instance, if two siblings have biological fathers with the same month of death (eg, R37722.00 and R37723.00), it may be reasonable to assume they share the same biological father.

‘Interpolation’ is our lingo when other siblings are used to leverage insight into the current pair. For example, assume Subject 101, 102, and 103 have the same mother. Further assume 101 and 102 report they share a biological father, and that 101 and 103 share one too. Finally, assume that we don’t have information about the relationship between 102 and 103. If we are comfortable with our level of uncertainty of these determinations, then we can interpolate/infer that 102 and 103 are full-siblings as well.

The math and height scores are duplicated from [ExtraOutcomes79](#), but are included here to make some examples more concise and accessible.

## Format

A data frame with 11,075 observations on the following 22 variables. There is one row per unique pair of subjects, irrespective of order.

**ExtendedID** see the variable of the same name in [Links79Pair](#)

**Subject1Tag** see the variable of the same name in [Links79Pair](#)

**Subject2Tag** see the variable of the same name in [Links79Pair](#)

**R** see the variable of the same name in [Links79Pair](#)

**RFull** This is a superset of R. This includes all the *R* values we estimated, while R (i.e., the variable above) excludes values like  $R=0$  for Gen1Housemates, and the associated relationships based on this *R* value (i.e., Gen2Cousins and AuntNieces).

**RelationshipPath** see the variable of the same name in [Links79Pair](#)

**EverSharedHouse** Indicate if the pair likely live in the same house. This is TRUE for Gen1Housemates, Gen2Siblings, and ParentChild. This is FALSE for AuntNiece and Gen2Cousins

**IsMz** Indicates if the pair is from the same zygote (ie, they are identical twins/triplets). This variable is a factor, with levels No=0, Yes=1, DoNotKnow=255.

**Subject1LastSurvey** The year of Subject1’s most recently completed survey. This may be different than the survey’s administration date.

**Subject2LastSurvey** The year of Subject2’s most recently completed survey. This may be different than the survey’s administration date.

**RImplicitPass1** The pair’s R coefficient, using only implicit information. Interpolation was NOT used.

**RImplicit** The pair’s R coefficient, using only implicit information. Interpolation was used.

**RImplicit2004** The pair's R coefficient released in our previous projects (\*\*need reference\*\*). This variable is provided primarily for previous users wishing to replicate previous analyses.

**RExplicitPass1** The pair's R coefficient, using only explicit information. Interpolation was NOT used.

**RExplicit** The pair's R coefficient, using only explicit information. Interpolation was used.

**RExplicitOlderSibVersion** The pair's R coefficient, according to the explicit item responses of the older sibling.

**RExplicitYoungerSibVersion** The pair's R coefficient, according to the explicit item responses of the younger sibling.

**RPass1** The pair's estimated R coefficient, using both implicit and explicit information. Interpolation was NOT used. The variable R is identically constructed, but it did use interpolation.

**GenerationSubject1** The generation of the first subject. Values for Gen1 and Gen2 are 1 and 2, respectively.

**GenerationSubject2** The generation of the second subject. Values for Gen1 and Gen2 are 1 and 2, respectively.

**Subject1ID** The ID value assigned by NLS to the first subject. For Gen1 Subjects, this is their "CaseID" (ie, R00001.00). For Gen2 subjects, this is their "CID" (ie, C00001.00).

**Subject2ID** The ID value assigned by NLS to the second subject.

**MathStandardized\_1** The PIAT-Math score for Subject1. See [ExtraOutcomes79](#) for more information about its source.

**MathStandardized\_2** The PIAT-Math score for Subject2. See [ExtraOutcomes79](#) for more information about its source.

**HeightZGenderAge\_1** The early adult height for Subject1. See [ExtraOutcomes79](#) for more information about its source.

**HeightZGenderAge\_2** The early adult height for Subject2. See [ExtraOutcomes79](#) for more information about its source.

## Author(s)

Will Beasley

## Source

See [Links79Pair](#).

## Examples

```
library(NlsyLinks) #Load the package into the current R session.
olderR <- Links79PairExpanded$RExplicitOlderSibVersion #Declare a concise variable name.
youngerR <- Links79PairExpanded$RExplicitYoungerSibVersion #Declare a concise variable name.

plot(jitter(olderR), jitter(youngerR)) #Scatterplot the siblings' responses.
table(youngerR, olderR) #Table of the relationship between the siblings' responses.
ftable(youngerR, olderR, dnn=c("Younger's Version", "Older's Version")) #A formatted table.

#write.csv(Links79PairExpanded, file='~/NlsyLinksStaging/Links79PairExpanded.csv',
# row.names=FALSE)
```

ReadCsvNlsy79

*Read a CSV file downloaded from the NLS Investigator***Description**

The function accepts a (file path to) CSV file and creates a `data.frame`. The `data.frame` is modified and augmented with columns to assist later routines.

**Usage**

```
ReadCsvNlsy79Gen1(filePath, dsExtract=read.csv(filePath))
```

```
ReadCsvNlsy79Gen2(filePath, dsExtract=read.csv(filePath))
```

**Arguments**

<code>filePath</code>	A path to the CSV file. Remember to use double back-slashes in Windows, or forward-slashes in Windows or Linux.
<code>dsExtract</code>	A ‘ <code>data.frame</code> ’ (containing the extract) can be passed instead of the file path if the data has already been read into R’s memory.

**Details**

The function does seven things.

1. Reads the CSV into a `data.frame`.
2. Checks that the NLSY variables `C00001.00` and `C00002.00` exist in the `data.frame`.
3. The NLSY variable `C00001.00` is renamed `SubjectID`.
4. A variable named `Generation` is given a value of 2 for all subjects.
5. The `SubjectTag` variable is created.
6. The NLSY variable `C00002.00` is multiplied by 100 and renamed `SubjectTagOfMother`.
7. The NLSY variable `R00001.49` (ie, their Mother’s HHID is attached to each Gen2 record).

**Value**

A `data.frame` to facilitate biometric analysis.

**Author(s)**

Will Beasley

**Examples**

```
## Not run:
filePathGen2 <- "~/Nlsy/Datasets/Gen2Birth.csv"
ds <- ReadCsvNlsy79Gen2(filePath=filePathGen2)

## End(Not run)
```

---

RGroupSummary	<i>Calculates summary statistics for each Relatedness Group in the sample.</i>
---------------	--

---

### Description

Before and after running ACE Models, it is important to examine the characteristics of the different groups. When the ACE is estimated with an SEM using multiple groups, it is even even more important. Groups may contain too few subjects to have a well-behaved covariance matrix.

If a group's covariance matrix is not Positive Definite (or it's misbehaving in some other way), it's typically recommended to exclude that group from the SEM.

### Usage

```
RGroupSummary(ds, oName_1, oName_2, rName,
  determinantThreshold=1e-5)
```

### Arguments

ds	The data.frame containing the following variables:
oName_1	The name of the outcome variable corresponding to the first subject in the pair.
oName_2	The name of the outcome variable corresponding to the first subject in the pair.
rName	The name of the variable specifying the pair's Relatedness coefficient.
determinantThreshold	The minimum value the covariance matrix's determinant (for the group) should exceed to be considered Positive Definite.

### Details

This function doesn't specific to an ACE model and groups defined by R. It could be applied to any multiple-group SEM with two manifest/outcome variables. In the future, we may generalize it beyond two manifest variables.

To get summary stats for the entire sample, create a dummy indicator variable that assigns everyone to the same group. See the second example below.

The default determinantThreshold value is nonzero, in order to forgive slight numerical inaccuracies caused by fixed-precision arithmetic.

### Value

A data.frame with one row per group. The data.frame contains the following variables:

R	The group's R value. Note the name of this variable can be changed by the user, by specifying a non-default value to the rName argument.
Included	Indicates if the group should be included in a multiple-group SEM.
PairCount	The number of pairs in the group with <i>complete</i> data for R and the two outcome/manifest variables.
O1Variance	The variance (of the outcome variable) among the group's first members.
O2Variance	The variance (of the outcome variable) among the group's second members.

O102Covariance	The covariance (of the outcome variable) across the group's first and second members.
Correlation	The correlation (of the outcome variable) across the group's first and second members.
Determinant	The determinant of the group's covariance matrix.
PosDefinite	Indicates if the group's covariance matrix is positive definite.

### Author(s)

Will Beasley and David Bard

### References

Please see ZZZ (200?) for more information about SEM with multiple groups.

TODO: refs for determinant & positive definite.

### Examples

```
library(NlsyLinks) #Load the package into the current R session.
dsLinks <- Links79PairExpanded #Load the dataset from the NlsyLinks package.
dsLinks <- dsLinks[dsLinks$RelationshipPath=='Gen2Siblings', ]
oName_1 <- "MathStandardized_1" #Stands for Outcome1
oName_2 <- "MathStandardized_2" #Stands for Outcome2
dsGroupSummary <- RGroupSummary(dsLinks, oName_1, oName_2)
dsGroupSummary

#Should return:
# R Included PairCount O1Variance O2Variance O102Covariance Correlation Determinant PosDefinite
# 1 0.250 TRUE 2719 169.1291 207.0233 40.66048 0.2172970 33360.38 TRUE
# 2 0.375 TRUE 141 167.9943 181.8788 40.67609 0.2327024 28900.07 TRUE
# 3 0.500 TRUE 5508 230.9663 233.3492 107.59822 0.4634764 42318.42 TRUE
# 4 0.750 FALSE 2 220.5000 18.0000 63.00000 1.0000000 0.00 FALSE
# 5 1.000 TRUE 22 319.1948 343.1169 277.58874 0.8387893 32465.62 TRUE

#To get summary stats for the whole sample, create one large inclusive group.
dsLinks$Dummy <- 1
(dsSampleSummary <- RGroupSummary(dsLinks, oName_1, oName_2, rName="Dummy"))

#Should return:
# Dummy Included PairCount M1Variance M2Variance M1M2Covariance Correlation Determinant PosDefinite
#1 1 TRUE 8392 216.466 229.2988 90.90266 0.4080195 41372.1 TRUE
###
### ReadCsvNlsy79
###
## Not run:
filePathGen2 <- "../NlsyLinksStaging/Datasets/Gen2Birth.csv"
ds <- ReadCsvNlsy79Gen2(filePath=filePathGen2)

## End(Not run)
```

SubjectDetails79

*Dataset containing further details of the Gen1 and Gen2 subjects.***Description**

These variables are useful to many types of analyses (not just behavior genetics), and are provided to save users time.

**Format**

A data frame with 24,181 observations on the following 12 variables.

**SubjectTag** see the variable of the same name in [Links79Pair](#)

**ExtendedID** see the variable of the same name in [Links79Pair](#)

**Generation** Indicates if the subject is in generation 1 or 2.

**Gender** Indicates if the subject is Male or Female.

**SiblingCountInNls** The number of the subject's siblings, including himself/herself (a singleton has a value of one). This considers only the siblings in the NLSY. For Gen1, this can exclude anyone outside the age range. For Gen2, this excludes anyone who doesn't share the same mother.

**BirthOrderInNls** Indicates the subject's birth order among the NLSY siblings.

**SimilarAgeCount** The number of children who were born within roughly 30 days of the subject's birthday, including the subject (for instance, even an only child will have a value of 1). For Gen2 subjects, this should reflect how many children the Gen1 mother gave birth to at the same time (1: singleton; 2: twins, 3: triplets). For Gen1 subjects, this is less certain, because the individual might have been living with a similarly-aged housemate, born to a different mother.

**HasMzPossibly** Indicates if the subject *might* be a member of an MZ twin/triplet. This will be true if there is a sibling with a DOB within a month, and they are the same gender.

**IsMz** Indicates if the subject has been identified as a member of an MZ twin/triplet.

**KidCountBio** The number of biological children known to the NLSY (but not necessarily interviewed by the NLSY).

**KidCountInNls** The number of children who belong to the NLSY. This is nonnull for only Gen1 subjects.

**MoB** The subject's month of birth. The exact day is not available to the public. By default, we set their birthday to the 15th day of the month.

**LastSurveyYearCompleted** ##This variable is not available yet## The year of the most recently completed survey.

**AgeAtLastSurvey** ##This variable is not available yet## The subject's age at the most recently completed survey.

**IsDead** ##This variable is not available yet## Indicates if the subject was alive for the last attempted survey.

**DeathDate** ##This variable is not available yet## The subject's month of death. The exact day is not available to the public. By default, we set their birthday to the 15th day of the month.

**Author(s)**

Will Beasley

**Source**

Gen1 information comes from the May 15, 2010 release of the **NLSY79 sample**. Gen2 information comes from the Sept 15, 2010 release of the **NLSY79 Children and Young Adults sample**. Data were extracted with the NLS Investigator (<https://www.nlsinfo.org/investigator/>).

**Examples**

```
library(NlsyLinks) #Load the package into the current R session.

summary(SubjectDetails79)

oldPar <- par(mfrow=c(3,2), mar=c(2,2,1,.5), tcl=0, mgp=c(1,0,0))
hist(SubjectDetails79$SiblingCountInNls, main="",
     breaks=seq(from=0, to=max(SubjectDetails79$SiblingCountInNls, na.rm=TRUE), by=1)
)
hist(SubjectDetails79$BirthOrderInNls, main="",
     breaks=seq(from=0, to=max(SubjectDetails79$BirthOrderInNls, na.rm=TRUE), by=1)
)
hist(SubjectDetails79$SimilarAgeCount, main="",
     breaks=seq(from=0, to=max(SubjectDetails79$SimilarAgeCount, na.rm=TRUE), by=1)
)
hist(SubjectDetails79$KidCountBio, main="",
     breaks=seq(from=0, to=max(SubjectDetails79$KidCountBio, na.rm=TRUE), by=1)
)
hist(SubjectDetails79$KidCountInNls, main="",
     breaks=seq(from=0, to=max(SubjectDetails79$KidCountInNls, na.rm=TRUE), by=1)
)
#hist(SubjectDetails79$Mob, main="",
#     breaks=seq.Date(
#       from=min(SubjectDetails79$Mob, na.rm=TRUE),
#       to=max(SubjectDetails79$Mob, na.rm=TRUE),
#       by="year")
#)
par(oldPar)
```

---

ValidateOutcomeDataset

*Validates the schema of datasets containing outcome variables.*


---

**Description**

The **NlsyLinks** handles a lot of the plumbing code needed to transform extracted NLSY datasets into a format that statistical routines can interpret. In some cases, a dataset of measured variables is needed, with one row per subject. This function validates the measured/outcome dataset, to ensure it posses an interpretable schema. For a specific list of the requirements, see Details below.

**Usage**

```
ValidateOutcomeDataset(dsOutcome, outcomeNames)
```



## Arguments

dsOutcome	A data frame with the measured variables
outcomeNames	The column names of the measure variables that eventually will be used by a statistical procedure.

## Details

The dsOutcome parameter must:#'

1. Have a non-missing value.
2. Contain at least one row.
3. Contain a column called 'SubjectTag' (case sensitive).
4. Have the SubjectTag column containing only positive numbers.
5. Have the SubjectTag column where all values are unique (ie, two rows/subjects cannot have the same value).

The outcomeNames parameter must:

1. Have a non-missing value
2. Contain only column names that are present in the dsOutcome data frame.

## Value

Returns TRUE if the validation passes. Returns an error (and associated descriptive message) if it false.

## Author(s)

Will Beasley

## Examples

```
library(NlsyLinks) #Load the package into the current R session.
ds <- ExtraOutcomes79
outcomeNames <- c("MathStandardized", "WeightZGenderAge")
ValidateOutcomeDataset(dsOutcome=ds, outcomeNames=outcomeNames) #Returns TRUE.
outcomeNamesBad <- c("MathMisspelled", "WeightZGenderAge")
#ValidateOutcomeDataset(dsOutcome=ds, outcomeNames=outcomeNamesBad) #Throws error.
```

---

ValidatePairLinks	<i>Validates the schema of a links for pairs of relatives</i>
-------------------	---

---

## Description

A helper function that verifies the linking dataset contains (A) the essential columns exist, and (B) at least one row. It is called by CreatePairLinks.

Typical use of **NlsyLinks** will not require this function, since a valid paired links are supplied for each supported sample (ie, [Links79Pair](#)).

The **NlsyLinks** uses several types of linking schemas. This function validates the type where each relative subject has their own row.

The following four columns must be present: (1) Subect1Tag, (2) Subect2Tag, (3) R, and (4) MultipleBirth. They must have a numeric mode/datatype.

**Usage**

```
ValidatePairLinks(linksPair)
```

**Arguments**

linksPair      The data.frame to validate.

**Value**

Returns TRUE if the validation passes. Returns an error (and associated descriptive message) if it false.

**Author(s)**

Will Beasley

**See Also**

[Links79Pair](#), [Links79PairExpanded](#),

**Examples**

```
dsSingleLinks <- data.frame(
  ExtendedID=c(1, 1, 1, 2),
  Subject1Tag=c(101, 101, 102, 201),
  Subject2Tag=c(102, 103, 103, 202),
  R=c(.5, .25, .25, .5),
  RelationshipPath=rep("Gen2Siblings", 4)
)
dsSingleOutcomes <- data.frame(
  SubjectTag=c(101, 102, 103, 201, 202),
  DV1=c(11, 12, 13, 41, 42),
  DV2=c(21, 22, 23, 51, 52))
dsDouble <- CreatePairLinksDoubleEntered(
  outcomeDataset=dsSingleOutcomes,
  linksPairDataset=dsSingleLinks,
  outcomeNames=c("DV1", "DV2"),
  validateOutcomeDataset=TRUE)
dsDouble #Show the 8 rows in the double-entered pair links
summary(dsDouble) #Summarize the variables

ValidatePairLinksAreSymmetric(dsDouble) #Should return TRUE.
```

---

ValidatePairLinksAreSymmetric

*Verifies that the pair relationships are symmetric.*

---

**Description**

For certain analyses, the pairs links (which can be considered a type of sparse matrix) need to be symmetric. For instance, if there is a row for Subjects 201 and 202 with R=0.5, there should be a second row for Subjects 202 and 201 with R=0.5.

This validation function is useful to some types of DF methods and some spatially-inspired methods.

**Usage**

```
ValidatePairLinksAreSymmetric(linksPair)
```

**Arguments**

linksPair        The [data.frame](#) object that should be symmetric

**Value**

Returns TRUE if symmetric. Throw an error with [stop](#) if asymmetric.

**Author(s)**

Will Beasley

**See Also**

[CreatePairLinksDoubleEntered](#)

**Examples**

```
dsSingleLinks <- data.frame(
  ExtendedID=c(1, 1, 1, 2),
  Subject1Tag=c(101, 101, 102, 201),
  Subject2Tag=c(102, 103, 103, 202),
  R=c(.5, .25, .25, .5),
  RelationshipPath=rep("Gen2Siblings", 4)
)
dsSingleOutcomes <- data.frame(
  SubjectTag=c(101, 102, 103, 201, 202),
  DV1=c(11, 12, 13, 41, 42),
  DV2=c(21, 22, 23, 51, 52))
dsDouble <- CreatePairLinksDoubleEntered(
  outcomeDataset=dsSingleOutcomes,
  linksPairDataset=dsSingleLinks,
  outcomeNames=c("DV1", "DV2"),
  validateOutcomeDataset=TRUE)
dsDouble #Show the 8 rows in the double-entered pair links
summary(dsDouble) #Summarize the variables

ValidatePairLinksAreSymmetric(dsDouble) #Should return TRUE.
```

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