TGA: a web tool for Time Group Analysis

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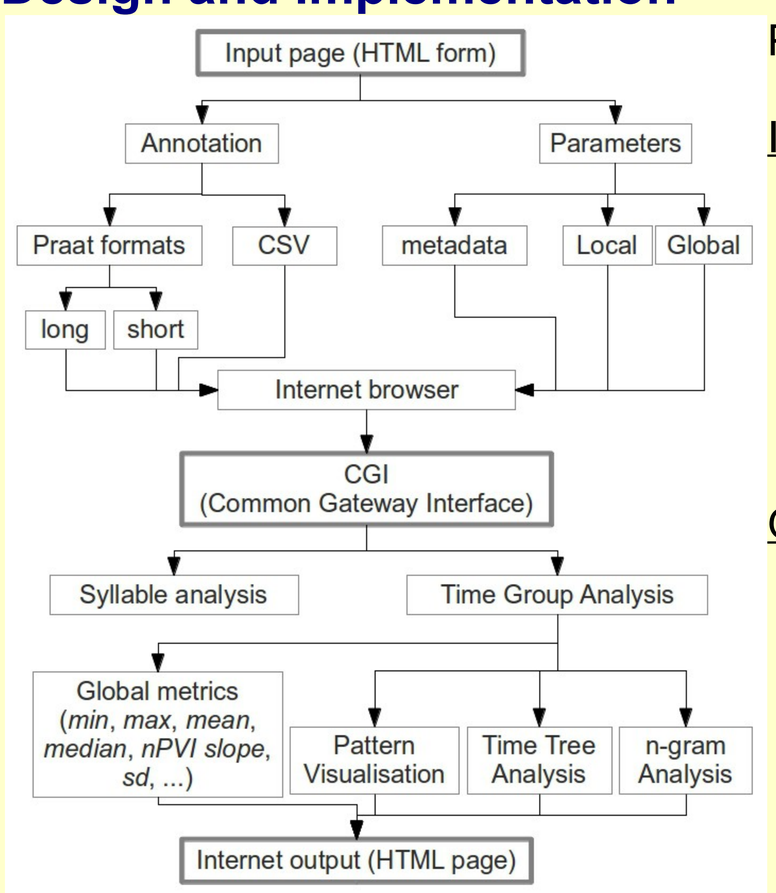
Requirements specification

- Annotation mining is the extraction of information from annotations, e.g. Praat TextGrids.
- In speech technology, annotated data are generally mined (semi-)automatically and efficiently.
- In phonetics, manual mining (with Praat visualisations) or semi-manual mining (with Praat TextGrid files), plus spreadsheet calculations, is common, but inefficient.
- The *Time Group Analyser* is designed to support phoneticians by performing a wide range of relevant computational tasks:

a) extract durations from TextGrids to table format,
b) calculate basic descriptive statistics, slope, *nPVI* …,
c) construct novel visualisations of timing structure:

- iambic/trochaic *Difference Tokens* for study of rhythm,
- *Time Trees* for comparison with language structure.

Design and implementation*



Python 2.7, CGI

Input:

- Praat TextGrid (long or short),
- CSV (Character Separated Values, with various separator chars).

Output:

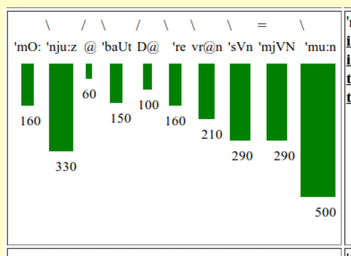
- HTML with text, syllable props, pausal group stats, *Diff Tokens*, *Time Trees*,
- CSV for further processing.

Summary statistics:

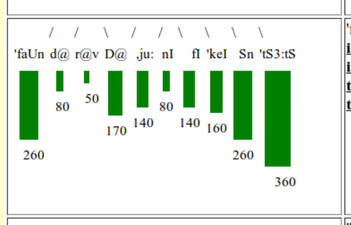
Summary table of global and accumulated TG duration functions (some do make sense...)
Time Group criterion: pausegroup, local threshold: 10, Min valid TG length: 2
Only inter-pause intervals measured; pauses not included

Overall duration:	6070	Overall raw longer, ms:	1510	Overall raw shorter, ms:	1410
Overall min:	50.00	Overall max:	500.00	Overall range:	450.00
Valid Time Groups:	4	Overall rate/sec:	5.11		
Components: global tendencies					
Overall mean:	195.81	Overall median:	160.00	Overall SD:	102.26
Overall npvi:	54.00	Overall intercept:	192.18	Overall slope:	0.24
Mean of means:	196.00	Median of means:	194.50	SD of means:	23.89
Mean of medians:	187.50	Median of medians:	170.00	SD of medians:	43.95
Mean of SDs:	93.25	Median of SDs:	89.12	SD of SDs:	18.97
Mean of nPVIs:	58.00	Median of mnPVIs:	52.00	SD of nPVIs:	5.59
Mean of intercepts:	154.94	Median of intercepts:	137.78	SD of intercepts:	56.84
Mean of slopes:	7.52	Median of slopes:	9.90	SD of slopes:	14.97
Components: correlations					
mean::TGdur:	0.384	median::TGdur:	-0.296	SD::TGdur:	0.935
nPVI::TGdur:	-0.623	slope::TGdur:	0.875	intercept::TGdur:	-0.762
nPVI::mean:	0.408	slope::mean:	-0.020	intercept::mean:	0.288
nPVI::median:	0.931	slope::median:	-0.710	intercept::median:	0.832
nPVI::SD:	-0.317	slope::SD:	0.666	intercept::SD:	-0.483

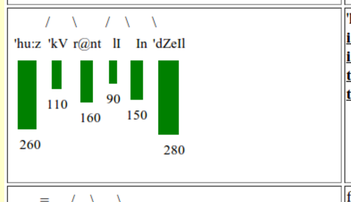
Difference Token Patterns and Time Tree Induction:



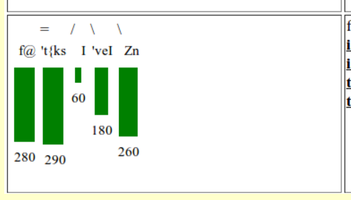
'mO::160 'nju:z:330 @:60 'baUt:150 D@:100 're:160 vr@n:210 'sVn:290 'mjVN:290 'mu:n:500 **PAUSE**:117 #
iambicTTgt: (('mO: 'nju:z) ((((@ 'baUt) ((D@ 're) vr@n)) 'sVn) ('mjVN 'mu:n)))
iambicTTgte: ('mO: 'nju:z @ 'baUt D@ 're vr@n ('sVn 'mjVN) 'mu:n **PAUSE**)
trochaicTTlt: (('mO: ('nju:z @)) ('baUt D@) ('re (vr@n ('sVn ('mjVN ('mu:n **PAUSE**))))))
trochaicTTlte: ('mO: 'nju:z @ 'baUt D@ 're vr@n 'sVn 'mjVN 'mu:n **PAUSE**)



'faUn:260 d@:80 r@v:50 D@:170 ,ju::140 nI:80 fI:140 'keI:160 Sn:260 'tS3:tS:360 **PAUSE**:184 #
iambicTTgt: ('faUn (((d@ (r@v D@)) ((ju: ((nI fI) 'keI)) Sn)) 'tS3:tS))
iambicTTgte: ('faUn d@ r@v D@ ju: nI fI 'keI Sn 'tS3:tS **PAUSE**)
trochaicTTlt: ((('faUn d@) r@v) ((D@ ju:) nI) fI 'keI (Sn ('tS3:tS **PAUSE**)))
trochaicTTlte: ('faUn d@ r@v D@ ju: nI fI 'keI Sn 'tS3:tS **PAUSE**)



'hu:z:260 'kV:110 r@nt:160 lI:90 In:150 'dZeIl:280 **PAUSE**:30 #
iambicTTgt: ('hu:z (('kV r@nt) ((lI In) 'dZeIl)))
iambicTTgte: ('hu:z 'kV r@nt lI In 'dZeIl **PAUSE**)
trochaicTTlt: ((((('hu:z 'kV) (r@nt lI)) (In ('dZeIl **PAUSE**))))
trochaicTTlte: ('hu:z 'kV r@nt lI In 'dZeIl **PAUSE**)



f@:280 't{ks:290 I:60 'veI:180 Zn:260 **PAUSE**:674 #
iambicTTgt: (f@ ('t{ks (((I 'veI) Zn) **PAUSE**)))
iambicTTgte: (f@ 't{ks I 'veI Zn **PAUSE**)
trochaicTTlt: ((f@ ('t{ks I)) 'veI Zn **PAUSE**)
trochaicTTlte: (f@ 't{ks I 'veI Zn **PAUSE**)

Samples of output type (from Aix-MARSEC)

Text extraction:

_
'mO: 'nju:z @ 'baUt D@ 're vr@n 'sVn 'mjVN 'mu:n _
'faUn d@ r@v D@ ,ju: nI fI 'keI Sn 'tS3:tS _
'hu:z 'kV r@nt lI In 'dZeIl _
f@ 't{ks I 'veI Zn _

Token *n*-gram distribution:

Difference unigram ranks and counts (n=35):
1.[46%(16):\] **2.**[26%(9):/] **3.**[11%(4):+] **4.**[11%(4):#] **5.**[6%(2):=]
Difference digram ranks and counts (n=31):
1.[23%(7):\\] **2.**[23%(7):/\] **3.**[13%(4):\/] **4.**[13%(4):\#] **5.**[6%(2)://] **6.**[6%(2):+/] **7.**[3%(1):\=] **8.**[3%(1):=\] **9.**[3%(1):=/] **10.**[3%(1):+\] **11.**[3%(1):+=]
Difference trigram ranks and counts (n=27)
1.[15%(4):/\\] **2.**[11%(3):\\\] **3.**[11%(3):\\#] **4.**[11%(3):\/\] **5.**[11%(3):/\/] **6.**[7%(2)://\] **7.**[4%(1):\\=] **8.**[4%(1):\=\] **9.**[4%(1):\//] **10.**[4%(1):=\#] **11.**[4%(1):=/\] **12.**[4%(1):+\/] **13.**[4%(1):+=/] **14.**[4%(1):+/\] **15.**[4%(1):+//]
Difference quadgram ranks and counts (n=23)
1.[9%(2):\/\\] **2.**[9%(2):/\\\] **3.**[9%(2):/\\#] **4.**[9%(2):/\/\] **5.**[4%(1):\\\\] **6.**[4%(1):\\\=] **7.**[4%(1):\\\#] **8.**[4%(1):\\=\] **9.**[4%(1):\=\#] **10.**[4%(1):\/\/] **11.**[4%(1):\/\] **12.**[4%(1):=/\\] **13.**[4%(1):/\//] **14.**[4%(1)://\\] **15.**[4%(1)://\/] **16.**[4%(1):+\/\] **17.**[4%(1):+=/\] **18.**[4%(1):+/\/] **19.**[4%(1):+//\]
Difference quingram ranks and counts (n=19)
1.[11%(2):/\/\\] **2.**[5%(1):\\\\#] **3.**[5%(1):\\\=\] **4.**[5%(1):\\=\#] **5.**[5%(1):\/\\\] **6.**[5%(1):\/\\#] **7.**[5%(1):\/\/\] **8.**[5%(1):\/\\] **9.**[5%(1):=/\\#] **10.**[5%(1):/\\\\] **11.**[5%(1):/\\\=] **12.**[5%(1):/\/\] **13.**[5%(1)://\\\] **14.**[5%(1):/\//] **15.**[5%(1):+\/\/] **16.**[5%(1):+=/\\] **17.**[5%(1):+/\/\] **18.**[5%(1):+//\/]

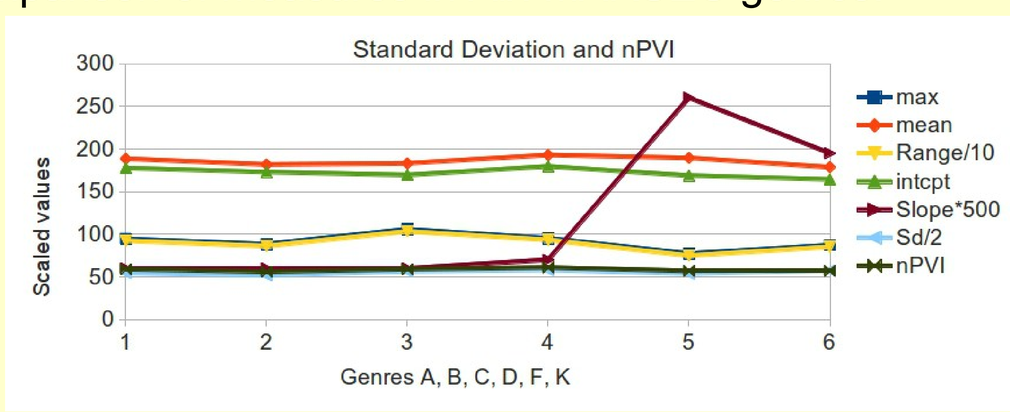
Syllable duration properties:

Duration properties (syllables)

Attributes	Values	Attributes	Values
n:	31	intercept:	192.177
min:	50	slope:	0.242
max:	500	std:	102.258
mean:	195.81	nPVI:	54
median:	160.0	rPVI:	97
total:	6070	100*rPVI/med:	61
range:	450	nPVI*med/100:	86

Applications in timing analysis

Comparison of measures in Aix-MARSEC genres:



- See also Yu (TRASP 2013) for application to Mandarin varieties.

Conclusion: TGA tool facilitates efficient timing analysis.

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TRASP 2013, Aix-en-Provence

*http://wwwhomes-uni-bielefeld.de/gibbon/TGA