

# Package: rhythm.metrics (via r-universe)

October 13, 2026

**Title** Analyse and Visualise Speech Rhythm and Timing Metrics

**Version** 1.1.0

**Description** Calculates and visualises speech rhythm and timing metrics. The 'rhythm.metrics' package provides a standardised workflow to compute common metrics including Delta C, Delta V, VarcoC, VarcoV, the percentage of vocalic intervals (%V), and both raw and normalised Pairwise Variability Indices (rPVI, nPVI). It includes functions for calculating and visualising these measures to facilitate cross-linguistic and developmental rhythm research. Delta C, Delta V, and %V measures are based on Ramus et al. (1999) <doi:10.1016/S0010-0277(99)00058-X>; VarcoC and VarcoV measures are based on Dellwo (2006, ISBN: 9783631554777); and rPVI-C and nPVI-V are based on Grabe & Low (2002) <doi:10.1515/9783110197105.2.515>.

**License** GPL (>= 3)

**URL** <https://congzhang365.github.io/rhythm.metrics>,  
<https://github.com/congzhang365/rhythm.metrics>

**BugReports** <https://github.com/congzhang365/rhythm.metrics/issues>

**Depends** R (>= 4.5.0)

**Imports** dplyr, ggplot2, ggsci, magrittr, rlang

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**VignetteBuilder** knitr

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**Repository** <https://congzhang365.r-universe.dev>

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|          |                              |
|----------|------------------------------|
| delta_cv | <i>Delta C &amp; Delta V</i> |
|----------|------------------------------|

---

Description

This function loads a dataframe as input and returns a dataframe containing the mean values and mean standard deviations of Delta C and Delta V.

Usage

```
delta_cv(df, cv_label, utterance_id, cv_duration)
```

Arguments

- df                    a data frame containing cv\_labels, utterance\_id, and cv\_duration values.
- cv\_label            the column name for whether a segment is a C(onsonant) or a V(owel)
- utterance\_id        the column name where each unique utterance has a unique id
- cv\_duration        the column name for the duration of C or V

Details

Delta C and Delta V are rhythm metrics based on Ramus, F., Nespor, M., & Mehler, J. (1999). Correlates of linguistic rhythm in the speech signal. *Cognition*, 73(3), 265-292.  
Delta C: SD of total C duration  
Delta V: SD of total V duration

Value

a data frame containing the results of Delta C and Delta V values

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

**Examples**

```
df_test <- data.frame(cv_label = c("c", "v", "c", "v", "c", "v", "c", "v"),
  utterance_id = c("utt_1", "utt_1", "utt_2", "utt_2",
    "utt_1", "utt_1", "utt_2", "utt_2"),
  cv_duration = c(0.1, 0.8, 0.2, 0.5, 0.3, 0.3, 0.4, 0.7))

delta_cv(df_test, cv_label, utterance_id, cv_duration)
```

npvi\_v

*nPVI V***Description**

This function loads a dataframe as input and returns a dataframe containing the mean values of nPVI of vowels.

**Usage**

```
npvi_v(df, cv_label, label_name, utterance_id, cv_duration)
```

**Arguments**

**df** a data frame containing cv\_labels, utterance\_id, and cv\_duration values.

**cv\_label** column name for the segment labels (e.g., cv\_label).

**label\_name** a string to filter the vowels, e.g. label\_name = 'vowel'.

**utterance\_id** column name for unique utterance IDs.

**cv\_duration** column name for the duration of C or V.

**Value**

a data frame containing the mean nPVI for vowels.

**Author(s)**

Cong Zhang, <cong.zhang@newcastle.ac.uk>

**Examples**

```
df_test <- data.frame(cv_label = rep(c("consonant", "vowel"), 8),
  utterance_id = rep(c("utt_1", "utt_2", "utt_3", "utt_4"), each = 4),
  cv_duration = c(0.1, 0.8, 0.2, 0.5, 0.3, 0.3, 0.4, 0.7,
    0.3, 0.88, 0.5, 0.9, 0.3, 0.57, 0.4, 0.97))

npvi_v(df_test, cv_label = cv_label, label_name = "vowel",
  utterance_id = utterance_id, cv_duration = cv_duration)
```

---

|              |                     |
|--------------|---------------------|
| percentage_v | <i>Percentage V</i> |
|--------------|---------------------|

---

### Description

This function loads a dataframe as input and returns a dataframe containing the mean values and mean standard deviations of %V.

### Usage

```
percentage_v(df, v_label, utterance_id, cv_duration, utterance_duration)
```

### Arguments

|                    |                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------|
| df                 | a data frame containing cv_labels, utterance_id, cv_duration, and utterance_duration values. |
| v_label            | a string to filter the vowels, e.g. v_label = 'vowel'                                        |
| utterance_id       | column name for unique utterance IDs                                                         |
| cv_duration        | column name for the duration of C or V                                                       |
| utterance_duration | column name for the duration of entire utterances                                            |

### Details

%V is a rhythm metrics based on Ramus, F., Nespor, M., & Mehler, J. (1999). Correlates of linguistic rhythm in the speech signal. *Cognition*, 73(3), 265-292. It calculates the percentage of an utterance occupied by vocalic material.

%V: (total V duration / total utterance duration) \* 100

### Value

a data frame containing the mean values and standard deviation of %V

### Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

### Examples

```
df_test <- data.frame(cv_label = c("consonant", "vowel", "consonant", "vowel"),
                     utterance_id = c("utt_1", "utt_1", "utt_2", "utt_2"),
                     cv_duration = c(0.1, 0.8, 0.2, 0.5),
                     utterance_duration = c(2.4, 2.4, 2.7, 2.7))

percentage_v(df_test, v_label="vowel", utterance_id, cv_duration, utterance_duration)
```

---

|               |                                   |
|---------------|-----------------------------------|
| plot_delta_cv | <i>Plot Delta C &amp; Delta V</i> |
|---------------|-----------------------------------|

---

### Description

This function loads a dataframe as input and returns a box plot for Delta C and Delta V values.

### Usage

```
plot_delta_cv(
  df,
  cv_label,
  utterance_id,
  cv_duration,
  save_fig = FALSE,
  fig_path = NULL
)
```

### Arguments

|              |                                                                          |
|--------------|--------------------------------------------------------------------------|
| df           | a data frame containing cv_labels, utterance_id, and cv_duration values. |
| cv_label     | column name for segment type (C or V).                                   |
| utterance_id | column name for unique utterance IDs.                                    |
| cv_duration  | column name for the duration of C or V.                                  |
| save_fig     | default is FALSE. Change to TRUE to save the plot.                       |
| fig_path     | default is NULL. Required if save_fig = TRUE.                            |

### Value

A boxplot for Delta C and Delta V values.

### Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

### Examples

```
df_test <- data.frame(
  cv_label = rep(c("consonant", "vowel"), 8),
  utterance_id = rep(paste0("utt_", 1:4), each = 4),
  cv_duration = c(
    0.10, 0.80, 0.20, 0.50,
    0.30, 0.30, 0.40, 0.70,
    0.30, 0.88, 0.50, 0.90,
    0.30, 0.57, 0.40, 0.97
  )
)
```

```

plot_delta_cv(
    df_test, cv_label, utterance_id, cv_duration, save_fig = FALSE
)

```

---

plot\_npvi

*Plot nPVI V*


---

### Description

This function loads a dataframe as input and returns a box plot for nPVI V values.

### Usage

```

plot_npvi(
  df,
  cv_label,
  label_name,
  utterance_id,
  cv_duration,
  save_fig = FALSE,
  fig_path = NULL
)

```

### Arguments

|              |                                                                          |
|--------------|--------------------------------------------------------------------------|
| df           | a data frame containing cv_labels, utterance_id, and cv_duration values. |
| cv_label     | column name for the segment labels (e.g., cv_label).                     |
| label_name   | a string to filter the vowels, e.g. label_name = 'vowel'.                |
| utterance_id | column name for unique utterance IDs.                                    |
| cv_duration  | column name for the duration of C or V.                                  |
| save_fig     | default is FALSE. Change to TRUE to save the plot.                       |
| fig_path     | default is NULL. Required if save_fig = TRUE.                            |

### Value

A boxplot for nPVI V values.

### Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

**Examples**

```
df_test <- data.frame(
  cv_label = rep(c("consonant", "vowel"), 8),
  utterance_id = rep(paste0("utt_", 1:4), each = 4),
  cv_duration = c(
    0.10, 0.80, 0.20, 0.50,
    0.30, 0.30, 0.40, 0.70,
    0.30, 0.88, 0.50, 0.90,
    0.30, 0.57, 0.40, 0.97
  )
)

plot_npvi(
  df_test,
  cv_label = cv_label,
  label_name = "vowel",
  utterance_id = utterance_id,
  cv_duration = cv_duration
)
```

---

|                   |                          |
|-------------------|--------------------------|
| plot_percentage_v | <i>Plot Percentage V</i> |
|-------------------|--------------------------|

---

**Description**

This function loads a dataframe as input and returns a box plot for %V values.

**Usage**

```
plot_percentage_v(
  df,
  cv_label,
  label_name,
  utterance_id,
  cv_duration,
  utterance_duration,
  save_fig = FALSE,
  fig_path = NULL
)
```

**Arguments**

|            |                                                                                              |
|------------|----------------------------------------------------------------------------------------------|
| df         | a data frame containing cv_labels, utterance_id, cv_duration, and utterance_duration values. |
| cv_label   | column name for the segment labels (e.g., cv_label).                                         |
| label_name | a string to filter the vowels, e.g. label_name = 'vowel'.                                    |

utterance\_id      column name for unique utterance IDs.  
cv\_duration       column name for the duration of C or V.  
utterance\_duration      column name for the duration of entire utterances.  
save\_fig           default is FALSE. Change to TRUE to save the plot.  
fig\_path           default is NULL. Required if save\_fig = TRUE.

**Value**

A boxplot for %V values.

**Author(s)**

Cong Zhang, <cong.zhang@newcastle.ac.uk>

**Examples**

```
df_test <- data.frame(
  cv_label = rep(c("consonant", "vowel"), 8),
  utterance_id = rep(paste0("utt_", 1:4), each = 4),
  cv_duration = c(
    0.10, 0.80, 0.20, 0.50,
    0.30, 0.30, 0.40, 0.70,
    0.30, 0.88, 0.50, 0.90,
    0.30, 0.57, 0.40, 0.97
  ),
  utterance_duration = rep(c(2.4, 2.7, 3.4, 1.8), each = 4)
)

plot_percentage_v(
  df_test,
  cv_label = cv_label,
  label_name = "vowel",
  utterance_id = utterance_id,
  cv_duration = cv_duration,
  utterance_duration = utterance_duration
)
```

---

|           |                    |
|-----------|--------------------|
| plot_rpvi | <i>Plot rPVI C</i> |
|-----------|--------------------|

---

**Description**

This function loads a dataframe as input and returns a box plot for rPVI C values.

**Usage**

```
plot_rpvi(
  df,
  cv_label,
  label_name,
  utterance_id,
  cv_duration,
  save_fig = FALSE,
  fig_path = NULL
)
```

**Arguments**

|                           |                                                                                                                   |
|---------------------------|-------------------------------------------------------------------------------------------------------------------|
| <code>df</code>           | a data frame containing <code>cv_labels</code> , <code>utterance_id</code> , and <code>cv_duration</code> values. |
| <code>cv_label</code>     | column name for the segment labels (e.g., <code>cv_label</code> ).                                                |
| <code>label_name</code>   | a string to filter the segments, e.g. <code>label_name = 'consonant'</code> .                                     |
| <code>utterance_id</code> | column name for unique utterance IDs.                                                                             |
| <code>cv_duration</code>  | column name for the duration of C or V.                                                                           |
| <code>save_fig</code>     | default is FALSE. Change to TRUE to save the plot.                                                                |
| <code>fig_path</code>     | default is NULL. Required if <code>save_fig = TRUE</code> .                                                       |

**Value**

A boxplot for rPVI values.

**Author(s)**

Cong Zhang, <cong.zhang@newcastle.ac.uk>

**Examples**

```
df_test <- data.frame(
  cv_label = rep(c("consonant", "vowel"), 8),
  utterance_id = rep(paste0("utt_", 1:4), each = 4),
  cv_duration = c(
    0.10, 0.80, 0.20, 0.50,
    0.30, 0.30, 0.40, 0.70,
    0.30, 0.88, 0.50, 0.90,
    0.30, 0.57, 0.40, 0.97
  )
)

plot_rpvi(
  df_test,
  cv_label = cv_label,
  label_name = "consonant",
  utterance_id = utterance_id,
  cv_duration = cv_duration
)
```

)

---

plot\_varco\_cv

*Plot Varco C & Varco V*

---

## Description

This function loads a dataframe as input and returns a box plot for Varco C and Varco V values.

## Usage

```
plot_varco_cv(
  df,
  cv_label,
  utterance_id,
  cv_duration,
  save_fig = FALSE,
  fig_path = NULL
)
```

## Arguments

|              |                                                                          |
|--------------|--------------------------------------------------------------------------|
| df           | a data frame containing cv_labels, utterance_id, and cv_duration values. |
| cv_label     | column name for segment type (C or V).                                   |
| utterance_id | column name for unique utterance IDs.                                    |
| cv_duration  | column name for the duration of C or V.                                  |
| save_fig     | default is FALSE. Change to TRUE to save the plot.                       |
| fig_path     | default is NULL. Required if save_fig = TRUE.                            |

## Value

A boxplot for Varco C and Varco V values.

## Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

## Examples

```
df_test <- data.frame(
  cv_label = rep(c("consonant", "vowel"), 8),
  utterance_id = rep(paste0("utt_", 1:4), each = 4),
  cv_duration = c(
    0.10, 0.80, 0.20, 0.50,
    0.30, 0.30, 0.40, 0.70,
    0.30, 0.88, 0.50, 0.90,
```

```

        0.30, 0.57, 0.40, 0.97
    )
)

plot_varco_cv(
  df_test, cv_label, utterance_id, cv_duration, save_fig = FALSE
)

```

rpvi\_c

*rPVI C*

## Description

This function loads a dataframe as input and returns a dataframe containing the mean values of rPVI of consonants.

## Usage

```
rpvi_c(df, cv_label, utterance_id, cv_duration, label_name = "consonant")
```

## Arguments

|              |                                                                          |
|--------------|--------------------------------------------------------------------------|
| df           | a data frame containing cv_labels, utterance_id, and cv_duration values. |
| cv_label     | the column name that contains the labels (consonant/vowel).              |
| utterance_id | column name for unique utterance IDs                                     |
| cv_duration  | column name for the duration of C or V                                   |
| label_name   | a string to filter the consonants, e.g. 'consonant'                      |

## Details

rPVI C is a rhythm metrics based on Grabe, E., & Low, E. L. (2002). Durational variability in speech and the rhythm class hypothesis. In *Laboratory phonology 7* (pp. 515-546). De Gruyter Mouton. It calculates the sum of the absolute differences between pairs of consecutive consonantal intervals divided by the number of pairs in the speech sample.

## Value

a data frame containing the mean rPVI for consonants

## Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

## Examples

```
df_test <- data.frame(cv_label = rep(c("consonant", "vowel"), 4),
                     utterance_id = rep(c("utt_1", "utt_2"), each = 4),
                     cv_duration = c(0.1, 0.8, 0.2, 0.5, 0.3, 0.3, 0.4, 0.7))

rpvi_c(
  df_test,
  cv_label = cv_label,
  utterance_id = utterance_id,
  cv_duration = cv_duration,
  label_name = "consonant"
)
```

---

varco\_cv

*Varco C & Varco V*


---

## Description

This function loads a dataframe as input and returns a dataframe containing the mean values of Varco C and Varco V.

## Usage

```
varco_cv(df, cv_label, utterance_id, cv_duration)
```

## Arguments

|              |                                                                          |
|--------------|--------------------------------------------------------------------------|
| df           | a data frame containing cv_labels, utterance_id, and cv_duration values. |
| cv_label     | column name indicating whether a segment is a C(onsonant) or a V(owel).  |
| utterance_id | column name for unique utterance IDs.                                    |
| cv_duration  | column name for the duration of C or V.                                  |

## Details

Varco C and Varco V are rhythm metrics based on Dellwo, Volker (2006). Rhythm and Speech Rate: A Variation Coefficient for deltaC. In: Karnowski, P; Szigeti, I. Language and language-processing. Frankfurt/Main: Peter Lang, 231-241.

Varco C:  $\Delta C / \text{mean}(C \text{ duration}) * 100$  Varco V:  $\Delta V / \text{mean}(V \text{ duration}) * 100$

## Value

a data frame containing the results of Varco C and Varco V values.

## Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

**Examples**

```
df_test <- data.frame(cv_label = c("c", "v", "c", "v", "c", "v", "c", "v"),
                      utterance_id = c("utt_1", "utt_1", "utt_2", "utt_2",
                                       "utt_3", "utt_3", "utt_4", "utt_4"),
                      cv_duration = c(0.1, 0.8, 0.2, 0.5, 0.3, 0.3, 0.4, 0.7))

varco_cv(df_test, cv_label, utterance_id, cv_duration)
```

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