Adding a corporate identity to reproducible research

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Summary

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Introduction

Me

- senior statistician at Research Institute for Nature and Forest (INBO)
- team Biometric and Quality Assurance
- statistical consultancy for scientists
  - getting the questions clear
  - design of experiments, sample size calculation
  - (assisting with) data analysis
  - what to report
- helpdesk for R and statistics
- training for scientists on R and statistics
- projects requiring a statistician
  - designing longterm monitoring
  - automated analysis of longterm monitoring

Quick poll

- who is using a WYSIWYG editor (Word, Powerpoint, LibreOffice, ...)?

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- who is using base R graphics?

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- who is using lattice graphics?

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- who is using ggplot2 graphics?

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- who is using ggplot2 graphics?
- who is using ggvis graphics?
- who is using RStudio IDE?

Our early history

Once upon a time there were only base graphics and MS Word

- copy-paste results from R into a Word document
  - tedious
  - error-prone when data or analysis changed
- graphics exported from R and imported with link to file in Word
- base graphics are tedious to lay-out
- combining references and equations in large documents was a horror story

Enter the LaTeX era

Pro

- no more problems with references and equations in large documents
- R code and text combined using Sweave
  - no more tedious and error-prone copy-paste
- lay-out can be defined in a style

Contra

- requires knowledge of LaTeX syntax
  - turned out to be impossible read for our clients
- pdf output instead of word

ggplot2 for graphics

Very short intro

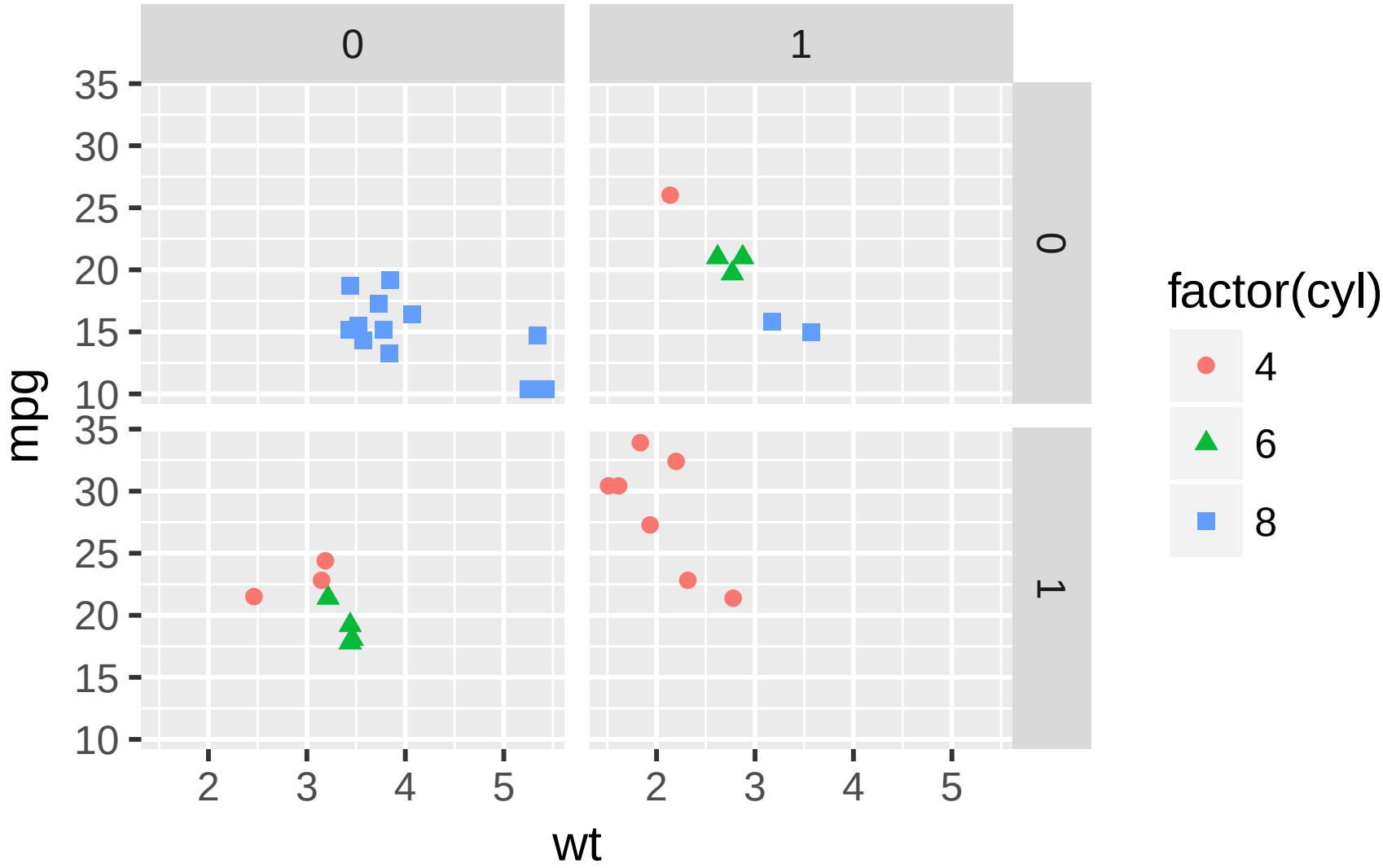
- based on the grammar of graphics (Wilkinson, 2005)
- plot specification at a high level of abstraction
- very flexible
- theme system for polishing plot appearance
- mature and complete graphics system
- many users, active mailing list

Basic idea

- `ggplot()` defines the defaults for data and aestethics
- `geom_xyz()` defines how the aestethics are represented on the plot
- `scale_type_xyz()` defines the scale of each aestethic
- `facet_zzz()` defines subsets in the data
- `coord_yyy()` defines coordinate systems
- `theme()` defines the general look and feel

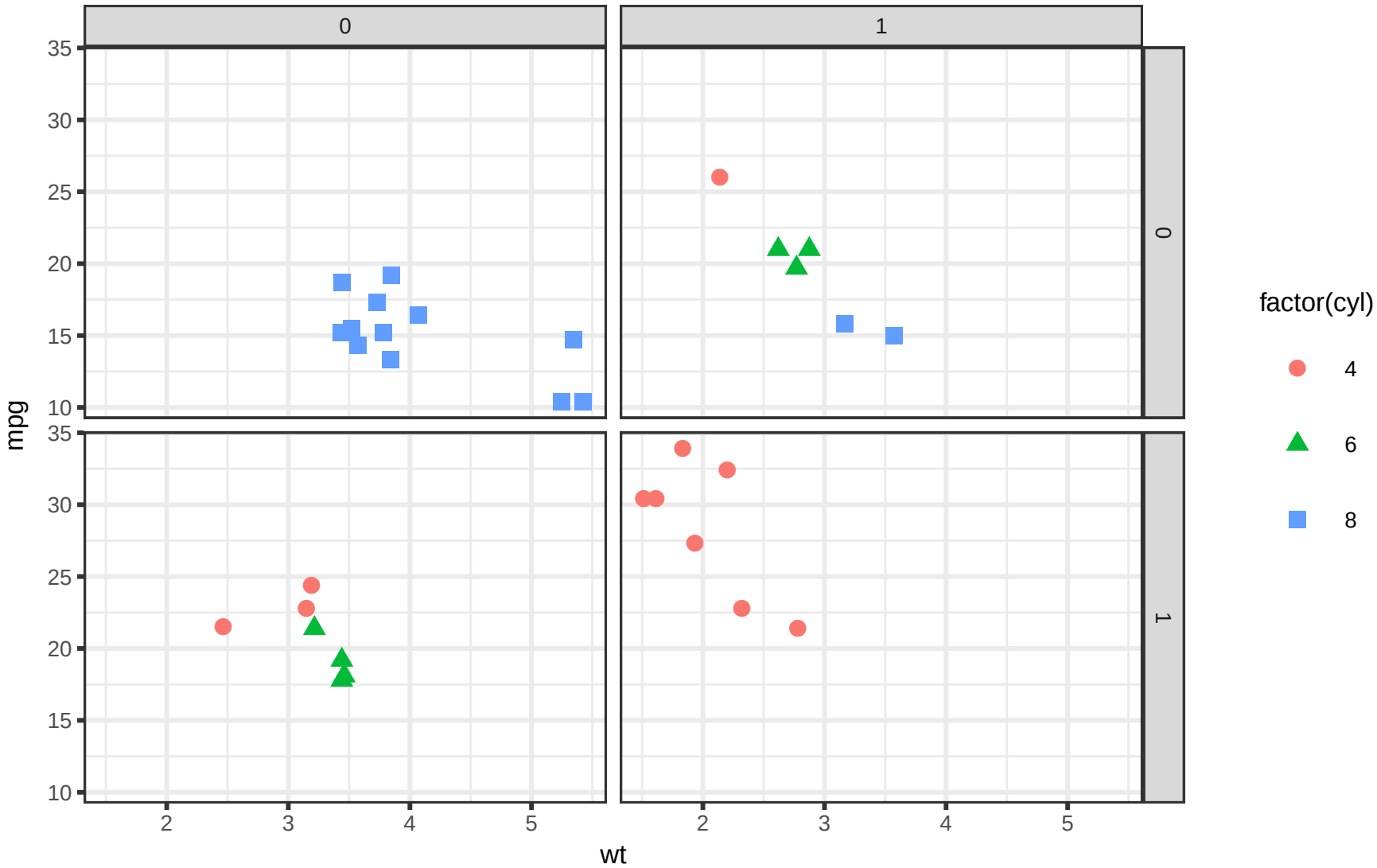
Example

```
library(ggplot2)
ggplot(mtcars, aes(x = wt, y = mpg, shape = factor(cyl), colour = factor(cyl))) +
  geom_point() + facet_grid(vs ~ am)
```



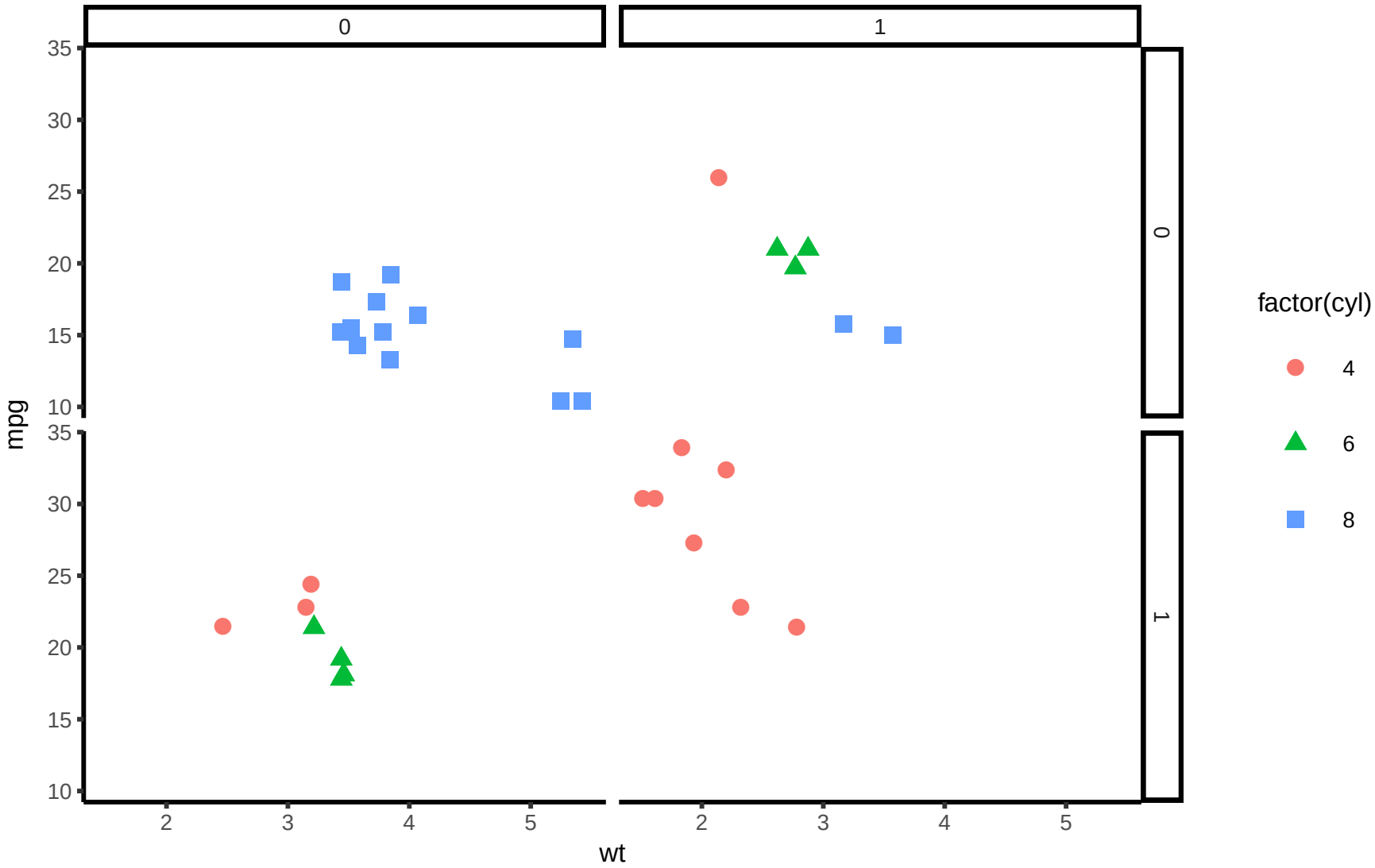
Using build-in themes

```
ggplot(mtcars, aes(x = wt, y = mpg, shape = factor(cyl), colour = factor(cyl))) +
  geom_point() + facet_grid(vs ~ am) + theme_bw(base_size = 6)
```



Setting a default theme

```
theme_set(theme_classic(base_size = 6))
ggplot(mtcars, aes(x = wt, y = mpg, shape = factor(cyl), colour = factor(cyl))) +
  geom_point() + facet_grid(vs ~ am)
```



Definition of a theme

theme_grey

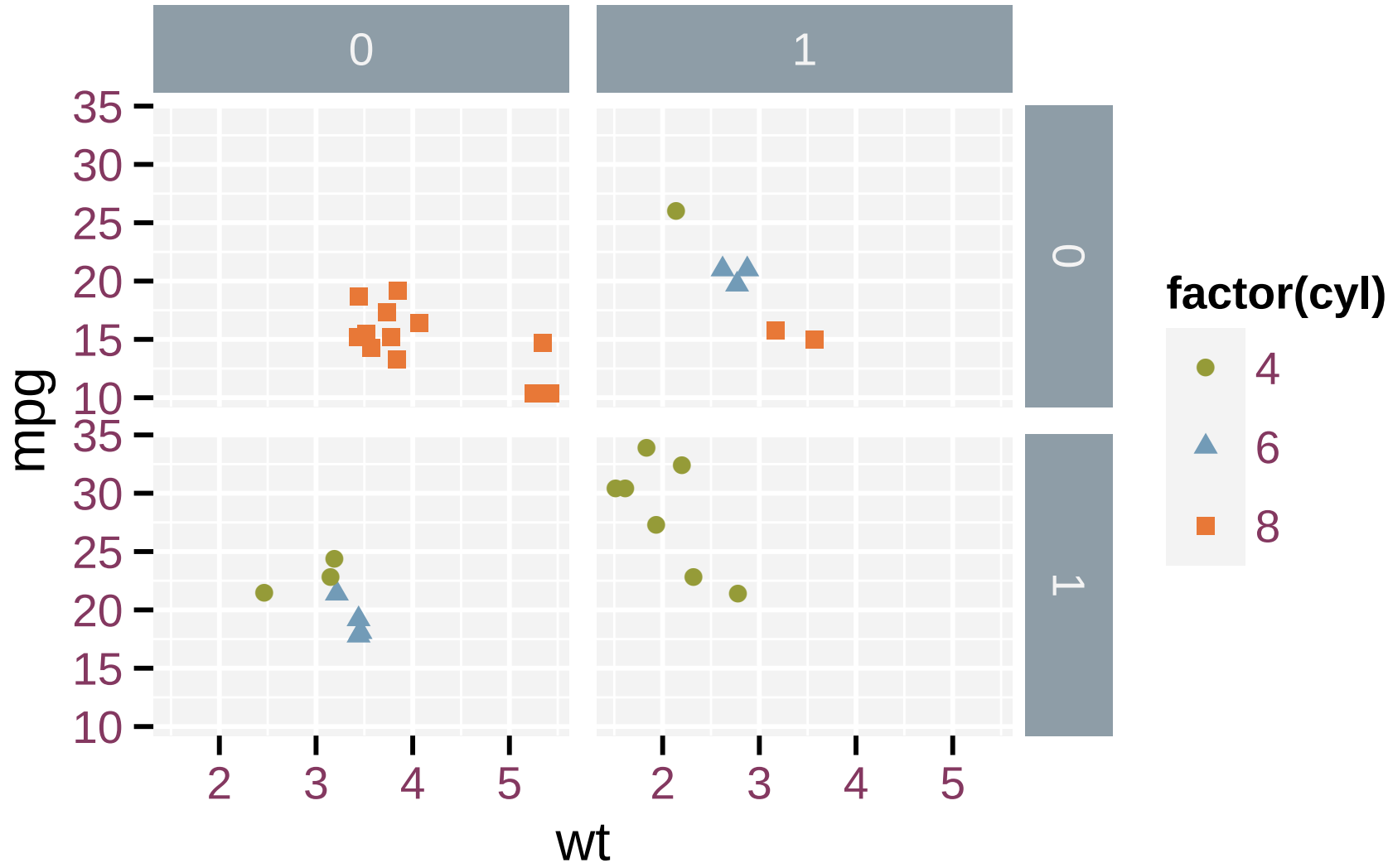
```
## function(base_size = 11, base_family = "") {
##   half_line <- base_size / 2
##
##   theme(
##     # Elements in this first block aren't used directly, but are inherited
##     # by others
##     line =               element_line(colour = "black", size = 0.5, linetype = 1,
##                             lineend = "butt"),
##     rect =               element_rect(fill = "white", colour = "black",
##                             size = 0.5, linetype = 1),
##     text =               element_text(
##                             family = base_family, face = "plain",
##                             colour = "black", size = base_size,
##                             lineheight = 0.9, hjust = 0.5, vjust = 0.5, angle = 0
##                             margin = margin(), debug = FALSE
##                          ),
##
##     axis.line =          element_blank(),
##     axis.line.x =        NULL,
##     axis.line.y =        NULL,
##     axis.text =          element_text(size = rel(0.8), colour = "grey30"),
##     axis.text.x =        element_text(margin = margin(t = 0.8 * half_line / 2), v
##     axis.text.x.top =    element_text(margin = margin(b = 0.8 * half_line / 2), v
##     axis.text.y =        element_text(margin = margin(r = 0.8 * half_line / 2), h
```

Custom themes: our approach

- create a custom theme starting from `theme_grey`
- use `update_geom_defaults()` to update default geom colour and fill
- currently no `update_scale_default()`
  - solution: define a custom version of `scale_type_xyz()`
  - **warning**: `ggplot2` must be loaded first in order to mask custom functions with same name in `ggplot2`
- store the functions in an R package
  - **tip**: add a vignette with lots of different figures to visualise the theme
- the package sets the relevant theme as default upon loading
- distribute the package to co-workers
  - **tip**: don't tweak the plot until the concept is finalised

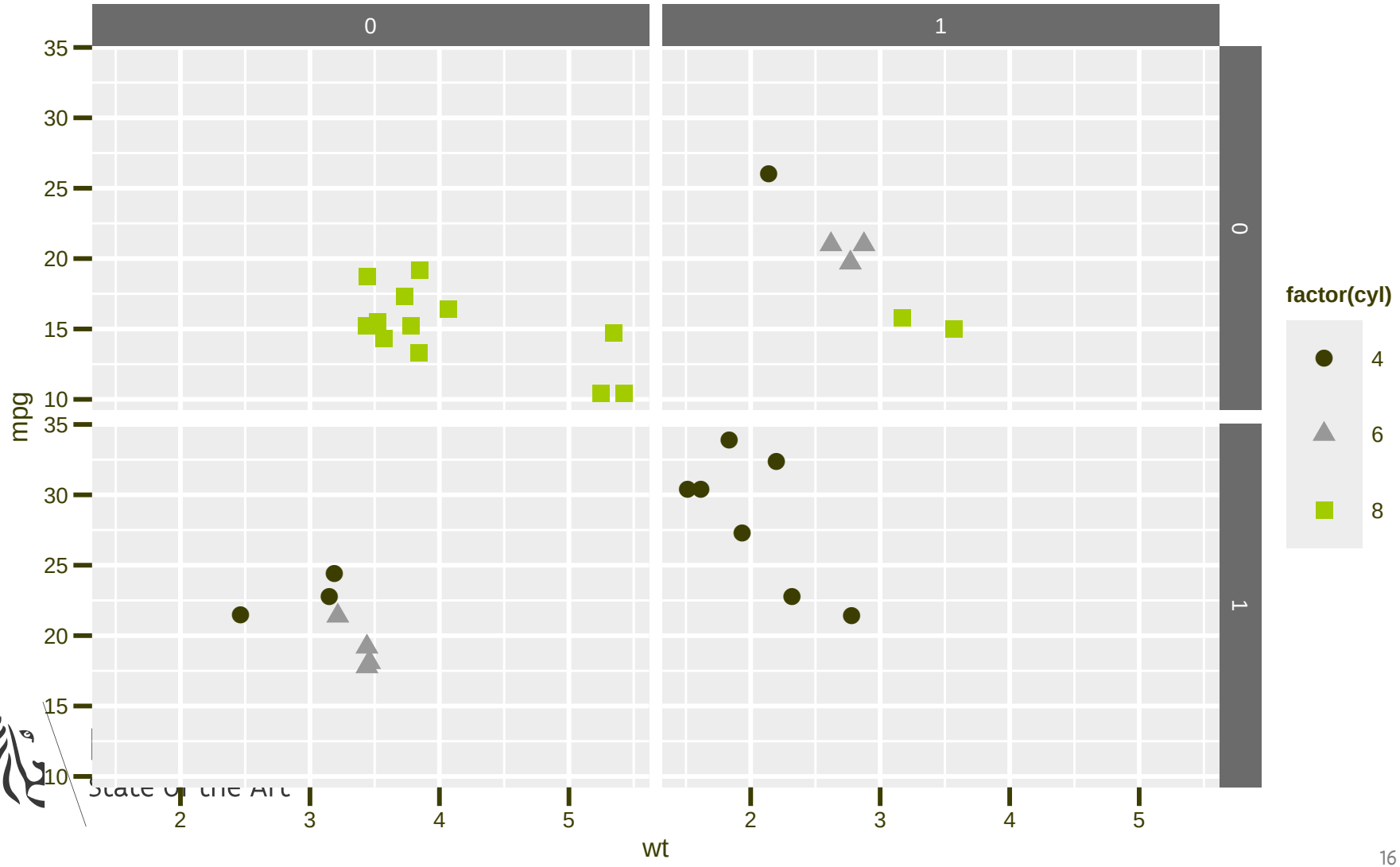
Using the default corporate identity

```
library(INBOtheme)
ggplot(mtcars, aes(x = wt, y = mpg, shape = factor(cyl), colour = factor(cyl))) +
  geom_point() + facet_grid(vs ~ am)
```



Switching to other theme in corporate identity

```
theme_set(theme_vlaanderen2015(6, transparent = "plot"))
switchColour(vl.darkyellow) #a bunch of update_geom_default() calls
ggplot(mtcars, aes(x = wt, y = mpg, shape = factor(cyl), colour = factor(cyl))) +
  geom_point() + facet_grid(vs ~ am)
```



Short Markdown intro

Markup language

- plain text file
- markup is added as extra code in between text
- similar principle as HTML or LaTeX but simpler syntax
  - syntax is more human readable than LaTeX or HTML
  - can be mixed with LaTeX or HTML
- use pandoc to convert markdown to the required format
  - pdf (through LaTeX), HTML, Word, Epub, odt, ...
  - syntax reflects greatest common denominator

Basic syntax

- one or more blank lines separate two paragraphs
- ****bold****, *_italics_*
- headers: line starts with one or more # followed by the title
  - chapter: `# chapter title`
  - section: `## section title`
  - subsection: `### subsection title`
- unnumbered list: start each item with -
- numbered lists: start each item with 1.

See the RStudio cheat sheet and reference guide on RMarkdown

YAML

- stands for **Y**AML **A**in't **M**arkup **L**anguage
- contains all settings for the corporate identity
- listed at the top of the file

```
---
title: "Adding a corporate identity to reproducible research"
author: "Thierry Onkelinx"
bibliography: RBelgium.bib
output:
  INBOmd::inbo_slides:
    location: "R Belgium, Zavemtem March 7 2017"
    institute: "Research Institute for Nature and Forest (INBO)"
    theme: "vlaanderen"
    flandersfont: TRUE
    toc_name: "Summary"
    cover: "1.jpg"
---
```

RMarkdown principle

- plain text formatted with Markdown + R chunks
- use `rmarkdown::render()` to render the file
  1. runs all R code of the Rmd file in a **new** session
  2. create an md file which has all chunks replaced by their output
  3. converts the resulting md file using pandoc
- `rmarkdown::render()` can render multiple output formats in one go
- RStudio: click the `knit` button

Creating a corporate identity for RMarkdown

Select output formats

- each output format requires
  - a dedicated function
  - a template
  - auxiliary files
- support for Word is limited to styles, for odt probably too
  - only useful for co-workers/clients how insist on having a word version
- we use pdf for reports and slides
  - requires a working installation of Tex
- HTML for website, epub and slides is on the to do list

Dedicated function

- defines which template to use
- handles all the arguments set in the YAML
- translates R function arguments to pandoc arguments
- sets default `knitr` chunk options
  - dimensions and resolution of figures
  - output width
  - ...
- combines everything into `rmarkdown::output_format()` which is used by `rmarkdown::render()`

(LaTeX) template

- basicaly a minimal source document for the required output format
- contains all elements which are generic for all documents of this template
  - replace exchangable element with pandoc variables (`$xxx$`)
  - simple if-else construct are available
  - useful to convert pandoc variables into LaTeX variables
- requires basic knowledge of LaTeX

```
\documentclass[11pt, twoside]{extreport}
\usepackage[babel = $lang$]{inborapport_2015}
\title{$title$}
\author{$author$}
$if(reportnr)$\reportnumber{$reportnr$}$endif$
\begin{document}
\maketitle
$body$
\end{document}
```

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(LaTeX) style

- loads all required LaTeX packages
- defines the style of headings, plain text, verbatim text, ...
- defines how the title page(s) should look like
- defines the different styles of pages for beamer presentation
- requires someone willing to dive deep into the bowels of LaTeX

```
\NeedsTeXFormat{LaTeX2e}
\ProvidesPackage{inborapport_2015}
\def\reportnumber#1{\def\@reportnumber{#1}}
\RequirePackage[yyyymmdd,hhmmss]{datetime}
\reportnumber{\today\space\currenttime}
\RequirePackage[a4paper, top = 2cm, bottom = 2.5cm, left = 3cm, right = 3cm]{geometry
\RequirePackage[no-math]{fontspec}
\setmainfont[Ligatures=TeX]{Calibri}
\setmonofont{Courier New}[Scale = 0.67]
\def\@makechapterhead#1{%
   {\fontsize{\fontsizechapter}{\fontsizechapter * \real{1.2}} \selectfont \bfseries
  \vspace{16pt}
  }
```

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CSL file (optional)

- **C**itation **S**tyle **L**anguage
- XML file
- required in case you want a specific style for the references
- use `http://editor.citationstyles.org/` to create it

RStudio template (optional)

- create a new Rmd file in RStudio from `File > New File > R Markdown`
- the dialog that pops up has the option `From template`
- this scans all installed R packages for templates
- works only if the package contains the required files in `inst/rmarkdown`
- the `skeleton.Rmd` can be the bare minimum or predefined text
  - useful for adding instructions or examples
- see `http://rmarkdown.rstudio.com/developer_document_templates.html`

Dedicated R package

The best way to bundle a corporate identity for Markdown is an R package

- `R` contains the functions
- `inst` contains the CSL files
- `inst/pandoc` contains the templates
- `inst/local_tex` contains a LaTeX directory structure with all the styles
- `inst/rmarkdown` contains RStudio menu templates

Tip: add a vignette which is a working example of the template.

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Tips and tricks

User requirements

- end user
  - knowledge of R and Markdown. LaTeX or HTML is a plus.
  - a good editor is a must. We like RStudio.
  - must have pandoc installed (included with RStudio)
  - must have a working installation of Tex for pdf output
  - will need good instructions on how to install and update the package in case of LaTeX styles. LaTeX styles require some additional steps after installing the R package
- package maintainer
  - Good R skills
  - Good LaTeX skills in case of pdf output
  - Good HTML and CSS skills in case of HTML output
  - Needs to provide support for end users

How to create a nice lay-out

- get a graphic designer to create a concept
- make sure that you have all the required details
  - font and fontsize
  - size and absolute positions of graphical elements
- convert the concept into an image and display it in the background
- don't be affraid of trial and error

Need to write an (e)-book or a large report?

- consider bookdown (www.bookdown.org)
- output formats limited to HTML, pdf and E-book
- adds an extra layer over RMarkdown
  - combine several Rmd files into one document
  - adds support for internal references without the need for LaTeX or HTML hacks
    - figures, tables, headers, equations, ...
  - support for custom blocks
  - automatic screenshot of HTML widgets in case output format is pdf
- render using `bookdown::render_book()` or `Build book` in build pane of RStudio
- `output_format` argument can handle rmarkdown functions for corporate identity

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Demo

References

Wilkinson L. (2005). The Grammar of Graphics, 2nd ed. Springer-Verlag, New York. DOI: 10.1007/0-387-28695-0.