

Fortitie en de perceptie van een buitenlands accent

Dag van de Fonetiek
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Fenneta vd Scheer, Roelien Bastiaanse, Dicky Gilbers (2011)

Data: Judith Feiken, Roel Jonkers, Fenneta vd Scheer

Overzicht

- Een spectaculair proces:
Foreign Accent Syndrome (FAS)

Claim: FAS is milde vorm van Apraxie

Verklaring gebaseerd op zowel fonetische als fonologische kennis

Goed wetenschappelijk onderzoek is falsificeerbaar

Foreign Accent Syndrome

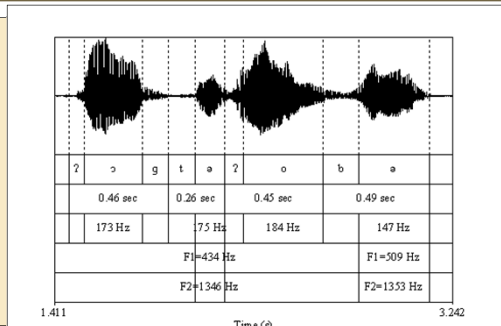


Een dertienjarig meisje uit Kroatië is onlangs uit een eendagscoma ontwaakt. Vanaf dat moment spreekt ze geen Kroatisch meer, maar vloeiend Duits. En dat terwijl ze voordat zij in coma raakte slechts wat schoolduits sprak. Is dit misschien het bewijs dat reïncarnatie bestaat?

Foreign Accent Syndrome

- The condition was first described in 1907 by the French neurologist Pierre Marie
- Edwards, Nikunj, Patel and Pople (2005)
 - Summary of 35 published FAS cases
- FAS lijkt vrij zeldzaam: niet opgevallen?
- FAS geen groot probleem voor communicatie/niet blijvend
- FAS lijkt op milde vorm van Apraxie (AoS) (motor planning speech disorder)

AoS (wel een probleem voor de communicatie)



?	o	g	t	a	?	o	b	a
0.46 sec		0.26 sec		0.45 sec		0.49 sec		
173 Hz		175 Hz		184 Hz		147 Hz		
F1=434 Hz				F1=509 Hz				
F2=1346 Hz				F2=1333 Hz				

1.411 Time (s) 3.242

Case Study FAS

Fenneta vd Scheer, Roelien Bastiaanse, Dicky Gilbers (2011)

- AA (50) 3 weeks post onset: (before stroke: 🇩🇪 🇫🇷)
- Foreign Accent
 - German?
 - French?
 - Asian?

Loos alarm op het strand

Groot alarm, afgelopen donderdag op het strand van Zandvoort. De klucht was gewaarschuwd dat er een persoon, die zich in het water had begeven, vermist was. Hij was tegelijk met nog twee andere personen de zee ingegaan en nu waren die twee personen komen vertellen dat ze hem misten. Ze waren er zeker van dat hij niet terug gegaan was naar het strand. De reddingsbrigades van Zandvoort en IJmuiden werden daarom ingeschakeld om deze ene persoon te zoeken. Ook er werd er een helikopter ingezet. Een ziekenauto werd in gereedheid gebracht. Het alarm dat was geslagen bleek loos te zijn, want er bleken niet drie maar twee personen in het water te zijn geweest. Tot groot paniek leidde het alarm onder de badgasten echter niet.

Account of FAS

- Characteristics of FAS speech:
 - Clear segmentation: **kustwacht**
 - Lack of coarticulation/lenition processes
 - f.i. no assimilation: **ingegaan** [ɪŋχəχa:n] not [ɪŋχəχa:n] (speech before stroke: **aankomen** [a:ŋko:m])
 - Fortition effects: **hem** [ʔɛm] not [hɛm]

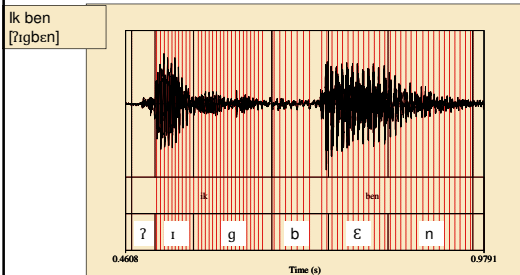
Assimilation

Regressive Assimilation of Place:

Dutch <i>inkoop</i> 'purchase'	
preferred realization:	[ʔɪŋko:p]
German <i>einkauf</i> 'purchase'	
preferred realization:	[ʔaɪnkau̯f]

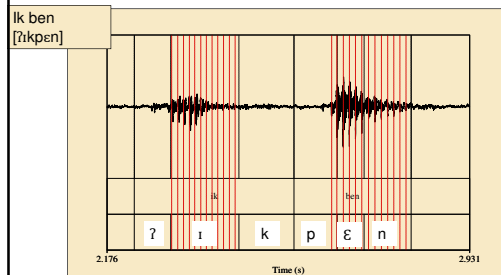
Assimilation

Regressive Assimilation of Voice (control speaker):



Assimilation

Regressive Assimilation of Voice (FAS speaker):



Measuring the force of articulation Main Parameters

1. Speech Rate
2. Pitch
3. Intensity
4. Length/Duration
5. Timbre

Measuring the force of articulation Individual Parameters

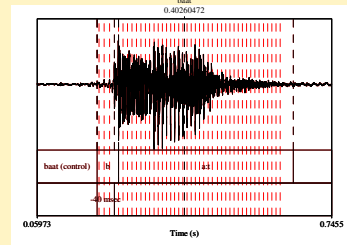
1. Speech Rate
2. Hyperarticulation
3. Alignment (pitch and duration)
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6. Voice Onset Time
7. Occlusion duration plosives
8. Release duration plosives
9. Release intensity intervocalic plosive/rise/duration preconsonantal vowel/decay
10. Segment duration (e.g. tense : lax vowels)
11. Syllable isochrony
12. (Lack of) vowel reduction
13. Stability (mid) vowels
14. F2 vowel after plosive
15. F2 in laterals...

Measuring the force of articulation Individual Parameters

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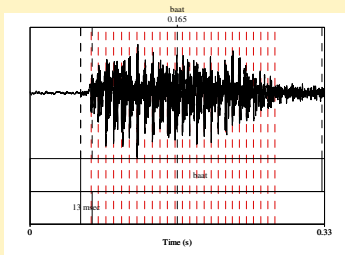
Measuring the force of articulation 6. Voice Onset Time

Baat realized by control speaker



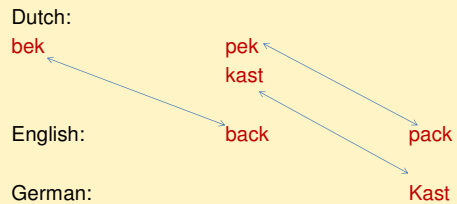
Measuring the force of articulation 6. Voice Onset Time

Baat realized by FAS speaker



Measuring the force of articulation: 6. Voice Onset Time

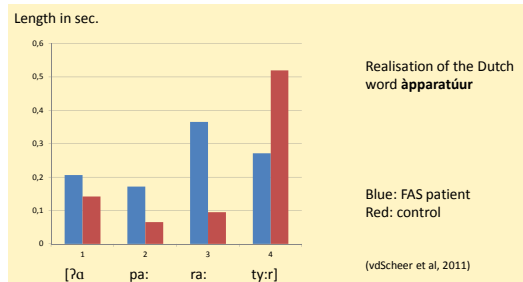
Negative V.O.T. < 0 sec	Short Lag between 0 and 35 msec.	Long Lag > 35 msec.
<small>(W.Jansen, 2004. However cf. Auzou et al, 2000)</small>		



Measuring the force of articulation: 11. Isochrony Syllables

- Ratio between **length stressed** and **unstressed syllables** can be measured
 - In normal stress-timed speech stressed syllables are longer than unstressed ones
 - Delwo (2003): syllable-timed languages: length syllables 1:1
 - stress-timed languages: distance stressed syllables 1:1
 - Expectation: Syllables are more isochronous in FAS speech
 - Expectation: Differences in length between stressed and unstressed syllables diminish in FAS speech

Measuring the force of articulation: 11. Isochrony Syllables



Stress-timed vs Syllable-timed

- Bounded feet (Dutch):

(o no)_Σ (ma to)_Σ (pee)_Σ

- Unbounded feet (French):

(o no ma to pee)_Σ

Stress-timed vs Syllable-timed

- In syllable-timed rhythm the syllables recur at equal intervals of time, they are *isochronous*

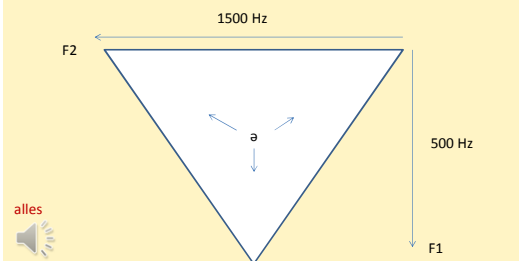
(Abercrombie, 1967)

- Distinction syllable-timed – stress-timed criticized:
(Roach, 1982; Liberman, 2008 a.o.)

Rather lack of vowel reduction than isochrony of duration

Measuring the force of articulation: 12. Vowel Reduction

FAS has less vowel reduction in unstressed syllables



Stress-timed vs Tone language

- Voorbeeld:

(1) [lo:χəpədi] (s w w s)
(2) [lo:χo:pe:di] (s s s s)

Perceptie van een toontaal

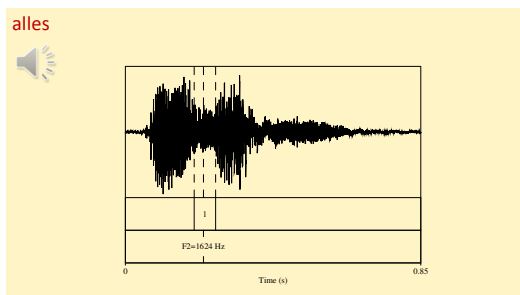
Measuring the force of articulation: 15. Timbre: Intervocalic Laterals

	Clear l	Dark l
Dutch		vallen
English		falling
German	fallen	
French	metallic	

The difference between clear l and dark l
(Recasens & Espinosa, 2005; Cox, 2008)

- Clear /l/: F1=200-400 F2=950-1500
- Dark /l/: F1=350-550 F2=650-850

Measuring the force of articulation: 15. Timbre: Clear and Dark Laterals



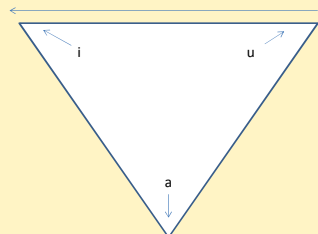
Measuring the force of articulation

- This set of parameters SPILT provides an instrument to measure the degree of fortition and segmentation

	Stage 1	Stage 2	Stage 3	Etc.
Parameter 1	[Line graph showing a curve that starts high, dips, and then rises]			
Parameter 2	[Line graph showing a curve that starts high, dips, and then rises]			
Parameter 3	[Line graph showing a curve that starts high, dips, and then rises]			
norm	[Horizontal line]			
Etc.	[Horizontal line]			

Measuring the force of articulation & OT

VB. van een conflict: KENMERK 1: als FAS spreker hyperarticuleert verwacht je een /u/ met een lagere F2



Measuring the force of articulation & OT

VB. van een conflict: KENMERK 2: als FAS meer fortitie kent verwacht je een hogere F2 in de vocaal direct na de plofklank:

The relative fortition of a consonant can be determined by looking at the F2 of the following vowel e.g. the difference in force of articulation of plosives: Fortition causes a higher F2 in the following vowel

- Verskil in parameterinvloed kan uitgedrukt worden in OT

Conclusion

- Further research:** Is this lack of binding typical for all cases of FAS?
- Hypothesis:** FAS is a special form of AoS
- Falsification:** If tone/syllable-timed language speakers are perceived as stress-timed language speakers or e.g. German/French speakers are perceived as speaking with a Dutch/English accent

Criteria Wetenschappelijke Theorie

- Karl Popper** (Wikipedia):
 - It is easy to obtain confirmations, or verifications, for nearly every theory — if we look for confirmations.
 - Confirmations should count only if they are the result of risky predictions; that is to say, if, unenlightened by the theory in question, we should have expected an event which was incompatible with the theory — an event which would have refuted the theory.
 - Every "good" scientific theory is a **prohibition**: it forbids certain things to happen. The more a theory forbids, the better it is.

Summary published FAS cases

Edwards, Patel and Pople (2005)

- Monrad-Krohn* (1947): Norwegian to German
- Whitty* (1964): English to German
- Schiff et al.* (1983): Portugese to Chinese
- Blumstein et al.* (1987): American to French
- Ingram et al.* (1992): Australian to Asian
- Moonis et al.* (1996): American to French
- Gurd et al.* (2001): English to French
- Coelho and Robb* (2001): American to French
- Hall et al.* (2003): American to French
- Coughlan et al.* (2004): Irish to French

Hierna de volledige set SPILT parameters

Measuring the force of articulation Main Parameters

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Measuring the force of articulation 1. Speech Rate

- Speech rate can be measured as number of **words per minute** (norm: 180-200 words per minute) (Klatt, 1987) Or **as number of syllables per second** (norm 5 syllables per second) (Verhoeven, De Pauw & Kluets, 2004)

Fast speech is characterized by lenition processes
Lower rates involve more fortition

We expect FAS speech to be slower than normal speech

Measuring the force of articulation: 2. Hyperarticulation

FAS has characteristics of hyperarticulation

Measuring the force of articulation 3. Alignment

- **Alignment:** The clear segmentation of vowels, consonants and syllables in FAS speech seems to be reflected in the intensification of domain boundaries:
- Boundaries of higher phonological domains, such as the end of a prosodic word or a phonological phrase, are marked by means of **lengthening** of or a **higher pitch** on domain final syllables, i.e. ways to intensify the prominence of the **domain edges**

Measuring the force of articulation 4. Pitch

- **Mean pitch** can be measured
 - Fortis speech has a higher pitch
No norm; but it enables to compare speech in different stages of therapy

Measuring the force of articulation 5. Intensity

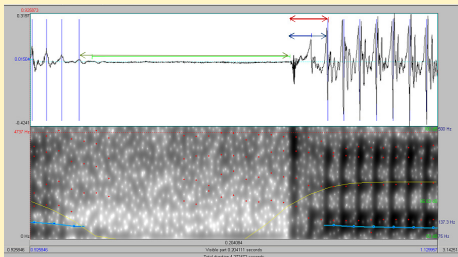
Problematic, because of variable distance between speaker and microphone

measure relative intensity:

Ik spreek **nu** het woord **boot** uit ("I now pronounce the word boat")

Measuring the force of articulation 6. Voice Onset Time (VOT)

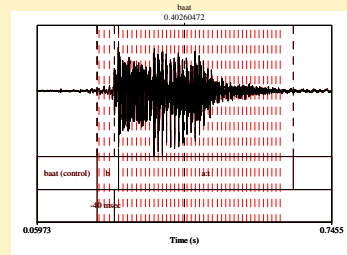
prevocalic: VOT = time from the start of the release to the start of the pulse
release duration = duration of the release (frication included, aspiration not)



groene lijn: duur van de occlusie; blauwe lijn: duur van de release; rode lijn: VOT)

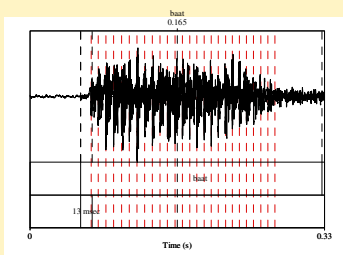
Measuring the force of articulation 6. Voice Onset Time

Baat realized by control speaker



Measuring the force of articulation 6. Voice Onset Time

Baat realized by FAS speaker



Measuring the force of articulation: 6. Voice Onset Time

Negative V.O.T.

< 0 sec

Short Lag

between 0 and 35 msec.

Long Lag

> 35 msec.

(W.Jansen, 2004. However cf. Auzou et al, 2000)

Dutch:

bek

pek

kast

English:

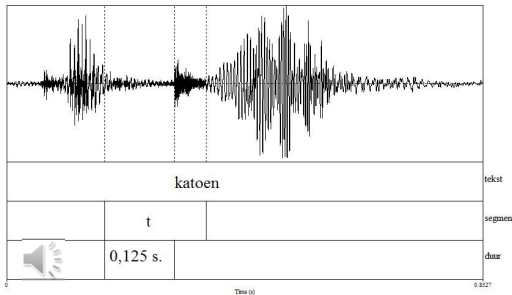
back

pack

German:

Kast

Measuring the force of articulation 7. Occlusion



Measuring the force of articulation 7. Occlusion

- Gillis & Verhoeven(2000):
 - 836 observations of occlusions
 - 77,13 ms / 78,85 ms
- Occlusion duration FAS: 149 - 184 ms

Measuring the force of articulation 8. Release Duration

- Alphen & Smits (2004):
 - Mean release duration voiceless stops: 25.1 msec
 - Mean release duration voiced stops: 15.1 msec
- FAS:
 - Mean release duration voiceless stops: 41,9 msec
 - Mean release duration voiced stops: 19,4 msec

Measuring the force of articulation: 9. Intensity Extensive

Van Ommen et al (2011): **prevocalic**:

VOT = time from the start of the release to the start of the pulse

release duration = duration of the release (frication included, aspiration not)

release intensity = peak intensity of release, compared to peak intensity of the word 'nu' in the same sentence

rise = rise of the vowel, from end of release to peak intensity - 10%

Measuring the force of articulation: 9. Intensity Extensive

Van Ommen et al (2011): **intervocalic**:

release duration = duration of the release (frication included)

release intensity = peak intensity of release, measured from above 500 hz (so excluding intensity of voice), compared to peak intensity of the word 'nu' in the same sentence

rise = rise of the postconsonantal vowel, from end of release to peak intensity - 10%

occdur = duration of the occlusion - release. so: duration of 'silent interval' (with and without voicing)

vowdur = duration of the preconsonantal vowel, from start of pulse till start of silent interval, excluding postaspiration

decay = decay of the preconsonantal vowel, from peak intensity -10% to lowest intensity +10% -> postaspiration included, seen as preaspiration is automatically included in rise as well.

intocc = mean intensity of the silent interval - occlusion, compared to the mean intensity of the 'nu' word.

Measuring the force of articulation: 10. Segment Duration

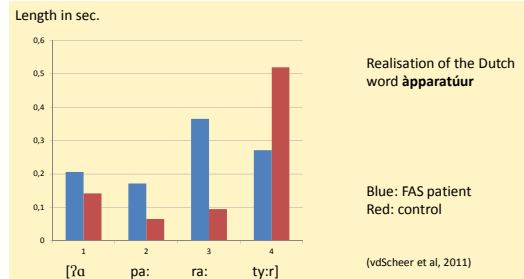
- **Segment length** can be measured, e.g. in order to compare the difference in duration between tense and lax vowels and schwa

We expect the duration difference between tense and lax vowels (and schwa) to be smaller in FAS speech.

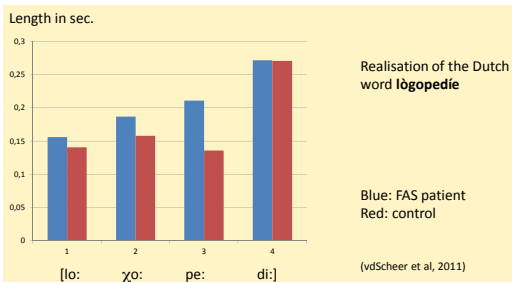
Measuring the force of articulation: 11. Isochrony Syllables

- Ratio between length stressed and unstressed syllables can be measured
 - In normal stress-timed speech stressed syllables are longer than unstressed ones
 - Dellwo (2003): syllable-timed languages: length syllables 1:1
 - stress-timed languages: distance stressed syllables 1:1
 - Expectation: Syllables are more isochronous in FAS speech
 - Expectation: Differences in length between stressed and unstressed syllables diminish in FAS speech

Measuring the force of articulation: 11. Isochrony Syllables



Measuring the force of articulation: 11. Isochrony Syllables



Stress-timed vs Syllable-timed

- Bounded feet (Dutch):

(o no)_Σ (ma to)_Σ (pee)_Σ

- Unbounded feet (French):

(o no ma to pee)_Σ

Stress-timed vs Syllable-timed

- In syllable-timed rhythm the syllables recur at equal intervals of time, they are *isochronous* (Abercrombie (1967))
- Distinction syllable-timed – stress-timed criticized: (Roach, 1982; Liberman, 2008)

Rather lack of vowel reduction than isochrony of duration

Stress-timed vs Syllable-timed

- Distinction syllable-timed – stress-timed criticized: (Roach, 1982; Liberman, 2008 a.o.)
- *Cauldwell (2002)* → It is not possible to divide languages into either 'syllable-timed' or 'stress-timed' categories
- *Ramus et al (1999)* → Vowel reduction: in stress-timed languages, unstressed syllables usually have a reduced vocalic system (sometimes reduced to just one vowel, schwa), and unstressed vowels are consistently shorter, or even absent
- *Roach (1982)* → There is no language which is totally syllable-timed or totally stress-timed – all languages display both sorts of timing

Stress-timed vs Syllable-timed

Lieberman (2008) disagrees with Abercrombie

Duration English Syllables depends on:

- The time it takes to make the articulatory movements (it takes longer to make a low vowel than it takes to make a high vowel)
- Pre-boundary lengthening
- Stress on certain syllables
- Speech rate
- The time it takes to make and realize a message (e.g. slowing down or pausing to plan the message)

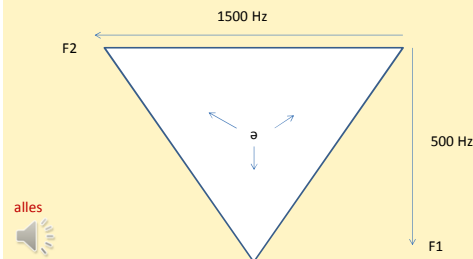
Measuring the force of articulation: 12. Vowel Reduction

- Full vowels tend to be reduced to **schwa** in **unstressed syllables**. The norm of formant values for schwa is: F1=500 Hz; F2=1500 Hz.

Expectation: Less vowel reduction in FAS speech because of the careful pronunciations. The formant values of vowels in unstressed positions can be measured and compared to the norm values of schwa. We expect more full vowels in FAS speech

Measuring the force of articulation: 12. Vowel Reduction

FAS has less vowel reduction in unstressed syllables



Stress-timed vs Tone language

- Example:

- (1) [lo:χəpədi] (s w w s)
 (2) [lo:χo:pədi] (s s s s)

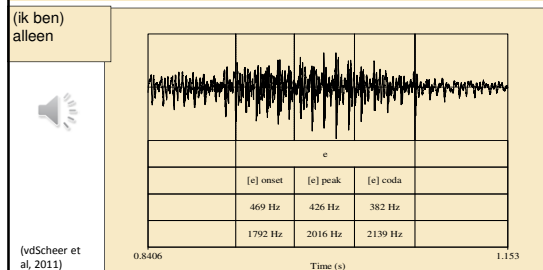
Measuring the force of articulation: 13. F2 post-stop Vowels:

The relative fortition of a consonant can be determined by looking at the F2 onset of the following vowel e.g. the difference in force of articulation of plosives: Fortition causes a higher F2 in the following vowel (Lindblom et al, 2007)

Locus equations: The F2 onset of a CV transition plotted against the F2 of the vowel midpoint

Measuring the force of articulation: 14: Stability of Vowels

Coarticulation control speaker:



Measuring the force of articulation: 14: Stability of Vowels

Coarticulation FAS speaker:

(ik ben) alleen

[?]	onset	[a]	[l]	[c]	[e] onset	[e] peak	[e] coda	[n]
				364 Hz	359 Hz	383 Hz		
				2151 Hz	2272 Hz	2239 Hz		

(vdScheer et al, 2011)

Measuring the force of articulation: 14: Stability of Vowels

Comparison control speaker – FAS speaker:

- Control speaker:
 - F1 difference beginning-end: 87 Hz
 - F2 difference beginning-end: 347 Hz
- FAS speaker:
 - F1 difference beginning-end: 19 Hz
 - F2 difference beginning-end: 88 Hz

Measuring the force of articulation: 14: Stability of Vowels

Realisation of the Dutch word **beet** 'bite'

Blue: FAS patient
Red: control

[e:] in beet at 5 steps

(vdScheer et al, 2011)

Measuring the force of articulation: 14: Stability of Vowels

Realisation of the Dutch word **boot** 'boat'

Blue: FAS patient
Red: control

[o:] in boot at 5 steps

(vdScheer et al, 2011)

Measuring the force of articulation: 15. Timbre: Clear and Dark Laterals

	Clear l	Dark l
Dutch		vallen
English		falling
German	fallen	
French	metallic	

The difference between **clear l** and **dark l**
(Recasens & Espinosa, 2005; Cox, 2008)

- Clear /l/: F1=200-400 F2=950-1500
- Dark /l/: F1=350-550 F2=650-850

Measuring the force of articulation: 15. Timbre: Clear and Dark Laterals

alles

F2=1624 Hz

Time (s)