

# Stabilization Analyses for Characters

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## Load libraries

If the libraries are not installed yet, you need to install them using, for example, the command: `install.packages("ggplot2")`. For the Hrate package this is different, since it comes from github. The devtools library needs to be installed, and then the `install_github()` function is used.

```
library(stringr)
library(ggplot2)
library(plyr)
library(entropy)
library(ggExtra)
library(gsubfn)
```

```
## Loading required package: proto
```

```
# library(devtools)
# install_github("dimalik/Hrate")
library(Hrate)
```

## List files

Create list with all the files in the directory “corpus”.

```
# give file paths to the files to be processed
file.list <- list.files(path = "~/Github/NaLaFi/data/",
                       recursive = T, full.names = T)
head(file.list)
```

```
## [1] "/home/chris/Github/NaLaFi/data//generated/random/random_ran_10"
## [2] "/home/chris/Github/NaLaFi/data//generated/random/random_ran_11"
## [3] "/home/chris/Github/NaLaFi/data//generated/random/random_ran_12"
## [4] "/home/chris/Github/NaLaFi/data//generated/random/random_ran_13"
## [5] "/home/chris/Github/NaLaFi/data//generated/random/random_ran_14"
## [6] "/home/chris/Github/NaLaFi/data//generated/random/random_ran_15"
```

```
length(file.list)
```

```
## [1] 330
```

## Stabilization analysis per file

```
# set counter
counter = 0
# set the maximal number of units (n), and the stepsize for stabilization analysis
# (i.e. in steps of how many units are values calculated?)
n = 1000
stepsize = 100
# initialize dataframe to append results to
stabilization.df <- data.frame(filename = character(0), subcorpus = character(0),
                                code = character(0), huni.chars = numeric(0),
                                hrate.chars = numeric(0), ttr.chars = numeric(0),
                                rm.chars = numeric(0), units = numeric(0))

# start time
start_time <- Sys.time()
for (file in file.list)
{
  try({ # if the processing failes for a certain file, there will be no output for this file,
    # but the try() function allows the loop to keep running

    # basic processing
    # loading textfile
    textfile <- scan(file, what = "char", quote = "",
                     comment.char = "", encoding = "UTF-8", sep = "\n" , skip = 7, nmax = 20)
    # skip 7 first lines, nmax gives the maximum number of lines to be read,
    # note that reading more lines will considerably increase processing time.
    # remove annotations marked by '<>'
    textfile <- gsub("<.*>", "", textfile)
    # print(head(textfile))
    # get filename
    filename <- basename(file)
    #print(filename) # for visual inspection
    # get subcorpus category
    subcorpus <- sub("_.*", "", filename)
    # print(subcorpus) # for visual inspection
    # get the three letter identification code + the running number
    code <- substring(substring(filename, regexpr("_", filename) + 1), 1, 8)

    # Split into individual characters/signs
    # remove tabs and parentheses, as well as star signs '*' and plus signs '+'
    # note that this might have to be tuned according to the text files included
    textfile <- str_replace_all(textfile, c("\\\\t" = "", "\\(" = "", "\\)" = "",
                                           "\\]" = "", "\\[" = "", "\\}" = "",
                                           "\\{" = "", "\\*" = "", "\\+" = ""))

    # split the textfile into individual utf-8 characters. Note that white spaces are
    # counted as utf-8 characters here.
    chars <- unlist(strsplit(textfile, ""))
    chars <- chars[1:n] # use only maximally n units
    chars <- chars[!is.na(chars)] # remove NAs for vectors which are already shorter
    # than n
    # chars <- chars[chars != " "] # remove white spaces from character vector

    # run loop with stepsizes
```

```

# define the number of units (i.e. characters) used for analyses (note that k is
# always either equal to or smaller than n)
k = length(chars)
for (i in 1:(k/stepsize))
{
  # unigram entropy estimation
  # calculate unigram entropy for characters
  chars.df <- as.data.frame(table(chars[1:(i*stepsize)]))
  # print(chars.df)
  huni.chars <- entropy(chars.df$Freq, method = "ML", unit = "log2")
  # entropy rate estimation
  # note: the values chosen for max.length and every.word will crucially
  # impact processing time. max.length = NULL means all units in the file are
  # considered.
  hrate.chars <- get.estimate(text = chars[1:(i*stepsize)], every.word = 1,
                             max.length = NULL)
  # calculate type-token ratio (ttr)
  ttr.chars <- nrow(chars.df)/sum(chars.df$Freq)

  # calculate repetition measure according to Sproat (2014)
  # the overall number of repetitions is the sum of frequency counts minus 1.
  R <- sum(chars.df$Freq-1)
  # calculate the number of adjacent repetitions
  r = 0
  if (length(chars) > 1){
    for (j in 1:(length(chars)-1)){
      if (chars[j] == chars[j+1]){
        r = r + 1
      } else {
        r = r + 0
      }
    }
    # calculate the repetition measure
    rm.chars <- r/R
  } else {
    rm.chars <- "NA"
  }

  # append results to dataframe
  local.df <- data.frame(filename, subcorpus, code, huni.chars, hrate.chars,
                        ttr.chars, rm.chars, units = i*stepsize)
  stabilization.df <- rbind(stabilization.df, local.df)
}
# counter
counter <- counter + 1
# print(counter)
})
}
end_time <- Sys.time()
end_time - start_time

```

```
## Time difference of 5.015187 mins
```

```
head(stabilization.df)
```

```
##      filename subcorpus   code huni.chars hrate.chars  ttr.chars  rm.chars
## 1 random_ran_10   random ran_10  3.271889   2.519729 0.10000000 1.1111111
## 2 random_ran_10   random ran_10  3.302176   2.649431 0.05000000 0.5263158
## 3 random_ran_10   random ran_10  3.287020   2.692097 0.03333333 0.3448276
## 4 random_ran_10   random ran_10  3.297567   2.702915 0.02500000 0.2564103
## 5 random_ran_10   random ran_10  3.291513   2.766336 0.02000000 0.2040816
## 6 random_ran_10   random ran_10  3.298953   2.804479 0.01666667 0.1694915
##   units
## 1   100
## 2   200
## 3   300
## 4   400
## 5   500
## 6   600
```

## Stabilization plots

### Unigram entropy characters

```
huni.chars.plot <- ggplot(stabilization.df, aes(x = units, y = huni.chars,
                                                colour = subcorpus)) +
  geom_line(alpha = 0.8, size = 1.5) +
  theme(legend.position = "bottom") +
  labs(x = "number of characters", y = "unigram entropy for characters") +
  facet_wrap(~code)
huni.chars.plot
```

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```



Safe figure to file

```
ggsave("~/Github/NaLaFi/figures/stabilization_huni_chars.pdf", huni.chars.plot, dpi = 300,
        scale = 1, device = cairo_pdf)
```

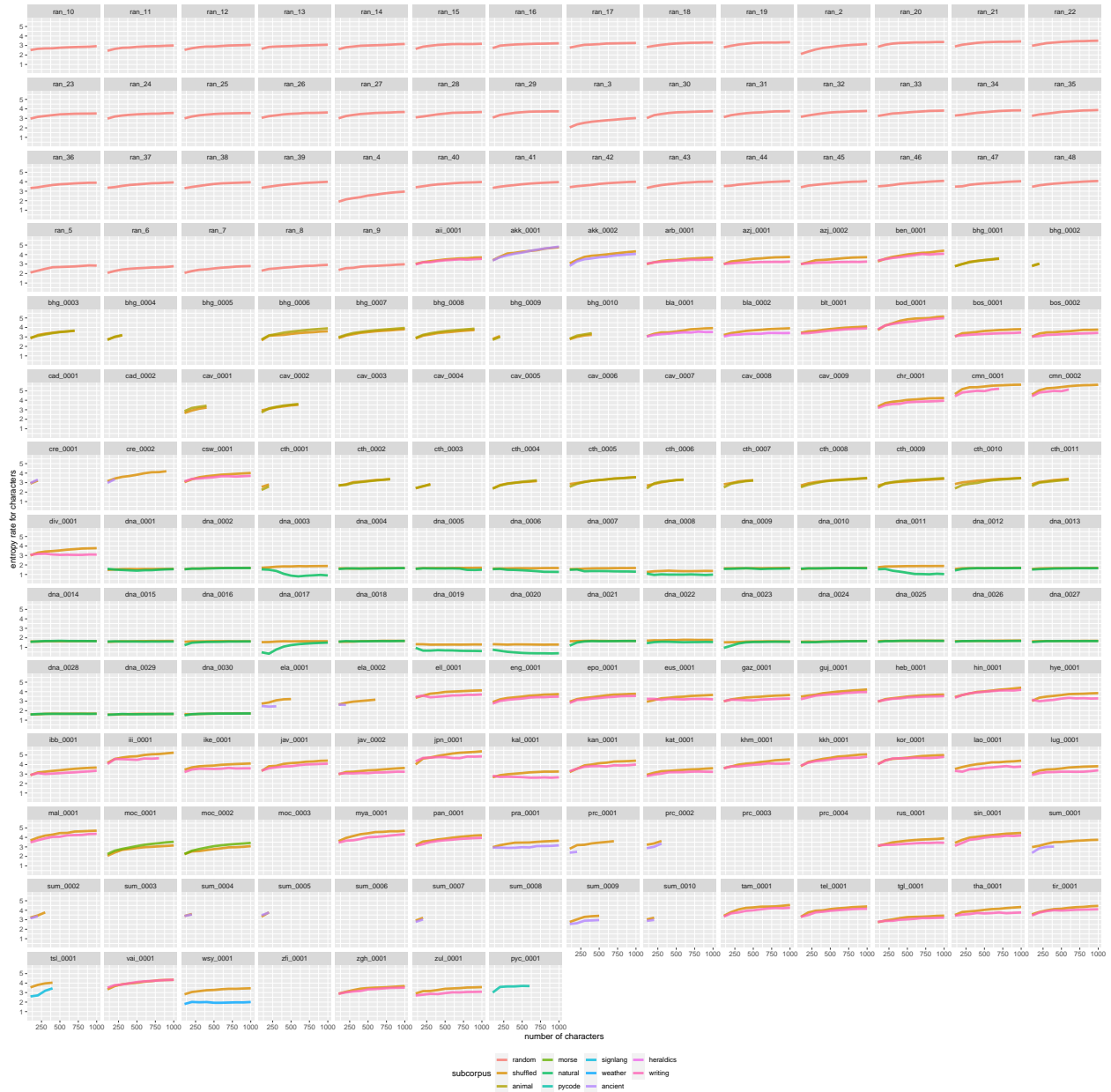
[illegible]

## Entropy rate characters

```
hrate.chars.plot <- ggplot(stabilization.df, aes(x = units, y = hrate.chars,
                                                colour = subcorpus)) +
  geom_line(alpha = 0.8, size = 1.5) +
  theme(legend.position = "bottom") +
  labs(x = "number of characters", y = "entropy rate for characters") +
  facet_wrap(~code)
hrate.chars.plot
```

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Safe figure to file

```
ggsave("~/Github/NaLaFi/figures/stabilization_hrate_chars.pdf", hrate.chars.plot, dpi = 300,
        scale = 1, device = cairo_pdf)
```

## Saving 20 x 20 in image

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```

## TTR characters

```
ttr.chars.plot <- ggplot(stabilization.df, aes(x = units, y = ttr.chars,
                                                colour = subcorpus)) +
  geom_line(alpha = 0.8, size = 1.5) +
  theme(legend.position = "bottom") +
  labs(x = "number of characters", y = "TTR for characters") +
  facet_wrap(~code)
ttr.chars.plot
```

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```



Safe figure to file

```
ggsave("~/Github/NaLaFi/figures/stabilization_ttr_chars.pdf", ttr.chars.plot, dpi = 300,
        scale = 1, device = cairo_pdf)
```

```
## Saving 20 x 20 in image
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```

## Repetition rate characters

```
rm.chars.plot <- ggplot(stabilization.df, aes(x = units, y = rm.chars,
                                              colour = subcorpus)) +
  geom_line(alpha = 0.8, size = 1.5) +
  theme(legend.position = "bottom") +
  labs(x = "number of characters", y = "RM for characters") +
  facet_wrap(~code)
rm.chars.plot
```

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Safe figure to file

```
ggsave("~/Github/NaLaFi/figures/stabilization_rm_chars.pdf", rm.chars.plot, dpi = 300,
        scale = 1, device = cairo_pdf)
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