

Katja Glass  
Consulting

# Open Source SAS Makros

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Was gibt es?

Wie nutze ich es?

Was sollte ich beachten?

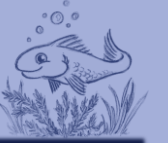
Katja Glaß





# Agenda

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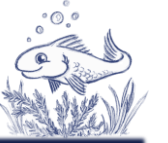
- Einleitung
  - Anwendungsbeispiel
  - Beispiele
  - Überlegungen
  - Ausblick
- 





# Einleitung

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## ➤ Was ist Open Source?

*„Als **Open Source** wird Software bezeichnet, deren Quelltext öffentlich und von Dritten eingesehen, geändert und genutzt werden kann. Open-Source-Software kann meistens kostenlos genutzt werden.“*

Wikipedia ([https://de.wikipedia.org/wiki/Open\\_Source](https://de.wikipedia.org/wiki/Open_Source))

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# Einleitung



- Was ist Open Source?
  - Quellcode offen und einsehbar
  - SAS Makros, Programme
  - Flexibel nutzbar / anpassbar
  - Lizenzbestimmungen



“Unlicense”, MIT -> “freie Lizenz”

Tu was du willst,  
auch kommerziell!

MIT: Copy  
license &  
copyright



GNU – Familie -> wenige bis einige Einschränkungen

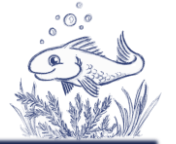


Andere

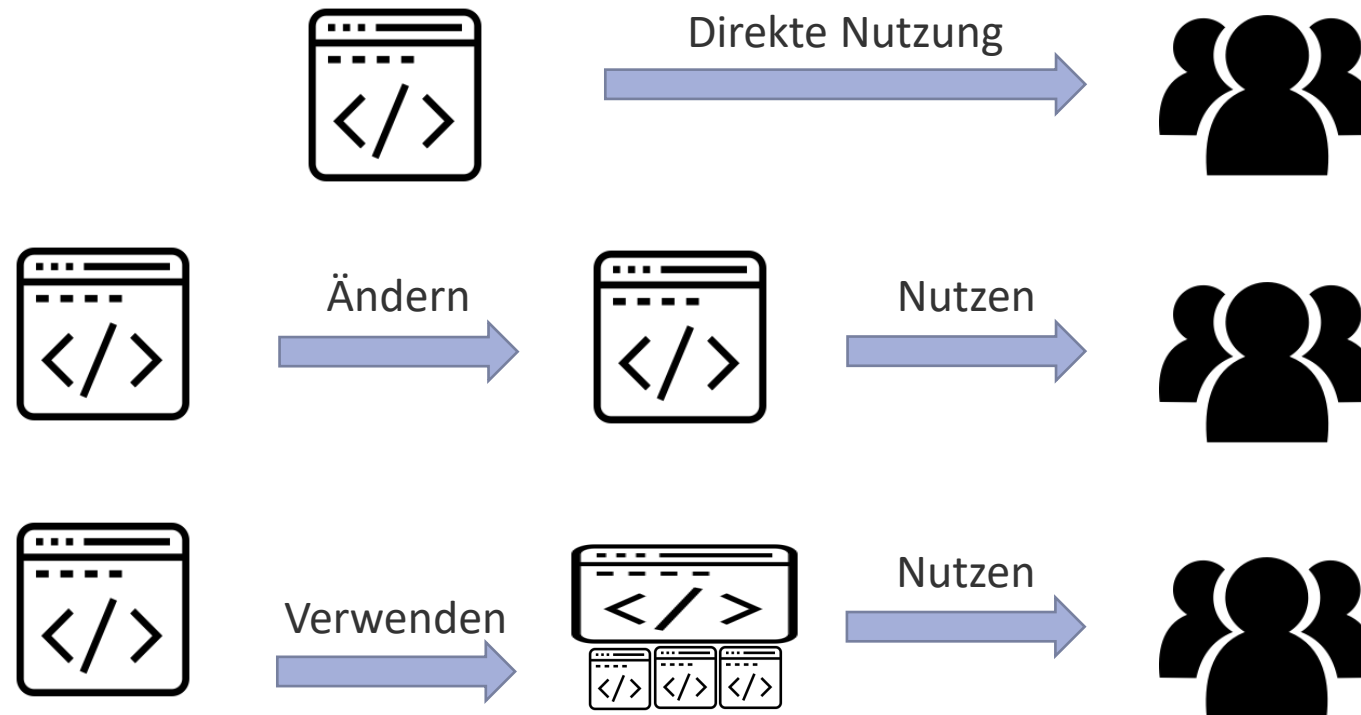
Beinhalte das originale „copyright“ oder  
originale Lizenz,  
Veröffentlichungspflicht bei Änderungen,  
Kommerzielle Einschränkungen u.ä.



# Einleitung



## ➤ Anwendungsfälle





# Einleitung

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## ➤ Vorteile

### ➤ Günstiger

- Geteilte Entwicklungskosten
- Trainingskosten

### ➤ Robuster

- Mehr Nutzer, mehr Tests
- Mehr Ideen
- Community

### ➤ Überprüfbar

- Keine Blackbox
- Volle Transparenz



## ➤ Funktionalität zum "Mitnehmen"

## ➤ Learning by doing


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# Einleitung




## ➤ Kurzer Ausflug zum Web Development

**Katja Glass Consulting**

Home Overview Programs Projects Info

Visual Table

### FDA Jumpstart Scripts




Clinical study evaluations scripts used by the FDA in their JumpStart tool has been developed based on SDTM standard. The FDA contributed the JumpStart SAS scripts so these are available on the PhUSE repository for use.

Standard Template	File	Format	Format	Format
Standard Template	File	Format	Format	Format

SAS Scripts Outputs

### RPact



The R package RPACT is a statistical program module, characterized as a comprehensive, validated software R package, that enables the simulation and analysis of parallel group designs with continuous, binary, and survival endpoint. RPACT can be downloaded per CRAN and will be available as open-source under LGPL3.

```
# Load the package
library(RPact)

# Display the version of the package
getRPactVersion()

# Create an instance of the RPact class with default parameters
design <- getRPactDesign()

# Take a look at the design and its default values
design


# Retrieve the design characteristics
getDesignCharacteristics(design)

# Plot the design with default type 1 (Boundary Plot)
plot(design)


# Create an "Storage template class and Power / Early Stop" plot
plot(design, type = "L", ylim = 0.5)
```

R Tool Statistics

### Visual Define-XML Editor



A cross-platform desktop application which allows to edit and review Define-XML files in a convenient and efficient way. It fully supports CDISC Define-XML v2.0 and ARM 1.0 standards.



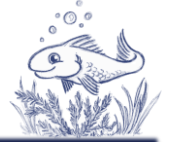
JavaScript, Node.js Tool Define

Basis HTML lernen?

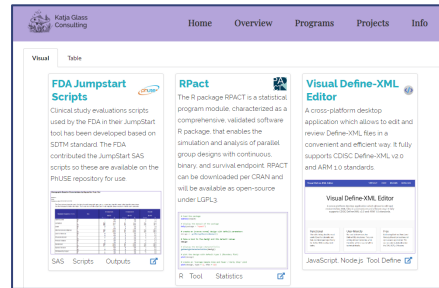
Nein!



# Einleitung



## ➤ Quick glance to Web Development



- Frameworks
- Komponenten
  - Filterbare Tabellen
  - Interaktive Graphiken (D3)
  - User Interface Themes



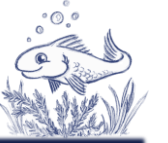
## ➤ Bausteinprinzip





# Einleitung

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- Vergleich mit SAS Programmierung

- Basisfunktionalität (Data Steps, SQL, FILE)



- Komplexe Blöcke (PROCs)



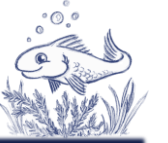
- Vollfunktion (Graphics Designer, Stored Process Applications)





# Einleitung

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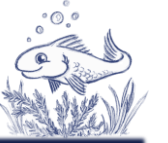
- Woran mangelt es?
  - Funktionsvielfalt der „Blöcke“
  - User-Blöcke meist nur lokal
  - „Kleine“ Community weniger Open Source
  - Anwendungsbereich von SAS hauptsächlich in kommerziellen Bereichen (Pharma, Finanzen, Versicherungen), weniger Motivationen





# Einleitung

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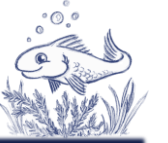
- Wie kann man Open Source fördern?
  - Mitarbeiter und Externe Open Source gestatten!
  - Studienarbeiten veröffentlichen
  - Arbeitsgruppen bilden und aktiv leben
  - In Open Source investieren





# Einleitung

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- Open Source entwickelt – und nun?
  - „Bekanntmachen“ von Open Source schwierig
  - Für R, releases in CRAN
  - Präsentationen auf Konferenzen (begrenzte Reichweite)

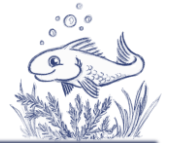


Findbarkeit von  
Open Source

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# Einleitung



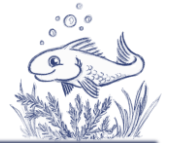
[www.glacon.eu/portal](http://www.glacon.eu/portal) (google: clinical open source portal)

The screenshot shows a web browser window with the URL [www.glacon.eu/portal/#/](http://www.glacon.eu/portal/#/). The website has a purple header with the logo 'Katja Glass Consulting' and navigation links: Home, Overview, Programs, Projects, and Info. The main content area has a blue background with white circles and the text 'OPEN SOURCE PORTAL' and 'For Clinical Study Evaluations'. Below this, there are three columns: 'Why?', 'What?', and 'How?'. The 'Why?' column explains the difficulty of finding open source solutions for clinical study evaluations. The 'What?' column describes the page as a link collection of open source solutions, programs, and scripts, with additional metadata and a user-friendly search mask. The 'How?' column states that the content is collected manually and provides contact information for further input.


Why?	What?	How?
Currently it is very difficult to investigate which open source solutions are available for clinical study evaluations. There are quite some lists available for open source R programs. PhUSE has a R-Shiny App to display	This page will be a link collection of open source solutions, programs and scripts for clinical study evaluations. Additional metadata will be stored and a user friendly search mask as well as different navigations are made	The content is collected manually. Further information and metadata are derived according available metadata and header analysis. If you want to provide additional input, please get in touch with me via <a href="mailto:info@glacon.eu">info@glacon.eu</a> .



# Einleitung




## ➤ Overview -> Tool Übersicht ([www.glacon.eu/portal](http://www.glacon.eu/portal))

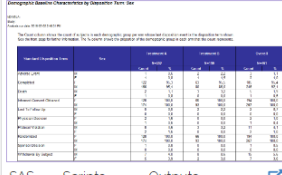
**Katja Glass Consulting**

Home Overview Programs Projects Info


Visual Table

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Clinical study evaluations scripts used by the FDA in their JumpStart tool has been developed based on SDTM standard. The FDA contributed the JumpStart SAS scripts so these are available on the PhUSE repository for use.




SAS Scripts Outputs

**RPact**


The R package RPACT is a statistical program module, characterized as a comprehensive, validated software R package, that enables the simulation and analysis of parallel group designs with continuous, binary, and survival endpoint. RPACT can be downloaded per CRAN and will be available as open-source under LGPL3.



R Tool Statistics

**Pinnacle21 Community Edition**

This tool supports various CDISC processes including the validation and creation of the

**Katja Glass Consulting**

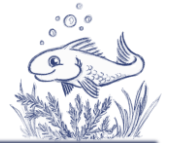
Home Overview Programs Projects Info

Visual Table






Name	Description	Type	Language	Last Updat...	License	Author Type	Area (Users)	Area (Works...	Size
		Show All ▾	SAS ▾			Show All ▾	Show All ▾	Show All ▾	Show All ▾
FDA Jumpstar	Clinical stud...	Scripts	SAS	2016-03-11	MIT	individual	ANALYST	Outputs	medium
SASUnit	SASUnit is a...	Tool	SAS	2019-07-08	GPLv3	company	DM, ANALY...	Programmi...	medium
Spectre (Rolar	A complete ...	Scripts	SAS	2015-06-17	Unlicense	individual	ANALYST	Outputs	large
SAS Macros b	Scott Bass ...	Scripts	SAS	2019-10-16	Unlicense	individual	DM, ANALY...	Programmi...	medium
SAS Macros b	Much qualit...	Scripts	SAS	2019-11-25	MIT	company	DM, ANALY...	Programmi...	medium
PhUSE White	PhUSE has ...	Scripts	R, SAS	2019-02-25	MIT	individual	ANALYST	Outputs	medium
Rholnc Plots	Multiple Plo...	Scripts	SAS	2019-08-08	MIT	company	ANALYST	Visualization	small
Going Translat	In this proje...	Scripts	R, RDF, SAS	2019-08-01	MIT	individual	PROG	Programmi...	small
PhUSE White	24 utility ma...	Scripts	SAS	2017-03-21	MIT	individual	PROG	Programmi...	small
PhUSE Contril	There are v...	Scripts	R, SAS, Other	2019-07-20	MIT	individual			small



# Einleitung



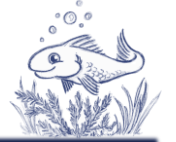
➤ Programs -> Programme & Makros ([www.glacon.eu/portal](http://www.glacon.eu/portal))

 Katja Glass Consulting							
Home Overview Programs Projects Info							
Tool	Name	Description	Type	Class	Lang_	Mod Date	Linen...
Show All 			Show 	Show 	SI 		
<div>Show All</div> <div>FDA Jumpstart Scripts</div> <div>Macro People Core - SAS Macros</div> <div>Roland's SAS® Macros</div> <div>SAS Macros by Scott Bass</div> <div>Whitepaper Scripts</div>			Script	Tool	SAS	2011-05-08	653
		MedDRA at a Glance Analysis Panel - The					
		MedDRA at a Glance Analysis Panel shows the					
		user the adverse events that occurred in the					
		study according to their place in the MedDRA					
		hierarchy and allows them to compare any two					
		arms according to a number of statistics.					
FDA Jumpstart S	ae_oncology_v1	AE Toxicity Analysis Panel - The AE Toxicity	Script	Tool	SAS	2011-06-02	408
		Analysis Panel provides the user with different					
		analyses to help understand the adverse events					
		present in the study and the frequency of their					
		occurrence by treatment arm. Statistical and					



# Einleitung

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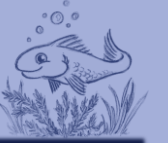


- Overview -> Filter SAS ([www.glacon.eu/portal](http://www.glacon.eu/portal))
    - FDA Jumpstart Scripts
    - SASUnit
    - Spectre (Roland's SAS® Macros)
    - SAS Macros by Scott Bass
    - SAS Macros by Macro People
    - PhUSE White Paper Central Tendencies Scripts
    - Data Visualization - SAS Blog
    - RhoInc Plots
    - (Going Translational with Linked Data)
    - PhUSE White Paper Utilities
    - PhUSE Contributed Scripts & Macros
    - Reindeer – Render SAS Results into Word
-



# Agenda

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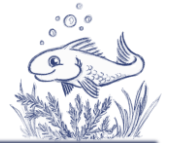


- Einleitung
  - **Anwendungsbeispiel**
  - Beispiele
  - Überlegungen
  - Ausblick
- 





# PhUSE White Paper Scripts



## ➤ Programme für diverse Tabellen und Grafiken

### PhUSE White Paper Central Tendencies Scripts



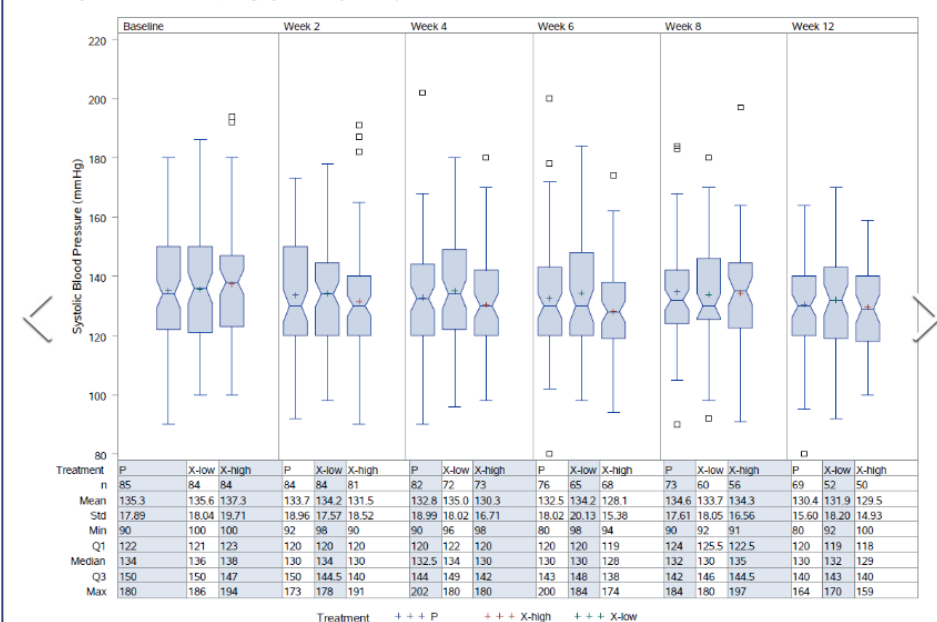
#### Description:

PhUSE has developed analysis and display white papers covering

evaluations. Additionally people  
and SAS scripts which create the white  
these scripts are made publicly available

g the pilot study data available and are  
programs needs adaptations when

Box Plot - Systolic Blood Pressure (mmHg) by Visit, Analysis Timepoint: AFTER STANDING FOR 1 MINUTE





Type	Scripts
Language	R, SAS
License	MIT
Last Update Date	2019-02-25
Link Source	<a href="https://github.com/...">https://github.com/...</a>
Link	<a href="https://github.com/...">https://github.com/...</a>
Documentation	Specifications and YAML (script metadata) available, documentation RShiny App can be downloaded from CRAN - R Package PhUSE
Author Type	individual
Author(s)	PhUSE Working Group
Area (Users)	ANALYST
Area (Workspace)	Outputs
Size	medium
Link	<a href="https://www.lexjansen.com/...">https://www.lexjansen.com/...</a>
Presentation(s)	



# PhUSE White Paper Scripts



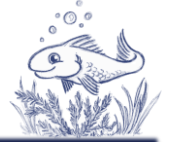
- Einzelprogramme sind suchbar, z.B. „boxplot“

 Katja Glass Consulting 							
Tool	Name	Description	Type	Class	Lang..	Mod Date	Line...
Whitepap... ▾	<input type="text"/>	<input type="text"/>	Show ▾	Show ▾	Σ ▾	<input type="text"/>	<input type="text"/>
Whitepaper Sc	ae_common	Table of Common AEs - Figure 7.1 Summary of Common Treatment-Emergent Adverse Events by Treatment	Script	Standalo...	SAS		29
Whitepaper Sc	ae_pref	AE Table of Preferred Terms	Script	Standalo...	SAS		29
Whitepaper Sc	ae_serious	Table of Serious AEs	Script	Standalo...	SAS		29
Whitepaper Sc	box_chg_time	Box Plot - xxx Change from Baseline Over Time	Script	Standalo...	R		25
Whitepaper Sc	box_obs_time	Box Plot - Observed Values of xxx Over Time	Script	Standalo...	R		25
Whitepaper Sc	box_obs_time	Box Plot Observed values of xxx Over Time	Script	Standalo...	SAS		29



# PhUSE White Paper Scripts

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- Hintergrund
  - PhUSE hat sogenannte „White Papers“ erstellt
  - „Central Tendency“
  - Programme & Quality Checks
  - 2014 Scriptathon für zusätzliche Outputs

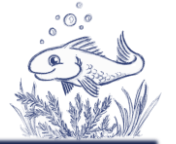
Analyses and Displays Associated with Measures of Central Tendency - Focus on Vital Sign, Electrocardiogram, and Laboratory Analyte Measurements in Phase 2-4 Clinical Trials and Integrated Submission Documents: (PDF) Version 1.0, 10-Oct-2013. Word Version

<https://www.phuse.eu/white-papers>

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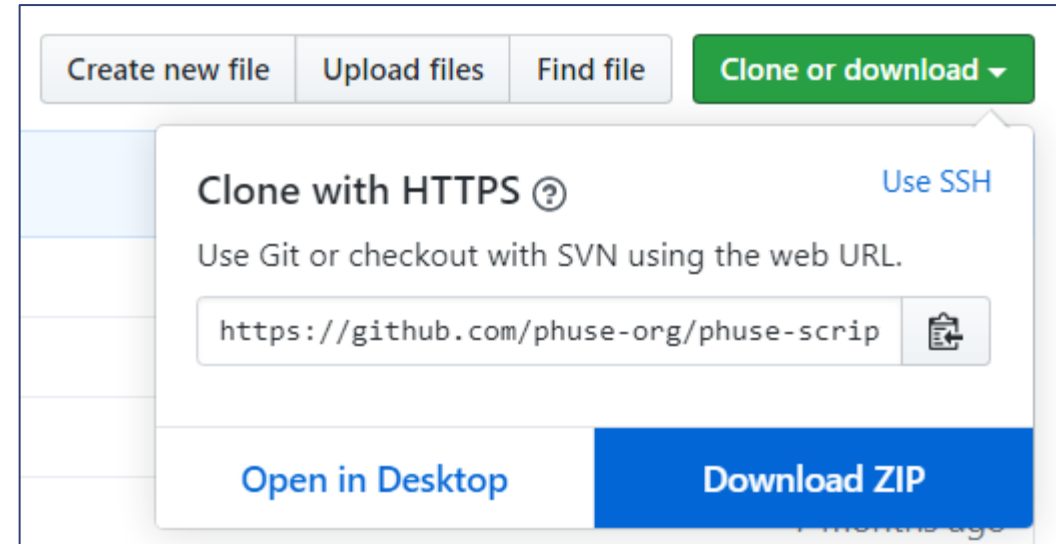


# PhUSE White Paper Scripts



## Anwendung

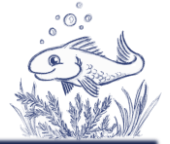
1. Repository Download
2. Script auswählen
3. Änderungen (Pfade)
4. Ausführen



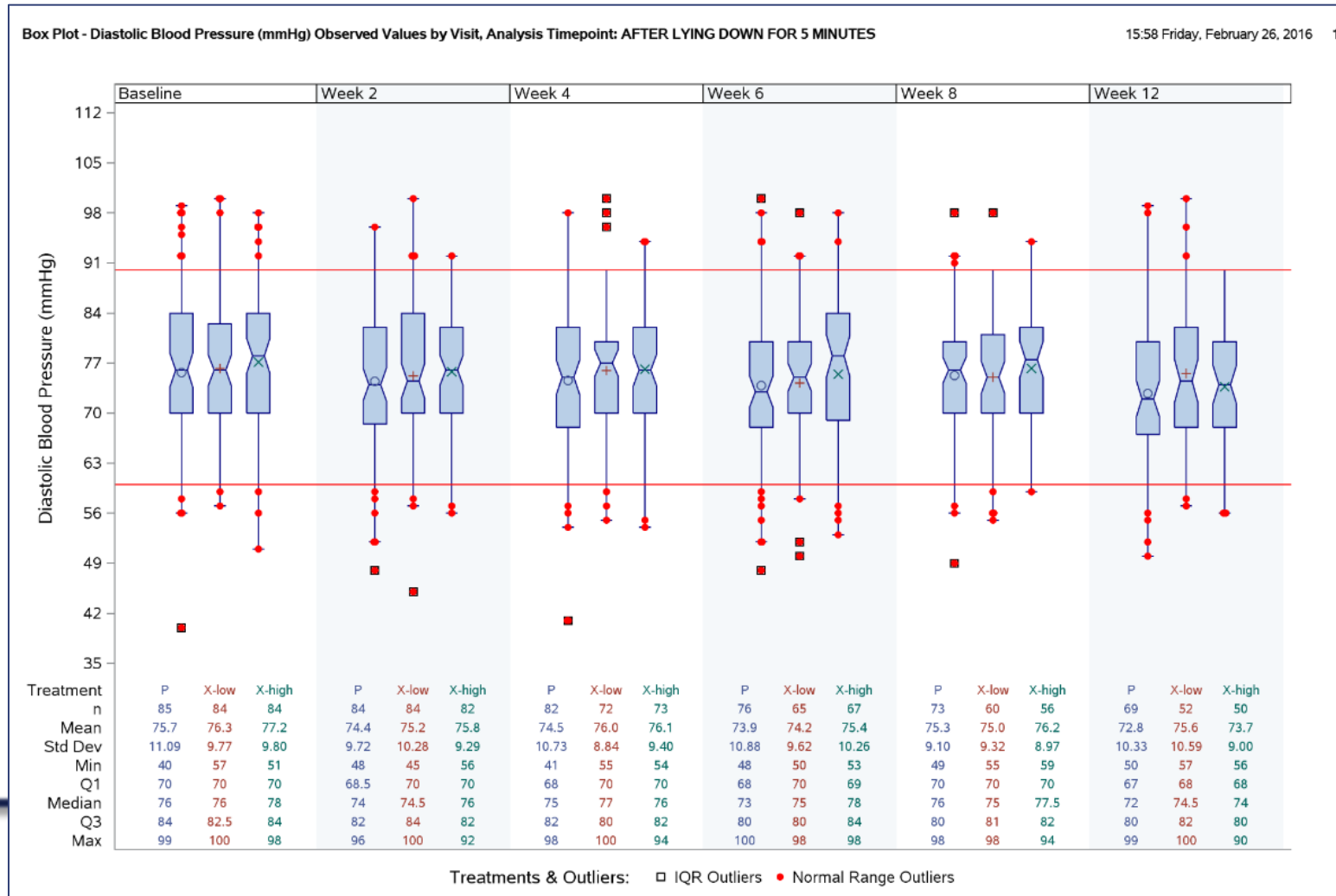
<https://github.com/phuse-org/phuse-scripts>



# PhUSE White Paper Scripts

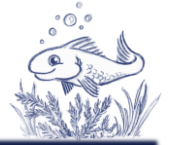


## ➤ Figure 7.1 Box plot - Measurements by ...“





# PhUSE White Paper Scripts



## ➤ Figure 7.1 Box plot - Measurements by ...“

\*\*\* *USER PROCESSING AND SETTINGS* \*\*\*

1) *REQUIRED - PhUSE CS Utilities macro library*

2) *OPTIONAL - Subset measurement data*

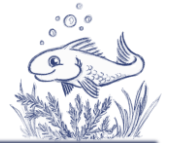
3) *REQUIRED - Key user settings*





# PhUSE White Paper Scripts

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## ➤ Geänderte Code Teile

```
%LET root = /folders/myshortcuts/git;  
%LET base = &root/SAS;  
%LET phuse = &root/phuse-scripts;  
  
OPTIONS SASAUTOS=("&phuse/whitepapers/utilities", SASAUTOS);  
OPTIONS MRECALL MAUTOSOURCE;  
  
%util_access_test_data(&ds, local=&phuse/data/adam/cdisc-split/) ;  
  
%let outputs_folder = &base/results;
```



# PhUSE White Paper Scripts



- Execute Processing parts
  - Fehler & Folgefehler

```
124
125     trtp_short = put(&tn_var,trt_short.);
126
127     %assert_timepoint_exist(ds=&ds._sub);

      180
WARNING: Apparent invocation of macro ASSERT_TIMEPOINT_EXIST not resolved.
ERROR 180-322: Statement is not valid or it is used out of proper order.

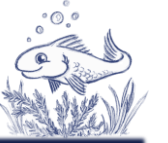
128         run;

NOTE: The SAS System stopped processing this step because of errors.
WARNING: The data set WORK.ADLBC_SUB may be incomplete. When this step was stopped there were 0 observations and 47 variables.
WARNING: Datei WORK.ADLBC_SUB wurde nicht ersetzt, da da dieser Schritt angehalten wurde.
NOTE: Verwendet wurde: DATA statement - (Gesamtverarbeitungszeit):
      real time          0.00 seconds
      cpu time           0.01 seconds
```



# PhUSE White Paper Scripts

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## ➤ Fehleranalyse

WARNING: Apparent invocation of macro ASSERT\_TIMEPOINT\_EXIST not resolved.  
ERROR 180-322: Statement is not valid or it is used out of proper order.

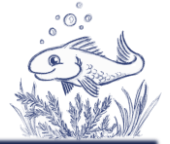
## ➤ Makro ist nicht verfügbar

## ➤ „nur“ check Makro -> auskommentieren (2x)



# PhUSE White Paper Scripts

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WARNING: (ASSERT\_DEPEND) Program requires OS like (AIX,WIN,HP IPF), but this &SYSSCP is LIN X64. Let us see what happens.

➤ Ignorieren

ERROR: (ASSERT\_VAR\_EXIST) Result is FAIL. "ATPT" is NOT a variable on data set WORK.ADLBC\_SUB.

...

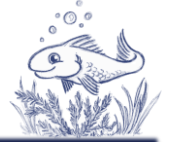
ERROR: (ASSERT\_VAR\_EXIST) Result is FAIL. "ATPTN" is NOT a variable on data set WORK.ADLBC\_SUB.

➤ Kritisches Problem

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# PhUSE White Paper Scripts



- Fehleranalyse
  - „\_SUB“ ist ein subsetting des Datensatzes
  - ADLBC Variablen prüfen
    - Timepoint Variablen ATPT & ATPTN nicht vorhanden
    - Dummy erstellen

```
470 ! goptions
```

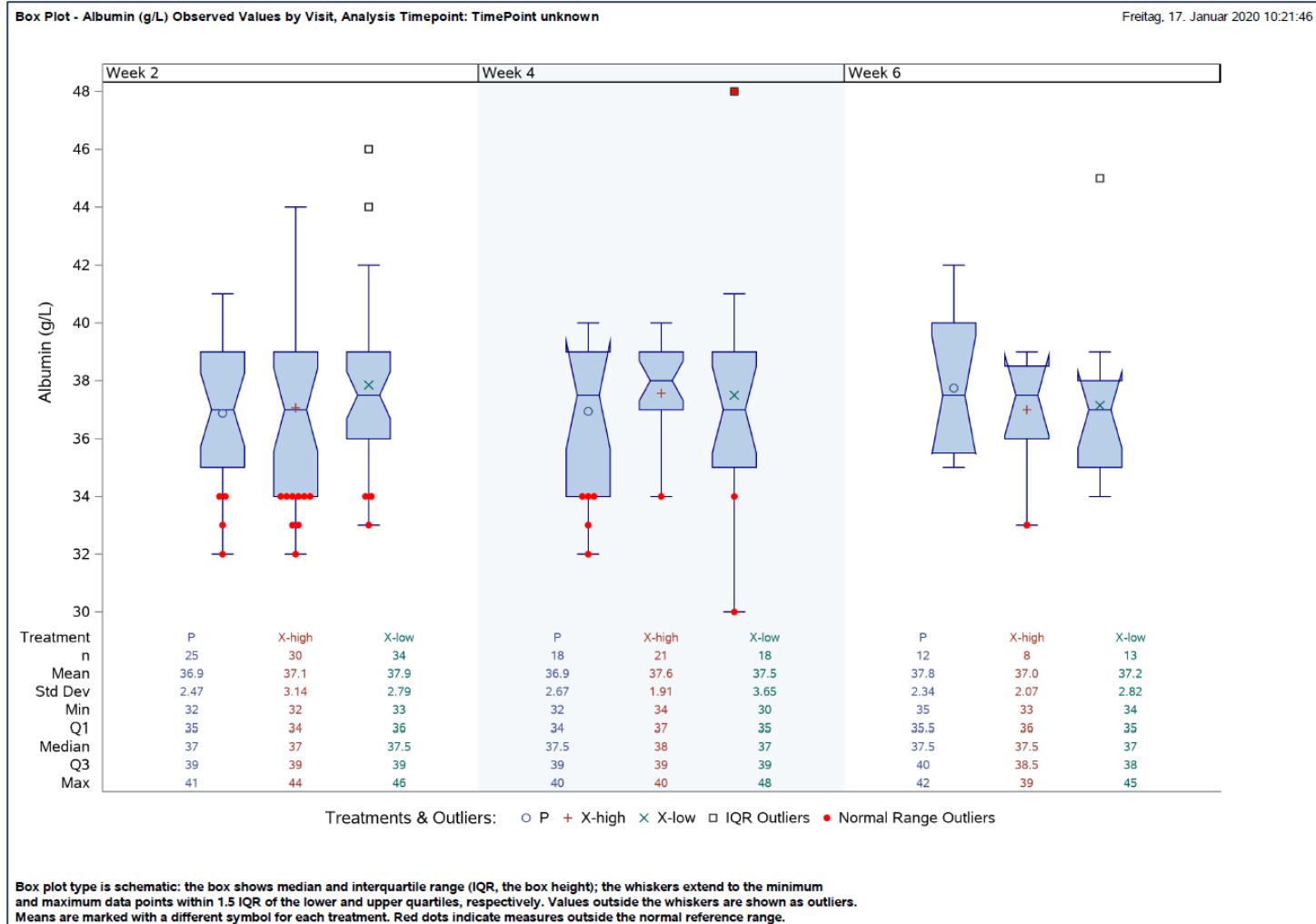
```
180
```

```
ERROR 180-322: Statement is not valid or it is used out of proper order.
```

- Ein Issue, aber unkritisch



# PhUSE White Paper Scripts





# PhUSE White Paper Scripts



## ➤ Lernen - „Wie erstellen ich so eine Grafik?“

```
%macro util_proc_template(template, designwidth=260);  
  
  *--- Set marker size relative to IQR outlier: MEAN  
  *--- Box width, Box plot cluster width and Scatter  
  %local iqr_size clusterwidth;  
  
  %let iqr_size = 6;  
  %let clusterwidth = 0.6;  
  
  %if %upcase(&template) = PHUSEBOXPLOT %then %do;  
    proc template;  
      define statgraph PhUSEboxplot;  
  
        dynamic _TITLE _DESIGN_WIDTH _DESIGN_HEIGHT  
          _MARKERS _BLOCKLABEL _XVAR _YVAR _Y  
          _YLABEL _YMIN _YMAX _YINCR  
          _REFLINES  
          _PERIOD _N _MEAN _STD _DATAMIN _Q1  
          ;
```

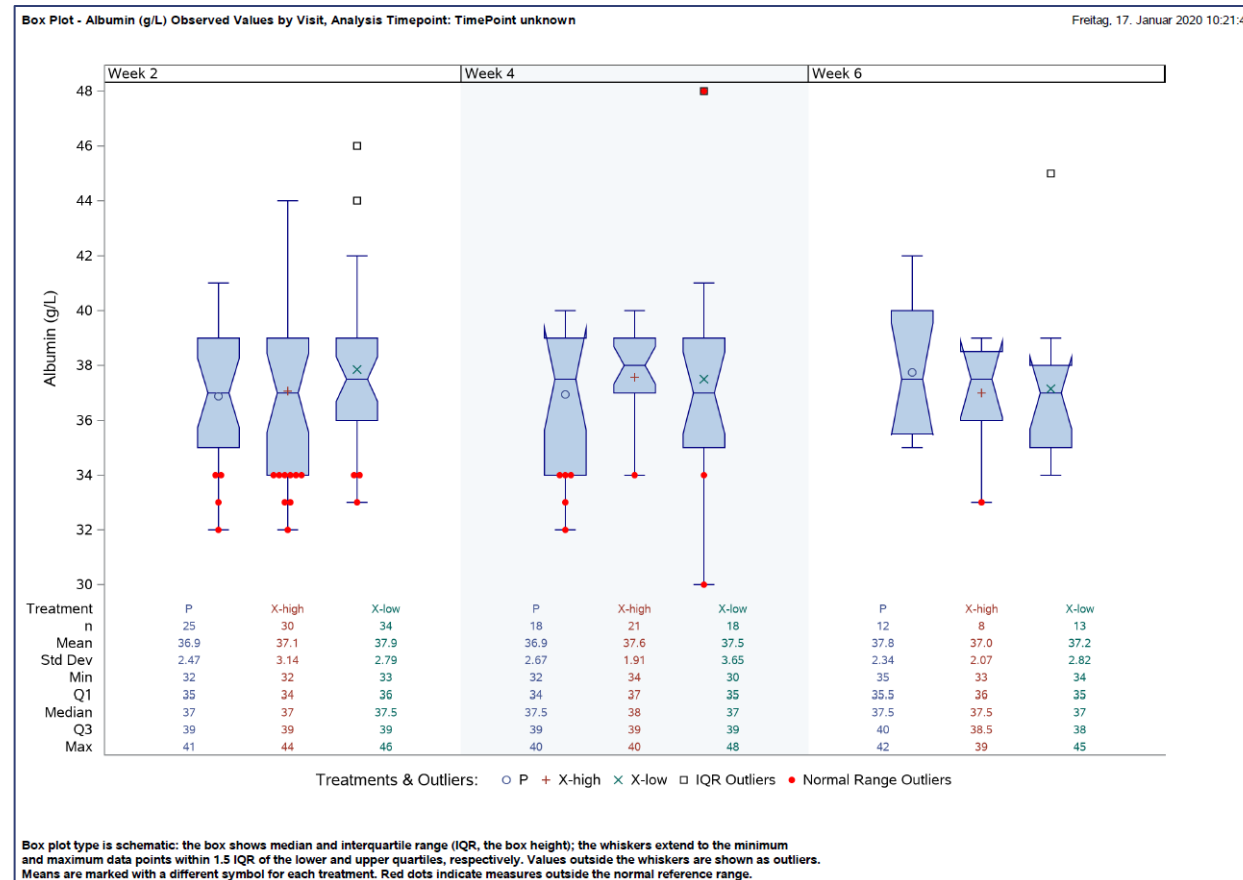
```
proc sgrender data=css_plot (where=( %unquote(&nxtvis) )) template=PhUSEboxplot ;  
  dynamic  
    _MARKERS      = "&t_var"  
    _XVAR          = 'avisitn'  
    _BLOCKLABEL    = 'avisit'  
    _YVAR          = "&m_var"  
    _YOUTLIERS     = 'm_var_outlier'  
  
    %if %length(&nxt_reflines) > 0 %then %do;  
      _REFLINES    = "%sysfunc(translate( &nxt_reflines, %str(,), %str( ) ))"  
    %end;  
  
    _YLABEL        = "&&paramcd_lab&pdx"  
    _YMIN          = %scan(&y_axis, 1, %str( ))  
    _YMAX          = %scan(&y_axis, 3, %str( ))  
    _YINCR         = %scan(&y_axis, 5, %str( ))  
    _N             = 'n'  
    _MEAN          = 'mean'  
    _STD           = 'std'  
    _DATAMIN       = 'datamin'  
    _Q1            = 'q1'  
    _MEDIAN        = 'median'  
    _Q3            = 'q3'  
    _DATAMAX       = 'datamax'  
    ;  
run;
```



# PhUSE White Paper Scripts



➤ Anwenden - „Erstelle diese Grafik für meine Daten!“

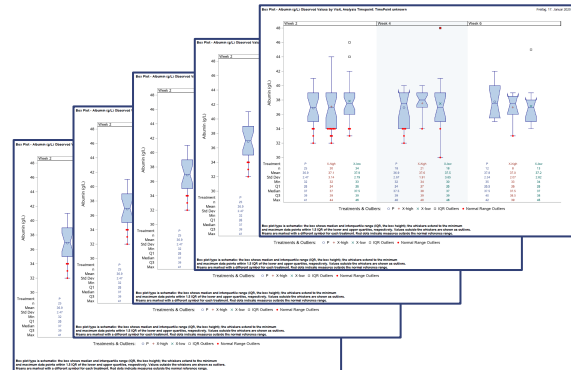




# PhUSE White Paper Scripts



- Weiterverwenden - „Nutze das für ...“
  - Studienauswertung
  - Generisches Makro
  - Tool





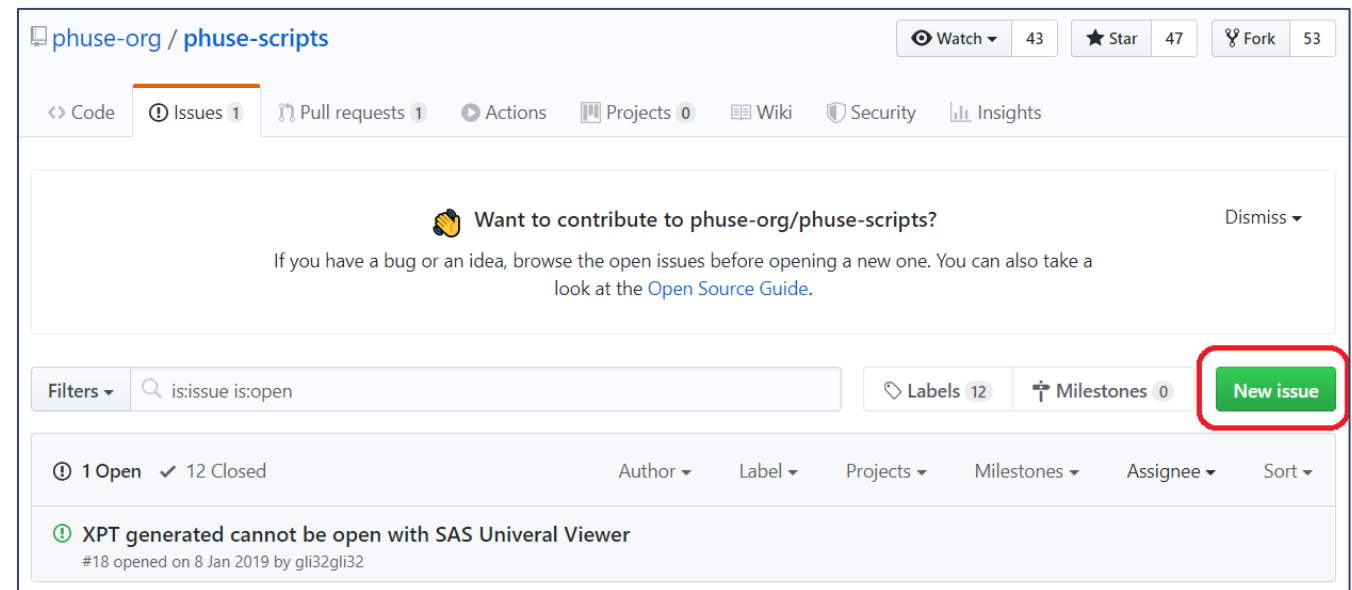
# PhUSE White Paper Scripts



- Aktionsmöglichkeiten
  - Probleme für Eigenzweck lösen



- Probleme berichten  
(Issues, Messages, Mail)
- Problem beheben /  
hochladen,  
ggf. "pull request"





# PhUSE White Paper Scripts

---



## ➤ PhUSE-Scripts

- Gemeinschaftlich
- Kein „Hauptansprechpartner“
- Viele Bereiche ohne Wartung

## ➤ Handlung

- Lokale Lösung -> nein, nicht collaborativ
  - Problemmeldung -> nein, wahrscheinlich nicht gewartet
  - Problembehebung -> ja
-



# PhUSE White Paper Scripts

---



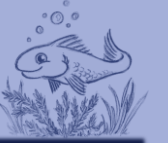
- Problembehebung
  - Codeteile groß ändern?
    - Nein, schließlich kann der originale „Output“ nicht erzeugt werden
  - Kommentarblock hinzufügen mit Anleitung „How to ...“
    - Ja





# Agenda

---

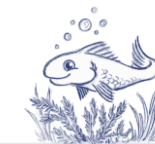


- Einleitung
  - Anwendungsbeispiel
  - **Beispiele**
  - Überlegungen
  - Ausblick
- 





# Beispiele – PhUSE White Paper Scripts



## ➤ Boxplots

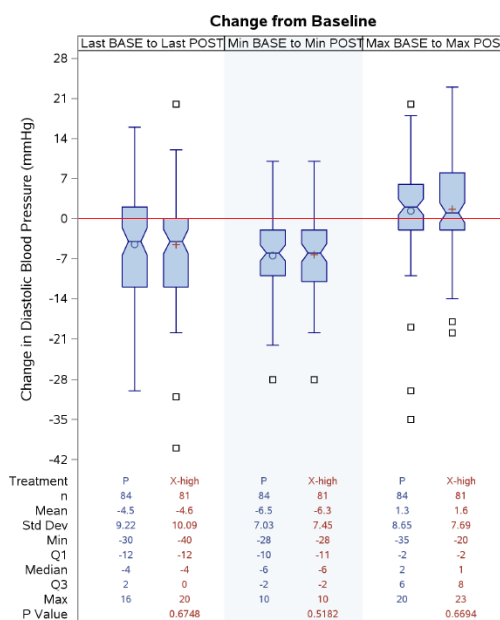
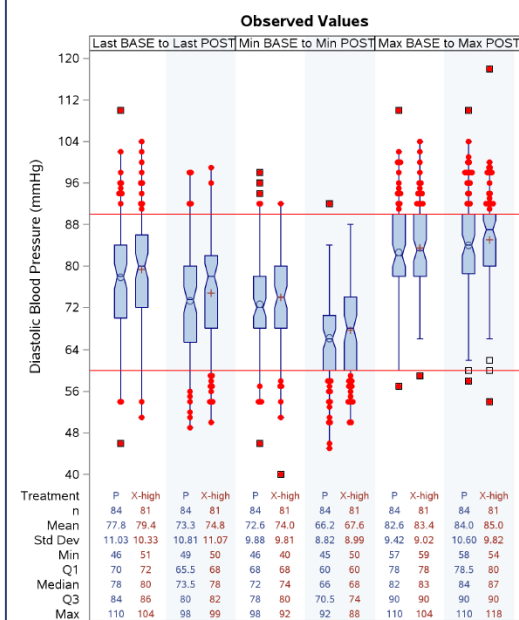
Box Plot - Diastolic Blood Pressure (mmHg) by Visit, Analysis Timepoint: AFTER LYING DOWN FOR 5 MINUTES



Box Plot - Diastolic Blood Pressure (mmHg) Observed Values by Visit, Analysis Timepoint: AFTER LYING DOWN FOR 5 MINUTES



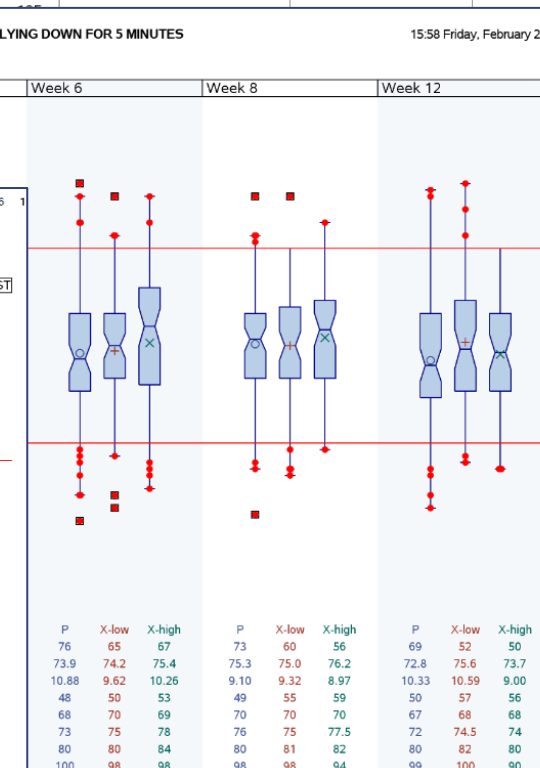
Box Plot - Diastolic Blood Pressure (mmHg) Last/Min/Max Baseline versus Last/Min/Max Post-baseline by Treatment  
Analysis Timepoint: AFTER STANDING FOR 3 MINUTES



Treatments & Outliers: □ IQR Outliers • Normal Range Outliers

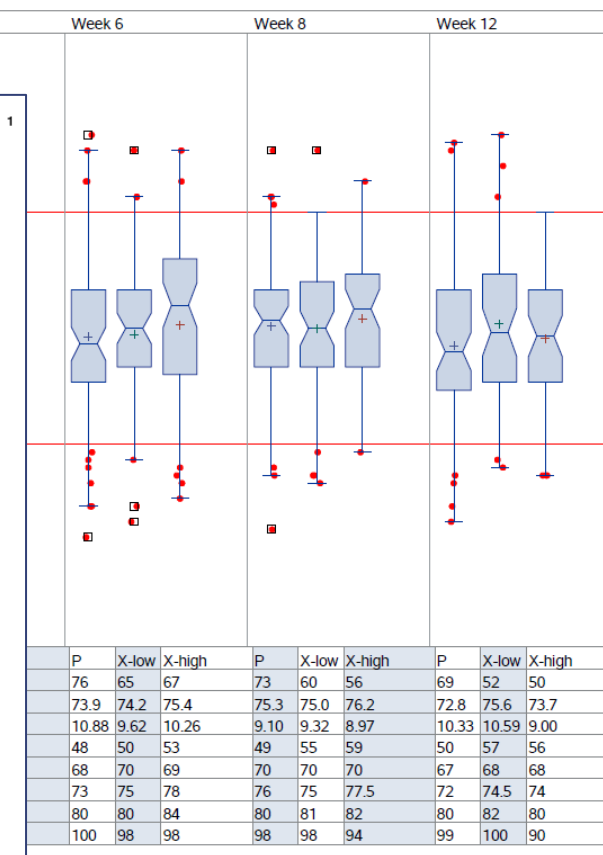
Treatments & Outliers: □ IQR Outliers

Box plot type is schematic: the box shows median and interquartile range (IQR, the box height); the whiskers extend to the minimum and maximum data points within 1.5 IQR of the lower and upper quartiles, respectively. Values outside the whiskers are shown as outliers. Means are marked with a different symbol for each treatment. Red dots indicate measures outside the normal reference range. P-value is for the treatment comparison from ANCOVA model Change = Baseline + Treatment.



Outliers • Normal Range Outliers

normal: the box shows median and interquartile range (IQR, the box height); the whiskers extend to the minimum and maximum data points within 1.5 IQR of the lower and upper quartiles, respectively. Values outside the whiskers are shown as outliers. Red dots indicate measures outside the normal reference range.



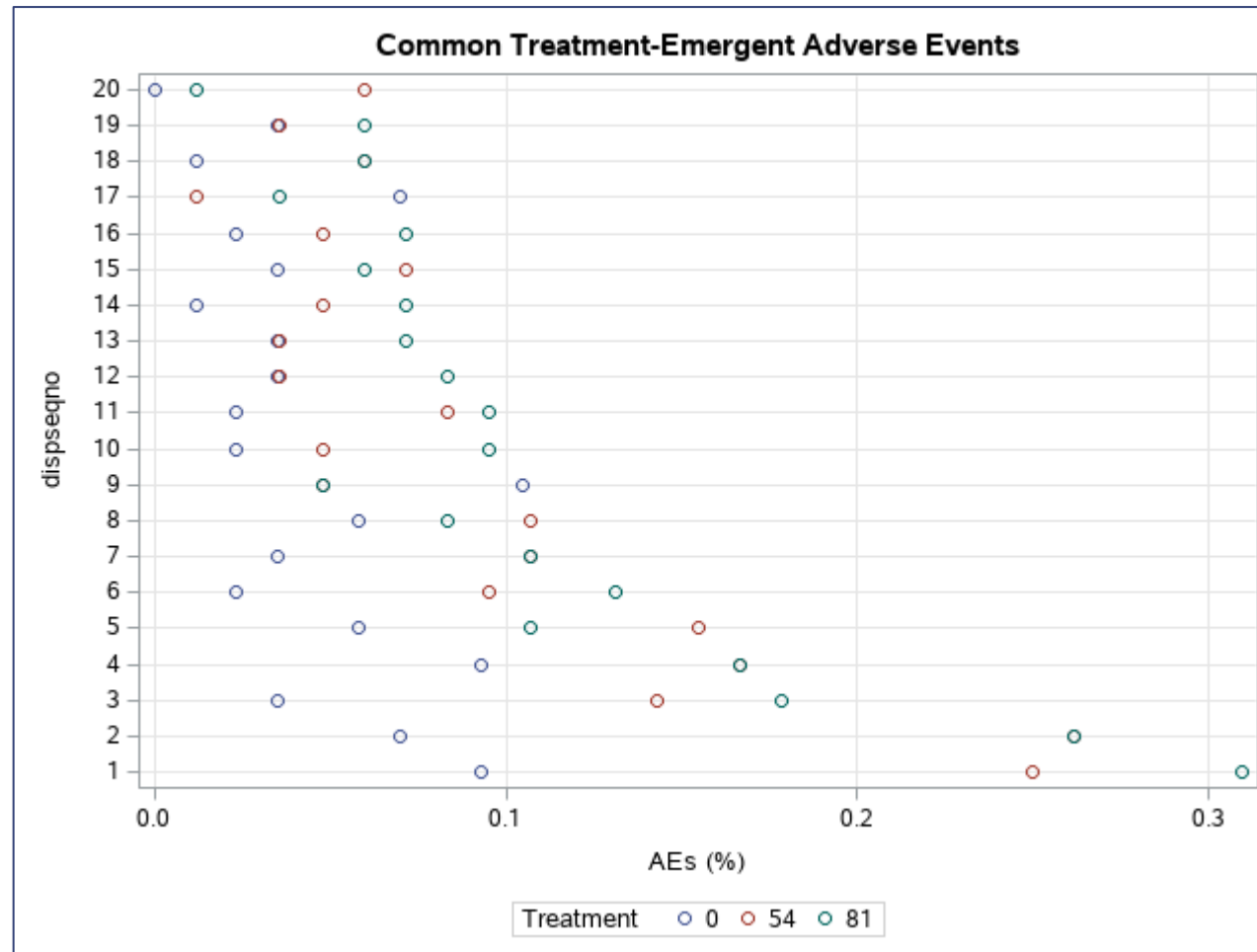
+ X-high + + + X-low



# Beispiele – PhUSE White Paper Scripts

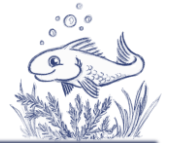


## ➤ Scriptathon





# Beispiele – PhUSE White Paper Scripts



## ➤ Scriptathon

Table 7.5 Summary of Serious Adverse Events  
Safety Population

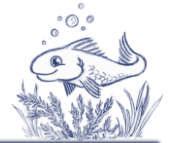
Preferred Term	Placebo N=86	Treatment 1 N=84	Treatment 2 N=84	p-value* <sup>b</sup>
Number of subjects reporting serious adverse events	0(0.0)	1(1.0)	2(2.0)	0.3255
PARTIAL SEIZURES WITH SECONDARY GENERALISATION	0(0.0)	0(0.0)	1(1.0)	0.6614
SYNCOPE	0(0.0)	1(1.0)	1(1.0)	0.5503

-  
Denominator for each % is treatment column N

\*<sup>b</sup> = p-values are from Fisher's Exact Test



# Beispiele – PhUSE White Paper Scripts

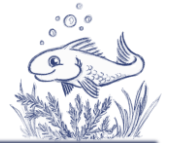


## ➤ Scriptathon

&under		&trtname1 (N=86)	trtname1 (N=84)	trtname1 (N=84)
Sex n(%)	n[a]	86 (100.0%)	84 (100.0%)	84 (100.0%)
	F	53 (61.6%)	50 (61.6%)	40 (61.6%)
	M	33 (38.4%)	34 (38.4%)	44 (38.4%)
Age (years)	n[a]	86	84	84
	Mean	75.2	75.7	74.4
	SD	8.6	8.3	7.9
	Median	76.0	77.5	76.0
	Q1, Q3	69.0, 82.0	71.0, 82.0	70.5, 80.0
	Min, Max	52, 89	51, 88	56, 88
Age categories n(%)	65-80	42 (48.8%)	47 (48.8%)	55 (48.8%)
	<65	14 (16.3%)	8 (16.3%)	11 (16.3%)
	>80	30 (34.9%)	29 (34.9%)	18 (34.9%)
	n[a]	86 (100.0%)	84 (100.0%)	84 (100.0%)
Race n(%)	n[a]	86 (100.0%)	84 (100.0%)	84 (100.0%)
	White	78 (90.7%)	78 (90.7%)	74 (90.7%)
	Black or African American	8 (9.3%)	6 (9.3%)	9 (9.3%)
	American Indian or Alaska Native	0	0	1
Ethnicity n(%)	n[a]	86 (100.0%)	84 (100.0%)	84 (100.0%)



# Beispiele – PhUSE White Paper Scripts



## ➤ Scriptathon

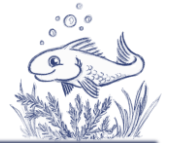
### Subject Disposition

Subject Disposition	Placebo (N=86)	Xanomeline Low Dose (N=84)	Xanomeline High Dose (N=84)
Completed	58 (67.4%)	25 (29.8%)	27 (32.1%)
Discontinued	28 (32.6%)	59 (70.2%)	57 (67.9%)
Adverse Event	8 (9.3%)	44 (52.4%)	40 (47.6%)
Death	2 (2.3%)	1 (1.2%)	
I/E Not Met	1 (1.2%)		2 (2.4%)
Lack of Efficacy	3 (3.5%)		1 (1.2%)
Lost to Follow-up	1 (1.2%)	1 (1.2%)	
Physician Decision	1 (1.2%)		2 (2.4%)
Protocol Violation	1 (1.2%)	1 (1.2%)	1 (1.2%)
Sponsor Decision	2 (2.3%)	2 (2.4%)	3 (3.6%)
Withdrew Consent	9 (10.5%)	10 (11.9%)	8 (9.5%)

Abbreviations: N = number of subjects in the population; n=number of subjects specified category  
% = Percentage of subjects with N as denominator

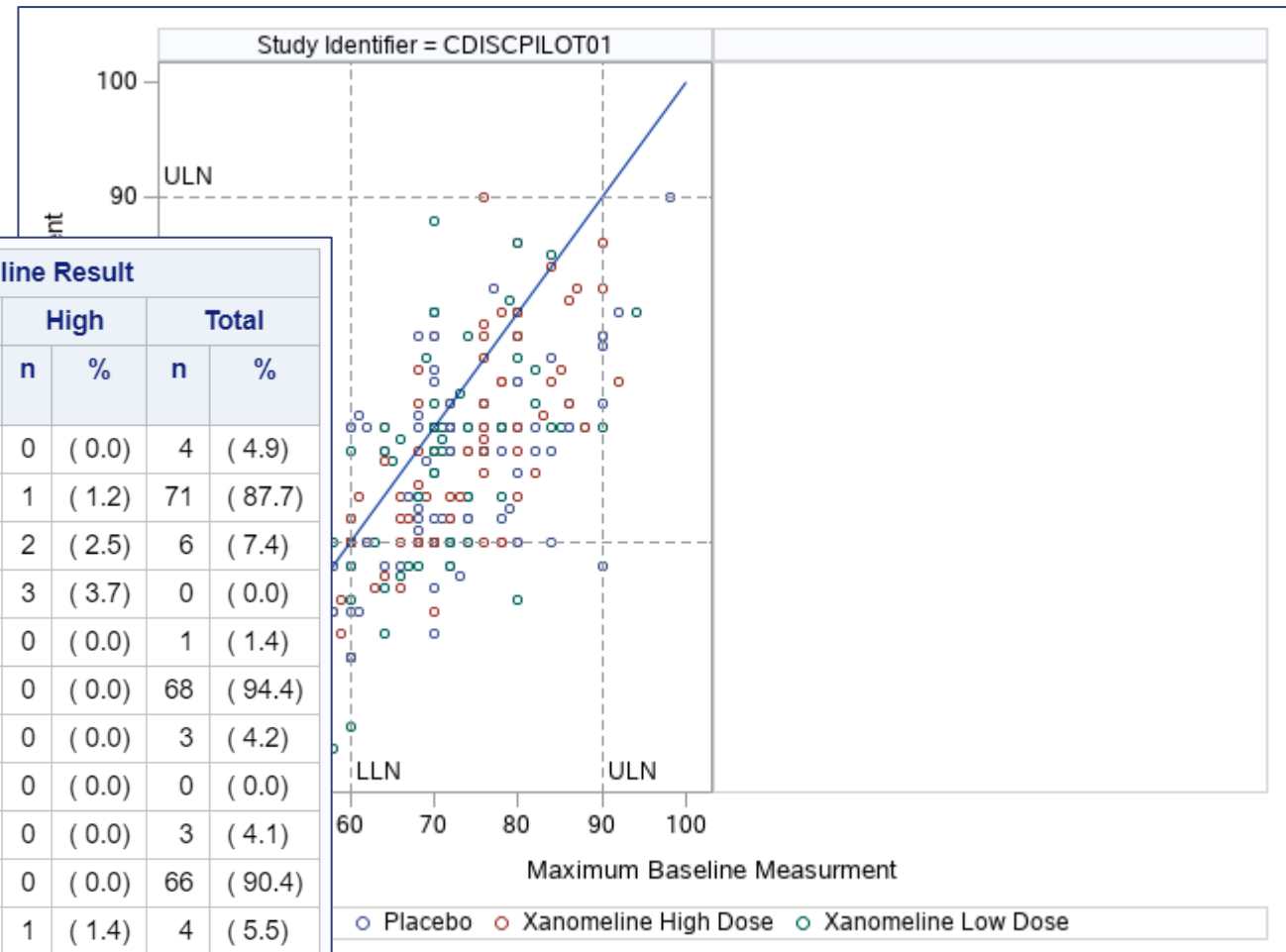


# Beispiele – PhUSE White Paper Scripts



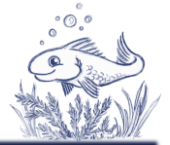
## ➤ Scriptathon

		Post-Baseline Result							
		Low		Normal		High		Total	
Treatment	Baseline Result	n	%	n	%	n	%	n	%
Placebo (N = 81)	Low	2	( 2.5)	2	( 2.5)	0	( 0.0)	4	( 4.9)
	Normal	4	( 4.9)	66	( 81.5)	1	( 1.2)	71	( 87.7)
	High	0	( 0.0)	4	( 4.9)	2	( 2.5)	6	( 7.4)
	Total	6	( 7.4)	72	( 88.9)	3	( 3.7)	0	( 0.0)
Xanomeline Low Dose (N = 72)	Low	0	( 0.0)	1	( 1.4)	0	( 0.0)	1	( 1.4)
	Normal	2	( 2.8)	66	( 91.7)	0	( 0.0)	68	( 94.4)
	High	0	( 0.0)	3	( 4.2)	0	( 0.0)	3	( 4.2)
	Total	2	( 2.8)	70	( 97.2)	0	( 0.0)	0	( 0.0)
Xanomeline High Dose (N = 73)	Low	1	( 1.4)	2	( 2.7)	0	( 0.0)	3	( 4.1)
	Normal	2	( 2.7)	64	( 87.7)	0	( 0.0)	66	( 90.4)
	High	0	( 0.0)	3	( 4.1)	1	( 1.4)	4	( 5.5)
	Total	3	( 4.1)	69	( 94.5)	1	( 1.4)	0	( 0.0)







# Beispiele – FDA Jumpstart Scripts



- Klinische Studienauswertungsprogramme von der FDA
- FDA hat PhUSE diese zur Verfügung gestellt
- MIT Lizenz



**Description:**


Clinical study evaluations scripts used by the FDA in their JumpStart tool has been developed based on SDTM standard. The FDA contributed the JumpStart SAS scripts so these are available on the PhUSE repository for use.

**Outstanding:**

It's amazing that the FDA contributed their JumpStart scripts.

**Think Abouts:**

The original scripts has been developed around 2011 and been made available around 2016. There had been nearly no updates. These scripts are still quite useful, as this is what the FDA will have a look at the companies data.

( + 7 )

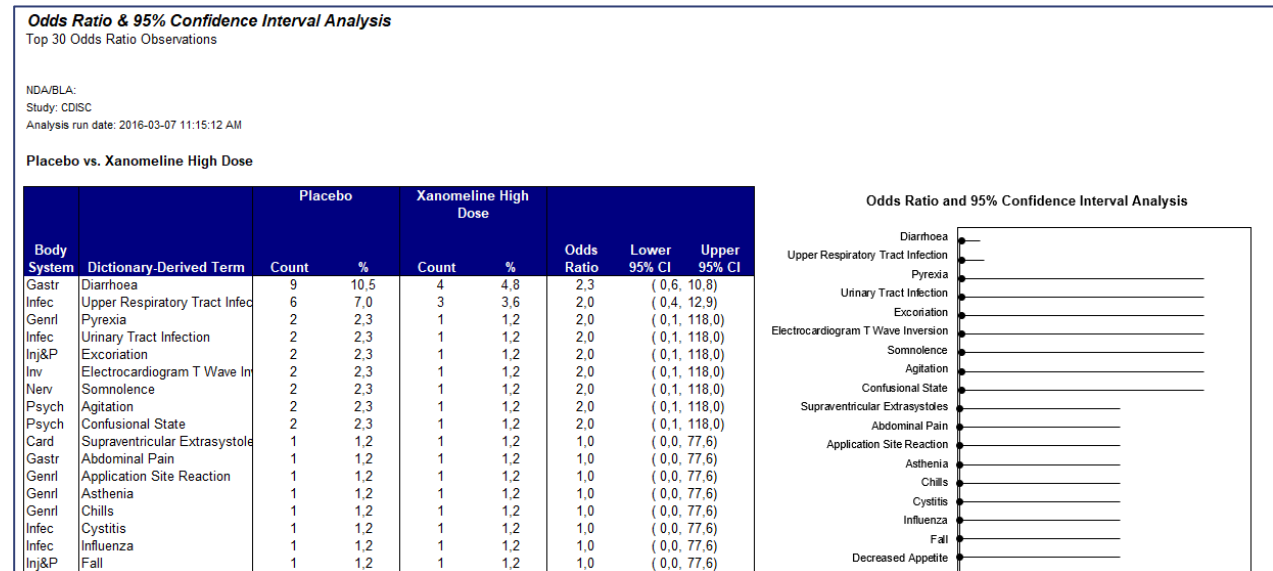
Type	Scripts
Language	SAS
License	MIT
Last Update Date	2016-03-11
Link Source	<a href="https://github.com/...">https://github.com/...</a>
Link	<a href="https://github.com/...">https://github.com/...</a>
Documentation	
Documentation	Detailed specifications are available in .doc format
Author Type	individual
Author(s)	FDA, PhUSE Working Group
Area (Users)	ANALYST
Area (Workspace)	Outputs
Size	medium
Link Paper(s)	<a href="https://www.lexjansen.com/...">https://www.lexjansen.com/...</a> , <a href="https://www.phuse.eu/...">https://www.phuse.eu/...</a>
Link	<a href="http://www.phusewiki.org/...">http://www.phusewiki.org/...</a>
Presentation(s)	<a href="https://www.lexjansen.com/...">https://www.lexjansen.com/...</a> , <a href="https://www.lexjansen.com/...">https://www.lexjansen.com/...</a>



# Beispiele – FDA Jumpstart Scripts



- Generisch für SDTM
- Makro
- Excel Outputs
  - Kein direkter Excel Output
  - XML Anpassungen
- Viel Dokumentation
- Präsentationen
- Qualitätsgeprüft bei PhUSE





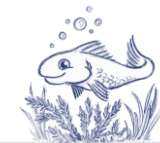
# Beispiele – FDA Jumpstart Scripts



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1														
2	<b>Preferred Term Analysis by Toxicity Grade</b>													
3														
4	NDA/BLA:													
5	Study: DelD													
6	Analysis run date: 2016-03-08 8:52:17 AM													
7														
8	Where subject count is the number of subjects experiencing at least one adverse event at the stated toxicity grade using the maximum													
9	toxicity grade per subject, organ class, and term													
10	Body System or Organ Class	Dictionary-Derived Term	Placebo N=86				Xanomeline High Dose N=84				Xanomeline Low Dose N=84			
11			All Grades		Grades 3/4/5		All Grades		Grades 3/4/5		All Grades		Grades 3/4/5	
12			Subject Count	%	Subject Count	%	Subject Count	%	Subject Count	%	Subject Count	%	Subject Count	%
13	Cardiac Disorders	Atrial Fibrillation	1	1,2	0	0,0	3	3,6	1	1,2	1	1,2	0	0,0
14	Cardiac Disorders	Atrial Flutter	0	0,0	0	0,0	1	1,2	0	0,0	1	1,2	0	0,0
15	Cardiac Disorders	Atrial Hypertrophy	1	1,2	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0
16	Cardiac Disorders	Atrioventricular Block First Degree	1	1,2	0	0,0	0	0,0	0	0,0	1	1,2	0	0,0
17	Cardiac Disorders	Atrioventricular Block Second Degree	1	1,2	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0
18	Cardiac Disorders	Bradycardia	1	1,2	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0
19	Cardiac Disorders	Bundle Branch Block Left	1	1,2	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0
20	Cardiac Disorders	Bundle Branch Block Right	1	1,2	0	0,0	0	0,0	0	0,0	1	1,2	0	0,0
21	Cardiac Disorders	Cardiac Disorder	0	0,0	0	0,0	1	1,2	0	0,0	0	0,0	0	0,0
22	Cardiac Disorders	Cardiac Failure Congestive	1	1,2	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0
23	Cardiac Disorders	Myocardial Infarction	4	4,7	2	2,3	4	4,8	0	0,0	2	2,4	0	0,0



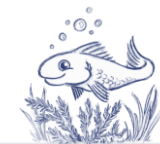
# Beispiele – FDA Jumpstart Scripts



Demographic Baseline Characteristics		Treatment A		Treatment B		Overall	
		N=302		N=159		N=461	
Age	Mean (SE)	61.8 (8.5)		60.4 (10.1)		61.3 (9.1)	
	Min	39		29		29	
	Q1	57		55		56	
	Median	61		62		61	
	Q3	68		67		68	
	Max	83		85		85	
		Count	%	Count	%	Count	%
Age Groups	Age between 1 year and 35 years	0	0,0	3	1,9	3	0,7
	Age between 35 and 65	186	61,6	102	64,2	288	62,5
	Age 65 and over	116	38,4	54	34,0	170	36,9
Sex	F	128	42,4	66	41,5	194	42,1
	M	174	57,6	93	58,5	267	57,9
Race	American Indian Or Alaska Native	2	0,7	0	0,0	2	0,4
	Asian	4	1,3	2	1,3	6	1,3
	Black Or African American	17	5,6	9	5,7	26	5,6
	Native Hawaiian Or Other Pacific Islander	1	0,3	0	0,0	1	0,2
	White	278	92,1	148	93,1	426	92,4
Ethnicity	Hispanic Or Latino	54	17,9	25	15,7	79	17,1
	Not Applicable	35	11,6	19	11,9	54	11,7
	Not Hispanic Or Latino	213	70,5	115	72,3	328	71,1



# Beispiele – FDA Jumpstart Scripts



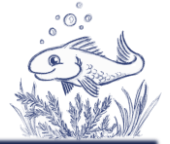
ALT Baseline  ALT Maximum		Placebo N = 50											
		ALT < 2x ULN		2x ≤ ALT < 5x ULN		5x ≤ ALT < 10x ULN		10x ≤ ALT < 20x ULN		ALT ≥ 20x ULN		ALT < 2x ULN	
		Subject Count	%	Subject Count	%	Subject Count	%	Subject Count	%	Subject Count	%	Subject Count	%
ALT < 2x ULN		49	98,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
2x ≤ ALT < 5x ULN		0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
5x ≤ ALT < 10x ULN		0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
10x ≤ ALT < 20x ULN		0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
ALT ≥ 20x ULN		0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00

AST Baseline  AST Maximum		Placebo N = 50											
		AST < 2x ULN		2x ≤ AST < 5x ULN		5x ≤ AST < 10x ULN		10x ≤ AST < 20x ULN		AST ≥ 20x ULN		AST < x2 ULN	
		Subject Count	%	Subject Count	%	Subject Count	%	Subject Count	%	Subject Count	%	Subject Count	%
AST < 2x ULN		49	98,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
2x ≤ AST < 5x ULN		0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
5x ≤ AST < 10x ULN		0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
10x ≤ AST < 20x ULN		0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
AST ≥ 20x ULN		0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00



# Beispiele – FDA Jumpstart Scripts

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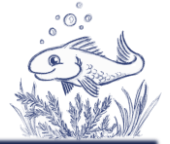


- Sehr empfehlenswert für klinische Studienausswertung
- Wertvolle Möglichkeiten für Anpassungen und Erweiterungen
- Hoher Komplexitätsgrad





# Beispiele – Data Visualizations – SAS Blog

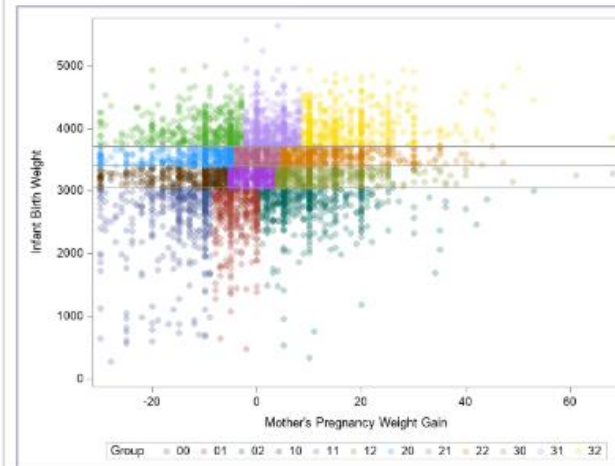


- Blog von SAS
- Viele Beschreibungen & Grafiken meist mit Code
- Lizenz fehlt, da von SAS wahrscheinlich frei nutzbar

## Data Visualization - SAS Blog



SAS has a blog post where various topics are discussed and examples are provided. The 'Data Visualization' blog contains a lot of examples including source code on what graphics can be created.

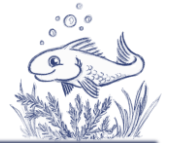


SAS Scripts Visualization

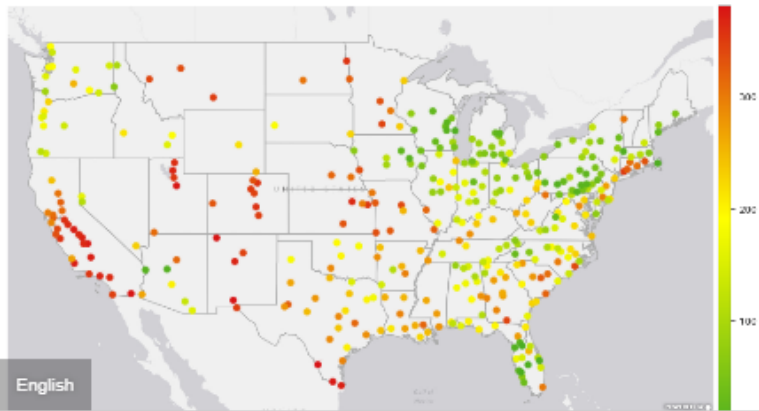




# Beispiele – Data Visualizations – SAS Blog



## Retirement Ranking, in U.S. Cities




### Data Visualization | Programming Tips

January 15, 2020

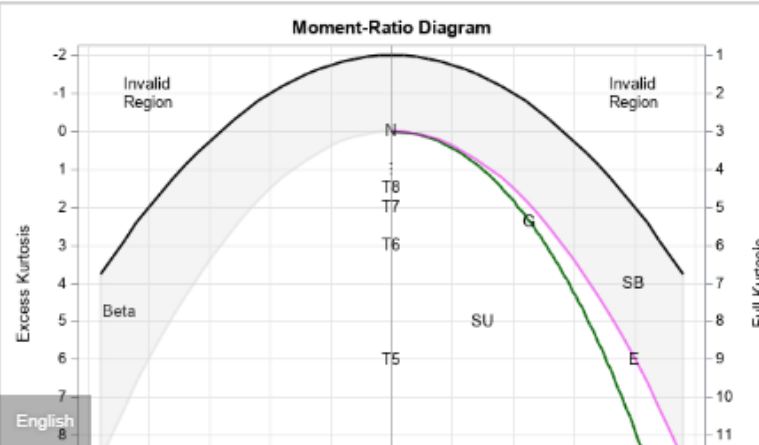
Where's the best place to retire, in the U.S.?

As I get older, a few of my buddies are starting to retire. And this makes me think about my own retirement (not that I'm anywhere near old enough to retire, mind you!) Therefore when I saw a list of the

[Read More](#)

 **Robert Allison**

## Moment-Ratio Diagram




### Advanced Analytics | Data Visualization

January 15, 2020

The moment-ratio diagram

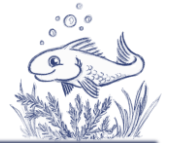
In my book *Simulating Data with SAS*, I show how to use a graphical tool, called the moment-ratio diagram, to characterize and compare continuous probability distributions based on their skewness and

[Read More](#)

 **Rick Wicklin**



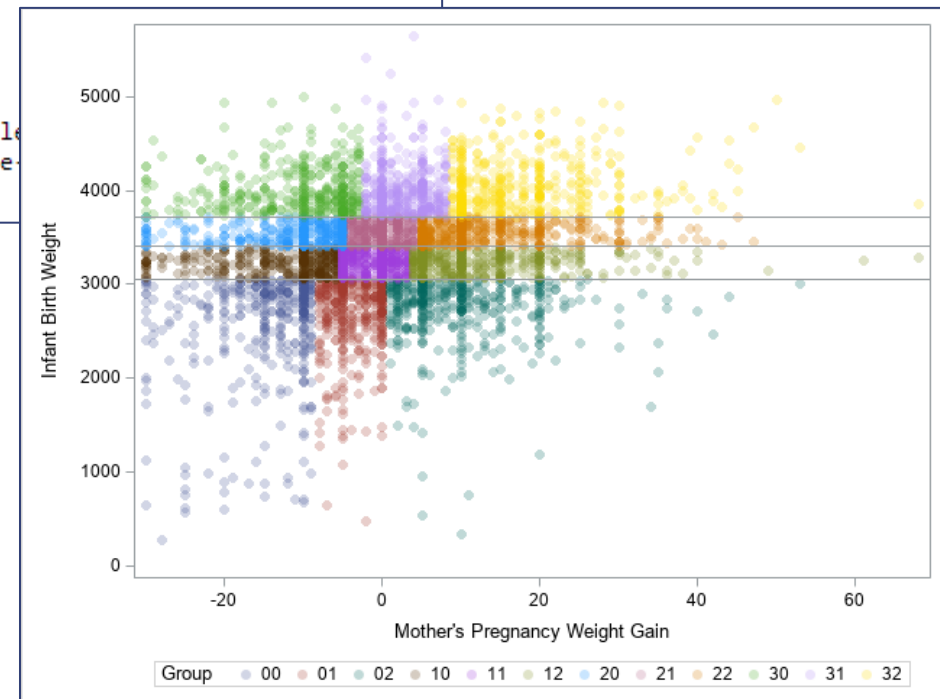
# Beispiele – Data Visualizations – SAS Blog



< > ⌂ | [blogs.sas.com/content/graphicallyspeaking/files/2019/12/waffle\\_house\\_locations.txt](https://blogs.sas.com/content/graphicallyspeaking/files/2019/12/waffle_house_locations.txt)

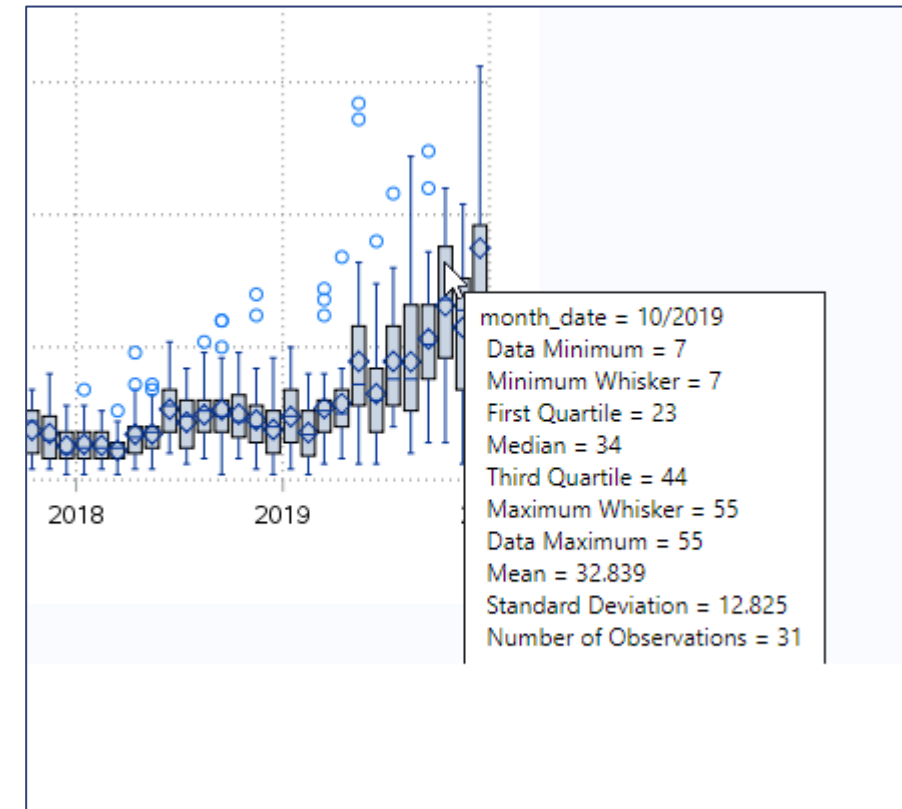
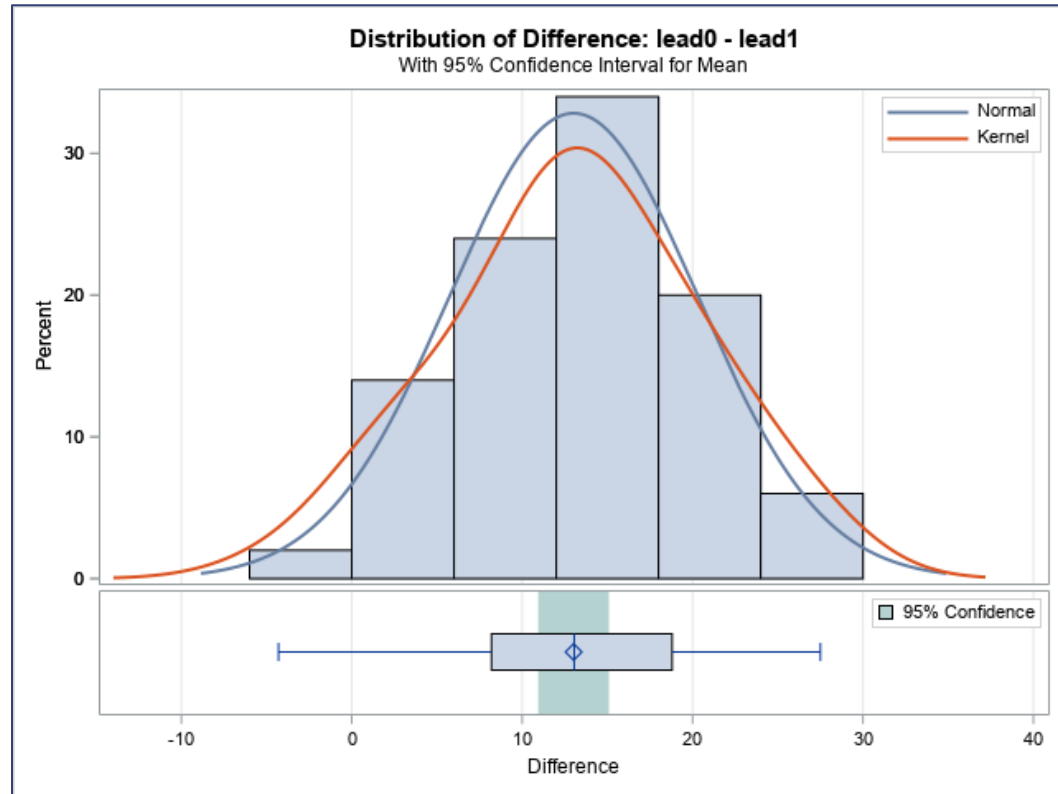
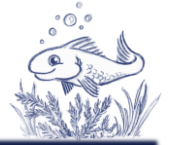
```
%let name=waffle_house_locations;  
  
/*  
Set your current-working-directory (to read/write files), if you need to ...  
%let rc=%sysfunc(dlgcd('c:\someplace\public_html'));  
*/  
filename odsout '.';  
  
/*  
Couldn't figure out an easy way to scrape the data from: https://locations.waffle  
So I bought the data from: https://www.scrapehero.com/store/product/waffle-house  
*/
```

Ice Core Drilling in Antarctica





# Beispiele – Data Visualizations – SAS Blog



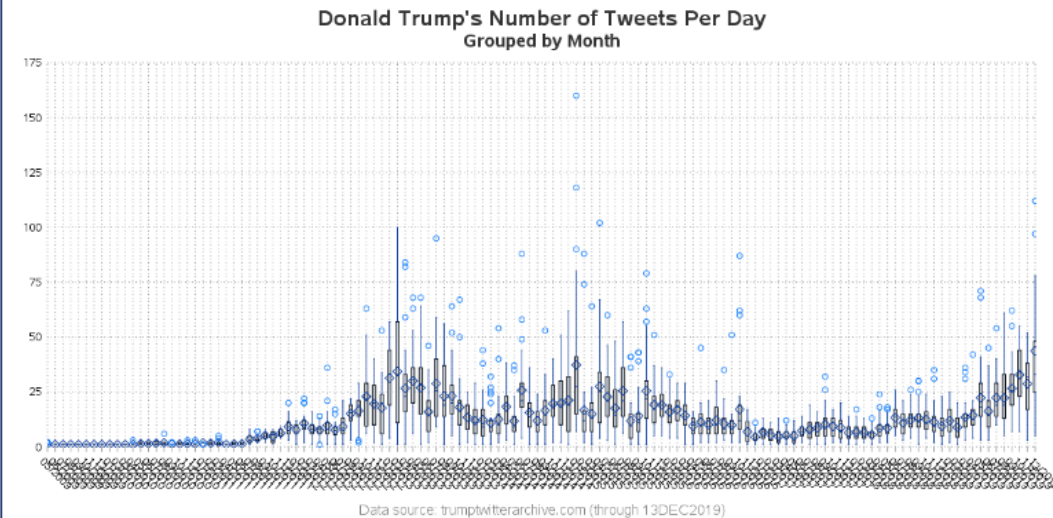


# Beispiele – Data Visualizations – SAS Blog



- Viele Beispiele
- Teilweise kein Code
- Mit Erklärungen

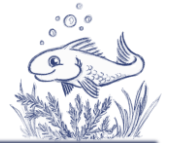
```
proc sgplot data=summarized_data noborder;  
vbox daily_tweet_count / category=month_date  
  outlierattrs=(color=cx0276FD size=7px);  
axis display=(nolabel noline) offsetmin=0 offsetmax=0  
  grid gridattrs=(pattern=dot color=gray88);  
yaxis display=(nolabel noline noticks) offsetmin=0 offsetmax=0  
  values=(0 to 175 by 25)  
  grid gridattrs=(pattern=dot color=gray88);  
run;
```



I got the box for each month - but what happened to my x axis (along the bottom of the graph)? Why is it labeling every box's month? Well, box plots just kinda work that way by default - they assume that when you're using a box plot, that each box is kind of a categorical/discrete thing. But in my case, my x axis is time



# Beispiele – RhoInc Plots

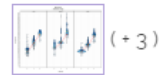


- Generische SAS Makros
- Paper mit Code
- MIT (meistens)

## RhoInc Plots

### Description:

Multiple Plot SAS Macros are made available by RhoInc employees in different GitHub subpages. There is a violin plot, sankey barchart, bee swarm and other related macros available.

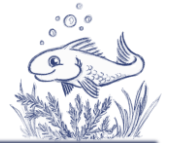


Type	Scripts
Language	SAS
License	MIT
Last Update Date	2019-08-08
Link Source	<a href="https://github.com/...">https://github.com/...</a>
Link Company	<a href="http://www.rhoinc.com">http://www.rhoinc.com</a>
Documentation	Readme files and wikis are available on the GitHub Subpages.
Author Type	company
Author(s)	RhoInc Employees
Area (Users)	ANALYST
Area (Workspace)	Visualization
Size	small
Link Paper(s)	<a href="https://www.lexjansen.com/...">https://www.lexjansen.com/...</a> <a href="https://www.lexjansen.com/...">https://www.lexjansen.com/...</a> <a href="https://analytics.ncsu.edu/...">https://analytics.ncsu.edu/...</a>

Link Paper(s) <https://www.lexjansen.com/...>,  
<https://www.lexjansen.com/...>,  
<https://analytics.ncsu.edu/...>



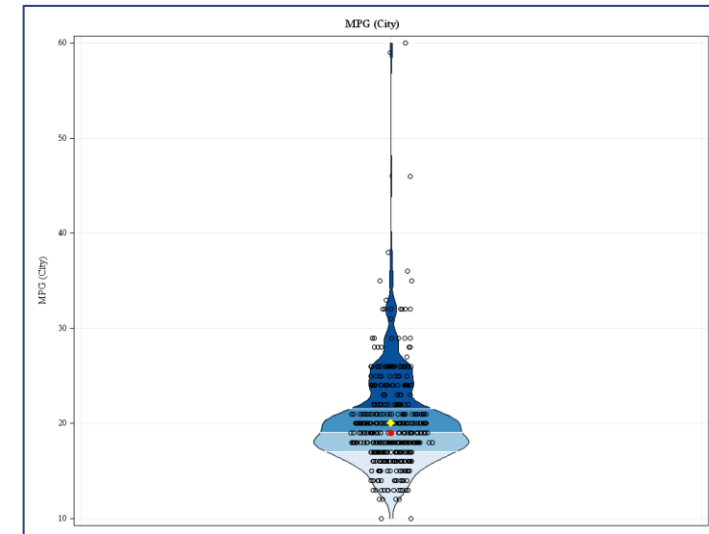
# Beispiele – RhoInc Plots



## Plug-and-play example

Run the code below in your local SAS session.

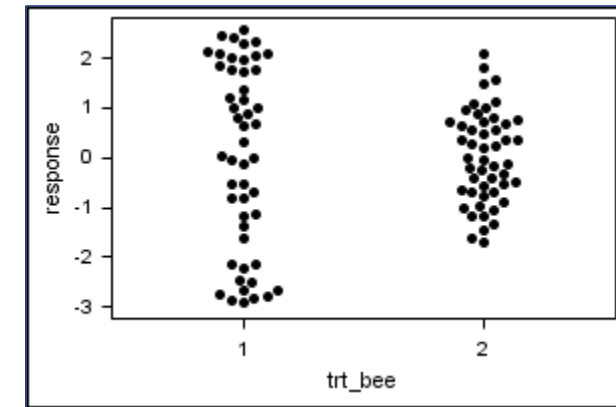
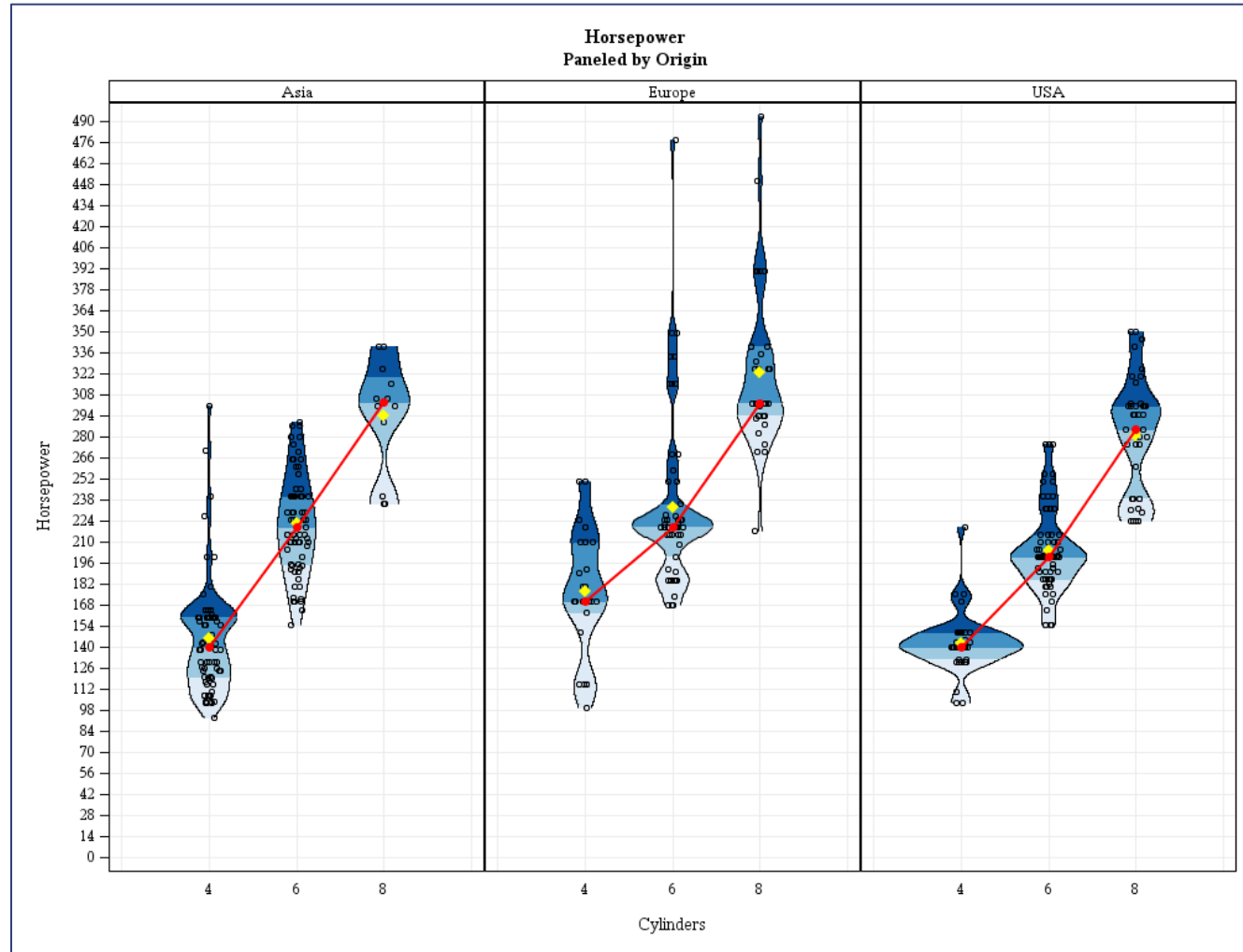
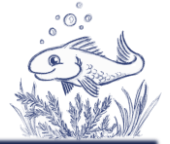
```
/*-----  
  Include %violinPlot directly from GitHub.  
  -----  
  
  %let repo = https://github.com/RhoInc/sas-violinPlot;  
  %let file = src/violinPlot.sas;  
  %let fileURL = %sysfunc(tranwrd(%nrquote(&repo), github.com, raw.githubusercontent.com))  
  
  filename fileURL url "&fileURL";  
  %include fileURL;  
  filename fileURL;  
  
/*-----  
  Output a violin plot of SASHELP.CARS.MPG_CITY.  
  -----  
  
  %sysexec C:;  
  %sysexec 'cd "Users\%USERNAME%";  
  ods pdf  
    file = 'Violin Plot of City MPG.pdf';  
  
  %violinPlot  
    (data = sashelp.cars  
     ,outcomeVar = mpg_city);  
  
  ods pdf close;
```



```
%violinPlot  
  
(data = sashelp.cars  
 ,outcomeVar = mpg_city);
```

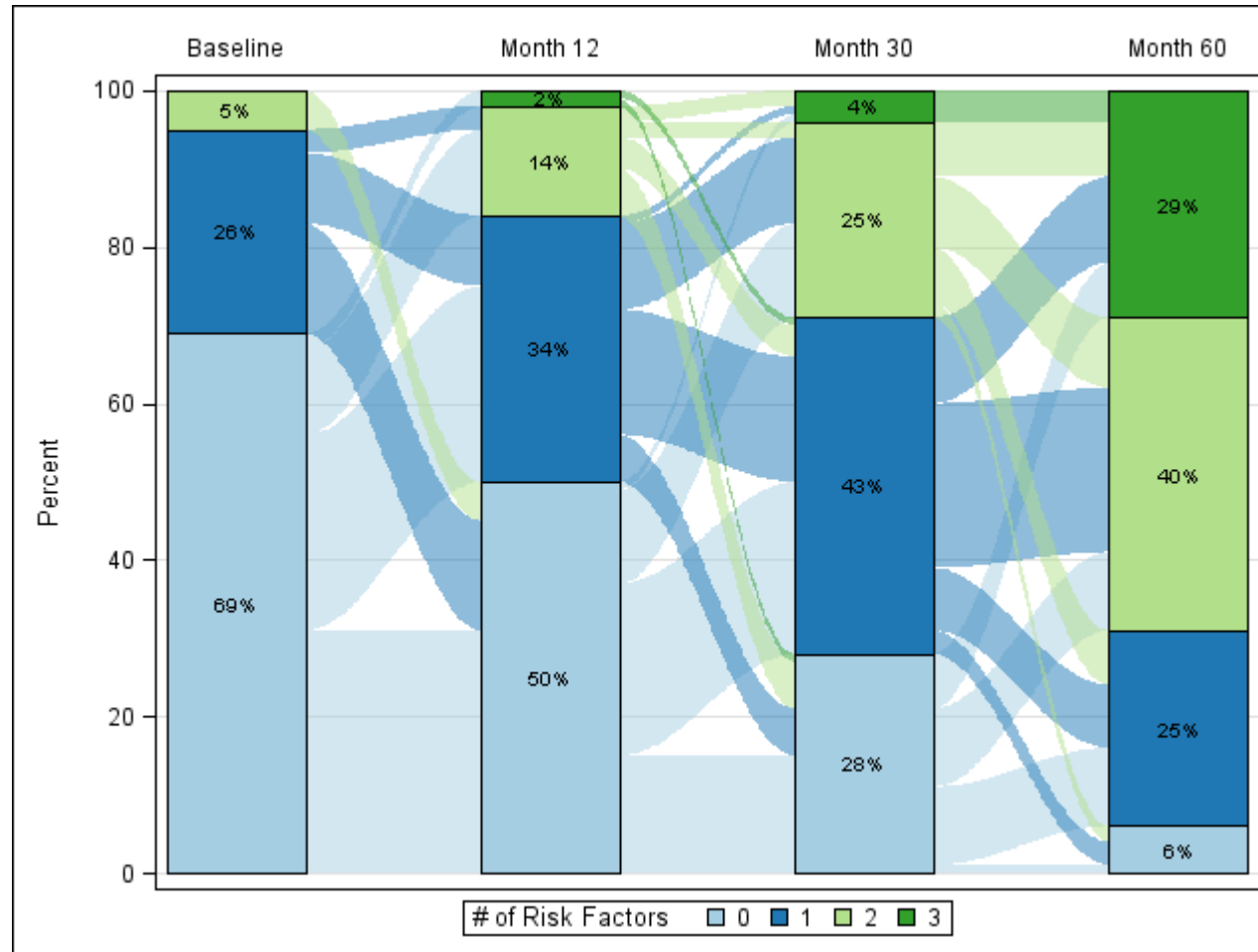
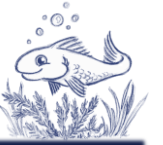


# Beispiele – RhoInc Plots





# Beispiele – RhoInc Plots





# Beispiele – RhoInc Plots



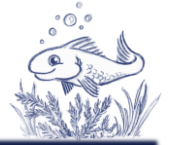
- Anwendung auf „eigene Daten“ einfach
- Umfangreiches Paper
- Andere nützliche Open Source Repositories

Parameter	Purpose
-----	-----
data	[REQUIRED] input dataset
outcomeVar	[REQUIRED] continuous outcome variable
groupVar	[optional] categorical grouping variable
panelVar	[optional] categorical paneling variable
byVar	[optional] categorical BY variable
outPath	[optional] output directory
outName	[optional] output name
widthMultiplier	[optional] kernel density width coefficient
...	



# Beispiele – Macro Collections

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- Macro Collections (Utility Tools)
  - SAS Macros by Macro People
  - SAS Macros by Scott Bass
  - Rolands SAS Macros
  - PhUSE White Paper Utilities
- „Kleinere Hilfsmakros“
- Unterschiedlicher Zielsetzung





# Beispiele – SAS Macros by Macro People

- Speziell für andere Entwickelt (& Eigennutzung)
- Wartung: Allen Bowe
- Aktive Weiterentwicklung
- Dokumentationsseite

# SAS Macros by Macro People

**MACRO CORE** (4)

Much quality. Many standards. The Macro Core library exists to save time and development effort! Herein ye shall find a veritable host of production quality SAS macros. These are a mix of tools, utilities, functions and code generators that are useful in the context of Application Development on the SAS platform. Contributions are welcomed.

42 commits

31 branches

29 packages

4 releases

1 contributor

MIT

Search macros

Open pull request

Find file

Discussions

View details on GitHub

Latest commit: 1/27/2021, 11 days ago

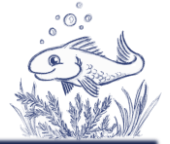
📁 base	fix: adjust macro base	14 days ago
📁 base	docs: updating source	last month
📁 base	fix: length as int	11 days ago
📁 base	docs: updating source	last month
📁 base	docs: migration	last month
📁 CONTRIBUTING.md	docs: updating source	last month
📁 Doolite	initial release	2 years ago
📁 LCHDGE	docs: migration	last month
📁 MACROCARD	docs: updating source	last month
📁 macrocard	fix: length as int	11 days ago
📁 macrolib	docs: updating source	last month
📁 macrolib	docs: updating source	last month

SAS Scripts Programming



# Beispiele – SAS Macros by Macro People

---



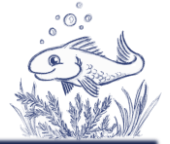
- mf\_abort
  - Spezieller Abbruch-Mechanismus
  - z.B. für WebApplications
- Existens-Checks
  - mf\_exists (Datensatz)
  - mf\_existvar (Variable)
  - mf\_existvarlist (Variablen)
- Get\* Informationen
  - mf\_getFileSize
  - mf\_getValue
  - mf\_getVarType
  - ...





# Beispiele – SAS Macros by Macro People

---

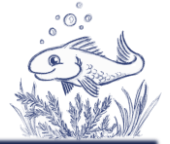


- mf\_mkdir (Verzeichnis erstellen)
- mp\_binaryCopy (Kopieren im Binärformat)
- mp\_dirlist (Verzeichnisse & Dateien listen)
- mp\_ds2cards (Datensatz zu CARDS Anweisungen)
- mp\_searchdata (Suche nach einem Text in einer Library)
- mp\_zip / mp\_unzip (Arbeiten mit .zip)
- ...





# Beispiele – SAS Macros by Macro People



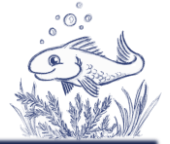
- Hilfmakros als Basisblöcke
- Zusätzliche Makros für
  - SAS Metadata Server
  - Viya
- Aktive Wartung

The screenshot shows the %MACRO CORE website interface. The header includes the logo "%MACRO CORE" and the tagline "Production Ready Macros for SAS Application Developers". A search bar is located in the top right corner. The left sidebar displays a "File List" under the "MacroCore" section, with the "base" directory expanded. The main content area, titled "base Directory Reference", lists several macros under the "Files" section:

File	Description
<code>mf_abort.sas</code>	abort gracefully according to context
<code>mf_exists.sas</code>	Checks whether a dataset OR a view exists.
<code>mf_existvar.sas</code>	Checks if a variable exists in a data set.



# Beispiele – SAS Macros by Scott Bass



- Scott Bass, IT-SAS Consulting
- Seine Kollektion als Open Source
- Aktive Wartung
- Hilfsmakros
- Dokumentation im Header
- Unlicense Lizenz

## SAS Macros by Scott Bass

Scott Bass has built up a (semi) large collection of utility macros over the years with 73 macros currently. These are put up on GitHub to make them available for anyone. Almost all are utility in nature, and not tied to any particular project.

**Scott Bass** scottbass  
Experienced IT professional and consultant, having worked across a broad range of industries.  
Sydney, Australia

Projects 0 Wiki Insights

scottbass Update libname\_sqlsrv.sas

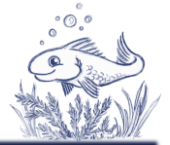
@TEMPLATE.sas	Update @TEMPLATE.sas
CreateTableOrView.sas	Add files via upload
IsNum.sas	Add files via upload
IsNumM.sas	Add files via upload
RunAll.sas	Add files via upload
age.sas	Add files via upload
align_decimals.sas	Add files via upload

SAS Scripts Programming



# Beispiele – SAS Macros by Scott Bass

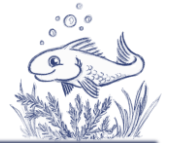
---



- RunAll (Asynchroner Programmstart)
  - AlignDecimals (Dezimale Ausrichtung)
  - Create\_format (Format erzeugen)
  - Delete\_file (Datei löschen)
  - Excel2SAS (Excel Datei einlesen)
  - Export\_\* (Export nach CSV, Excel, ...)
  - Logparse (Performance Statistiken aus Log)
  - txt2rtf (RTF erstellen aus Text Dateie)
  - ...
-



# Beispiele – SAS Macros by Scott Bass



## ➤ Compare (Vergleich ein Datensatz)

```
%compare (  
  base=adam.adtte,  
  comp=adam_mod.adtte,  
  by=usubjid);
```

### Comparing adam.adtte and adam\_mod.adtte datasets

Die Prozedur COMPARE  
Vergleich von WORKSPDE.\_BASE\_ mit WORKSPDE.\_COMP\_  
(Methode=EXACT)

#### Dateizusammenfassung

Datei	Erstellt	Geändert	NVar	NObs
WORKSPDE._BASE_	20JAN20:10:43:23	20JAN20:10:43:23	27	254
WORKSPDE._COMP_	20JAN20:10:43:23	20JAN20:10:43:23	27	241

#### Zusammenfassung der Variablen

Anzahl der gemeinsamen Variablen: 26.  
Anzahl Variablen in WORKSPDE.\_BASE\_, jedoch nicht in WORKSPDE.\_COMP\_: 1.  
Anzahl Variablen in WORKSPDE.\_COMP\_, jedoch nicht in WORKSPDE.\_BASE\_: 1.  
Anzahl der ID-Variablen: 1.

WARNING: Data set WORKSPDE.\_BASE\_ contains 1 variables not in WORKSPDE.\_COMP\_.  
WARNING: Data set WORKSPDE.\_COMP\_ contains 1 variables not in WORKSPDE.\_BASE\_.  
WARNING: Data set WORKSPDE.\_BASE\_ contains 14 observations not in WORKSPDE.\_COMP\_.  
WARNING: Data set WORKSPDE.\_COMP\_ contains 1 observations not in WORKSPDE.\_BASE\_.  
WARNING: Werte der folgenden 2 Variablen unterscheiden sich: RACE AVAL  
WARNING: The data sets WORKSPDE.\_BASE\_ and WORKSPDE.\_COMP\_ contain unequal values.



# Beispiele – SAS Macros by Scott Bass



## ➤ Compare (Vergleich Libraries)

```
%compare(  
  base=adam,  
  comp=adam_mod,  
  by=usubjid);
```

Comparing adam.ADAE and adam\_mod.ADAE datasets

Die Prozedur COMPARE  
Vergleich von WORKSPDE.\_BASE\_ mit WORKSPDE.\_COMP\_  
(Methode=EXACT)

Dateizusammenfassung

Datei	Erstellt	Geändert	NVar	N
WORKSPDE._BASE_	20JAN20:10:46:31	20JAN20:10:46:31	56	
WORKSPDE._COMP_	20JAN20:10:46:31	20JAN20:10:46:31	56	

Zusammenfassung der Variablen  
Anzahl der gemeinsamen Variablen: 56.  
Anzahl der ID-Variablen: 1.

Anzahl der gemeinsamen Variablen: 56.  
Anzahl der ID-Variablen: 1.

Anzahl der ID-Variablen: 1.

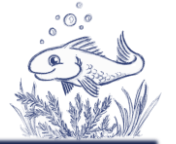
Anzahl der gemeinsamen Variablen: 56.  
Anzahl der ID-Variablen: 1.

Library comparison report between adam and adam\_mod libraries

Flags			Base			Compare			
Base	Compare	Matched?	Libname	Memname	# of Obs	Libname	Memname	# of Obs	Obs Diff?
1	1	MATCHED	ADAM	ADAE	1,191	ADAM_MOD	ADAE	1,191	
1	1	MATCHED	ADAM	ADSL	254	ADAM_MOD	ADSL	254	
1	1	MATCHED	ADAM	ADTTE	254	ADAM_MOD	ADTTE	241	<<<
1	1	MATCHED	ADAM	ADVS	32,139	ADAM_MOD	ADVS	32,139	
0	1	NO MATCH			.	ADAM_MOD	NEW	1	<<<
1	0	NO MATCH	ADAM	ADADAS	12,463			.	<<<
1	0	NO MATCH	ADAM	ADCIBC	730			.	<<<
1	0	NO MATCH	ADAM	ADLBC	37,132			.	<<<
1	0	NO MATCH	ADAM	ADLBGPV	37,132			.	<<<
1	0	NO MATCH	ADAM	ADLBH	24,966			.	<<<
1	0	NO MATCH	ADAM	ADLBHPV	24,966			.	<<<
1	0	NO MATCH	ADAM	ADLBHY	9,954			.	<<<
1	0	NO MATCH	ADAM	ADNPIX	31,140			.	<<<



# Beispiele – SAS Macros by Scott Bass



- Sehr viele teilweise sehr praktische Makros
- Ohne Einschränkungen nutzbar „unlicense“

The screenshot shows the GitHub profile of Scott Bass, who is a contributor to the 'SAS' repository. A tooltip is visible over the profile picture, displaying the following information:

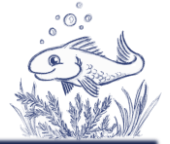
- Scott Bass** scottbass
- Experienced IT professional and consultant, having worked across a broad range of industries.
- Sydney, Australia

The repository page shows a 'Watch' button with 8 notifications and a 'Create new file' button. Below the repository name, there is a list of files and their latest commit messages:


File Name	Latest Commit Message
@TEMPLATE.sas	Add files via upload
CreateTableOrView.sas	Update CreateTableOrView.sas
IsNum.sas	Update IsNum.sas
IsNumD.sas	Add files via upload
IsNumM.sas	Add files via upload



# Beispiele – Rolands SAS Macros

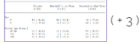


- Roland komplexes Makro Framework „Spectre“
  - Proprietärer Datenstandard
  - Sehr komplex
- Utility Makros sehr nützlich
- Leider verstorben, keine Wartung
- Fokus auf Eigennutzung
- Weniger Dokumentation und Checks

 **Spectre (Roland's SAS® Macros)**

**Description:**  
A complete clinical reporting engine is provided as Spectre. It's a comprehensive macro framework. Additionally 244 useful utility macros are available.

**Think Abouts:**  
It's a complex and comprehensive macro framework with many dependencies. The person who had developed this unluckily faded away.



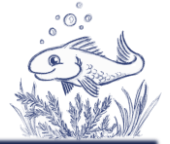
(+ 3)

Type	Scripts
Language	SAS
License	Unlicense
Last Update Date	2015-06-17
Link Source	<a href="http://www.datasavantconsulting.com/">http://www.datasavantconsulting.com/...</a>
Link Homepage	<a href="http://www.datasavantconsulting.com/">http://www.datasavantconsulting.com/...</a>
Documentation	Basic documentation in HTML format can be downloaded at the source link.
Author Type	individual
Author(s)	Roland Rashleigh-Berry
Area (Users)	ANALYST
Area (Workspace)	Outputs
Size	large
Link	<a href="http://www.datasavantconsulting.com/">http://www.datasavantconsulting.com/...</a>
Presentation(s)	



# Beispiele – Rolands SAS Macros

---



- age (Altersberechnung aus Datum)
  - allunique (Einmalige Ausprägungen einer Var in Lib)
  - char2num (Umwandlung character -> numeric)
  - combine (Datensatzkombination)
  - delmac (Löschen von Makros aus WORK.SASMACR)
  - dslabel (Datensatz Label ermitteln)
  - flatten (Datensatzreduktion auf 1 Obs pro BY)
  - ... (243 Stück)
-



# Beispiele – Rolands SAS Macros



- compvars - Vergleich Variablen -> Makro Variablen

NOTE: Variables found in adam.adtte but not adam\_mod.adtte:

SAFFL

NOTE: Variables found in adam\_mod.adtte but not adam.adtte:

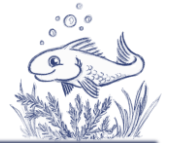
newvar

NOTE: Variables found in both adam.adtte and adam\_mod.adtte:

ADT AGE AGEGR1 AGEGR1N AVAL CNSR EVNTDESC PARAM PARAMCD RACE RACEN SEX  
SITEID SRCDOM SRCSEQ SRCVAR STARTDT STUDYID TRTA TRTAN TRTDUR TRTEDT TRTP  
TRTSDT USUBJID



# Beispiele – Rolands SAS Macros



## ➤ complib – Vergleich der Datensätze in Libraries

### Comparison of ADAE dataset between ADAM and ADAM\_MOD libraries

Die Prozedur COMPARE  
Vergleich von WORK\_BASE mit WORK\_COMP  
(Methode=EXACT)

#### Dateizusammenfassung

Datei	Erstellt	Geändert	NVar	NObs
WORK_BASE	20JAN20:10:15:23	20JAN20:10:15:23	55	1191
WORK_COMP	20JAN20:10:15:23	20JAN20:10:15:23	55	1191

#### Zusammenfassung der Variablen

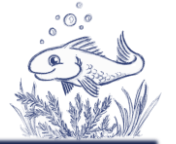
Anzahl der gemeinsamen Variablen: 55.  
Anzahl der ID-Variablen: 1.

Anzahl der gemeinsamen Variablen: 55.  
Anzahl der ID-Variablen: 1.

Anzahl der ID-Variablen: 1.



# Beispiele – Rolands SAS Macros

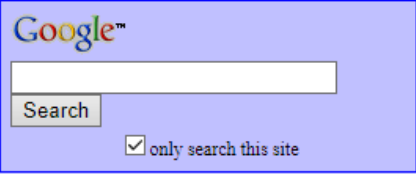



- Sehr umfangreich
- Nicht sehr robust
- Viele Möglichkeiten

## Roland's SAS® Macros

[This site is not connected with the SAS Institute]

(Author: Roland Rashleigh-Berry Last updated: 22 Feb 2016)  
[Spectre](#) ---- [Latest updates](#) ---- [Macro list](#) ---- [Download](#) ---- [SAS Tips](#) ---- [RGPP](#)



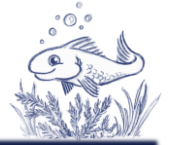


We regret to inform you that Roland Rashleigh-Berry sadly passed away on Tuesday 12th April 2016.

Therefore, please don't be surprised if the website is no longer available at some point in future or that Roland doesn't respond to any emails that are sent to him.



# Beispiele – PhUSE White Paper Utilities



- Spezifisch für PhUSE „Use-Cases“
  - Assert Makros für diverse Checks
  - `util_access_test_data`
  - `util_boxplot_block_ranges`
  - ...

## Utility Macro Index (SAS)

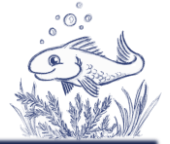
Dante Di Tommaso edited this page on 1 Mar 2016 · 19 revisions

Scripts - Description	State	Results	Artifacts
<a href="#">assert_complete_refds.sas</a> - Assert that a "reference" dset contains info for all obs in a "details" dset	qualified	PASS 6 of 6 tests	<a href="#">Test plan</a> <a href="#">Test-script</a> <a href="#">SAS log</a> <a href="#">Results</a>
<a href="#">assert_continue.sas</a> - error handling mechanism for standard scripts. if error detected, stop processing data and write message to user.	implemented	to do PASS 0 of 0 tests	<a href="#">to do</a> <a href="#">Test plan.docx</a> <a href="#">Test script</a> <a href="#">SAS log</a> <a href="#">Results</a>
<a href="#">assert_depend.sas</a> - Assert all dependencies of a standard script are satisfied	qualified	PASS 17 of 17 tests	<a href="#">Test plan</a> <a href="#">Test script</a> <a href="#">SAS log</a> <a href="#">Results</a>



# Beispiele – PhUSE Contributed Scripts & Macros

---



- Weitere Scripte und Makros im PhUSE GitHub
  - Teilweise schwierig zu identifizieren
  - Nützliche versteckte „Diamanten“





# Beispiele – SASUnit



- Validierungsframework
  - Nutzung eher als „Tool“ und nicht als „Open Source“
  - Umfangreich Funktionalität & Dokumentation
  - Für Qualitätschecks & Validierungen

SASUnit Examples

▼ Scenarios

▶ saspkg/assertexternal\_example\_test.sas

▶ saspkg/assertimage\_example\_test.sas

▶ saspkg/asserttext\_example\_test.sas

▷ saspkg/boxplot\_test.sas

▶ saspkg/comparison\_test.sas

▶ saspkg/crossreference\_test.sas

▶ saspkg/database\_test.sas

▶ saspkg/generate\_test.sas

▶ saspkg/getvars\_test.sas

▼ saspkg/nobs\_test.sas

▶ 001

▶ 002

▶ 003

▶ 004

▶ 005

▶ 006

▶ saspkg/programdocumentation\_test.sas

▷ saspkg/regression\_test.sas

▶ Units under Test

▶ Program documentation

No.010

ScenarioTests for nob.sas - has to fail!

Programsaspkg/nobs\_test.sas

Last Run12JUL2017:10:19:13

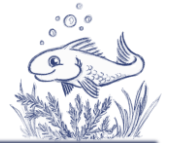
Duration2.5 s

Test Cases


No.	Test Case	Unit under Test	Last Run	Duration	Result
001	simple example with sashelp.class	nobs.sas	12JUL2017:10:19:14	0.1 s	
002	failed test - must be red!	nobs.sas	12JUL2017:10:19:15	0.1 s	
003	example with big dataset	nobs.sas	12JUL2017:10:19:15	0.3 s	
004	example with empty dataset	nobs.sas	12JUL2017:10:19:15	0.1 s	
005	dataset not specified	nobs.sas	12JUL2017:10:19:15	0.1 s	
006	invalid dataset	nobs.sas	12JUL2017:10:19:16	0.1 s	




# Beispiele – Reindeer – Render SAS Results



- Word-Makro Tool
  - Open Source
  - Gesponsort durch ClinStat GmbH
  - Intuitiv
  - Listing & RTFs in Word einbinden

 Katja Glass Consulting  
(Developer)

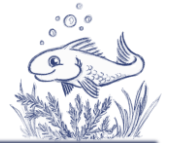
Reindeer

 ClinStat  
www.clinstat.eu  
(Sponsor)

**Reindeer –  
a Result Render Tool**[Run](#)



# Beispiele – Reindeer – Render SAS Results



```
*content - Editor
Datei Bearbeiten Format Ansicht Hilfe
Replace;[todayDate];[todayDate]
Replace;[reportID];REPI025889
Replace;[creator];Katja Glass Consulting (2)
Replace;[sponsor];ClinStat GmbH
Header1;ResultRenderer Example Document According Content File
Header2;Listing Outputs Below
Listing01 class 1st
```



ResultRenderer  
Example Template  
Rendered: 14FEB2020

Table g: RTF - Multi page cars output with PAGE grouping and multiple heading lines

Make=Acura

Model	Type	MSRP
MDX	SUV	\$36,945
RSX Type S 2dr	Sedan	\$23,820
TSX 4dr	Sedan	\$26,990
TL 4dr	Sedan	\$33,195
3.5 RL 4dr	Sedan	\$43,755
3.5 RL w/Navigation 4dr	Sedan	\$46,100
NSX coupe 2dr manual S	Sports	\$89,765

Created as example.  
This includes footnotes.



Reindeer  
Example Template  
Rendered: 14FEB2020

Report: REPI025889



Example Template for the tool

**Reindeer**

Created by Katja Glass Consulting



Sponsored by ClinStat

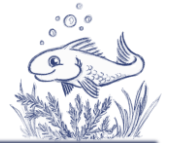


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Table 2: Multi page cars output .....	5
Table 3: Multi page cars output with PAGE grouping and multiple heading lines .....	9

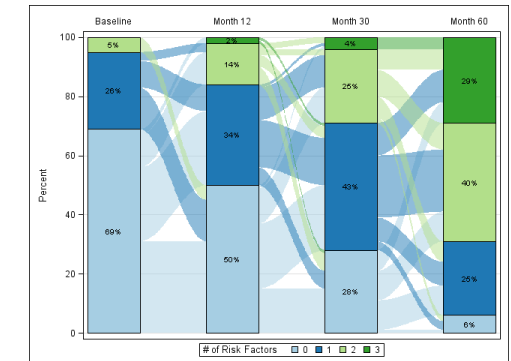


# Beispiele



- Verschiedenste Lösungen
- Finden und Nutzen
- Neue hinzufügen!

Library comparison report between adam and adam_mod libraries									
Flags			Base			Compare			Obs Diff?
Base	Compare	Matched?	Libname	Memname	# of Obs	Libname	Memname	# of Obs	
1	1	MATCHED	ADAM	ADAE	1,191	ADAM_MOD	ADAE	1,191	
1	1	MATCHED	ADAM	ADSL	254	ADAM_MOD	ADSL	254	
1	1	MATCHED	ADAM	ADTTE	254	ADAM_MOD	ADTTE	241	<<<
1	1	MATCHED	ADAM	ADVS	32,139	ADAM_MOD	ADVS	32,139	
0	1	NO MATCH			.	ADAM_MOD	NEW	1	<<<
1	0	NO MATCH	ADAM	ADADAS	12,463			.	<<<
1	0	NO MATCH	ADAM	ADCIBC	730			.	<<<
1	0	NO MATCH	ADAM	ADLBC	37,132			.	<<<
1	0	NO MATCH	ADAM	ADLBPCV	37,132			.	<<<
1	0	NO MATCH	ADAM	ADLBH	24,966			.	<<<
1	0	NO MATCH	ADAM	ADLBHPV	24,966			.	<<<
1	0	NO MATCH	ADAM	ADLBHY	9,954			.	<<<
1	0	NO MATCH	ADAM	ADNPIX	31,140			.	<<<



<b>SASUnit Examples</b>	
▼ Scenarios	No. 010
▶ saspgm/assertexternal_example_test.sas	Scenario Tests for nobis.sas - has to fail!
▶ saspgm/assertimage_example_test.sas	Program saspgm/nobis_test.sas
▶ saspgm/asserttext_example_test.sas	Last Run 12JUL2017:10:19:13
▶ saspgm/boxplot_test.sas	Duration 2.5 s
▶ saspgm/comparison_test.sas	
▶ saspgm/crossreference_test.sas	
▶ saspgm/database_test.sas	
▶ saspgm/generate_test.sas	
▶ saspgm/getvars_test.sas	
▼ saspgm/nobis_test.sas	
▶ 001	
▶ 002	
▶ 003	
▶ 004	
▶ 005	
▶ 006	
▶ saspgm/programdocumentation_test.sas	
▶ saspgm/regression_test.sas	
▶ Units under Test	
▶ Program documentation	

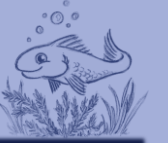
No.	Test Case	Unit under Test	Last Run	Duration	Result
001	simple example with sashelp.class	nobis.sas	12JUL2017:10:19:14	0.1 s	✓
002	failed test - must be red!	nobis.sas	12JUL2017:10:19:15	0.1 s	✗
003	example with big dataset	nobis.sas	12JUL2017:10:19:15	0.3 s	✓
004	example with empty dataset	nobis.sas	12JUL2017:10:19:15	0.1 s	✓
005	dataset not specified	nobis.sas	12JUL2017:10:19:15	0.1 s	✓
006	invalid dataset	nobis.sas	12JUL2017:10:19:16	0.1 s	✓





# Agenda

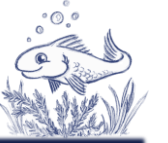
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- Einleitung
  - Anwendungsbeispiel
  - Beispiele
  - **Überlegungen**
  - Ausblick
- 







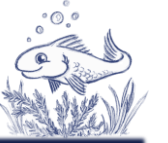
## Anwendung und Lizenzen

---



# Überlegungen - Anwendung

---



- Anwendung – einfach so?
  - Jein, Lizenz beachten
  - Wenige spezielle Lizenzen, z.b. „für nicht-kommerzielle Zwecke“
- Lizenzen
  - Übersicht - <https://choosealicense.com/licenses/>

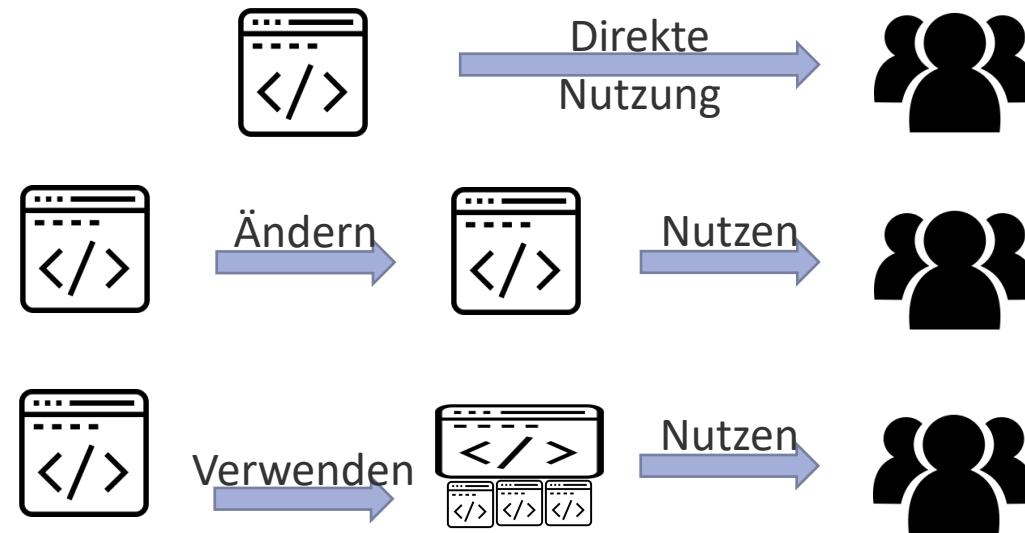




# Überlegungen - Anwendung



- Anwendung (Unlicense, MIT, GNU\*)
  - Verwenden, meist nichts zu beachten
  - In Software / Quellcode einbinden, Lizenz beachten
  - Verändern und verwenden, Lizenz beachten





# Überlegungen - Anwendung

---

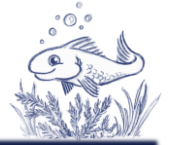


- Lizenz unbekannt
  - SAS Papers, Blogs, Posts
  - Copyright regeln gelten
  
- Nutzen solcher Quellen?
  - Autor nach Erlaubnis fragen
  - „Idee“ verwenden, eigene Implementation
  - „Basis-Implementierungen“ können verwendet werden
    - Geringe Komplexität
    - z.B. PROC SORT Beispiel

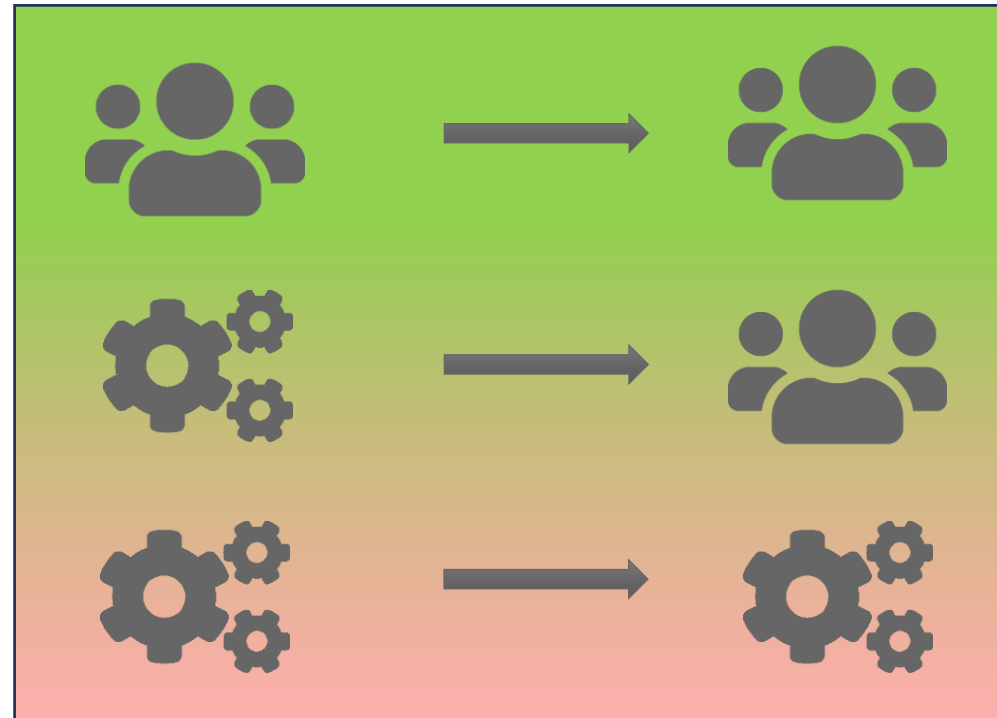




# Überlegungen - Anwendung



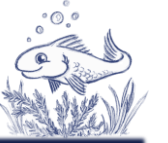
## ➤ Anwendung in Firmen



Erstellung

Validation / QC





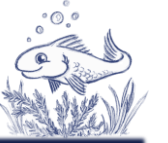
## Herausforderungen

---



# Überlegungen - Herausforderungen

---



- (Erstellung)
- Kommunikation
- Wartung
- Weiterentwicklung
- Dokumentation
- Validierung, Qualität





# Überlegungen - Herausforderungen

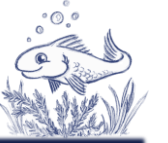
---



- Motivation für Funktionalität hoch
- Motivation für Dokumentation etc. meist niedrig
- Qualitätsgarantie / Verbesserung
  - Open Source mit Business Konzept
  - Finanzierung von Open Source







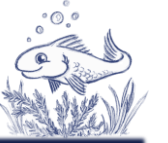
## Motivation

---

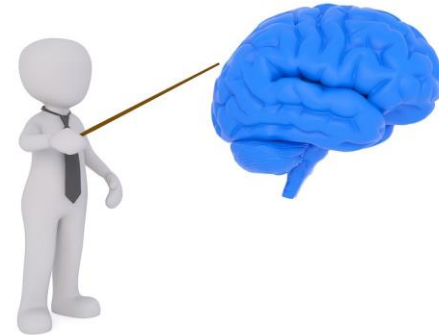


# Überlegungen - Motivation

---

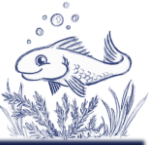


- Warum erstellen Leute Open Source?
  - Engagiert
  - Können zeigen
  - Kommerzieller Hintergrund

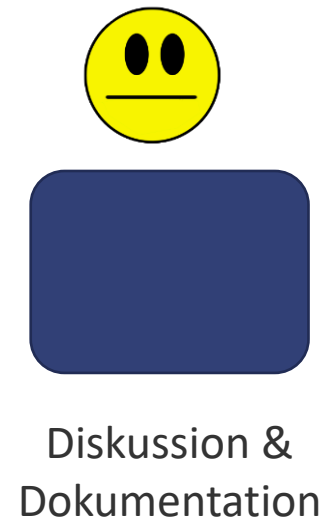
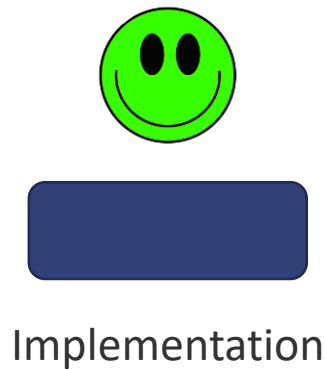




# Überlegungen - Motivation



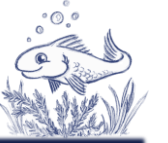
## ➤ Entwicklung nach Bereichen (Pharma)





# Überlegungen - Motivation

---



- Open Source Fördern
  - Internen & Externen Open Source gestatten
  - Studentische Arbeiten veröffentlichen
  - Open Source Arbeitsgruppen gründen und mitarbeiten
  - In Open Source investieren





# Überlegungen - Motivation

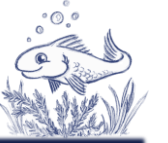
---



- Warum investieren?
  - Kommerzielle Motivation ist die vielversprechendste für
    - Qualität
    - Dokumentation
    - Projektzielbestimmung
    - Zeitplan
- Open Source ist nicht kostenlos, aber man kann sich die Kosten teilen!





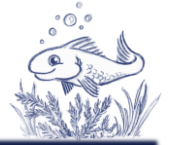


## Open Source Erstellen

---



# Überlegungen – Open Source Erstellen

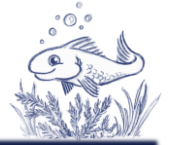


- Wie kann ich Open Source erstellen?
  - SAS Lizenz?
    - Education-Version (nicht-kommerziell)
  - Welche OS Lizenz?
    - MIT, ...
  - Online Stellen?
    - GitHub
    - CRAN, ...
  - Kommunizieren
    - Konferenzen
    - Social Media
    - Open Source Portal





# Überlegungen – Open Source Erstellen



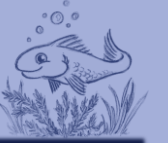
- Open Source erstellen lassen?
  - Studenten einstellen
  - Selbstständigen finden
  - Firma finden
  
- Zusammenschlüsse gründen
  - Gemeinsame Open Source Projekte
  - Ausschreibungen
  - Tests / Pilot





# Agenda

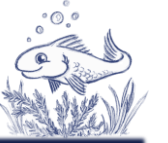
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- Einleitung
  - Anwendungsbeispiel
  - Beispiele
  - Überlegungen
  - **Ausblick**
- 







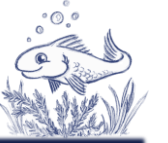
- Hohes Potential der Arbeitserleichterung
- Einige Lösungen vorhanden
- Portal für die Suche



**Es liegt an uns das Potential auszuschöpfen!**

---



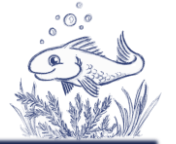


## Es liegt an uns das Potential zu erweitern!

- Mitarbeiter und Externe Open Source gestatten!
- Studienarbeiten veröffentlichen
- Arbeitsgruppen bilden und aktiv leben
- In Open Source investieren







- Weitere Informationen
  - Katja Glass Consulting @YouTube
  - Open Source Portal ([www.glacon.eu/portal](http://www.glacon.eu/portal))
  - Open Source Guides (<https://opensource.guide/>)

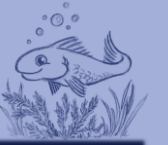
The screenshot shows the YouTube channel page for 'Katja Glass Consulting'. The navigation bar at the top includes 'ÜBERSICHT' (selected), 'VIDEOS', 'PLAYLISTS', 'KANÄLE', 'DISKUSSION', and 'KANALINFO'. Below the navigation bar, the 'Uploads' tab is active, showing a list of videos. The first video is 'Using an Open Source SAS Macro - How to do?' with a duration of 33:29 and 41 views from 2 months ago. The second video is 'Open Source Portal for Clinical Study Evaluations - ...' with a duration of 4:37 and 49 views from 4 months ago. The third video is 'Open Source for Pharma - Solutions, Challenges and...' with a duration of 17:09 and 85 views from 6 months ago. The fourth video is 'Open Source Collaborations in Clinical Study Evaluations A Way to Go' with a duration of 6:42 and 16 views from 7 months ago.

Video Title	Duration	Views	Time Ago
Using an Open Source SAS Macro - How to do?	33:29	41 Aufrufe	vor 2 Monaten
Open Source Portal for Clinical Study Evaluations - ...	4:37	49 Aufrufe	vor 4 Monaten
Open Source for Pharma - Solutions, Challenges and...	17:09	85 Aufrufe	vor 6 Monaten
Open Source Collaborations in Clinical Study Evaluations A Way to Go	6:42	16 Aufrufe	vor 7 Monaten



# Vielen Dank

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Katja Glass Consulting

[info@glacon.eu](mailto:info@glacon.eu)

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