Obstruent production by Greek-speaking children with atypical phonological development

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Phonological development

- Children's production patterns are influenced by several parameters including:
- Universal constraints on perception and production
  - Sounds that are more difficult to produce are acquired later
  - For example, fricatives vs stops
- Phoneme and phoneme sequence frequency
  - Frequency of sound in ambient language facilitates early acquisition

Phonological development

Common error patterns

- Substitution
  - Stopping ['tupa] for /'supa/
  - Fronting ['tola] for /'kola/
  - Liquid deviation [ne'lo] for /ne'ro/
- Affecting syllable structure
  - weak syllable deletion [pa'to] for /pago'to/
  - final consonant deletion ['kokora] for /'kokoras/
  - Reduplication [ma'mame] for /ki'mame/
  - Reduction of consonant clusters ['piti] for /'spiti/
- Assimilation
  - Consonant harmony [da'daki] for /tsa'daki/
  - Prevocalic voicing ['bodi] for /'podi/

Atypical phonological development

- persisting error patterns
  - patterns continue after a certain age, e.g. consonant harmony after 4
- chronological mismatch
  - advanced patterns co-occur with early ones, e.g. consonant harmony co-occurs with consonant clusters
- variable error patterns
  - different errors for the same structures, e.g. final consonant deletion or substitution of final consonant by glottal stop
- systematic sound preference
  - e.g. [t] for /θ/, /f/, /s/, S/
- atypical error patterns
  - e.g. gliding of fricatives, frication of stops, initial consonant deletion, etc.

Aims

- investigate error patterns in obstruent production and s stop & stop s consonantal sequences produced by children with atypical phonological development
- examine the effect of word frequency in production
- look into the influence of the ambient language in the error patterns observed

Acquisition of Greek consonants and clusters

75%	t	k	kj	s	❁	ts
PAL (1995)	2;6-3;0	2;6-3;0	2;6-3;0	3;6-4;0	4;0-4;6	4;6-5;0

75%	sp	st	sk	ps	ks
PAL (1995)	3;6-4;0	4;0-4;6	4;0-4;6	4;0-4;6	4;0-4;6

PAL: Panhellenic Association of Logopedists (1995)

Acquisition of Greek

(source: PAL)

2;6-3;0:
fronting, backing, stopping, consonant harmony, consonant deletion, final consonant deletion, cluster reduction, metathesis/migration

3;0-3;6:
consonant deletion, fronting and backing are declining

3;6-4;0:
consonant harmony and stopping are declining

4;0-5;0:
syllable reduction, metathesis/migration and final consonant deletion are declining

Acquisition of clusters

- follows acquisition of singletons
- /s/-stop clusters before stop-/s/ clusters
- some error patterns in TD children
  - deletion of first member of the cluster
    - /s/ more often in /s/-stop clusters.
    - stop more often in stop-/s/ clusters.
  - most frequent substitution for /s/-stop clusters is a stop
  - most frequent substitution for /ps/ and /ks/ is a fricative or other stop-fricative sequence [ts]

Syrika et al (2007)

Speech material

- obstruents /t, k, kj, s, θ, ts/
- s-stop and stop-s sequences
  - /sp, st, sk, ps, ts, ks/
  - recorded for one child only
- word-initial position
- vowel context: /i, e, a, o, u/
- real words:
  - familiar to the children
  - 2-3 syllables long
  - word initial stress
  - picturable
- nonsense words (for singleton obstruents)
  - 3-4 syllables long
  - anti-penultimate stress

Subjects

- 3 Greek–speaking children with atypical phonological development
  - one girl (3;3)
  - two boys (3;6 and 4;3)
- normal hearing
- normal IQ

atypical phonological development:
- based on parent and teacher report
- based on informal observation at time of testing
- based on opinion of a Greek speech-language pathologist who listened to the recordings

Subjects

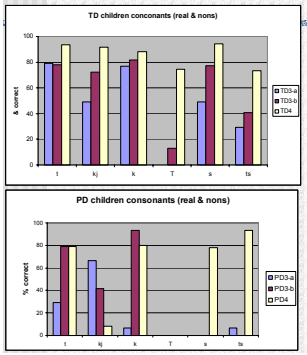
- 12 Greek-speaking children with typical phonological development
  - three groups of 4 children matched in age with children with PD
  - normal hearing
  - normal IQ
  - age-appropriate speech and language development, based on parent and teacher report

Procedure

- picture and digitized recording of each stimulus presented simultaneously
- children repeated the word they heard
- children's repetitions were digitally recorded

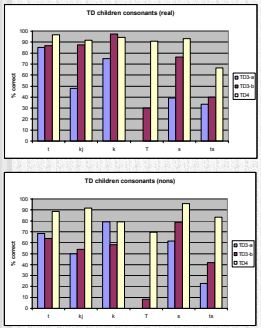
- native speaker transcription using PRAAT
- two native speakers transcribed the PD data
- initial consonant and cluster labelled
  - correct-incorrect
  - if incorrect, phonetic transcription of perceived error
  - agreement between transcribers was good, differences were resolved by discussion

Consonant production: TD children



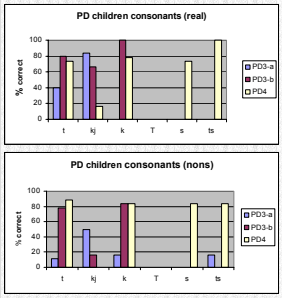
- accuracy increases with age
- [t] and [k] above 75% correct for all groups
- younger children
  - most errors for [θ] and [ts]
- PD children
  - Incorrect production of [θ]
  - Incorrect production of [s], [ts] for younger children
  - Individual variation
    - Incorrect production of stops /t, k/ for PD3-a
    - Incorrect production of [kj] for PD-4

Consonant production: TD children



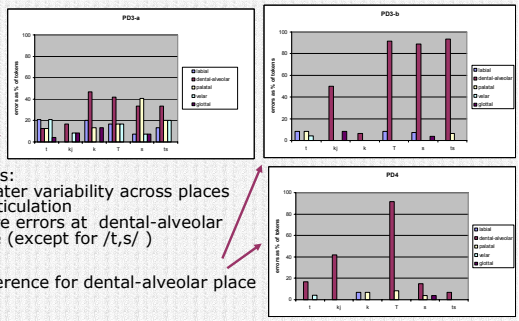
- Production in real vs nonsense words
  - More correct productions in real words for most consonants for all children groups

Consonant production: PD children



- Production in real vs nonsense words
  - variability among consonants and children
  - more correct productions for [kj] in real words for all children

Error analysis



Errors:
•greater variability across places of articulation
•more errors at dental-alveolar place (except for /t,s/)

Preference for dental-alveolar place

Variability in production

- Interesting variability for correct and incorrect productions
  - [t], [t^h], [t^s], [t’]
  - [k], [k^h], [k^x], [k’]
  - [c], [cç]
  - [s], [s’], [ʃ]
  - [ts], [ts’], [tʃ], [tɕ]
- Coarticulatory effects:
  For example:
  - retracted /s/ in back vowel environment
  - palatalised /s/ in front vowel environment

Error patterns – child PD3-a

Incorrect production (100%) of [θ, s,] and [k], [ts] (real words)

- /t/:
  - backing [kj], [k]
- /k/, [kj]:
  - fronting [t, p]
  - backing [h]
- /θ/:
  - stopping, backing [t, s, tʃ, k, kj]
- /s/
  - backing, stopping [k, kj, h, t]
- [ts]:
  - stopping, backing [t, k, kj]
- Consonant harmony: [papuzi] for [karpuzi], [kjakja] for [kialja]
- Migration: [puta] for [supa]
- Loss of contrasts: [Kjita] for [tsisa], [kjalja] for [salja]

Error patterns – child PD3-b

Incorrect production of [θ, s, ts] (100%)

- /t/:
  - backing [k, kj]
- /k/:
  - fronting [t] (nons words, one error)
- /kj/:
  - fronting [t]
  - backing [k, h]
- /θ/:
  - stopping [t]
- /s/
  - stopping [t, ts]
  - backing [h]
- [ts]:
  - Stopping, backing [t, kj]
- Consonant harmony: [dadaki] for [tsadaki], [ðiðeo for siðero], [dedo] for [ðendro]

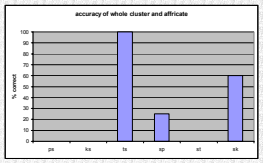
Error patterns – child PD4

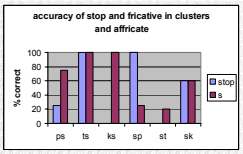
Incorrect production (100%) of [θ] and [kj] (except for one token in nonsense words)

- /t/:
  - backing [k] (nonsense words, one token)
- /k/:
  - fronting [p, kj]
  - metathesis, epenthesis
- /kj/:
  - fronting [t]
- /θ/:
  - stopping, backing [t, ts, s]
- /s/
  - stopping [t, ts]
  - backing [ɕ]
- [ts]:
  - stopping [t] (nonsense words, one token)

Consonant harmony: [tsatsi] for /taksi/, [tsotso] for /tokso/, [teto] for /kendro/, [tsulitsas] for /turistas/

Cluster production – PD4





Correct production of [ts]
Incorrect production of [ps, ks, st]

preference for affricate production

Cluster production

- no ps, ks, st clusters at 4;3 (0%)
- [ts] acquired (100%)
- [ts] substitutes for
  - [ps], [ks],
  - [st],
  - [sk] in front vowel environment
- [p] and [k] (in certain contexts) correct in s-stop clusters [sp, sk]
- not in target stop-s clusters [ps, ks] (produced [ts])
- /s/ more correct in target [ps, ts, ks] (all produced [ts]) than s-stop clusters

Summary

The PD children of this study show instances of:

- persisting error patterns,
  - e.g. consonant harmony after 4 (PD4)
- chronological mismatch,
  - e.g. production of affricate but not [kj] after 4 (PD4)
- variable error patterns,
  - e.g. fronting and backing of [k], [k] or [t] for /ts/ (PD3a)
- sound preference,
  - /t/ for [θ, s, ts, k] (PD3-b), /t/ for [θ, s, ts, kj] (PD4),[ts] for [ps, ks, st sk (certain contexts)] (PD4)
- atypical error patterns,
  - e.g. glottal replacement (PD3-a, PD3-b)

Conclusions

Children show some error patterns that are:

- common across languages (e.g. English, German, Cantonese, Turkish, etc)
  - fronting, stopping, consonant harmony
- not common across languages
  - backing, glottal replacement

- glottal replacement can be considered a simplification error
- backing characterises atypical phonological development in some languages such as English, but
- has been observed for other languages with rich systems of velars and high frequency of occurrence, e.g. Vietnamese, Japanese

- Effect of word frequency (real vs nonsense words) on accuracy is not systematic

- Results point towards the importance of cross-linguistic work in typical and atypical phonological development