SQLBITS 2020

THE GREATEST DATA SHOW

„A journey through the TidyveRse“

Your tour guide is: Thomas Hütter

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SQLBits online 2020

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- Application developer, consultant, accidental DBA, author
- Worked at consultancies, ISVs, end user companies
- SQL Server > 6.5, former „Navision“ > 3.0, R > 3.1.2
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Agenda

- Prerequisites: R base system, IDE, Tidyverse packages

- The Tidyverse concept: why and what?

- The Tidyverse components: packages and demos

- Wrap-up, ressources & credits, Q&A

Pre-Prerequisites

- Programming language for statistical computing and visualization, widely used by statisticians, data miners, analysts, data scientists
- Created by **R**oss Ihaka and **R**obert Gentleman, Uni Auckland, in 1993 as an open source implementation of the (1970s) S language
- GNU project, maintained by the R Foundation for Statistical Computing, compiled builds für Mac OS, Linux, Windows, supported by R Consortium
- Extensible through user-created packages, > 16000 available on CRAN
- Commercial support, e.g. since 2007 by Revolution Analytics, acquired by Microsoft in 2015, now provide Microsoft R Open, R Server
- IDEs: R.App, RStudio, MS R Tools for VisualStudio (< Version 2019)
- Support for R now in SQL Server (R services), Power BI, Azure ML

Prerequisites

- You already have an idea what R can be used for

- Install the R base system, available from https://cran.r-project.org/index.html

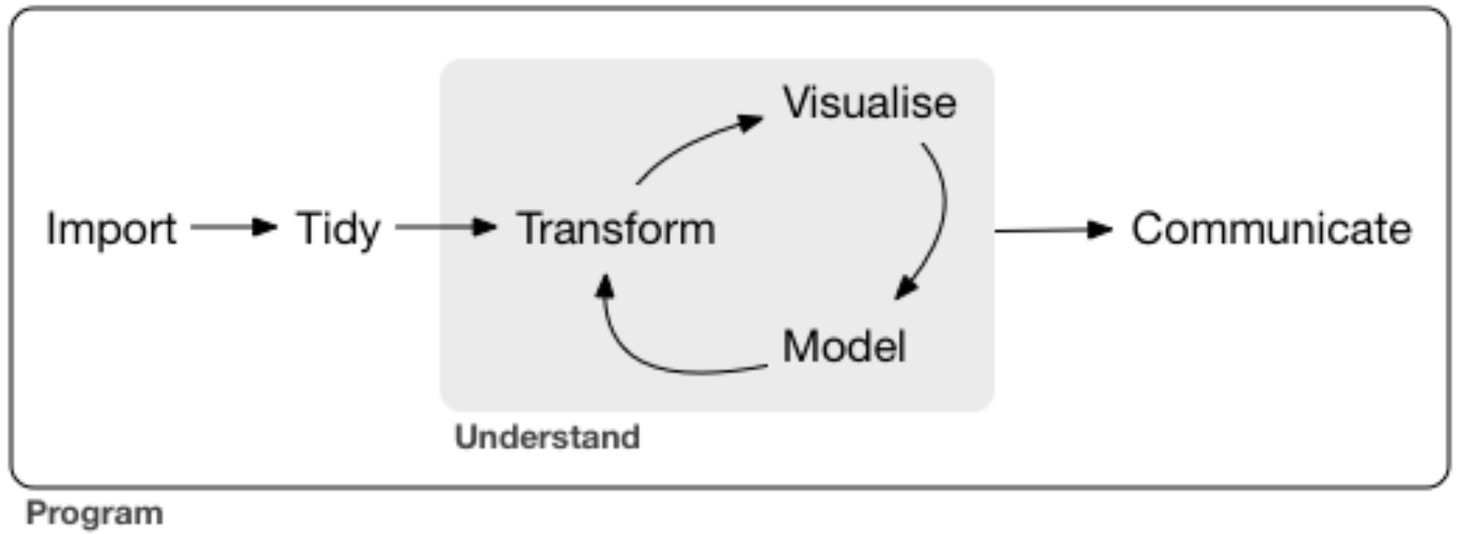
- Get the IDE of your choice, in my case RStudio: https://www.rstudio.com/products/rstudio/download/

- Of course we'll need the Tidyverse `install.packages(„tidyverse“)` then `library(tidyverse)` will load the core packages

- Let the fun begin!

The Tidyverse concept: why and what?

What a typical data analysis/data science project may look like



The components of the Tidyverse cover these tasks and can help you to accomplish them in a concise manner.

figure © 2017 Wickham/Grolemund: „R for Data Science"

The Tidyverse concept: why and what?

- „The goal of these principles is to provide a uniform interface so that Tidyverse packages work together naturally“. *)

- Tidy data is data stored it in a consistent, reusable structure, preferably in rectangular datasets, where ideally:
  1 row = 1 observation and 1 column = 1 variable.

- No need for conversions in the middle of analysis.

- You can concentrate on your data!

*) © 2017 Wickham: „The tidy tools manifesto“

The Tidyverse components

- Import: readr, readxl, DBI, haven, httr, XML2, rvest, jsonlite
- Tidy: tibble, tidyr
- Transform: dplyr, stringr, forcats, lubridate, hms, blob
- Visualize: ggplot2
- Model: tidymodels package collection (replacing modelr)
- Communicate: *R Markdown*, ggplot2, *Shiny*
- Program: purrr, magrittr, glue

Packages are: Core, additional, *non-Tidyverse*

Import

- readr: mainly imports flat files like csv and others
- readxl: import Excel files into R (xls and xlsx)
- DBI: database interface, encapsulates low-level driver work
- haven: import/export files from SPSS, Stata, SAS systems
- httr: handles http requests as GET() and POST()
- XML2: parse XML files
- rvest: scrape („harvest“) web pages; wraps httr and XML2
- jsonlite: JSON anyone? Parse, generate, stream, …

Transform

- dplyr: „A grammar of data manipulation“, provides functions according to the verbs of basic data manipulation: select, filter, arrange, mutate, summarize …
- stringr: simple, consistent wrapper for string operations
- forcats: tools for working with factors (reordering levels etc.)
- lubridate: functions to work with date-times and time-spans
- hms: a „pretty“ time-of-day class
- blob: for storing binary („blob) data

Tidy

- tibble: „Tibbles are a modern take on data frames“
  - never change input types (strings <-> factors)
  - never adjust variable names (allow crazy names)
  - no row.names()
  - prettier print output
- tidyr: easily tidy data mainly with these functions:
  - gather() collapses multiple columns into key-value pairs
    converts wide -> long
  - spread() does the inverse of gather()
    converts long -> wide
  - watch out for pivot_longer() and pivot_wider functions !

Visualize

- ggplot2: create elegant data visualizations using the „grammar of graphics“
  - initialize a plot stating the data frame to be used
  - define the aesthetic mappings per plot or per layer
  - add layers of geometric representation of the data
  - optionally add other options: scales, themes, facets

Model

The tidymodels collection of packages (former modelr):

- rsample: efficient data splitting and resampling
- parsnip: common API to modeling/analysis functions
- recipes: tidy interface to data pre-processing tools
- workflows: bundle pre-processing, modeling, post-processing
- tune: helps optimizing hyperparameters
- yardstick: performance metrics for models
- broom: converts statistical info into user-friendly formats
- dials: creates and manages tuning parameters

Communicate

- *R Markdown*: package and tool to render markdown files to (X)HTML, pdf or other output formats

- ggplot2: see „Visualize“ section

- *Shiny*: a framework for easily building interactive web applications in R with minimal effort

Program

- magrittr: the forward pipe operator %>% for R, chaining of commands by forwarding the result of one function/expression into the next function call

- purrr: tools for functional programming, e.g.
  - using map_*() functions instead of loops or apply()
  - error handling: safely(), possibly(), quietly()

- glue: provides alternatives to paste() for easier combination of data and strings

Tidyverse wrap-up

- „Tidy datasets are all alike, but every messy dataset
  is messy in it's own way“ (Hadley Wickham)
- To avoid this, engage the tidy data philosophy and tools
- So preferably convert 'messy' to tidy data, where tidy means:
  - one variable per column
  - one observation per row
  - each type of observational unit is a tibble
- Easier passing of data between the tools / packages
- Make the tools work together in a natural way

Resources & credits

- The Tidyverse web site http://www.tidyverse.org/
- R for Data Science, Hadley Wickham & Garrett Grolemund, O'Reilly, ISBN 978-1491910399, also at http://r4ds.had.co.nz
- The tidy tools manifesto https://mran.microsoft.com/web/packages/tidyverse/vignettes/manifesto.html
- More on the Shiny framework http://shiny.rstudio.com/ and on R markdown http://rmarkdown.rstudio.com/
- World economic outlook database: International monetary fund http://www.imf.org/external/pubs/ft/weo/2019/02/weodata/download.aspx
- F1 data from: http://www.formel1.de/rennergebnisse/wm-stand/2016/

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Thank you for your interest & keep in touch:

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This file and all demo scripts can be found at:
http://bit.ly/DerFredoSQLBits2020

Do we have time for Q & A?