Pathophysiology of dysarthrias

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(aknowledgements: P. Auzou)

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The Mayo clinic team approach

Darley et al 1969, 1975

- Concerning dysarthrias, pathophysiology may represent one among the structural elements of classification (Auzou 2007)
- From the anatomophysiology of the vocal tract, it is needed:

  - first: to identify the functional level of any disorder (respiratory, phonatory, velopharyngeal, articulatory)

  - second: to describe the symptomatic (perceptual) level on the speech production (weakness, slowness, spasticity, ataxia….)

The Mayo clinic team approach

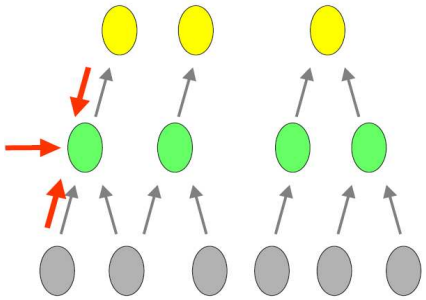
Darley et al 1969, 1975

- Different diagnoses may share some pathophysiological mechanisms, and some perceptual disorders may result from multiplex pathophysiology: perceptual clusters

Perceptual level

Pathophysiology

Diagnosis



The Mayo clinic team approach

Darley et al 1969, 1975

- 7 groups of 30 patients, each representing 1 pathology (bulbar PNS for flaccid, pseudo-bulbar CNS for spastic, cerebellar for ataxic, parkinsonism for hypokinetic, choreo-athetosis and dystonia for hyperkinetic, ALS for mixed)
- Corpus: reading of « Grandfather passage » with cotation of 38 criteria (from 1 to 7) of 7 categories (pitch, SPL, vocal quality, respiration, prosody, articulation and global) by 3 listeners
- Selection of the 24 criteria with mean >1.5 and of the most impaired for defining perceptual clusters characterising each of 7 dysarthria types

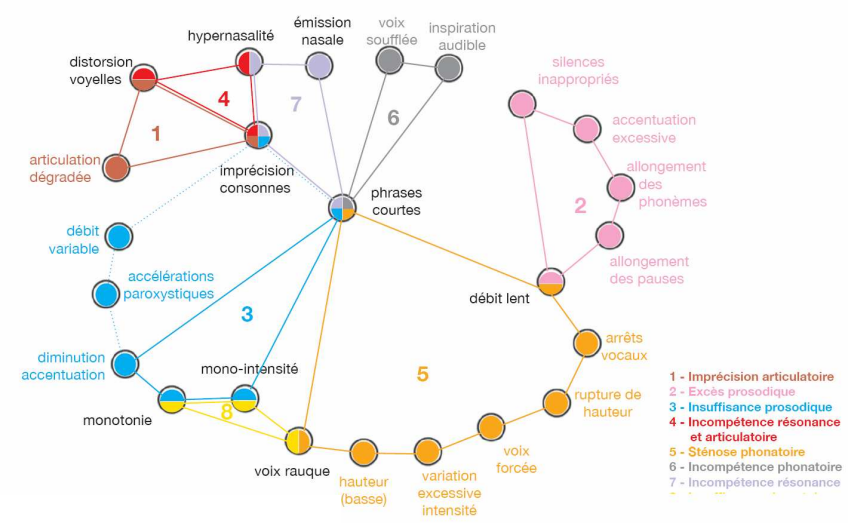
Darley perceptual criteria list

- 1. Hauteur
- 2. Rupture de hauteur
- 3. Monotonie
- 4. Tremblement vocal
- 5. Mono-intensité
- 6. Variation excessive d'intensité
- 7. Décroissance d'intensité
- 8. Instabilité de l'intensité
- 9. Intensité
- 10. Voix rauque
- 11. Voix humide
- 12. Voix soufflée (continu)
- 13. Voix soufflée (intermittent)
- 14. Voix forcée
- 15. Arrêts vocaux
- 16. Hypernasalité
- 17. Hyponasalité
- 18. Emission nasale
- 19. Inspiration-expiration forcées
- 20. Inspiration audible
- 21. Bruit en fin d'expiration
- 22. Débit
- 23. Phrases courtes
- 24. Augmentation du débit (segment)
- 25. Augmentation du débit (global)
- 26. Diminution de l'accentuation
- 27. Débit variable
- 28. Allongement des pauses
- 29. Silences inappropriés
- 30. Accélérations paroxystiques
- 31. Accentuation excessive
- 32. Imprécision des consonnes
- 33. Allongement des phonèmes
- 34. Répétition de phonèmes
- 35. Dégradations articulatoires
- 36. Distorsion des voyelles
- 37. Intelligibilité
- 38. Bizarrerie

The Mayo clinic team approach

Darley et al 1969, 1975

The different perceptual clusters



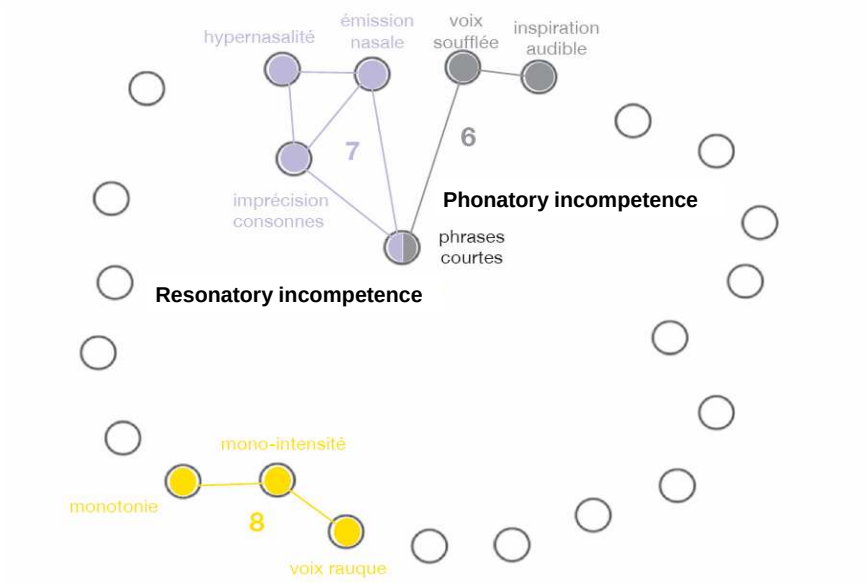
Main disorders/ dysarthria type

	Flaccid	Spastic	Ataxic	Hypokinetic	Hyperkinetic (choreic)	Hyperkinetic (dystonic)	Mixed
Hauteur		X		X			X
Rupture de hauteur		X					
Monotonie	X	X	X	X	X	X	X
Mono Intensité	X	X	X	X	X		X
Variation excessive d'intensité					X	X	
Voix rauque	X	X	X	X	X	X	X
Voix soufflée	X Continue	X Intermittente		X Continue			X Continue
Voix forcée		X			X	X	X
Arrêts vocaux						X	
Hypernasalité	X	X			X		X
Emission nasale	X						X
Inspiration audible	X						X
Débit		X	X			X	X
Phrases courtes	X	X			X	X	X
Diminution de l'accentuation		X		X	X	X	X
Débit variable				X	X		
Allongement des pauses			X		X	X	X
Silences inappropriés				X	X	X	X
Accélérations paroxystiques				X			
Accentuation excessive		X	X		X		X
Imprécision des consonnes	X	X	X	X	X	X	X
Allongement des phonèmes			X		X	X	X
Dégradations articulatoires			X		X	X	
Distorsion des voyelles		X	X		X	X	X

Perceptual clusters/dysarthria type

	Flaccid	Spastic	Ataxic	Hypokinetic	Hyperkinetic (Choreic)	Hyperkinetic (Dystonic)	Mixed
Imprécision articulatoire			X			X	
Excès prosodique		X	X		X	X	X
Insuffisance prosodique		X		X	X	X	X
Incompétence de la résonance et articulatoire		X			X		X
Sténose phonatoire		X			X	X	X
Incompétence phonatoire	X			X			X
Incompétence de la résonance	X				X		X
Insuffisance phonatoire et prosodique	X		X				

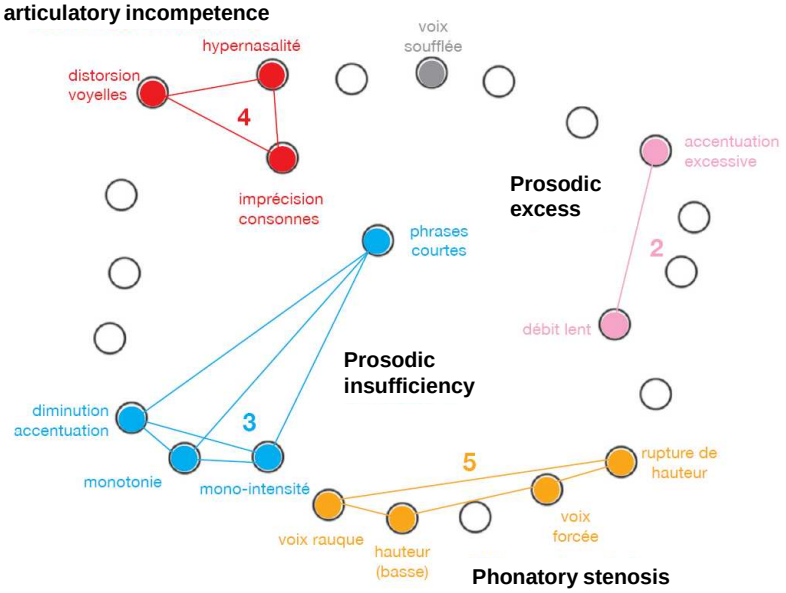
Flaccid dysarthria



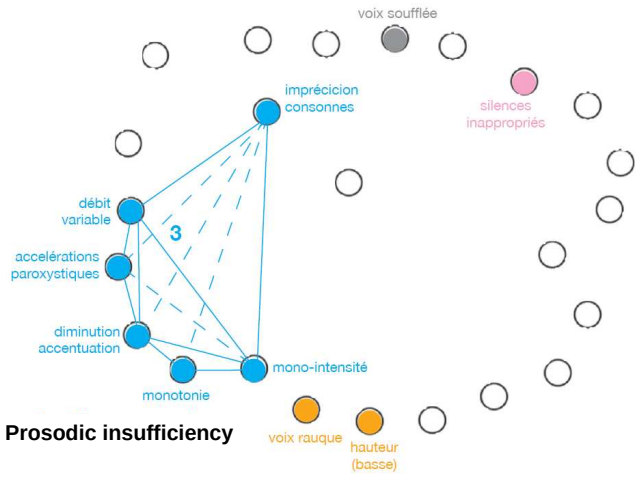
Phonatory and prosodic insufficiency

Spastic dysarthria

Resonatory and articulatory incompetence

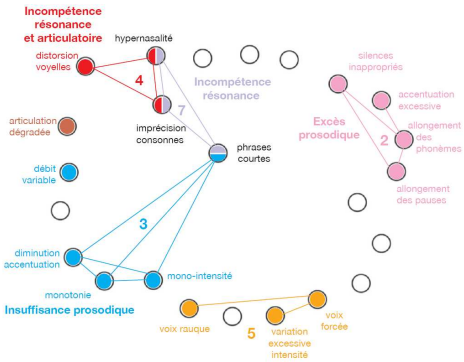


Hypokinetic dysarthria

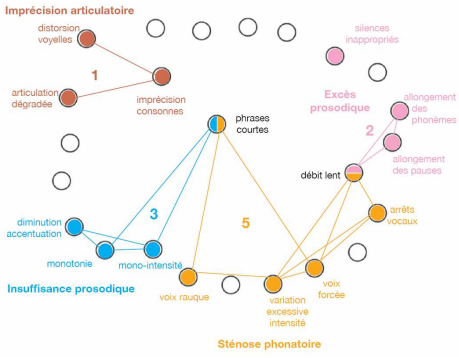


Hyperkinetic dysarthria

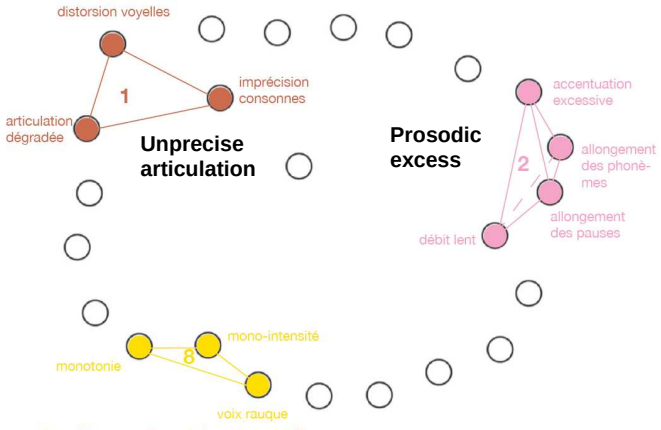
Choreic



Dystonic



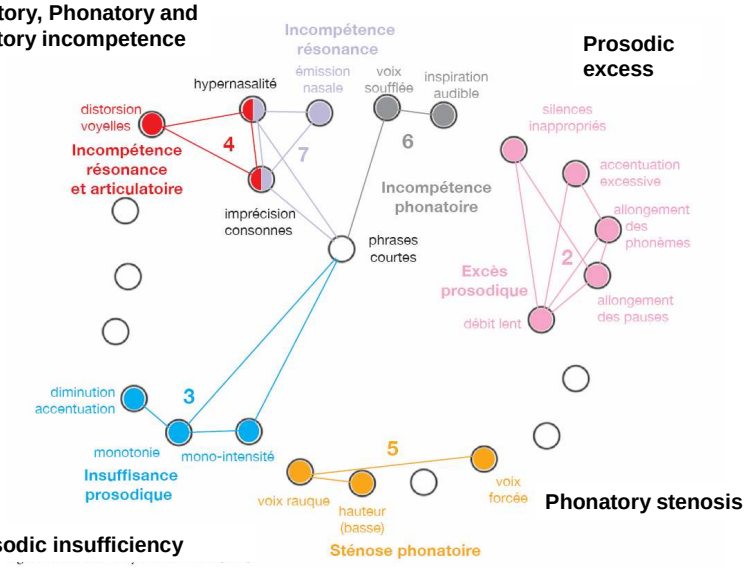
Ataxic dysarthria



Phonatory and prosodic insufficiency

Mixed dysarthria

Resonatory, Phonatory and articulatory incompetence



Prosodic insufficiency

Phonatory stenosis

Discussion

- This clinical (perceptual) approach, which is difficult to replicate, needs to be referred to the objective aspects of speech assessment (acoustics and aerodynamics).
- What is phonatory incompetence/ respiration, glottal leakage, pneumophonic coordination, control of laryngeal stability?
- What is prosodic insufficiency/ pitch and SPL modulation, rhythm and rate control?