Daten verarbeiten und vorbereiten

Dirk Seidensticker/Clemens Schmid

6. Februar 2016

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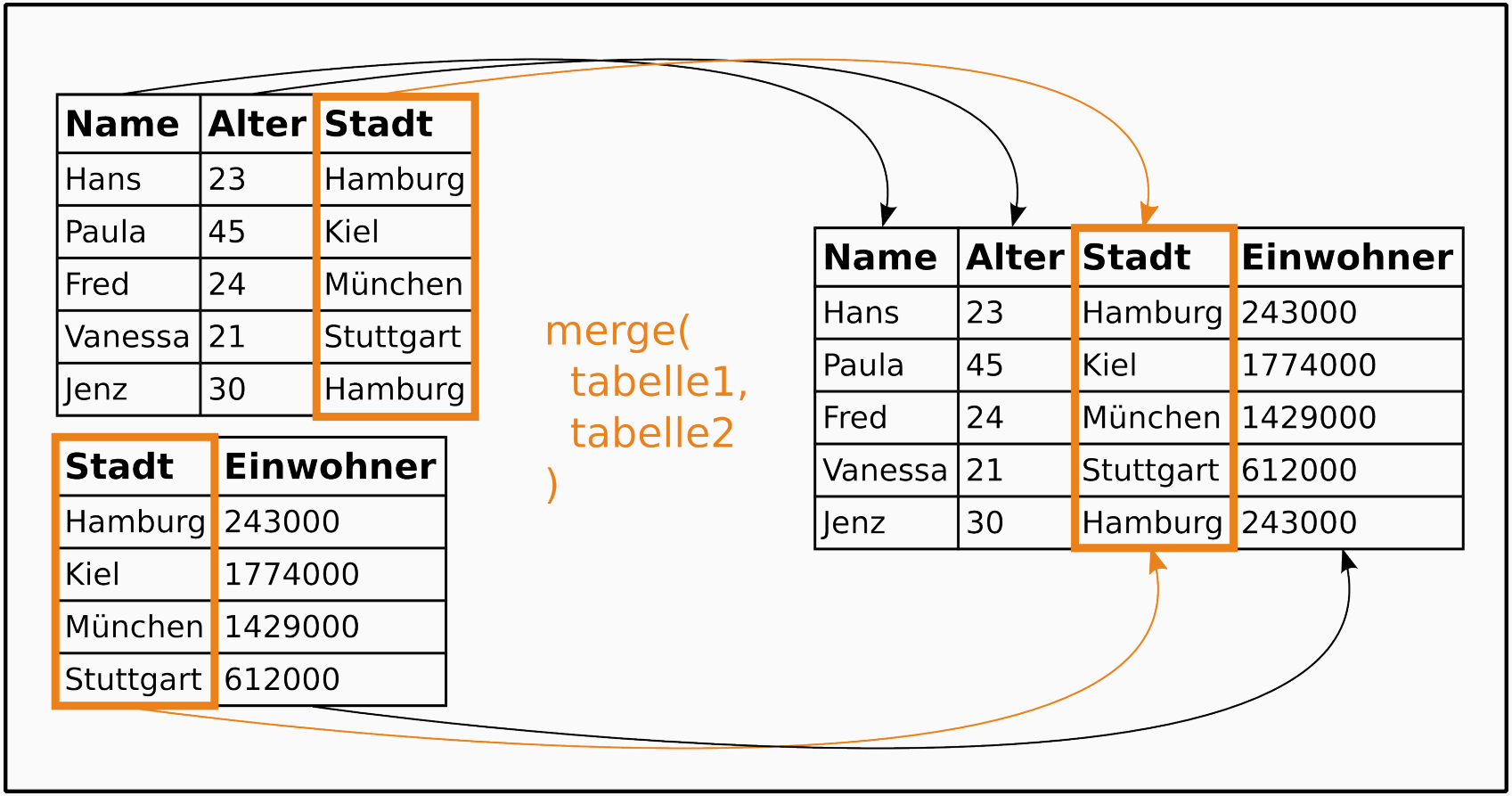
Daten verknüpfen (%in%, merge)

Daten verknüpfen - Idee

Zusammenführen von Informationen aus verschiedenen Tabellen.



Vergleiche **Join-Operationen** in SQL (NATURAL JOIN, INNER JOIN, LEFT JOIN, RIGHT JOIN).

Am Anfang steht oft die Frage, ob gemeinsame Merkmalsausprägungen vorhanden sind: **%in%**

base::merge()

*merge(**x**, **y**, **by** = intersect(names(x), names(y)), **by.x** = by, **by.y** = by, **all** = FALSE, **all.x** = all, **all.y** = all, sort = TRUE, suffixes = c(".x",".y"), incomparables = NULL, . . .)*

Beschreibung

Merge two data frames by common columns or row names, or do other versions of database join operations.

Beispiel

```
R <- data.frame(V1 = c(1,2,3), V2 = c(4,5,6), V3 = c("A","B","C"))
S <- data.frame(V4 = c(7,8,9), V5 = c(10,11,12), V6 = c("A","C","D"))

merge(x = R, y = S, by.x = "V3", by.y = "V6", all.x = TRUE)
```

```
##   V3 V1 V2 V4 V5
## 1  A  1  4  7 10
## 2  B  2  5 NA NA
## 3  C  3  6  8 11
```

base::match()

*match(**x**, **table**, **nomatch** = NA_integer_, incomparables = NULL)*

*x **%in%** table*

Beschreibung

match returns a vector of the positions of (first) matches of its first argument in its second.

%in% is a more intuitive interface as a binary operator, which returns a logical vector indicating if there is a match or not for its left operand.

Beispiel

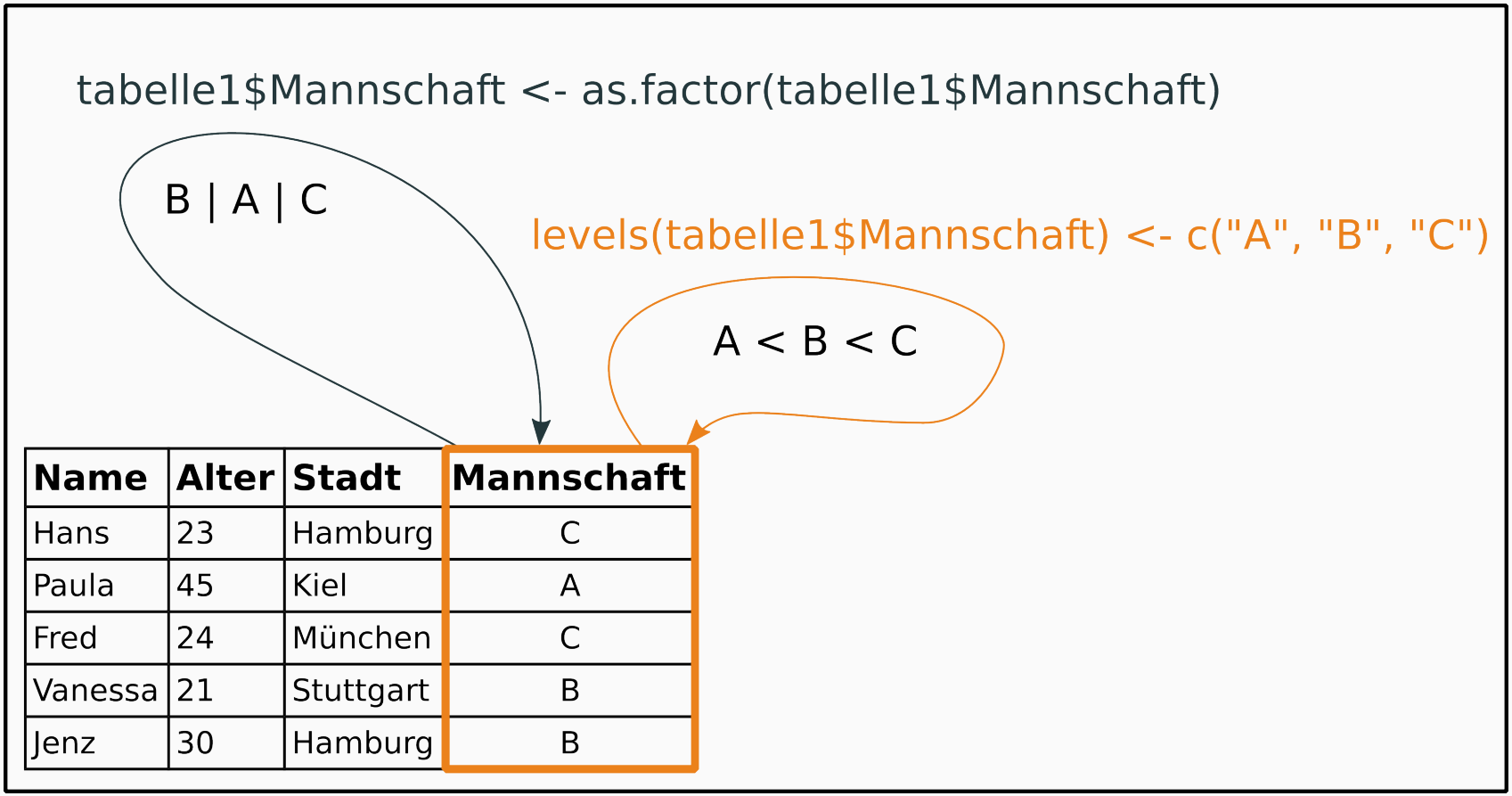
```
R <- data.frame(V1 = c(1,2,3), V2 = c(4,5,6), V3 = c("A","B","C"))
S <- data.frame(V4 = c(7,8,9), V5 = c(10,11,12), V6 = c("A","C","D"))

R$V3 %in% S$V6
```

```
## [1]  TRUE FALSE  TRUE
```

Kategorisierung und Rangfolgen (factor & levels)

Kategorisierung und Rangfolgen - Idee

Werte zu Klassen zusammen fassen und Klassen in eine Rangfolgen bringen



Name	Alter	Stadt	Mannschaft
Hans	23	Hamburg	C
Paula	45	Kiel	A
Fred	24	München	C
Vanessa	21	Stuttgart	B
Jenz	30	Hamburg	B

Klassifizierung und die Qualität von Klassen stecken nicht direkt in Daten - sie müssen klar zugewiesen werden.
Insbesondere für Plots von Bedeutung.

base::factor()

*factor(**x** = character(), **levels**, **labels** = levels, exclude = NA, **ordered** = is.ordered(x), nmax = NA)*

Beschreibung

The function factor is used to encode a vector as a factor (the terms 'category' and 'enumerated type' are also used for factors). If argument ordered is TRUE, the factor levels are assumed to be ordered.

Beispiel

```
R <- data.frame(V1 = c(1.1,1.2,1.3), V2 = c(1,2,3))
R$V1 <- as.factor(x = R$V1)
R$V1
```

```
## [1] 1.1 1.2 1.3
## Levels: 1.1 1.2 1.3
```

base::levels()

*levels(**x**)*

*levels(**x**) <- value*

Beschreibung

levels provides access to the levels attribute of a variable. The first form returns the value of the levels of its argument and the second sets the attribute.

Beispiel

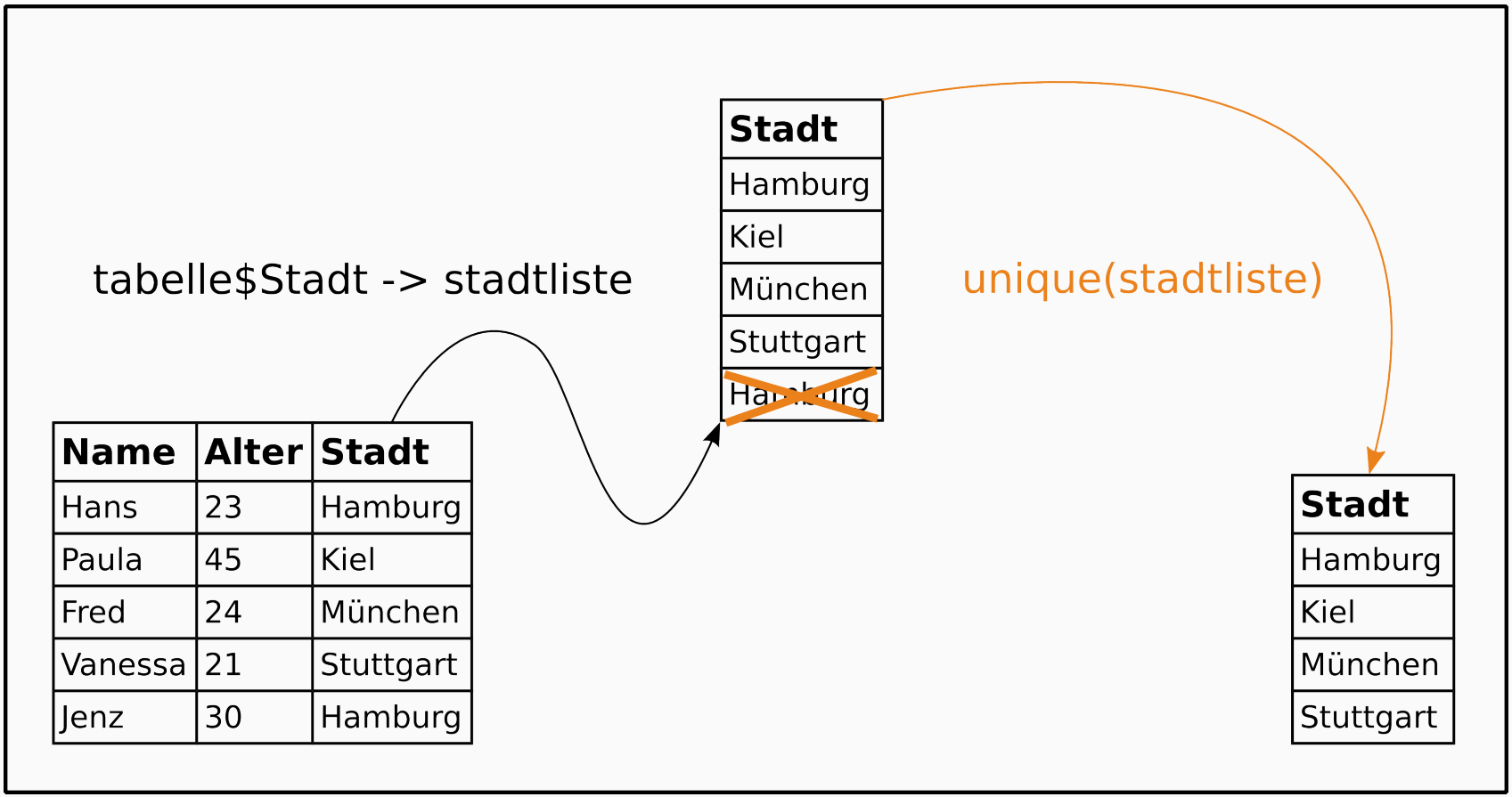
```
R <- data.frame(V1 = c(1.1,1.2,1.3), V2 = c(1,2,3))
levels(x = R$V1) <- c(1.3,1.2,1.1)
R$V1
```

```
## [1] 1.1 1.2 1.3
## attr(,"levels")
## [1] 1.3 1.2 1.1
```

Duplikate entfernen (unique & duplicated)

Duplikate entfernen - Idee

Finden und Entfernen doppelter Werte und Wertekombinationen



Duplikate entfernen und Bandbreite einer Merkmalsausprägung erfassen: “Was gibt es überhaupt?”

base::unique()

*unique(**x**, incomparables = FALSE, **fromLast** = FALSE, nmax = NA, ...)*

Beschreibung

unique returns a vector, data frame or array like x but with duplicate elements/rows removed.

Beispiel

```
R <- data.frame(V1 = c(1,1,1), V2 = c(2,2,2), V3 = c("A","A","B"))
unique(x = R)
```

```
##   V1 V2 V3
## 1  1  2  A
## 3  1  2  B
```

base::duplicated()

*duplicated(**x**, incomparables = FALSE, **fromLast** = FALSE, nmax = NA, . . .)*

Beschreibung

duplicated() determines which elements of a vector or data frame are duplicates of elements with smaller subscripts, and returns a logical vector indicating which elements (rows) are duplicates.

Beispiel

```
R <- data.frame(V1 = c(1,1,1), V2 = c(2,2,2), V3 = c("A","A","B"))
duplicated(x = R, fromLast = TRUE)
```

```
## [1]  TRUE FALSE FALSE
```

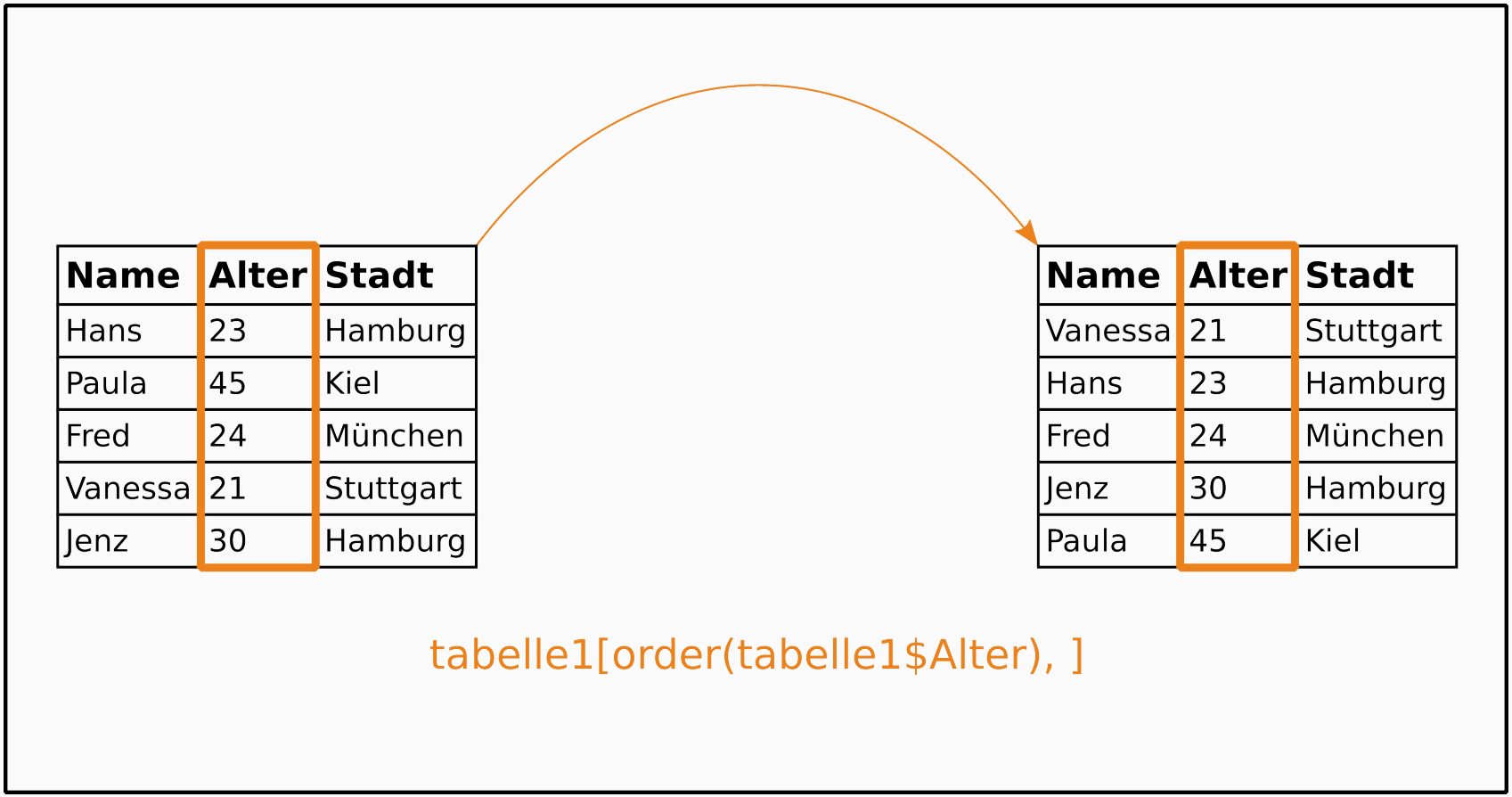
```
any(duplicated(R))
```

```
## [1] TRUE
```

Sortieren (sort & order)

Sortieren - Idee

Werte und Wertekombinationen in eine Reihenfolge bringen



Sortieren läuft für verschiedene Datentypen unterschiedlich ab: Vgl. Zahlwerte, Worte, BLOBs, etc.

base::sort()

*sort(**x**, **decreasing** = FALSE, na.last = NA, . . .)*

Beschreibung

Sort a vector or factor into ascending or descending order.

Beispiel

```
V <- c("A","F","G","Käsebrot","B","X","Q")
sort(x = V, decreasing = TRUE)
```

```
## [1] "X"         "Q"         "Käsebrot" "G"         "F"         "B"
## [7] "A"
```

base::order()

order(..., *na.last* = *TRUE*, ***decreasing*** = *FALSE)*

Beschreibung

order returns a permutation which rearranges its first argument into ascending or descending order, breaking ties by further arguments.

Beispiel

```
R <- data.frame(V1 = c(1,1,1), V2 = c(132,78,5), V3 = c("B","A","A"))
order(R$V3, R$V2)
```

```
## [1] 3 2 1
```

```
R[order(R$V3, R$V2), ]
```

```
##   V1  V2 V3
## 3  1   5  A
## 2  1  78  A
## 1  1 132  B
```

Gruppieren und Gruppenoperationen (aggregate & group_by & summarise)

Gruppieren und Gruppenoperationen - Idee

Gruppen bilden und gruppenbezogene Fragen stellen

Name	Alter	Stadt	Mannschaft
Hans	23	Hamburg	C
Paula	45	Kiel	A
Fred	24	München	C
Vanessa	21	Stuttgart	B
Jenz	30	Hamburg	B

summarise(group_by(tabelle1, Mannschaft), mean(Alter))

Mannschaft	Name	Alter	Stadt
A	Paula	45	Kiel
B	Vanessa	21	Stuttgart
B	Jenz	30	Hamburg
C	Hans	23	Hamburg
C	Fred	24	München

Mannschaft	mean(Alter)
A	45
B	25.5
C	23.5

Gruppen werden immer in Abhängigkeit von Merkmalsausprägungen definiert.

Gruppenbezogene Fragen lassen nur gruppenbezogene Antworten zu - individuelle Werte gehen verloren.

stats::aggregate()

*aggregate(**x**, **by**, **FUN**, . . . , simplify = TRUE)*

*aggregate(**formula**, **data**, **FUN**, . . . , subset, na.action = na.omit)*

Beschreibung

Splits the data into subsets, computes summary statistics for each, and returns the result in a convenient form.

Beispiel

```
R <- data.frame(V1 = c(3,5,1), V2 = c(3,8,5), V3 = c("B","A","A"))
aggregate(x = R, by = list(R$V3), FUN = "mean") -> a1
aggregate(V2~V3, data = R, FUN = "sum")
```

```
##   V3 V2
## 1  A 13
## 2  B  3
```

dplyr::group_by()

*group_by(**.data**, **...**, add = FALSE)*

Beschreibung

The group_by function takes an existing tbl and converts it into a grouped tbl where operations are performed "by group".

Beispiel

```
R <- data.frame(V1 = c(3,5,1), V2 = c(3,8,5), V3 = c("B","A","A"))
group_by(R, V3)
```

```
## Source: local data frame [3 x 3]
## Groups: V3 [2]
##
##      V1    V2     V3
##   (dbl) (dbl) (fctr)
## 1     3     3      B
## 2     5     8      A
## 3     1     5      A
```

dplyr::summarise()

*summarise(**.data**, **...**)*

Beschreibung

Summarise multiple values to a single value.

Beispiel

```
R <- data.frame(V1 = c(4,5,1), V2 = c(3,8,5), V3 = c("B","A","A"))
R.g <- group_by(R, V3)
summarise(R.g, Mittwelwert = mean(V1), Summe = sum(V2))
```

```
## Source: local data frame [2 x 3]
##
##       V3 Mittwelwert Summe
##   (fctr)       (dbl) (dbl)
## 1      A           3    13
## 2      B           4     3
```

Pivotieren (*apply & dcast)

Pivotieren

```
atlant <- read.csv(
  "../data/AtlantData1.csv",
  sep = "\t",
  header = TRUE
  )
```

Kreuztabelle mit Auszählen

```
table(atlant$site, atlant$size)
```

```
##
##      30 70 120 200 500
##    A  0  0   1   2   5
##    B  0  0   0   2   2
##    C  0  1   2   0   1
##    D  0  8   7   1   0
##    E  0  0   0   2   2
##    F  1 12  20  23   9
##    G  0  0   1   2   2
##    H  0 15   8   5   0
```

Kreuztabelle mit Auszählen

dito mit tapply

```
a <- tapply(atlant$qty, list(atlant$site, atlant$size), length)
a[is.na(a)] <- 0
a
```

```
##   30 70 120 200 500
## A  0  0   1   2   5
## B  0  0   0   2   2
## C  0  1   2   0   1
## D  0  8   7   1   0
## E  0  0   0   2   2
## F  1 12  20  23   9
## G  0  0   1   2   2
## H  0 15   8   5   0
```

Berechnungen in Abhängigkeit zu einer Variable

```
tapply(atlant$wt, list(atlant$site), sum)
```

```
##     A     B     C     D     E     F     G     H
##  8805  6621  1641  1760  4825 22849  3525  4530
```

Berechnungen in Abhängigkeit zu einer Variable

```
data.frame(tapply(atlant$wt, list(atlant$site), sum))
```

```
##   tapply.atlant.wt..list.atlant.site...sum.
## A                                      8805
## B                                      6621
## C                                      1641
## D                                      1760
## E                                      4825
## F                                     22849
## G                                      3525
## H                                      4530
```

Berechnungen in Abhängigkeit zu einer Variable

```
data.frame(tapply(atlant$wt, list(atlant$site),
                  function(x){sum(x)/1000}))
```

```
##   tapply.atlant.wt..list.atlant.site...function.x...
## A                                              8.805
## B                                              6.621
## C                                              1.641
## D                                              1.760
## E                                              4.825
## F                                             22.849
## G                                              3.525
## H                                              4.530
```

Berechnungen in Abhängigkeit zu zwei Variablen

```
b <- data.frame(tapply(atlant$wt,
                list(atlant$site, atlant$size), sum),
                check.names = FALSE)
b[is.na(b)] <- 0
b
```

```
##    30  70  120  200   500
## A   0   0   67 1536  7202
## B   0   0    0 1003  5618
## C   0  45  148    0  1448
## D   0 272 1150  338     0
## E   0   0    0 1481  3344
## F   6 453 2015 9812 10563
## G   0   0   84 1002  2439
## H   0 512 1007 2921     0
```

Auszählen in Abhängigkeit zu drei Variablen

```
library(reshape2)

pivot <- dcast(atlant, site + feature ~ size)


## Using vesselShape as value column: use value.var to override.
## Aggregation function missing: defaulting to length

head(pivot)


##   site feature 30 70 120 200 500 NA
## 1    A       1  0  0   1   1   4  0
## 2    A surface  0  0   0   1   1  0
## 3    B surface  0  0   0   2   2  0
## 4    C surface  0  1   2   0   1  0
## 5    D       1  0  6   4   1   0  0
## 6    D       2  0  1   1   0   0  0
```

Berechnungen in Abhängigkeit zu drei Variablen

```
pivot2 <- dcast(atlant, site + feature ~ size,
      value.var = "wt",
      fun.aggregate = sum)

head(pivot2)
```

```
##   site feature 30  70 120  200  500 NA
## 1    A       1  0   0  67 1012 5630  0
## 2    A surface  0   0   0  524 1572  0
## 3    B surface  0   0   0 1003 5618  0
## 4    C surface  0  45 148    0 1448  0
## 5    D       1  0 159 749  338    0  0
## 6    D       2  0  74 167    0    0  0
```

Datenanordnung - wide to long und long to wide (melt)

Melt

Eingabeformat für ggplot2()!!!

Wir wollen diese vorhin erstelle Tabelle plotten:

```
a
```

```
##    30 70 120 200 500
## A   0  0   1   2   5
## B   0  0   0   2   2
## C   0  1   2   0   1
## D   0  8   7   1   0
## E   0  0   0   2   2
## F   1 12  20  23   9
## G   0  0   1   2   2
## H   0 15   8   5   0
```

Melt

```
library(reshape2)
atlant_sites.size <- melt(a)

head(atlant_sites.size)
```

```
##   Var1 Var2 value
## 1    A   30     0
## 2    B   30     0
## 3    C   30     0
## 4    D   30     0
## 5    E   30     0
## 6    F   30     1
```

Melt

```r
colnames(atlant_sites.size) <- c('site', 'size', 'qty')

head(atlant_sites.size)
```

```
##   site size qty
## 1    A   30   0
## 2    B   30   0
## 3    C   30   0
## 4    D   30   0
## 5    E   30   0
## 6    F   30   1
```

```r
# write.table(atlant_sites.size,
#             "data/AtlantPottey_Sites-Sizes.csv",
#             sep = '\t')
```

Filtern (subset & filter)

Filter und Subseting nach site 'F'

```
atlant_sub <- subset(atlant, site == 'F')
head(atlant_sub)
```

```
##    site      X       Y    archont feature                  object cla
## 37    F 458694 3951533 Autochthon       2                    -8:1
## 38    F 458694 3951533 Autochthon       1                    -3:1
## 39    F 458694 3951533 Autochthon       1                    -6:2
## 40    F 458694 3951533 Autochthon       2     -2:2 -4:3,10-11,13
## 41    F 458694 3951533 Autochthon       2                   -4:2
## 42    F 458694 3951533 Autochthon       2 -4:5-6,8,12,14-21 -5:3
##    sherd qty  wt size wall muendungsD muendungsH minD minD_H maxD ma
## 37     G   1 829  500    7       20.5       12.5 17.5    8.5 19.0
## 38     G   1 155  120    4       11.5        6.5 12.0    5.0  5.0
## 39     G   1 504  200    4        5.0       18.5  6.5   14.0 16.5
## 40     G   1 419  200   10       19.0       14.0 17.0   10.0 17.5
## 41     G   1 691  500   10       20.0       12.0 17.5    9.0 18.0
## 42     G   1 623  500   10       18.5       13.0 17.0   11.0 18.0
##    bodenD temperSize vesselShape
## 37    0.0         VF         S1b
```

Filter mit mehrere Bedingungen

```r
library(dplyr)

atlant_filter <- filter(atlant, site == 'F' & wall > 5)
head(atlant_filter)
```

```
##   site      X       Y    archont feature                  object clas
## 1    F 458694 3951533 Autochthon       2                    -8:1
## 2    F 458694 3951533 Autochthon       2     -2:2 -4:3,10-11,13
## 3    F 458694 3951533 Autochthon       2                   -4:2
## 4    F 458694 3951533 Autochthon       2 -4:5-6,8,12,14-21 -5:3
## 5    F 458694 3951533 Autochthon       2    -4:4,7,9 -5:4-6,8-9
## 6    F 458694 3951533 Autochthon       2                   -5:2
##   sherd qty   wt size wall muendungsD muendungsH minD minD_H maxD ma
## 1     G   1  829  500    7       20.5       12.5 17.5    8.5 19.0
## 2     G   1  419  200   10       19.0       14.0 17.0   10.0 17.5
## 3     G   1  691  500   10       20.0       12.0 17.5    9.0 18.0
## 4     G   1  623  500   10       18.5       13.0 17.0   11.0 18.0
## 5     G   1  344  200   10         NA         NA 18.0    8.5 17.5
## 6     G   1 1671  500   12       24.5       15.0 21.5   10.5 22.5
```