#### DEMOGRAPHIC RESEARCH

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Research article

# (R)Markdown template for Demographic Research Journal

#### First Last

#### **First Last**

This article is part of the Special Collection on "Data Visualization," organized by Guest Editors Tim Riffe, Sebastian Klüsener, and Nikola Sander.

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## Contents

1	Introduction	901
2	Figures and Tables	901
3	Equations	905
4	Lists	906
5 5.1 5.1.1	Section Subsection Subsubsection	906 906 906
6	Acknowledgments	906
	References	907
	Appendix A	908
	Appendix B	910

## (R)Markdown template for Demographic Research Journal

First Last <sup>1</sup>
First Last <sup>2</sup>

#### **Abstract**

#### BACKGROUND

What is the motivation for this submission? Why read it?

#### **OBJECTIVE**

What specific question(s) does this submission address?

#### **METHODS**

How does the submission reach its objective? What data? What methods?

#### RESULTS

What are the main findings?

#### **CONCLUSIONS**

What do the findings mean?

#### CONTRIBUTION

What new contribution does this submission make to the scientific literature?

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<sup>&</sup>lt;sup>2</sup> Department, University, Country. foob@bar.com.

#### 1. Introduction

Lorem ipsum dolor sit amet, id mel oratio lucilius eloquentiam, nam cu mazim erant aliquip. Nam et minim abhorreant, ferri minimum facilisis ad sit. In cum summo civibus appareat. Mei cu legimus accusata dissentiet. Qui illud gloriatur te. Probatus accommodare ut est, sed et atqui equidem dignissim.

Soluta legimus qui id, nam semper malorum ut. Est magna clita civibus id. Pro ne summo animal. Ne mucius partiendo sit, ne eos natum quodsi periculis.

Te usu movet nominavi, eu eum quod consul. Justo eligendi concludaturque no eam, aliquam fuisset convenire vis ne, purto vide instructior ex duo. An solet appetere sit, ea vis dolore aliquid scaevola, has omnes dolores eu. Eu per enim dolor civibus, no usu consul propriae. Vix id sale civibus definitiones, quis soluta an eum.

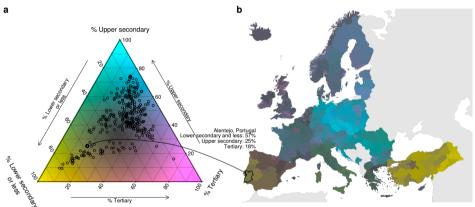
## 2. Figures and Tables

Variably referred to as de Finetti-, simplex-, or triangle plot, the ternary diagram is based upon a coordinate system that maps each point within an equilateral triangle to a unique three-part composition and as such has found use wherever the problem domain spans three parts of a whole. The diagram emerged during the 18th century as a means of illustrating relative mixtures of primary colors (Howarth 1996). It was subsequently adopted as the standard method to depict phase transitions in three-component alloys (Bancroft 1897), the genotype composition of a population (De Finetti 1926), soil composition (Davis and Hammond 1927), or the potential for flammability given different mixtures of three gases (Zabetakis 1965). In the social sciences, ternary diagrams depict population compositions along demographic characteristics, with an early example appearing in the USSR's first census report showing the distribution of workers across labor market segments in various regions (Kvitkin 1932).<sup>3</sup>

2

<sup>&</sup>lt;sup>3</sup> A footnote (Ware 2013; Denil 2015). Soluta legimus qui id, nam semper malorum ut. Est magna clita civibus id. Pro ne summo animal. Ne mucius partiendo sit, ne eos natum quodsi periculis.

Figure 1: Demonstration of the ternary balance scheme showing the composition of educational attainment by region in Europe 2016. Data by Eurostat.



A Ternary diagram showing the population composition by education The regions in this map have been color-coded with the ternary balance level for each European NUTS-2 region in 2016 ages 25–64. The colors scheme as displayed in figure a. Bright and vivid colors indicate regions correspond to the ternary balance scheme used to color map b and show where most people have the same education level whereas desaturated direction (via hue) and magnitude (via lightness and saturation) of the deviation from a perfectly balanced composition.

Figure 2: The "tricolore" package for the statistical programming language R implements the centered ternary balance color scheme and provides a user interface for quickly testing different parametrizations.

Tricolore: A flexible color scale for ternary compositions



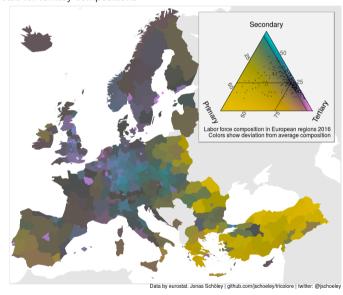


Table 1: A table with a caption that stretches across two lines. Nearly there... Done. Does it align nicely?

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
5.1	3.5	1.4	0.2	setosa
4.9	3.0	1.4	0.2	setosa
4.7	3.2	1.3	0.2	setosa
4.6	3.1	1.5	0.2	setosa
5.0	3.6	1.4	0.2	setosa
5.4	3.9	1.7	0.4	setosa

## 3. Equations

Given the observed death counts  $D_{jk}$  in age group j and stratum k and associated persondays of exposure to risk  $O_{jk}$  I fit the model

$$D_{jk} \sim \text{Pois}(\lambda_{jk} O_{jk}) \lambda_{jk} = e^{\beta_{0k} + \beta_{1k} \log(x_{jk} + 1) + \beta_{2k} \log^2(x_{jk} + 1)},$$
(1)

where  $\lambda_{jk}$  are mortality rates by age group and stratum. For each stratum, a smooth hazard is recovered by evaluating  $\lambda_{jk}$  over a continuous range of ages x.

The stratum specific coefficients  $\beta_{0k}$ ,  $\beta_{1k}$ ,  $\beta_{2k}$  are sums of baseline coefficients  $\beta$ , prematurity effects  $\beta^{Pm}$ , prematurity-birth weight interactions  $\beta^{Pm \times Bw}$ , and prematurity-birth weight-Apgar interactions  $\beta^{Pm \times Bw \times Ap}$  resulting in the multilevel structure

$$\begin{pmatrix} \beta_{0k} \\ \beta_{1k} \\ \beta_{2k} \end{pmatrix} = \underbrace{\begin{pmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \end{pmatrix}}_{\text{lyl 0}} + \underbrace{\begin{pmatrix} \beta_{0,p[k]}^{\text{Pm}} \\ \beta_{1,p[k]}^{\text{Pm}} \\ \beta_{2,p[k]}^{\text{Pm}} \end{pmatrix}}_{\text{lyl 1}}_{\text{deviations by prematurity}} + \underbrace{\begin{pmatrix} \beta_{0,p[k],b[k]}^{\text{Pm}} \\ \beta_{1,p[k],b[k],a[k]}^{\text{Pm}} \\ \beta_{2,p[k],b[k]}^{\text{Pm}} \\ \beta_{2,p[k],b[k]}^{\text{Pm}} \end{pmatrix}}_{\text{lyl 2}}_{\text{deviations by birth weight given prematurity}} + \underbrace{\begin{pmatrix} \beta_{0,p[k],b[k],a[k]}^{\text{Pm}} \\ \beta_{0,p[k],b[k],a[k]}^{\text{Pm}} \\ \beta_{1,p[k],b[k],a[k]}^{\text{Pm}} \\ \beta_{2,p[k],b[k],a[k]}^{\text{Pm}} \end{pmatrix}}_{\text{deviations by Apgar given prematurity and birth weight}},$$

where p[k], b[k] and a[k] denote the prematurity, birth weight and Apgar level associated with stratum k. Except for the baseline  $\beta$ 's each set of coefficients is assumed to be drawn from a multivariate-Normal distribution with zero mean and covariance matrix

$$\Sigma = \begin{pmatrix} \sigma_{\beta_0}^2 & \sigma_{\beta_0\beta_1} & \sigma_{\beta_0\beta_2} \\ \sigma_{\beta_0\beta_1} & \sigma_{\beta_1}^2 & \sigma_{\beta_1\beta_2} \\ \sigma_{\beta_0\beta_2} & \sigma_{\beta_1\beta_2} & \sigma_{\beta_2}^2 \end{pmatrix},$$

with separate estimates for levels one to three.

## 4. Lists

- Ringo
  - Drums
- George
  - Guitar
- Paul
  - Bass
  - Piano
- John
  - Guitar
  - Piano

#### 5. Section

- 5.1 Subsection
- 5.1.1 Subsubsection

## 6. Acknowledgments

I'd like to thank my husband whose caring love allowed me to fully concentrate on my work.

#### References

- Bancroft, W.D. (1897). A triangular diagram. *Journal of Physical Chemistry* 1(7): 403–410. doi:10.1021/j150589a002.
- Davis, R.O.E. and Hammond, B.H. (1927). *Grouping of soils on the basis of mechanical analysis*. Department Circular 419, Washington D. C. https://archive.org/details/groupingofsoilso419davi.
- De Finetti, B. (1926). Considerazioni matematiche sull'ereditarietà mendeliana. *METRON* VI(1): 3–411.
- Denil, M. (2015). Trivariate sea ice presence map. In: 6<sup>th</sup> Symposium on the Impacts of an Ice-Diminishing Arctic on Naval and Maritime Operations. National Ice Center. https://www.star.nesdis.noaa.gov/star/documents/meetings/Ice2015/posters/Denil\_M\_poster.png.
- Howarth, R.J. (1996). Sources for a history of the ternary diagram. *The British Journal for the History of Science* 29(3): 337–356. doi:10.1017/S000708740003449X.
- Kvitkin, O.A. (1932). On types of urban settlements [o tipakh gorodskikh poseleniy]. USSR census 1926.
- Ware, C. (2013). *Information visualization. Perception for design*. Waltham, MA: Elsevier, 3 ed. doi:10.1016/C2009-0-62432-6.
- Zabetakis, M.G. (1965). Flammability characteristics of combustible gases and vapors. Tech. Rep. 627, Washington D. C. https://apps.dtic.mil/dtic/tr/fulltext/u2/701576.pdf.

## Appendix A

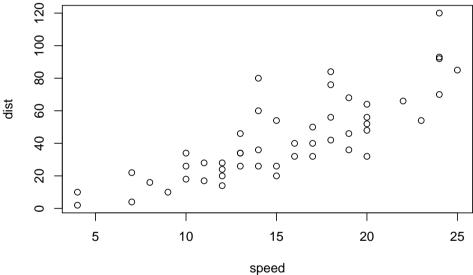
```
#' Get Stratified Life-table From Survival Data
    # 1
2
    #' Aggregate individual level survival data into a stratified
    #' life-tables with prespecified age-groups using the assumptions of
    #' piecewise-constant hazards.
    # "
    #' @param df a data frame
    #' @param x time at censoring or event
    #' Oparam event event indicator, 0 if censoring, 1 if event
    #' @param cuts vector of cuts for life-table age groups
10
    #' @param ... strata
11
    # '
    #' @author Jonas Schöley
13
   GetLifeTable <- function (df, x, event, cuts, ...) {
15
     x_i = enquo(x); event_i = enquo(event); strata = enexprs(...)
16
17
     lt <-
18
        df %>%
19
        # aggregate individual level event and censoring times
20
        # into predefined age groups
       mutate(
22
          i =
23
            .bincode(
24
              x = !!x_i, breaks = cuts,
25
              # [a, b)
26
27
              right = FALSE, include.lowest = FALSE
            ),
          x_jk =
29
            cuts[j]
        ) 응>응
31
32
        group_by(!!!strata, j, x_jk) %>%
        summarise(
33
          # total observed deaths in interval
34
          D_{jk} = sum(!!event_i),
35
          # total observed censorings in interval
36
          C_jk = sum(!(!!event_i)),
37
          # average time spent in interval for
38
39
          # those who leave during interval (by death or censoring)
          a_jk = mean(!!x_i - first(x_jk))
40
41
        ) 응>응
        ungroup() %>%
42
43
        # add predefined age intervals to table where no deaths or
        # censorings occoured
44
        complete(
45
          nesting (x_jk = head(cuts, -1), j = 1:length(head(cuts, -1))),
46
47
          nesting(!!!strata),
          fill = list(D_jk = 0, C_jk = 0, a_jk = NA)
```

```
) 응>응
49
50
        arrange(!!!strata, x jk) %>%
        mutate(
51
          k = group indices(., !!!strata)
52
        53
        group_by(k) %>%
54
        # calculate life-table
55
        mutate(
56
          # width of the interval
57
          n jk =
58
59
            c(diff(x_jk), last(cuts)-last(x_jk)),
          # observed population alive at start of interval
60
          N_{jk} =
61
            head(cumsum(c(sum(C_jk+D_jk), -(C_jk+D_jk))), -1),
          # total person-time of exposure over interval
63
64
          O_jk =
            (N_jk-D_jk-C_jk)*n_jk +
65
            ifelse(is.na(a_jk), 0, a_jk*(D_jk+C_jk)),
          # mortality rate over interval
67
          m jk =
68
            ifelse(O_jk == 0, 0, D_jk/O_jk),
69
          # probability of surviving interval
70
          # assuming constant force of mortality
71
          p_jk =
72
            exp(-m_jk*n_jk),
73
          # probability of death during the interval given survival
74
75
          # to interval
          q_jk =
76
            1-p_jk,
          # probability of survival until interval start
78
          1 ik =
            cumprod(c(1, head(p_jk, -1))),
80
          # probability of death in interval
81
          d_jk =
82
            c(-diff(l_jk), last(l_jk)*last(q_jk))
83
        # distribution of stratum-specific exposures by age
85
        group_by(j) %>%
        mutate(
87
          pi_jk = O_jk/sum(O_jk)
88
        ) 응>응
89
        ungroup() %>%
90
91
        select(
          k, j, !!!strata, x_jk, n_jk, N_jk, a_jk, O_jk, D_jk, C_jk,
92
          m_jk, q_jk, l_jk, d_jk, pi_jk
93
94
      return(lt)
96
97
    }
98
```

## Appendix B

ı plot(cars)

Figure B-1: The cars data set



Last, Last: (R)Markdown template for Demographic Research Journal