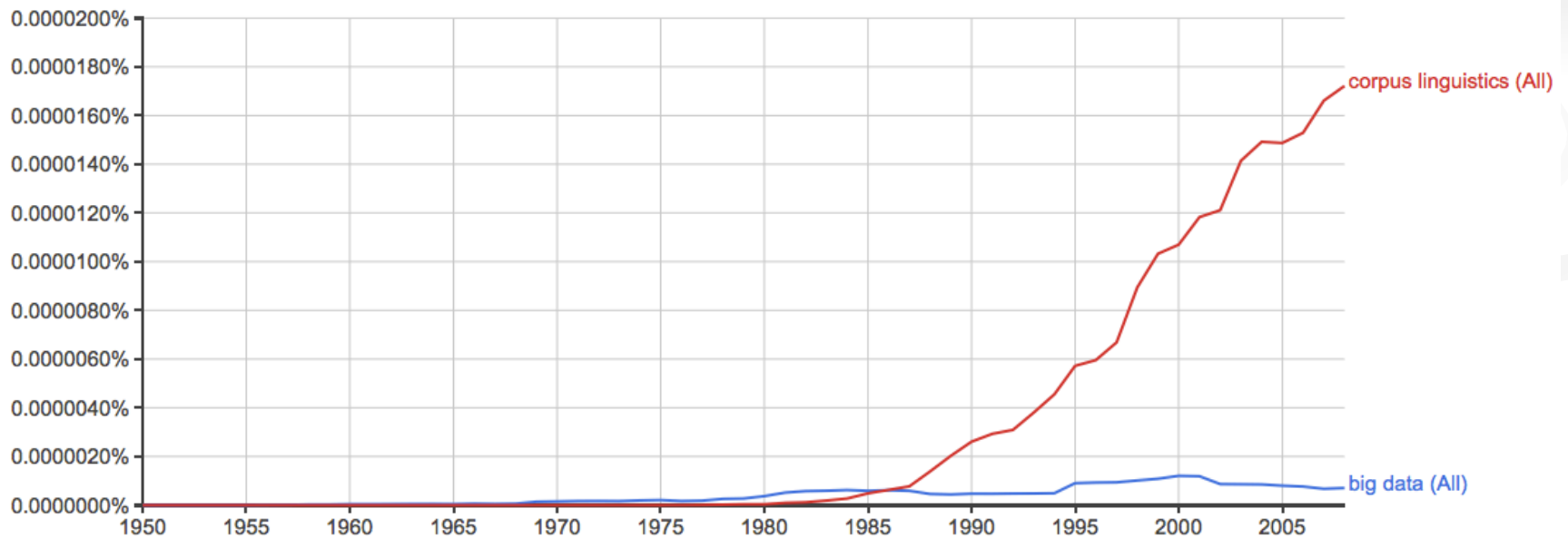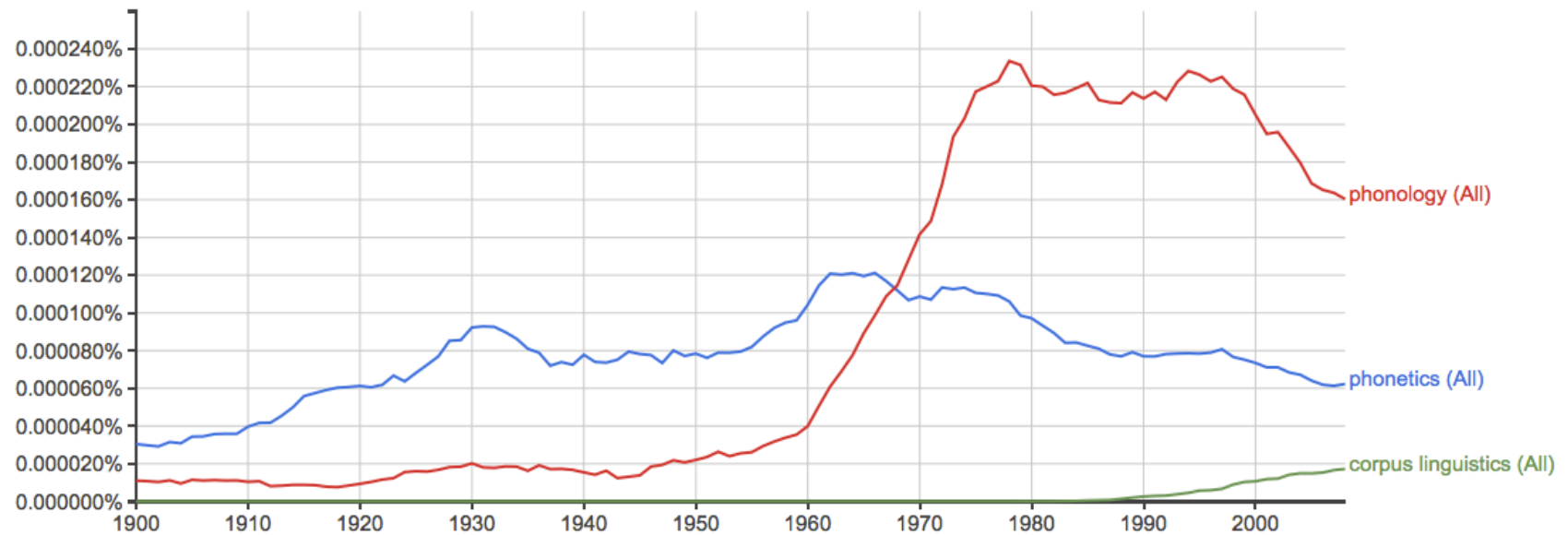# How to use Forced Alignment Systems

Tae-Jin Yoon
Department of English Language and Literature
Cheonju University

The rise of corpus linguistics
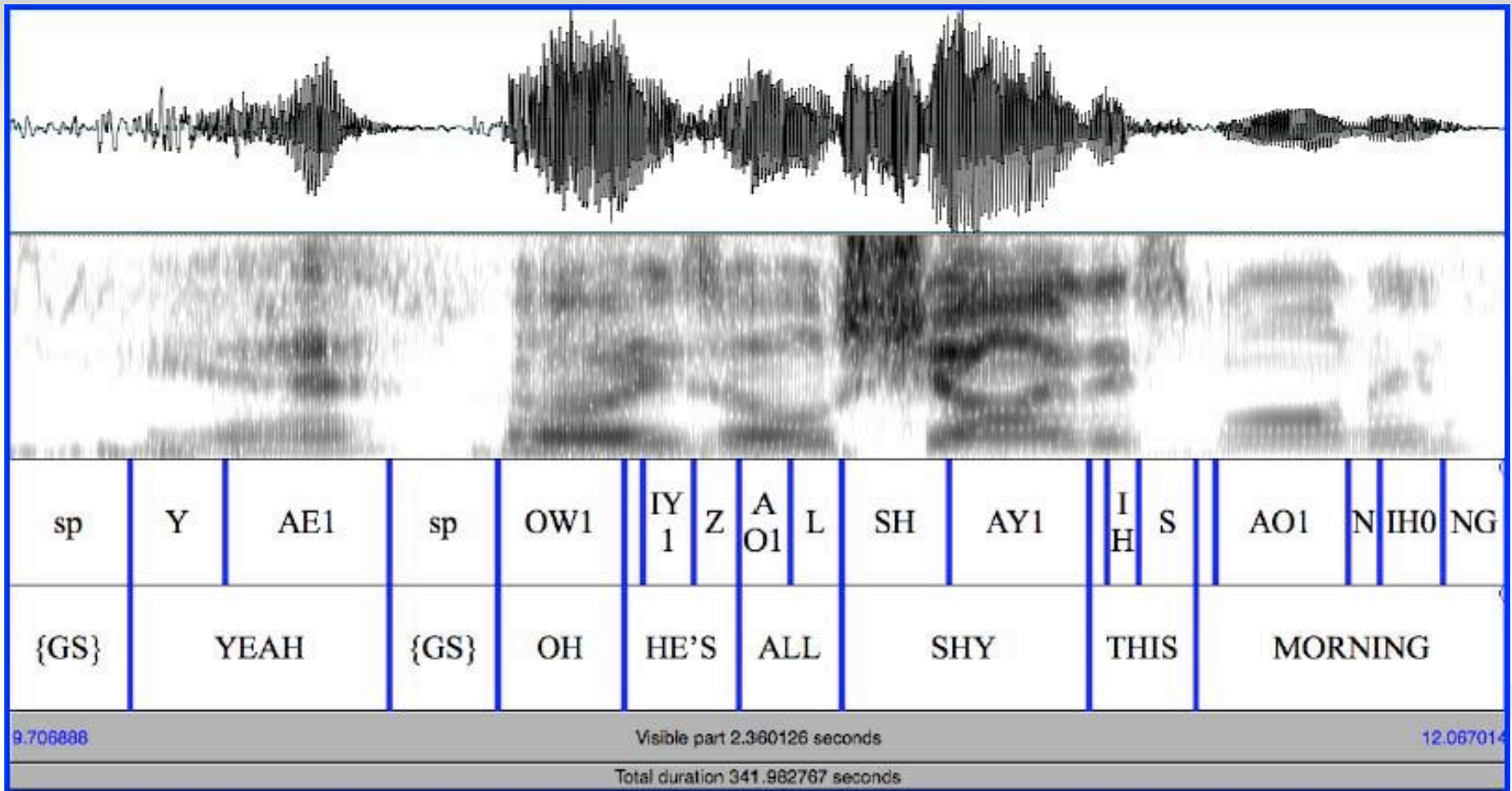

Google books **Ngram Viewer**

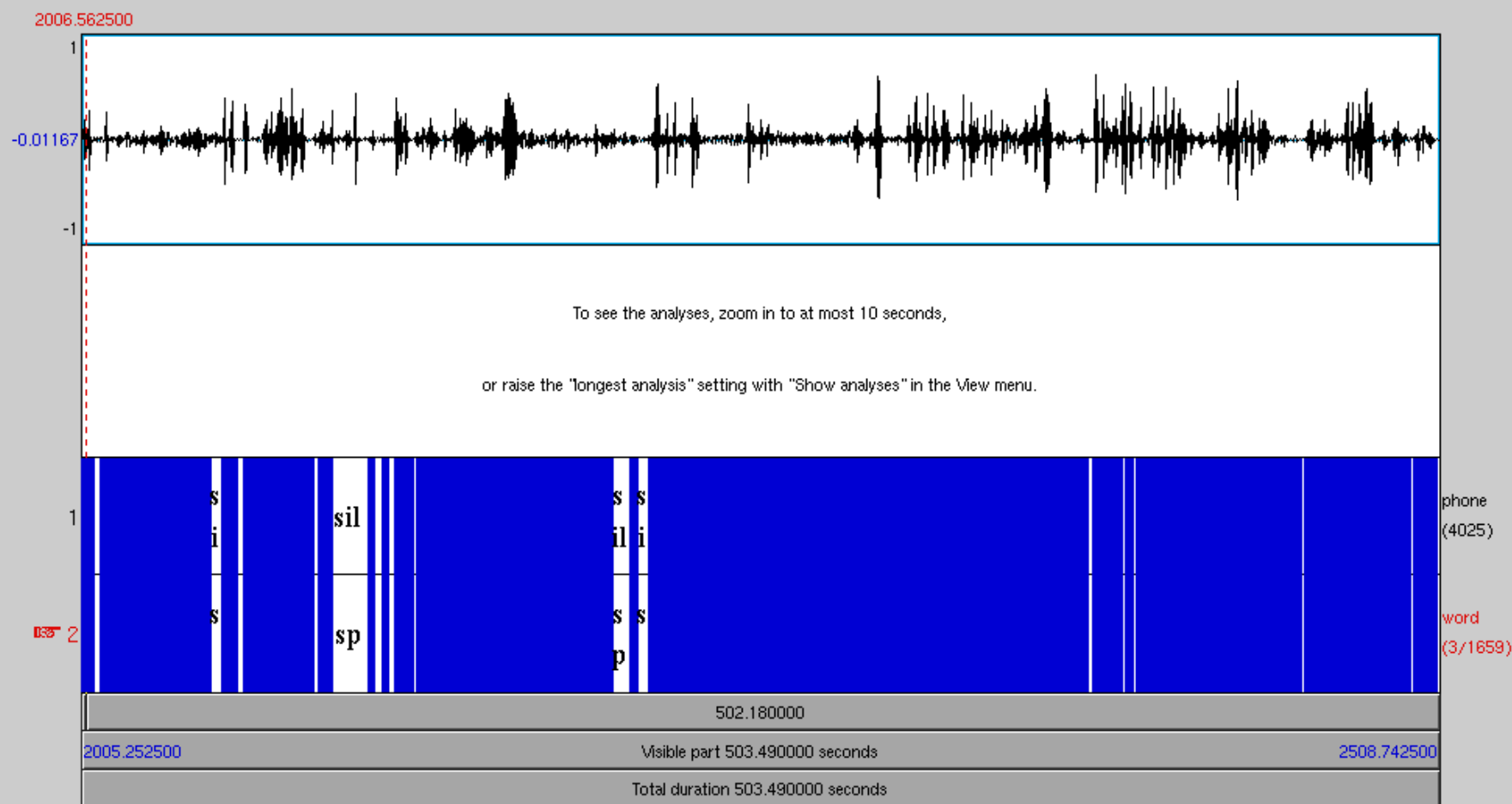# Phonetics, phonology and corpus linguistics

I have a sound file to be transcribed. How do I transcribe?

x 21 million

How about this very long sound file?
→ Need for forced alignment

FAVE alignment

- An Online Interface to the Penn Forced Aligner
- **http://fave.ling.upenn.edu/FAAValign.html**
- **An example file needed to be aligned**

FAVE-align

An online interface for the Penn Forced Aligner

fave_test.wav
fave_test.lab

Upload files:

Please select the files to be aligned:

[?]Sound file: [_____] [찾아보기...]
[?]Transcription file: [_____] [찾아보기...]

Options:

☐ **-u**: Check transcription for unknown words[?]

☐ **-i**: Import dictionary transcriptions:[?] [_____] [찾아보기...]

Personal information:

First name: [_____]
Last name: [_____]
Institution: [_____]
Email address: [_____] *
confirm email address: [_____] *
[?]Comments:
| How did you hear about this web site? Are you using it for research (which area/field?), or other purposes? Anything we can do to improve the interface? |

* required

Align!

Depending on the size of your sound file and the speed of your internet connection, the file upload may take a while.

Webmaster: Ingrid Rosenfelder
Last modified: February 21, 2013

Pronunciation Dictionary

```
A42128  EY1 F AO1 R T UW1 W AH1 N T UW1 EY1 T
AAA  T R IH2 P AH0 L EY1
AABERG  AA1 B ER0 G
AACHEN  AA1 K AH0 N
AAKER  AA1 K ER0
AALSETH  AA1 L S EH0 TH
AAMODT  AA1 M AH0 T
AANCOR  AA1 N K AO2 R
AARDEMA  AA0 R D EH1 M AH0
AARDVARK  AA1 R D V AA2 R K
AARON  EH1 R AH0 N
AARON'S  EH1 R AH0 N Z
AARONS  EH1 R AH0 N Z
```

Phoneme	Example	Translation
AA	odd	AA D
AE	at	AE T
AH	hut	HH AH T
AO	ought	AO T
AW	cow	K AW
AY	hide	HH AY D
B	be	B IY
CH	cheese	CH IY Z
D	dee	D IY
DH	thee	DH IY
EH	Ed	EH D
ER	hurt	HH ER T
EY	ate	EY T
F	fee	F IY
G	green	G R IY N
HH	he	HH IY
IH	it	IH T
IY	eat	IY T
JH	gee	JH IY
K	key	K IY
L	lee	L IY
M	me	M IY
N	knee	N IY
NG	ping	P IH NG
OW	oat	OW T
OY	toy	T OY
P	pee	P IY
R	read	R IY D
S	sea	S IY
SH	she	SH IY
T	tea	T IY
TH	theta	TH EY T AH
UH	hood	HH UH D
UW	two	T UW
V	vee	V IY
W	we	W IY
Y	yield	Y IY L D
Z	zee	Z IY
ZH	seizure	S IY ZH ER

http://www.speech.cs.cmu.edu/cgi-bin/cmudict

C The ARPAbet

Vowels			Consonants		
Phoneme	**Example**	**Transcription**	**Phoneme**	**Example**	**Transcription**
AA	bot	B AA T	B	be	B IY
AE	bat	B AE T	CH	cheese	CH IY Z
AH	but	B AH T	D	day	D EY
AO	bought	B AO T	DH	that	TH AE T
AW	bout	B AW T	F	fee	F IY
AY	bite	B AY T	G	go	G OW
EH	bet	B EH T	HH	he	HH IY
ER	bird	B ER D	JH	just	JH AH S T
EY	bait	B EY T	K	key	K IY
IH	bit	B IH T	L	late	L EY T
IY	beat	B IY T	M	me	M IY
OW	boat	B OW T	N	knee	N IY
OY	boy	B OY	NG	sing	S IH NG
UH	put	P UH T	P	pay	P EY
UW	boot	B UW T	R	read	R IY D
			S	sea	S IY
			SH	she	SH IY
			T	tea	T IY
			TH	thanks	TH AE NG K S
			V	vain	V EY N
			W	we	W IY
			Y	yes	Y EH S
			Z	zoo	Z UW
			ZH	pleasure	P L EH ZH ER

Stress is indicated by digits following the stressed vowels. There are three levels of stress:

Value	Level of stress
0	no stress
1	primary stress
2	secondary stress

Example:

in	AH0 N, IH1 N
the	DH AH0, DH AH1, DH IY0
dictionary	D IH1 K SH AH0 N EH2 R IY0
stress	S T R EH1 S
is	IH1 Z, AH0 Z
indicated	IH1 N D AH0 K EY2 T AH0 D
by	B AY1
digits	D IH1 JH AH0 T S
following	F AA1 L OW0 IH0 NG
stressed	S T R EH1 S T
vowels	V AW1 AH0 L Z

```
MC      Mary Costa      16.02   16.976  John F. Smith.
MC      Mary Costa      18.1    20.099  And the year was eighteen ninety-five
MC      Mary Costa      21.34   23.332  I never noticed before. Just when --
MC      Mary Costa      23.332  26.332  It's about, oh when we papered his house it was about
MC      Mary Costa      26.4    27.366  sixteen,
MC      Mary Costa      27.446  29.515  seventeen years ago when I papered the house.
MC      Mary Costa      29.57   33.274  I mean, we had it scraped. And that's when I noticed it.
MC      Mary Costa      35.32   35.766  Yeah.
MC      Mary Costa      38.702  43.063  Yeah, on Ninth Street, I know. I was born there, Eight Twenty-Four Christian Street.
MC      Mary Costa      48.103  49.678  Perry, yeah I know who you mean.
MC      Mary Costa      50.109  51.659  Yeah, ((Taker)), yeah I know.
MC      Mary Costa      52.395  52.929  I know.
MC      Mary Costa      53.52   55.08   We know the Perry's well.
MC      Mary Costa      55.537  57.619  Yeah, we know the Perry's well. Oh do you?
MC      Mary Costa      58.164  58.675  Oh yeah.
MC      Mary Costa      59.26   62.01   Well, Perry, ((Berry)), my sist' and all, we had him for --
MC      Mary Costa      62.2    62.718  (())
MC      Mary Costa      64.72   65.452  No.
MC      Mary Costa      65.5    67.492  Oh the -- No, he didn't die in jail.
MC      Mary Costa      67.532  69.907  Joe Perry. What's the matter with you, you made a mistake.
MC      Mary Costa      70.3    71.75   ((I assure was a)) was a
MC      Mary Costa      72.13   72.874  somethin'
MC      Mary Costa      78.12   78.636  Yeah.
MC      Mary Costa      78.7    79.381  Yeah
MC      Mary Costa      80.87   82.131  ((Geytan)), that's right.
MC      Mary Costa      82.34   83.42   Well, he died too.
MC      Mary Costa      85.05   86.145  Yeah I know. I heard he --
MC      Mary Costa      86.69   88.775  Well not as sudden as ((up at)) Darby.
MC      Mary Costa      89.99   93.443  The ((sons)) has a place up at Darby, ((Gate Dusserson))
MC      Mary Costa      97.32   99.518  Oh the daughter, his son. She still runs it there?
MC      Mary Costa      99.54   101.508 I haven't been around there so long, I don't know.
MC      Mary Costa      112.12  115.613 A f- fraternity like a brother. Like all of
MC      Mary Costa      117.67  120.279 Italy, you know. The country they come from.
MC      Mary Costa      120.43  121.037 ((Gazent)).
MC      Mary Costa      122.42  126.636 Well it's cause I'm, I -- my mother and father, an', he comes from the same town.
MC      Mary Costa      127.71  130.48  It's called ((Terra Nova de Citre, Rovinchi, Gazent)).
MC      Mary Costa      131.01  131.44  That's it.
```
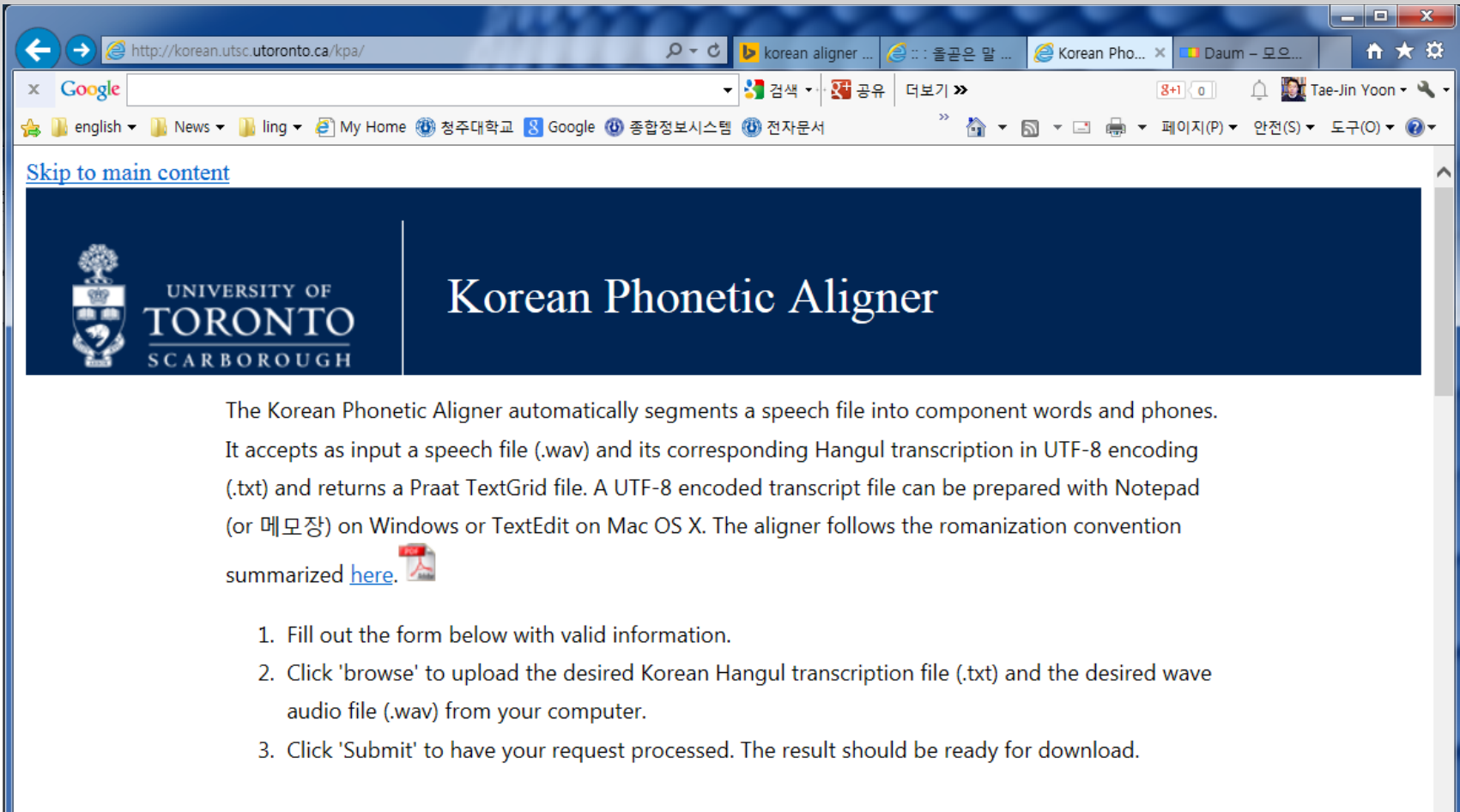
http://fave.ling.upenn.edu/downloads/Convert_To_FAVE-align_Input.praat

```
###############################################################
# This Praat script exports orthographic transcriptions in Praat
## to a format suitable as input to the FAVE-align forced aligner
## (http://fave.ling.upenn.edu/FAAValign.html).
## The transcription will be converted to a 5-column tab-delimited .txt file
## as outlined in the instructions on the FAVE web site.
##
## To run this program, select the TextGrid containing the transcriptions,
## open this script, and select "Run" > "Run".
##
## This script was written by Ingrid Rosenfelder,
## last modified October 31, 2011
################################################################ ##
```

```
## get TextGrid name
info$ = Info
filename$ = extractLine$(info$, "Object name: ")
outfile$ = filename$ + ".txt"
## ask the user before overwriting exiting file
if fileReadable(outfile$)
    pause 'filename$'.txt already exists. Overwrite?
    deleteFile(outfile$)
endif
## extract transcription info and write to file
n_tiers = Get number of tiers
for tier from 1 to n_tiers
    tiername$ = Get tier name... 'tier'
    n_intervals = Get number of intervals... 'tier'
    for interval from 1 to 'n_intervals'
        start = Get start point... 'tier' 'interval'
        end = Get end point... 'tier' 'interval'
        label$ = Get label of interval... 'tier' 'interval'
        if label$ <> ""
            fileappend'outfile$''tiername$''tab$''tiername$''tab$'
              ...'start''tab$''end''tab$''label$''newline$'
         endif
      endfor
endfor
echo Written transcription in FAVE-align input format to file 'outfile$'.
```

Can I use the FAVE Aligner for Korean?

Korean Phonetic Aligner

http://korean.utsc.utoronto.ca/kpa/

1. Fill out the form below with valid information.
2. Click 'browse' to upload the desired Korean Hangul transcription file (.txt) and the desired wave audio file (.wav) from your computer.
3. Click 'Submit' to have your request processed. The result should be ready for download.

First Name *	TJ
Last Name *	Yoon
Email *	yoon.taejin@gmail.com
Affiliation *	cju
Upload transcription file (*.txt) *	C:\Users\Cju\Dropbox\실ᄒ 찾아보기...
Upload Wav file (*.wav) *	C:\Users\Cju\Dropbox\실ᄒ 찾아보기...

☑ I authorize the collection of the information provided in the form.

Submit

한글_test1 - 메모장

파일(F) 편집(E) 서식(O) 보기(V) 도움말(H)

기차도 전기도 없었다.|

Content

Cju ▶ Dropbox ▶ 실험음성학회_총무 ▶ 실험음성학회발표

구성 ▼   새 폴더

☆ 즐겨찾기
　🗗 Dropbox
　📥 다운로드
　🖥 바탕 화면
　📑 최근 위치
　🎨 iCloud 사진

📁 라이브러리
　📄 문서
　🎬 비디오
　🖼 사진
　🎵 음악

kdict1

파일 이름(N): 한글_test1.txt

파일 형식(T): 텍스트 문서(*.txt)

Save as .txt and utf-8

폴더 숨기기

인코딩(E): UTF-8

저장(S)

Result of Korean Phonetic Aligner
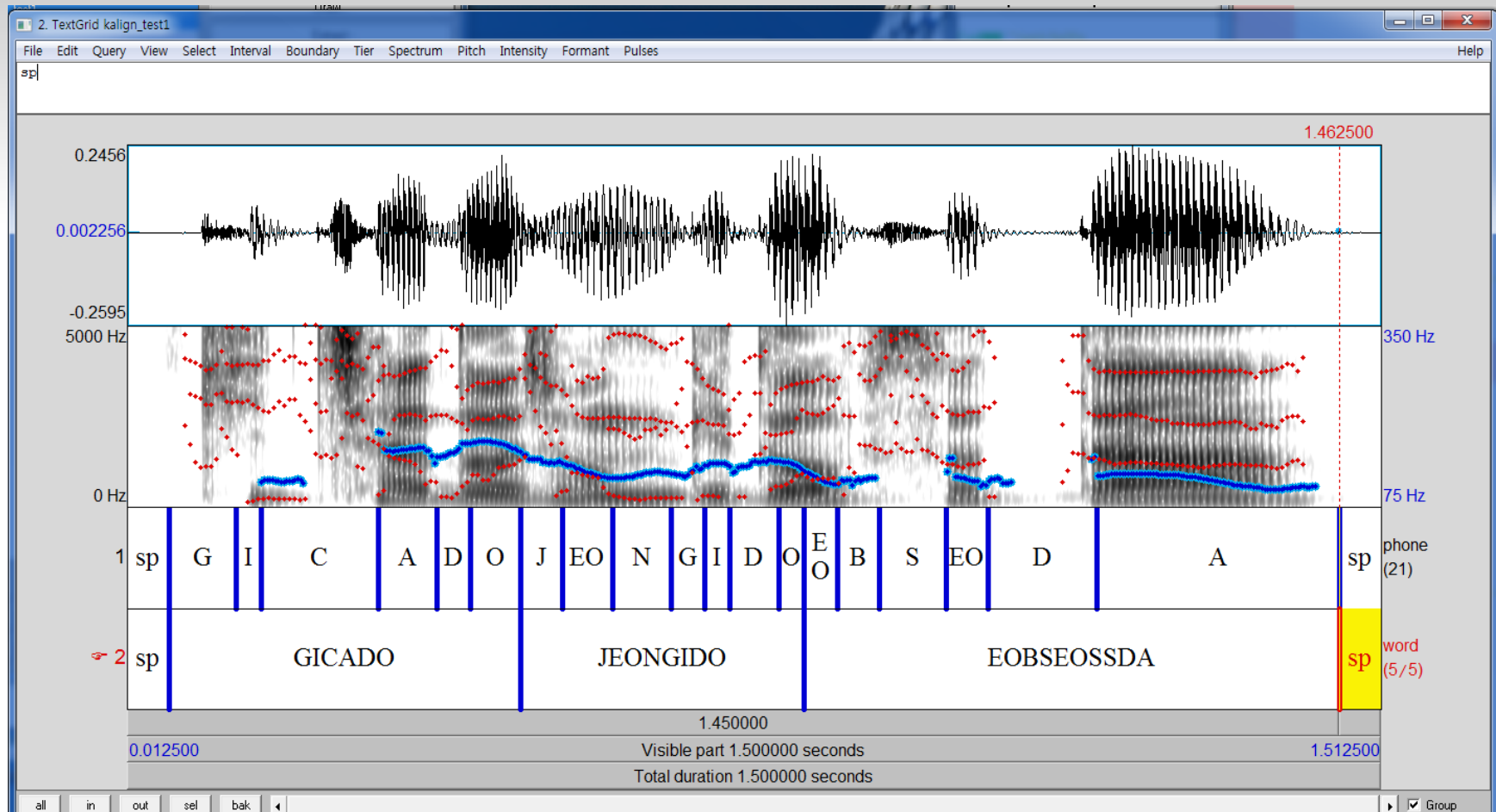
Romanization convention

Romanization convention used in the Korean Phonetic Aligner

<Vowels>

Transcription	Hangul	Phonetic
A	ㅏ	ɑ
AE	ㅐ	æ
E	ㅔ	e
EO	ㅓ	ə
EU	ㅡ	ɨ
I	ㅣ	i
O	ㅗ	o
OE	ㅚ	we/ø
U	ㅜ	u
WA	ㅘ	wa
WAE	ㅙ	wæ
WE	ㅞ	we
WEO	ㅝ	wə
WI	ㅟ	wi/y
YA	ㅑ	jɑ
YAE	ㅒ	jæ
YE	ㅖ	je
YEO	ㅕ	jə
YI	ㅢ	ɨi
YO	ㅛ	jo
YU	ㅠ	ju

<Consonants>

Transcription	Hangul	Phonetic
B	ㅂ	p (b: between sonorants)
BB	ㅃ	p'
P	ㅍ	pʰ
D	ㄷ	t (d: between sonorants)
DD	ㄸ	t'
T	ㅌ	tʰ
G	ㄱ	k (g: between sonorants)
GG	ㄲ	k'
K	ㅋ	kʰ
J	ㅈ	ts (dz: between sonorants)
JJ	ㅉ	ts'
C	ㅊ	tsʰ
S	ㅅ	s (ʃ: before a high front vocoid)
SS	ㅆ	s' (ʃ: before a high front vocoid)
H	ㅎ	h
M	ㅁ	m
N	ㄴ	n
NG	ㅇ	ŋ
L(coda)/R (onset)	ㄹ	l (coda, geminate), ɾ (intervocalic)
sp		Silent pause

Wow, it's great! Can I use the forced alignment for any types of sound files?

Challenges for alignments

- Transcription errors
- Long untranscribed portions
- Some transcribed regions with no audio (lost in copying)
- Broadcast recordings may include untranscribed commercials
- Transcripts generally edit out dysfluencies

Challenges for alignments

- Overlapping speakers
- Background noise/music/babble
- Variable signal loudness
- Reverberation
- Distortion
- Poor speaker vocal health/voice quality
- Unexpected accents: need multidialect pronouncing dictionary

I have 1000 files to process. Is there a way to process the multiple files much easily?

THERE ARE GEEKY WAYS!

Then, you need a Linux-like environment

- ./align.py filename.wav filename.lab filename.TextGrid


```
Cju@ 00 ~/work/kp2fa
$ ./align.py test/fv01_t01_s01.wav test/fv01_t01_s01.lab test/fv01_t01_s01.TextGrid
./tmp/sound.wav -> ./tmp/tmp.mfc
Running HVite...
```

What do I need for the Linux-like environment?

- Windows
  - Cygwin
  - HTK
- Mac OS X
  - XCode
  - HTK

On Windows: cygwin

- Cygwin (pronounced as SIG-win) = GNU + Cygnus + Windows.
- The mother site for Cygwin is [www.cygwin.com.](www.cygwin.com)
- According to the developers, "Cygwin is a Open-source *Linux*-like environment for *Windows*.
- It consists of two parts:
  - A DLL (cygwin1.dll) which acts as a Linux API emulation layer providing substantial Linux API functionality.
  - A collection of tools which provide Linux look and feel."

YouTube Clip for installing Cygwin on Window 8

- http://www.youtube.com/watch?v=hh-V6el8Oxk

Cygwin설치하기 1편 및 2편

http://detectiveboy.tistory.com/22

http://detectiveboy.tistory.com/23
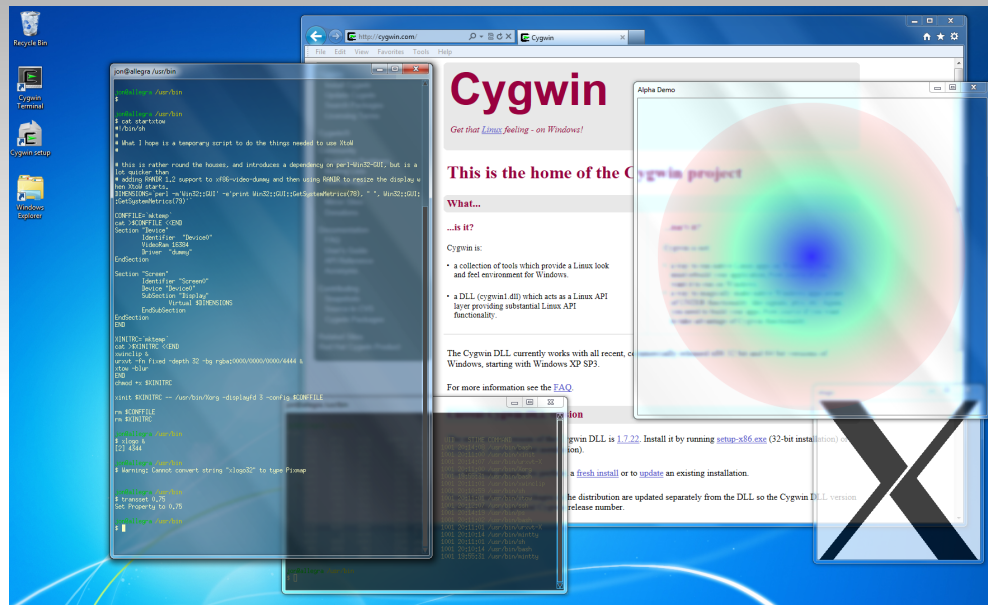
On Mac OS X: terminal
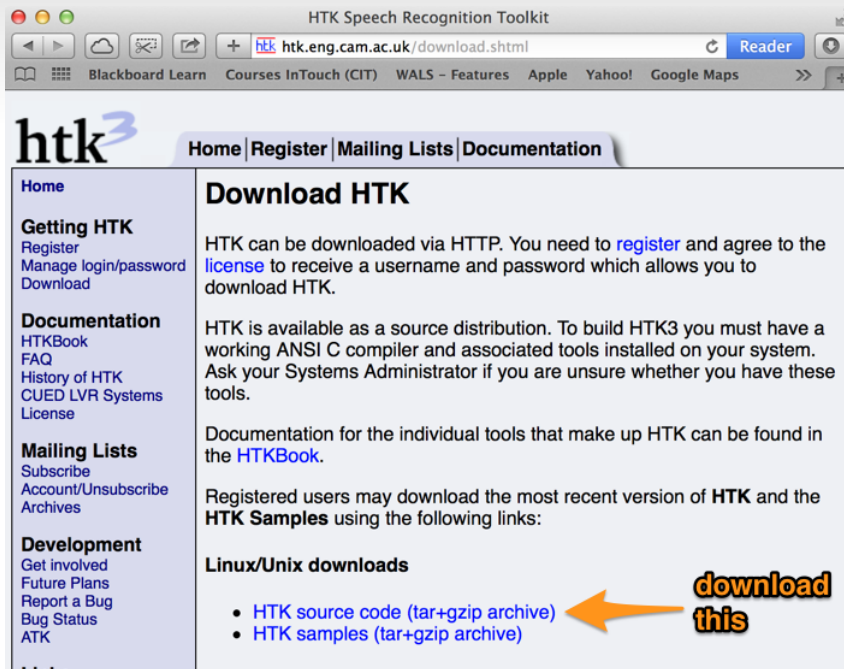
Mac OS X: Install Xcode

Freely Available from App Store
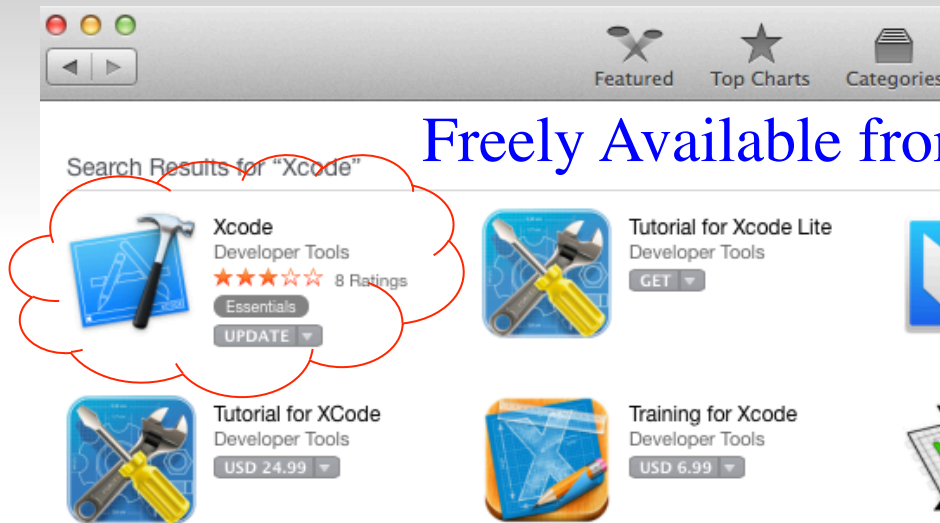
HTK (HMM Toolkit)

HTK Toolkit

- You'll need to register (free) with HTK to download it.
- Visit http://htk.eng.cam.ac.uk/register.shtml to register, and they will e-mail you a password.
- After that, visit http://htk.eng.cam.ac.uk/download.shtml , and download the HTK source code appropriate for your operating system.

If you have the following problem, see the next page.

```
Cju@윤태진 ~/work/kp2fa
$ ./align.py test/fv01_t01_s01.wav test/fv01_t01_s01.lab test/fv01_t01_s01.TextGrid
./tmp/sound.wav -> ./tmp/tmp.mfc
Running HVite...
  ERROR [+8522]  LatFromPaths: Align have dur<=0
 FATAL ERROR - Terminating program HVite
Traceback (most recent call last):
  File "./align.py", line 316, in <module>
    writeTextGrid(outfile, readAlignedMLF(output_mlf, SR, float(wave_start)))
  File "./align.py", line 135, in readAlignedMLF
    raise ValueError("Alignment did not complete succesfully.")
ValueError: Alignment did not complete succesfully.

Cju@윤태진 ~/work/kp2fa
$
```

Fixing the HTK Source

- In the htk directory, navigate to **htk/HTKLib**, and open the file HRec.c in a plain text editor. Find the line 1650 which reads

```
if (dur<=0 && labid != splabid) HError(8522,"LatFromPaths:
Align have dur<=0 ");
```
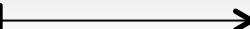
- labid in this line should be changed to labpr. It should look like this:

```
if (dur<=0 && labpr != splabid)
HError(8522,"LatFromPaths: Align have dur<=0 ");
```

Now I have an HTK installed, how can I process multiple files?

■ Scripting in Bash shell

imagine you have the data in the following structure:

data/s01_01.wav
data/s01_02.wav
…
data/s01_99.wav
data/s02_01.wav
data/s02_02.wav
…
data/s02_99.wav
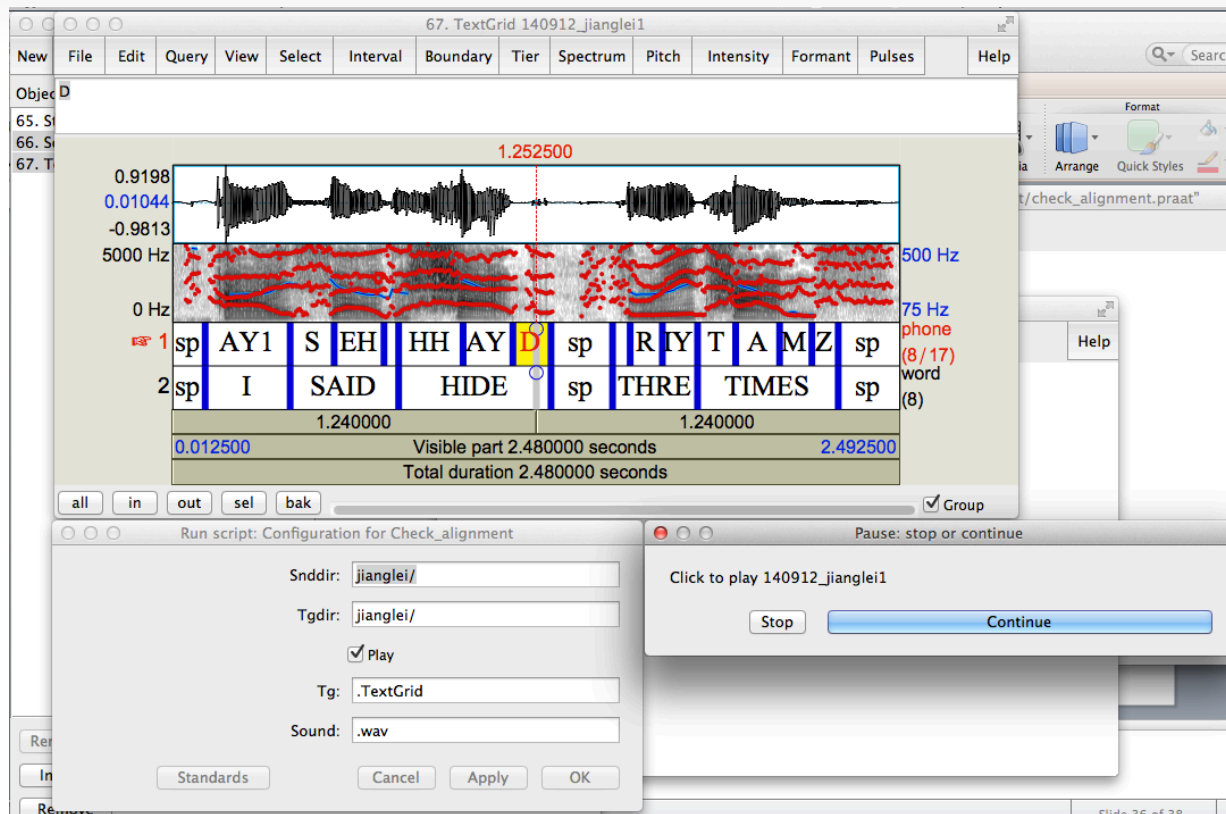…
data/s10_99.wav

example: run.sh

```sh
#!/bin/sh


for SID in 0 1 2 3 4 5 6 7 8 9
do
    for CID in 0 1 2 3 4 5 6 7 8 9
        do
          if [ -e data/s${SID}_${CID}.wav ]; then
             echo 'Alignining the speech file of ' s${SID}_${CID}.wav
             ./align.py data/s${SID}_${CID}.wav data/s${SID}_${CID}.lab data/s${SID}_${CID}.TextGrid
        fi
          done
    done
~
```

I want to check the aligned data

- check_alignment.praat

check_alignment.praat

```
form Configuration for Check_alignment
    sentence Snddir ./test/
    sentence Tgdir ./test/
    sentence Sound .wav
endform
clearinfo
Create Strings as file list... filelist 'snddir$'*'sound$'
num_files = Get number of strings

for j from 1 to num_files
    select Strings filelist
    fname$ = Get string... 'j'
    basename$ = fname$-sound$
    wavname$ = basename$+"sound$"
    tgname$ = basename$ + ".TextGrid"
    printline We will label 'fname$'
    if fileReadable("'tgdir$''tgname$'")
        printline 'tgname$' exists!
        Read from file... 'snddir$''fname$'
        Read from file... 'tgdir$''tgname$'
        btime = Get start time
        etime = Get end time
        select Sound 'basename$'
        plus TextGrid 'basename$'
        View & Edit
                editor TextGrid 'basename$'
                        pause Click to play 'basename$'
                        Play... btime etime
                        pause Click to close 'basename$'
                        Close
                endeditor
    else
        printline 'tgname$' does not exists!
    endif
endfor
select Strings filelist
Remove
```