An Update on Broom

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Outline

1. What is `broom`?
2. `broom 0.5.0` release
3. Lessons learned
4. Moving forward

What is `broom`?

`broom` tidies model objects

Input: model object

Output: tidy tibble

- `tidy()` summarizes information about model components
- `glance()` reports information about the entire model
- `augment()` adds informations about observations to a dataset

Usage

```r
fit <- lm(hp ~ ., mtcars)

tidy(fit)
```

```
## # A tibble: 11 x 5
##   term        estimate std.error statistic p.value
##   <chr>          <dbl>     <dbl>     <dbl>   <dbl>
## 1 (Intercept)    79.0     185.       0.428   0.673
## 2 mpg            -2.06      2.09    -0.987   0.335
## 3 cyl             8.20     10.1      0.813   0.425
## # ... with 8 more rows
```

```r
glance(fit)
```

```
## # A tibble: 1 x 12
```

broom 0.5.0

`broom 0.5.0`: new features

- Tibble output
- New test suite
- New function documentation
- New vignette
- New tidiers
- Many bug fixes
- Many deprecations

broom 0.5.0: tibble output

```r
tidy(prcomp(iris[, 1:4]), matrix = "d")
```

```
## # A tibble: 4 x 4
##      PC std.dev percent cumulative
##   <dbl>   <dbl>   <dbl>      <dbl>
## 1     1   2.06   0.925       0.925
## 2     2   0.493  0.0531      0.978
## 3     3   0.280  0.0171      0.995
## # ... with 1 more row
```

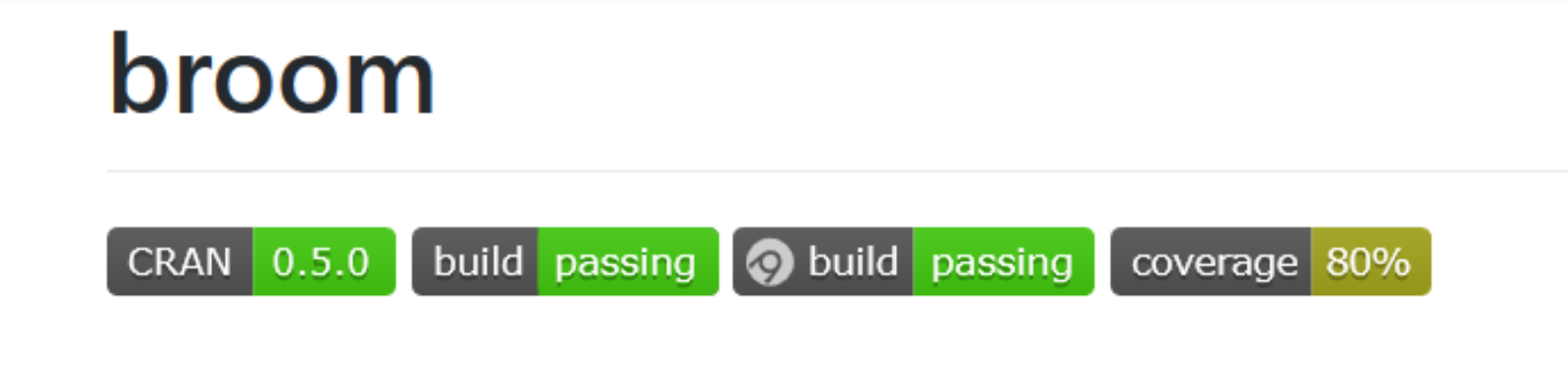
`broom 0.5.0`: tibble output

This was a breaking change. Common issues:

- subsetting with `[` and expecting a vector.
- setting rownames on a tibble.
- using augment on models making use of matrix covariates / outcomes.
  - i.e. `survival::Surv()`

Broom has 92 reverse dependencies. This (plus deprecations) broke 15 of them.

broom 0.5.0: new test suite



- Line coverage: 40% → 80%
- Higher in practice since we skip deprecated tests
- Revived the Travis CI build

broom 0.5.0: what gets tested

Test that

- tidy(), glance(), and augment() return tibbles.
- glance() returns a single row.
- Occasionally check dimensions of output

```
fit <- lm(hp ~ ., mtcars)
td <- tidy(fit)
check_tidy_output(td)
```

broom 0.5.0: new function documentation

- Gave each function it's own roxygen
  - Had started to document too much in one place
- Heavily cross-linked and aliased new docs
- Users requested more explicit doc for stuff like:

```
#' @rdname augment.lm
#' @export
augment.glm <- augment.lm
```

broom 0.5.0: dealing with repeated documentation

Many repeated arguments:

```
tidy.betareg <- function(x,
  conf.int = FALSE,
  conf.level = .95, ...)

tidy.ivreg <- function(x,
  conf.int = FALSE,
  conf.level = .95,
  exponentiate = FALSE, ...)
```

Should share documentation for `conf.int`.

broom 0.5.0: roxygen2 @templates

roxygen2 templates make this easy:

```
@template param_confint
```

Where `man-roxygen/param_confint.R` looks like:

```
#' @param conf.int Logical indicating
#'   whether or not to include a
#'   confidence interval in the tidied
#'   output. Defaults to `FALSE`.
#' @md
```

`broom 0.5.0`: what is templated

Templates currently used to generate:

- `@title`,
- `@description`,
- `@params`, and
- some `@return`

documentation sections.

broom 0.5.0: new README + pkgdown site

broom part of the tidyverse

Intro Reference Articles News

Overview

broom summarizes key information about models in tidy `tibble()` s. broom provides three verbs to make it convenient to interact with model objects:

- `tidy()` summarizes information about model components
- `glance()` reports information about the entire model
- `augment()` adds informations about observations to a dataset

For a detailed introduction, please see `vignette("broom")` .

broom tidies 100+ models from popular modelling packages and almost all of the model objects in the `stats` package that comes with base R. `vignette("available-methods")` lists method availabilty.

If you aren't familiar with tidy data structures and want to know how they can make your life easier, we highly recommend reading Hadley Wickham's Tidy Data.

Installation

```
# we recommend installing the entire tidyverse, which includes broom:
install.packages("tidyverse")
```

Links

Download from CRAN at https://cloud.r-project.org/package=broom

Browse source code at http://github.com/tidyverse/broom

Report a bug at http://github.com/tidyverse/broom/issues

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Developers

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Author, maintainer

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Dev status

broom 0.5.0: new vignette

Adding new tidiers to broom

Thank you for your interest in contributing to broom! This document is a **work in progress** describing the conventions that you should follow when adding tidiers to broom.

General guidelines:

- Try to reach a minimum 90% test coverage for new tidiers. To check your test coverage we recommend using `covr::report()`.
- `tidy`, `glance` and `augment` methods **must** return tibbles.
- Update `NEWS.md` to reflect the changes you've made
- Follow the tidyverse style conventions. You can use the `styler` package to reformat your code according to these conventions, and the `lintr` package to check that your code meets the conventions.
- Use new tidyverse packages such as `dplyr` and `tidyr` over older packages such as `plyr` and `reshape2`.
- It's better to have a predictable number of columns and unknown number rows than an unknown number of columns and a predictable number of rows.
- It's better for users to need to `tidyr::spread` than `tidyr::gather` data after it's been tidied.
- Add yourself as a contributor to `DESCRIPTION`.
- Pull requests must pass the AppVeyor and Travis CI builds to be merged.

broom 0.5.0: new tidiers

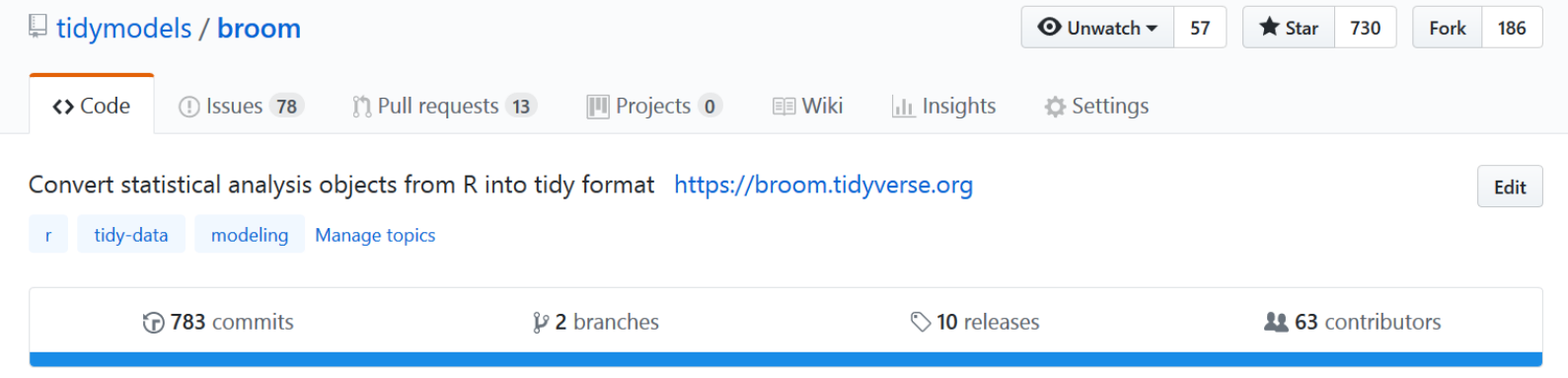
- `lavaan` objects from the `lavaan` package
- `ivreg` objects from the `AER` package
- `Kendall` objects from the `Kendall` package
- `garch` objects from the `tseries` package
- `irlba` lists from the `irlba` package
- `durbinWatsonTest` objects from the `car` package
- `confusionMatrix` objects from the `caret` package
- `glmnet` and `cv.glmnet` objects from the `glmnetUtils` package
- `clm` and `clmm` objects from the `ordinal` package
- `svyolr` objects from the `survey` package, and
- `polr` objects from the `MASS` package.

broom 0.5.0: Bug fixes and pull requests

Start of internship: 134 issues, 34 pull requests

- Triaged two year backlog of issues
- Closed ~80 issues
- Merged 40 pull requests

Current status:



`broom 0.5.0`: Bug fixes and pull requests

- Contributors are enthusiastic and fun to work with
- Lots of issues, but generally easy to fix
- *Beginner Friendly* tag has been immensely popular:

- Check if tidy.density works for multivariate densities `beginner-friendly` `documentation` — 2
  #438 opened 2 days ago by alexpghayes
- Update tidy.anova to play well with lme4 anova results `beginner-friendly` `feature-request` — 1
  #434 by alexpghayes was closed 2 days ago 0.7.0
- order of model terms changes in tidy dfs for `clm` and `clmm` when `conf.int = TRUE` — 4
  `beginner-friendly` `bug`
  #420 opened 16 days ago by IndrajeetPatil 0.7.0
- Adding statistic and p-values to `rq` class objects `beginner-friendly` `consistency/specification` `feature-request` — 2
  #404 opened 24 days ago by IndrajeetPatil 0.7.0
- `broom::augment` doesn't work if weights are provided for glm `beginner-friendly` `bug` — 1
  #381 opened on Jun 17 by IndrajeetPatil
- `MASS::rlm` tidy output doesn't contain confidence intervals `beginner-friendly` `bug` — 4
  #380 opened on Jun 16 by IndrajeetPatil
- broom::tidy throws error on quantreg::rq model when run on a constant `beginner-friendly` `bug` — 2
  #354 by lboller was closed on Jun 18
- Throw an informative error for `glance.rq` with multiple tau `beginner-friendly` `bug`
  #330 by alexpghayes was closed on Jun 9
- augment.smooth.spline doesn't accept new data in the data argument `beginner-friendly` — 2
  `consistency/specification` `feature-request`
  #318 opened on Jun 5 by alexpghayes

`broom 0.5.0`: deprecations: tidy statistical objects only

- Some people were using `broom` like `as_tibble()`
- Deprecations to prevent this:
  - `tidy.data.frame()`
  - `tidy.matrix()`
  - `tidy.numeric()`
  - `tidy.character()`
  - `tidy.logical()`

`broom 0.5.0`: soft deprecations: mixed models

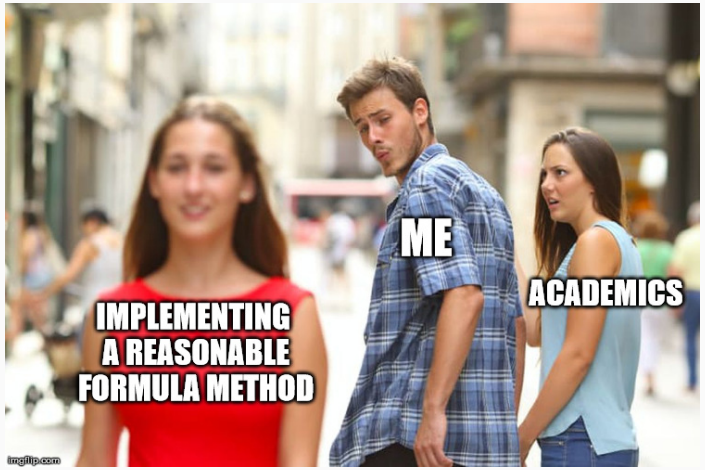
Due to high maintanence burden, moving tidiers for

- lme, lme4 and nmle models,
- brms models,
- rstanarm models, and
- mcmc objects

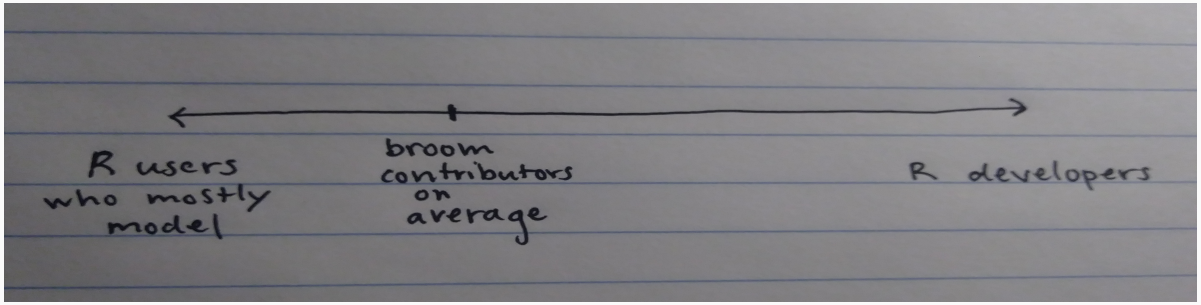
to Ben Bolker's `broom.mixed` (hopefully on CRAN soon).

Lessons learned

Lesson: writing and sanity checking tidiers is hard



Lesson: `broom` depends on high quality PRs



Key: empower contributors to make high quality PRs

- Document behavioral expectations for tidying methods
- Provide consistent documentation
- Automate as much as possible in tests

Merge now, fix later: community involvement far more important than perfect code

Lesson: `augment()` is hard

Original thought: `tidy()` is most ambiguous method, will be hardest to work with

Incorrect: `augment()` is hard

- Need different behavior for `data` and `newdata` args
- People often don't implement it
- Have to deal with both model input and output

Lesson: there are many ways to represent a model

Representations of a fit model:

- Mathematical: $y \sim \mathcal{N}(X\hat{\beta}, \sigma^2)$
- Code object: `fit <- lm(hp ~ . , mtcars); fit`
- Relational: `tidy(fit), glance(fit), augment(fit)`
- ???

Opinion: need a *tidy modelling* paper to clarify the key objects in play like *tidy data* did

Moving forward

What's happening next

- More tools for contributors
- More deprecations
- Integrating `broom` and friends into `tidymodels`
- I will likely take over as `broom` maintainer

Tools for contributors: tests for argument names

```
check_arguments(tidy.lm)
```

- Checks arguments against master list
- Checks default arguments
  - Shouldn't be missing
  - `conf.int = FALSE`
  - `conf.level = 0.95`
  - `conf.int` and `conf.level` always come as a pair
- Tests written, but not yet passing

Goal: enforce consistency, especially in new PRs

Tools for contributors: tests for column names

```r
library(lavaan)

cfa.fit <- cfa(
   "F =~ x1 + x2 + x3 + x4 + x5",
   data = HolzingerSwineford1939, group = "school"
)

select(glance(cfa.fit), 1:5)
```

```
## # A tibble: 1 x 5
##    agfi   AIC   BIC   cfi chisq
##   <dbl> <dbl> <dbl> <dbl> <dbl>
## 1 0.971 4473. 4584. 0.766  99.3
```

Tools for contributors: `column_glossary` approach

- Describe acceptable column names in `tidy.yaml`:

```
- column: AIC
  description: Akaike's Criterion.
  used_by:
    - ivreg
```

- Compile `tidy.yaml` into a `column_glossary` tibble
- Export `column_glossary` (downstream package maintainers have asked for this)
- Test output column names against `column_glossary`
- Populate documentation from `column_glossary`

Tools for contributors: more vignettes

- Second draft of *Adding new tidiers* vignette
  - Detailed and explicit behavioral specification
  - Will write tests for as many of these as possible
- New vignette on adding tidiers to packages other than broom
  - Based on reexport generics from `modelgenerics`

More deprecations

- Hard deprecate mixed model tidiers in favor of `broom.mixed`
- Soft deprecate time series tidiers in favor of `sweep`
- `tidy.table()`
- `tidy.ftable()`
- etc

`tidymodels` integration: vision

- Finish any missing aspects of the tidier behavior specification
- Document this clearly
- Develop tests for as much fo the spec as possible
- Reach out to package maintainers
- Invite them to join `tidymodels` once they meet the spec??
- Some system for keeping track of where tidiers live
- Potentially break boom into smaller pieces

```
library(tidymodels)  # load everything
```

`tidymodels` integration: possible collaborations

- `sweep`: time series
- `tidytext`: natural language processing
- `broomstick`: trees
- `broom.mixed`: mixed models, bayesian models
- `biobroom`: bioconductor objects
- `schoenberg`: gams
- `tidybayes`: bayesian models
- `broom.base`: broom infrastructure
- `mlbroom`: doesn't exist yet but demand seems high

Priorities for the next 3 weeks

1. Vignette on addings tidiers to packages other than broom
2. Infrastructure for auto-building `@return` documentation
3. Write `tidy.yaml`, `glance.yaml` and `augment.yaml`
4. Move time series stuff into sweep
5. Reach out to potential collaborators
6. Make sure existing tidiers meet behavioral specification

Questions?

Read more about broom 0.5.0 release on the tidyverse blog.

You can follow broom development on our Github page.

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Appendix

broom 0.5.0: matrix column and augment example

```r
y <- rnorm(5)
x <- matrix(rnorm(10), nrow = 5)

df <- data.frame(x, y)  # ok
tibble::tibble(x, y)    # errors

fit <- lm(y ~ x, df)    # problem: this works
augment(fit)            # this goes kaboom
```

Passing `data` argument can help:

```r
augment(fit, data = df)  # happy again
```

Aside: model coverage

```r
# glance.arima coverage was 100 percent.
# tested output of:
glance(arima(lh, order = 1:3))

# but this was broken until recently:
glance(arima(lh, order = 1:3, method = "CSS"))
```

- Same class can correspond to many varied model objects
- Hard to write varied tests for unfamiliar model objects

Aside: arguments disappearing into ...

```r
fit <- lm(hp ~ ., mtcars)

# misspelled argument
td <- tidy(fit, conf.int = TRUE, comf.level = 0.9)

# no error, output looks exactly like
# you might expect
```