Current Trends in the Assessment of CAS

Georgia Organization of School-Based SLPs

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NOTICE

- The use of cameras, audio recording devices, and/or video recording devices, including cellphones, is prohibited. Participants found recording audio or video of any portion of this session will be asked to leave immediately.

Disclosures

Nonfinancial: Ms. Caspari is a member of the Professional Advisory Council of Apraxia Kids for which she receives no complensation

Ms. Caspari donated videos for the DEMSS training tape and received no compensation.

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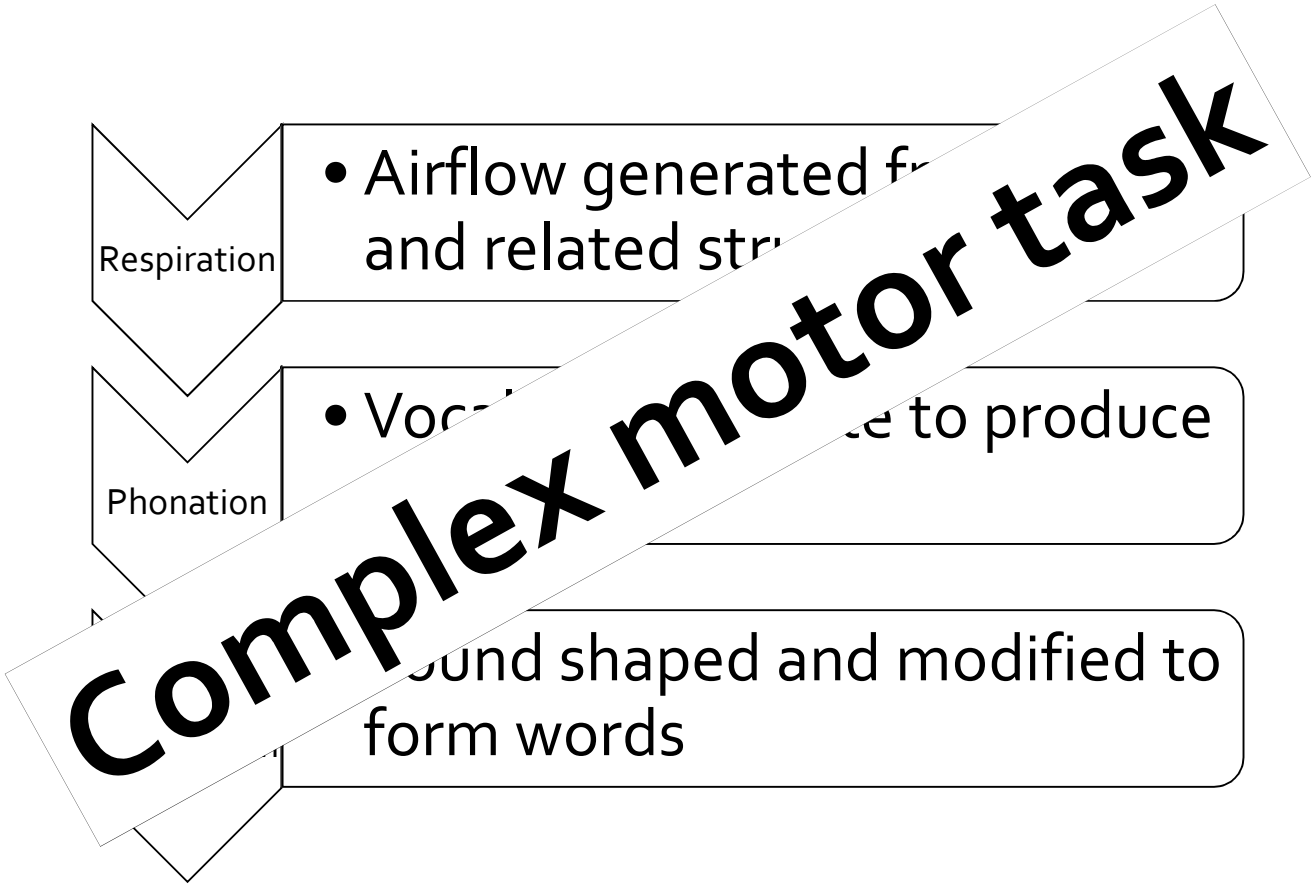
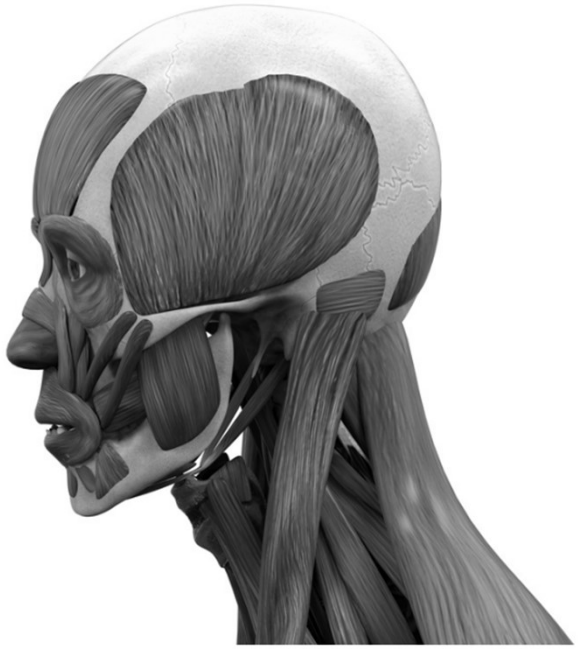
Overview

- Speech as a complex motor task
- CAS as a breakdown in speech motor skill
- Motor speech exam as a critical component to assessment when trying to rule out CAS
- Review of some tools for assessing motor speech skill
  - Dynamic Assessment – including the NEW Dynamic Evaluation of Motor Speech Skill (DEMSS)!
  - Syllable Repetition Task
  - Maximum Performance Tasks
  - Pause Marker Method
  - Adaptation of the Mayo 10

Speech Production

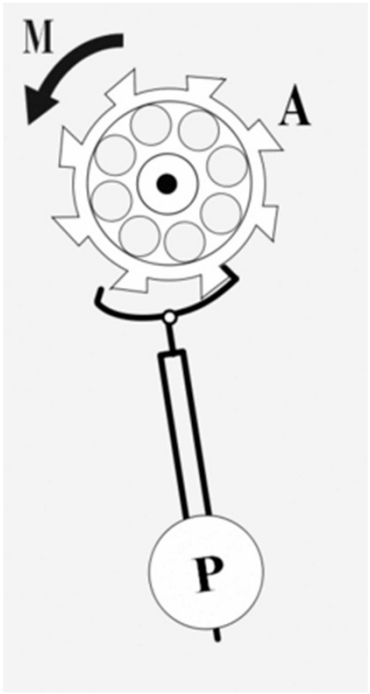


How many muscles and body parts?



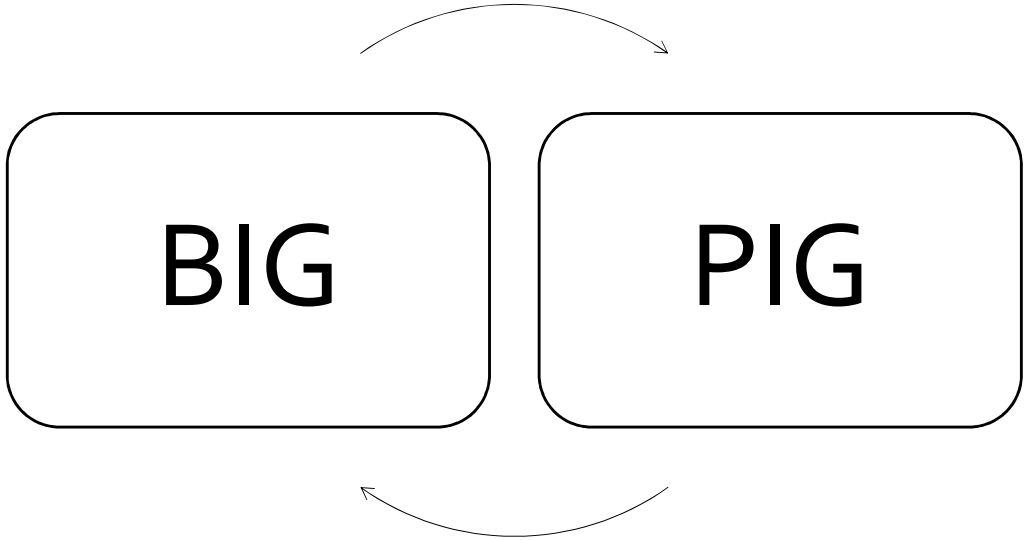
(Thelen, 1991)

How fast do they have to move when we speak?



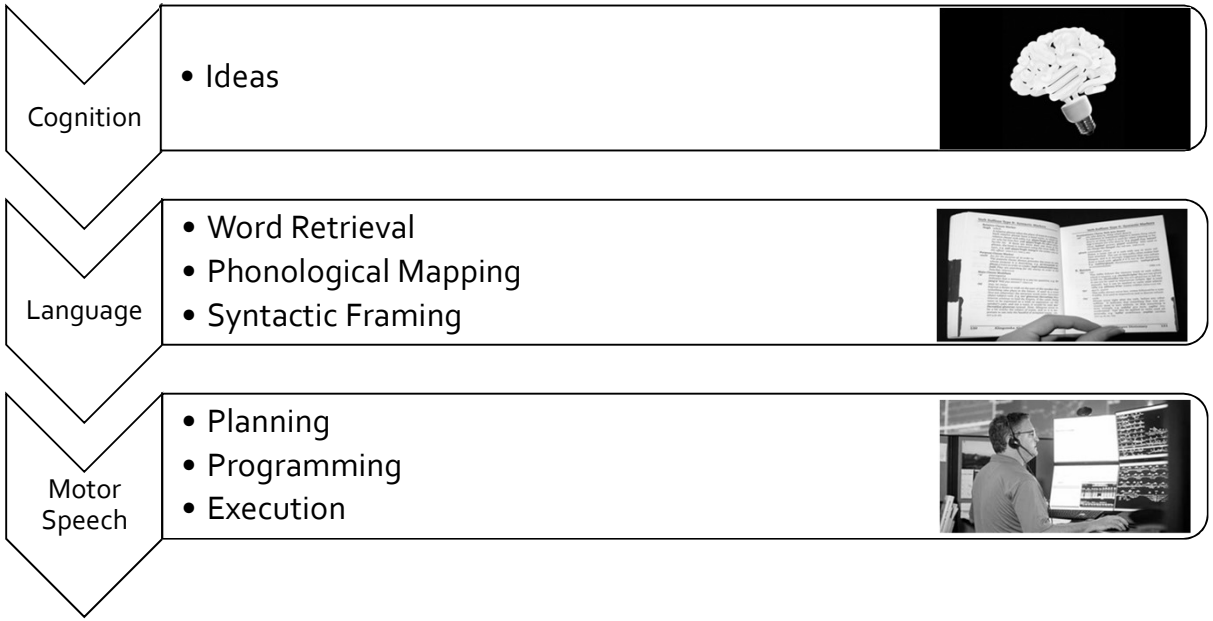
(Caruso & Strand, 1999)

How precise does it have to be?

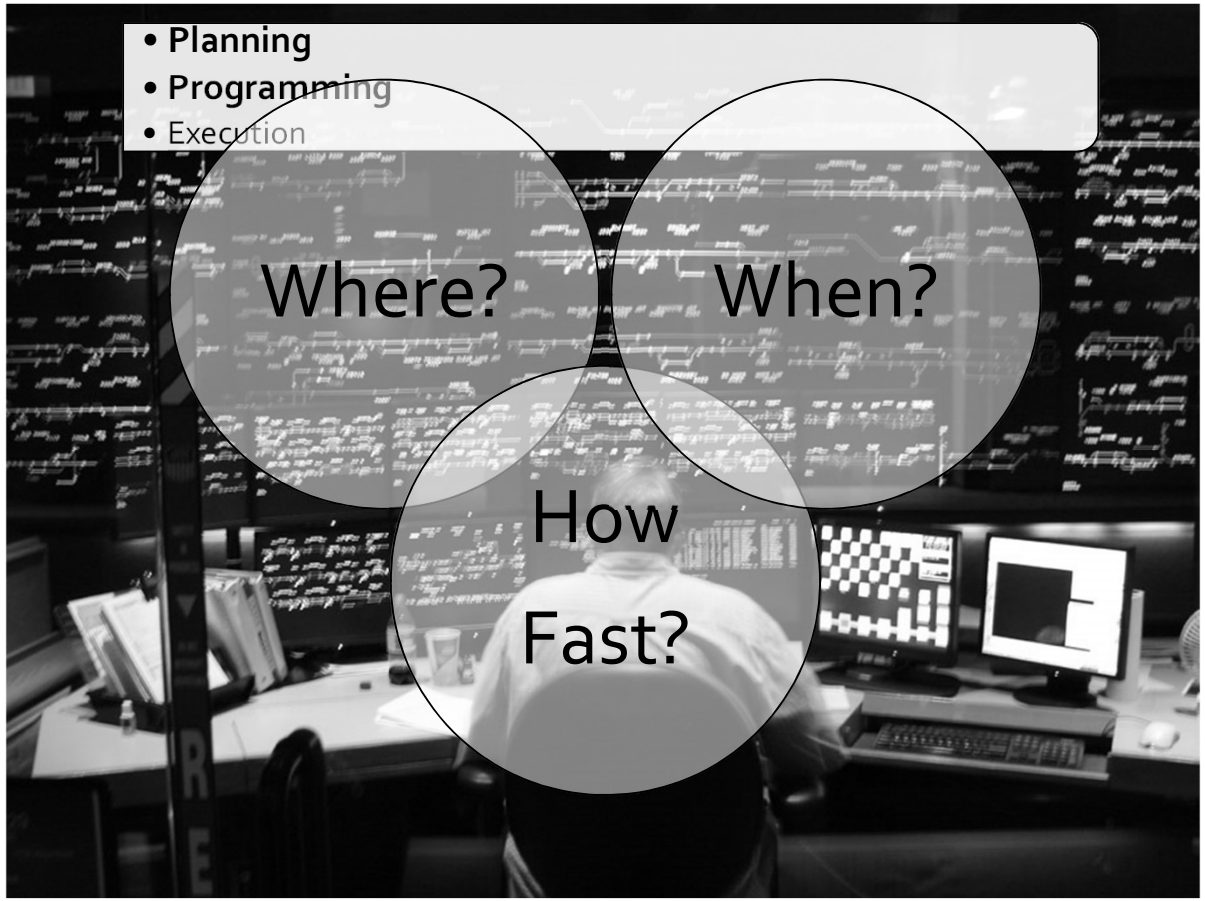


(Borden, 1984)

Model of Speech Production
How do we coordinate all these mvts?



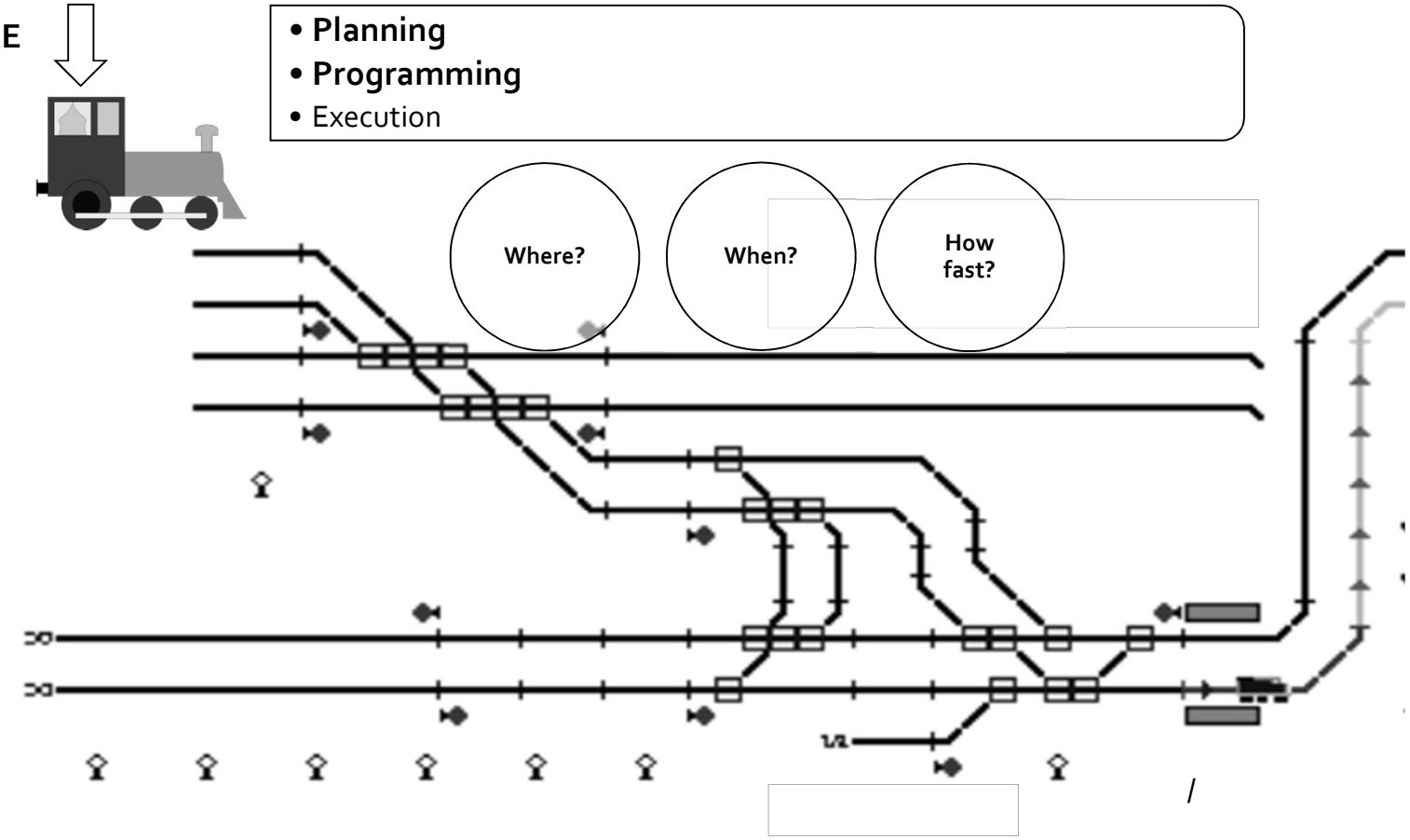
(Caruso & Strand, 1999)



Thank you to my students: Jackie Eisenberg, Lauren Firely, Maddie Kosce, and Lisa Mintzer

START HERE

- **Planning**
- **Programming**
- Execution



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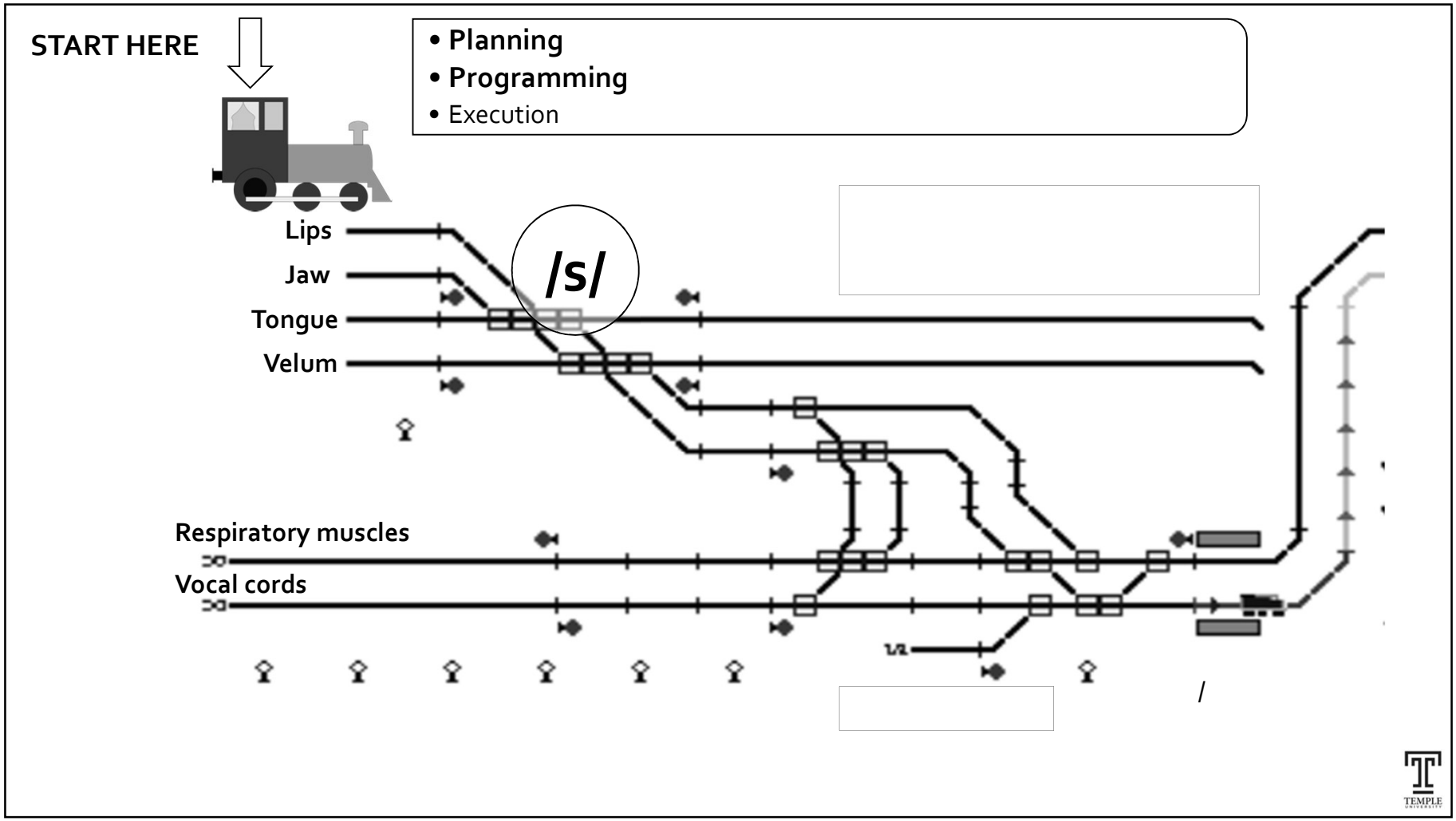

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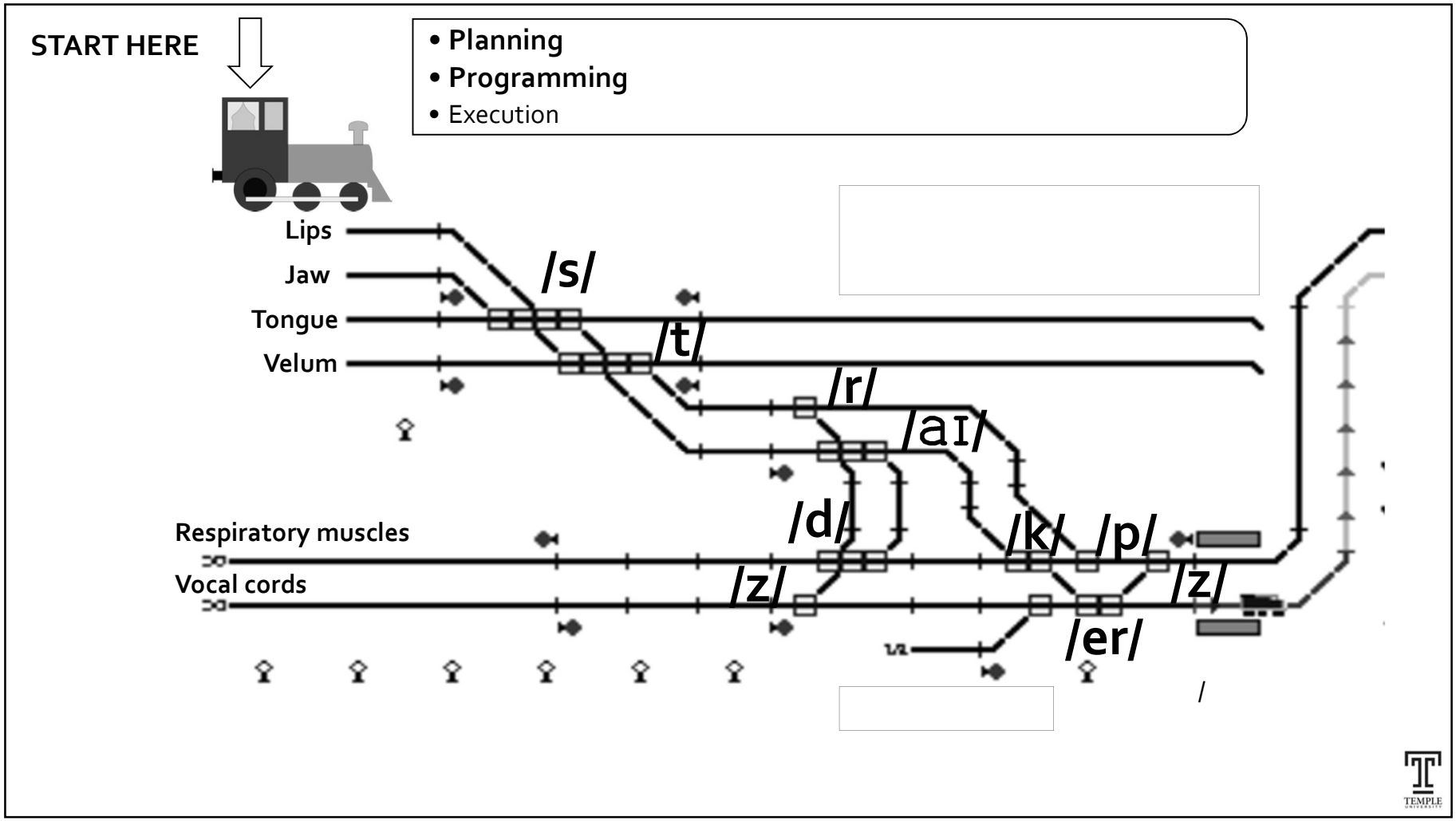

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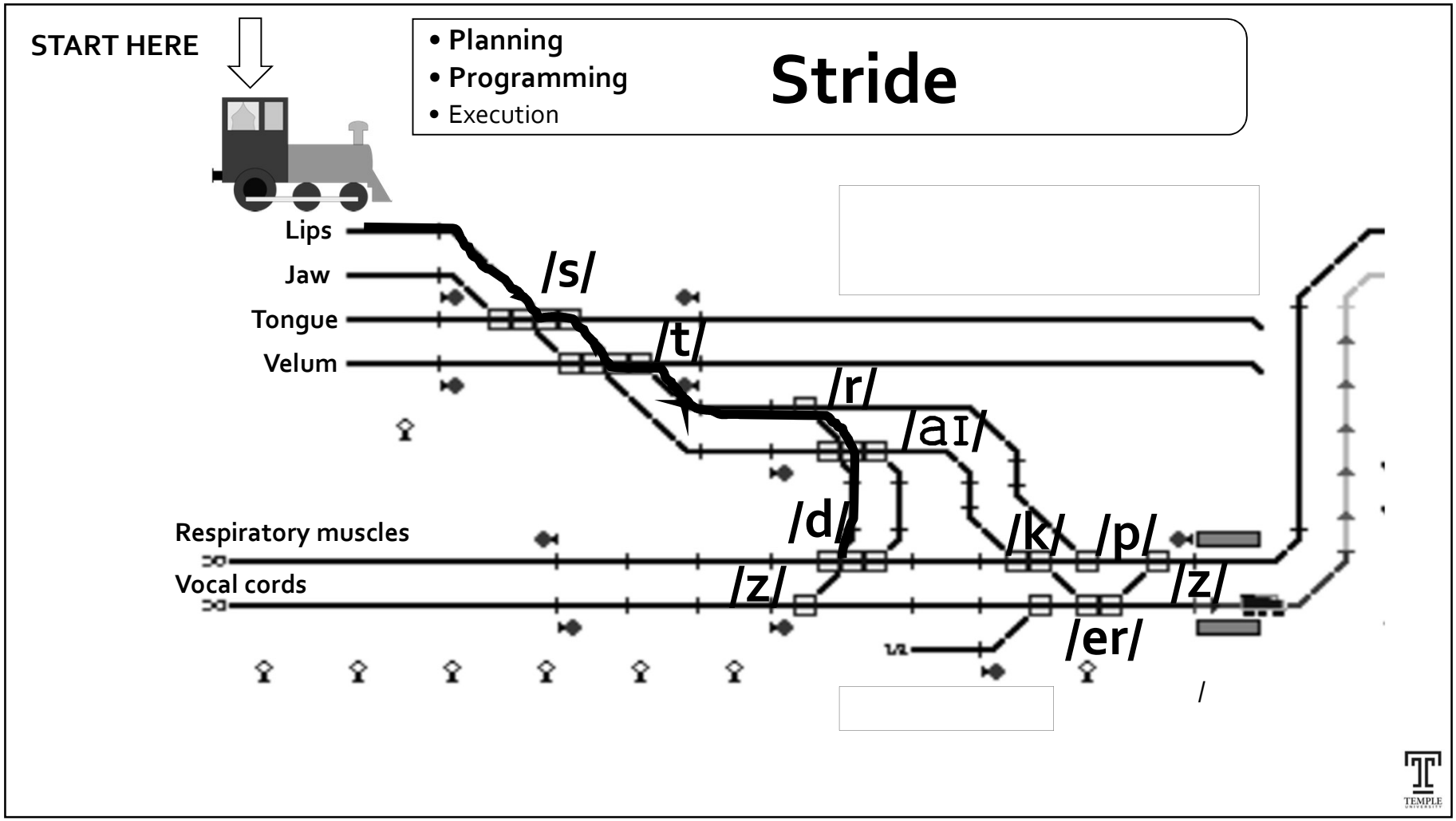

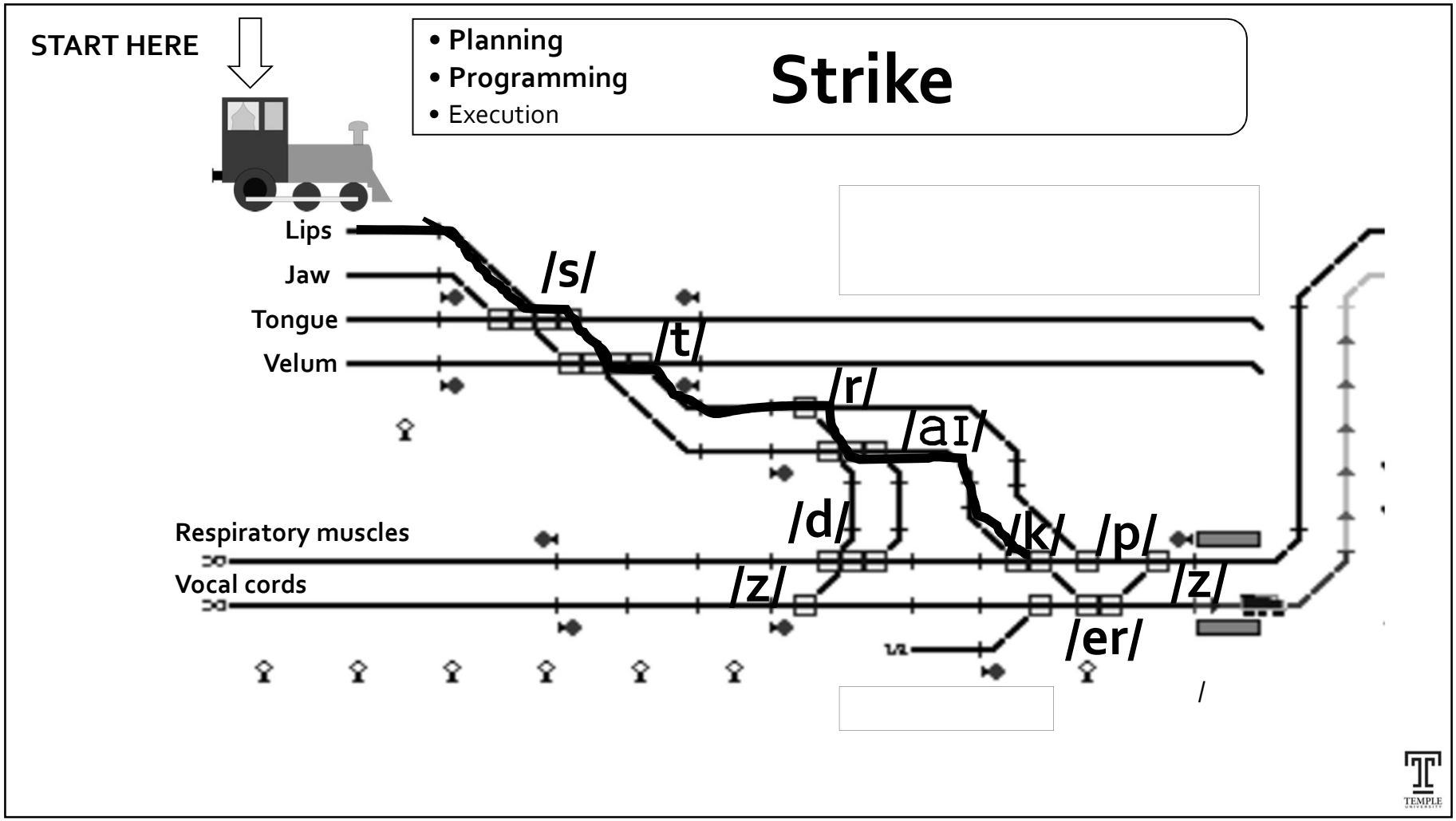

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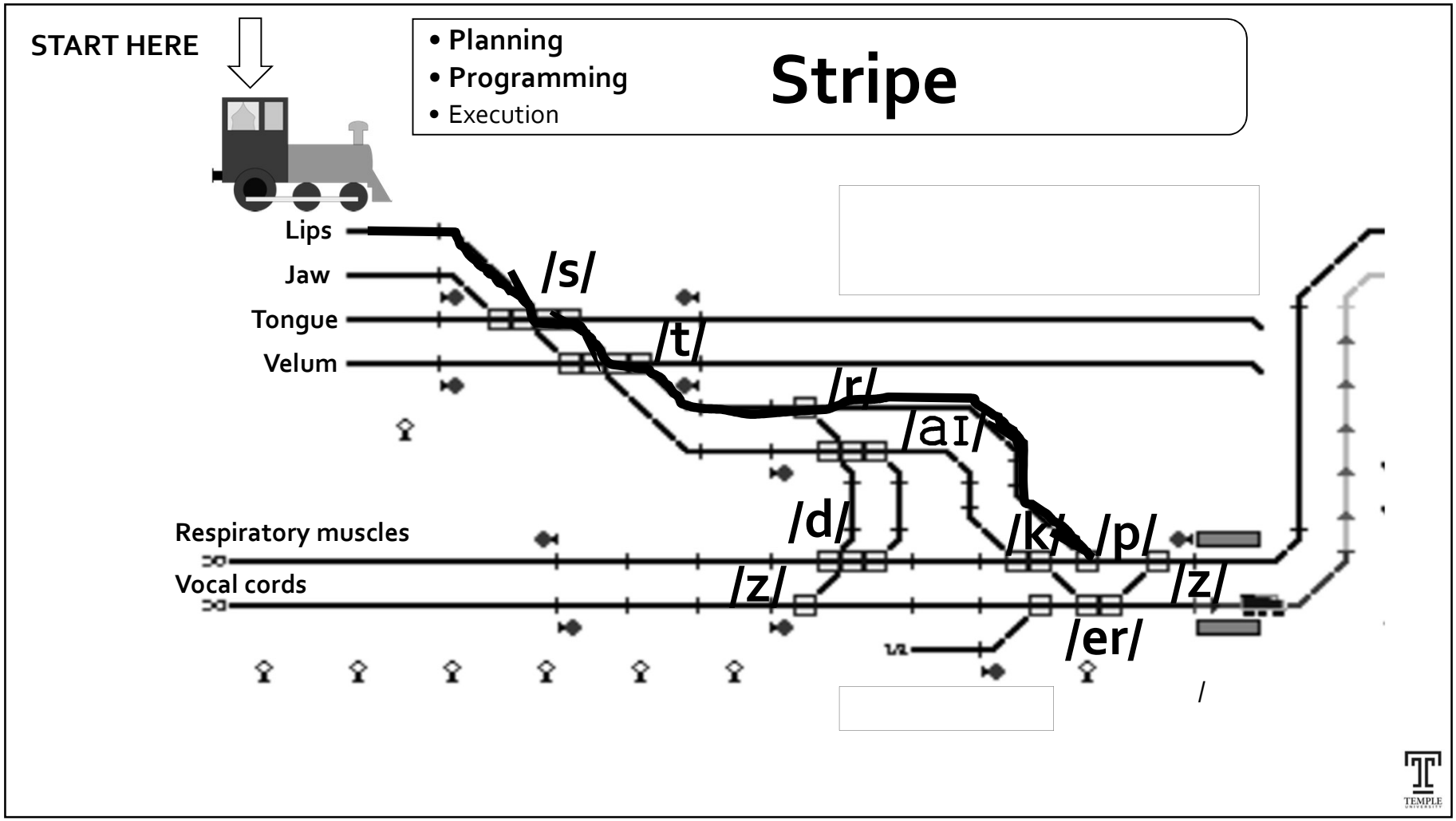

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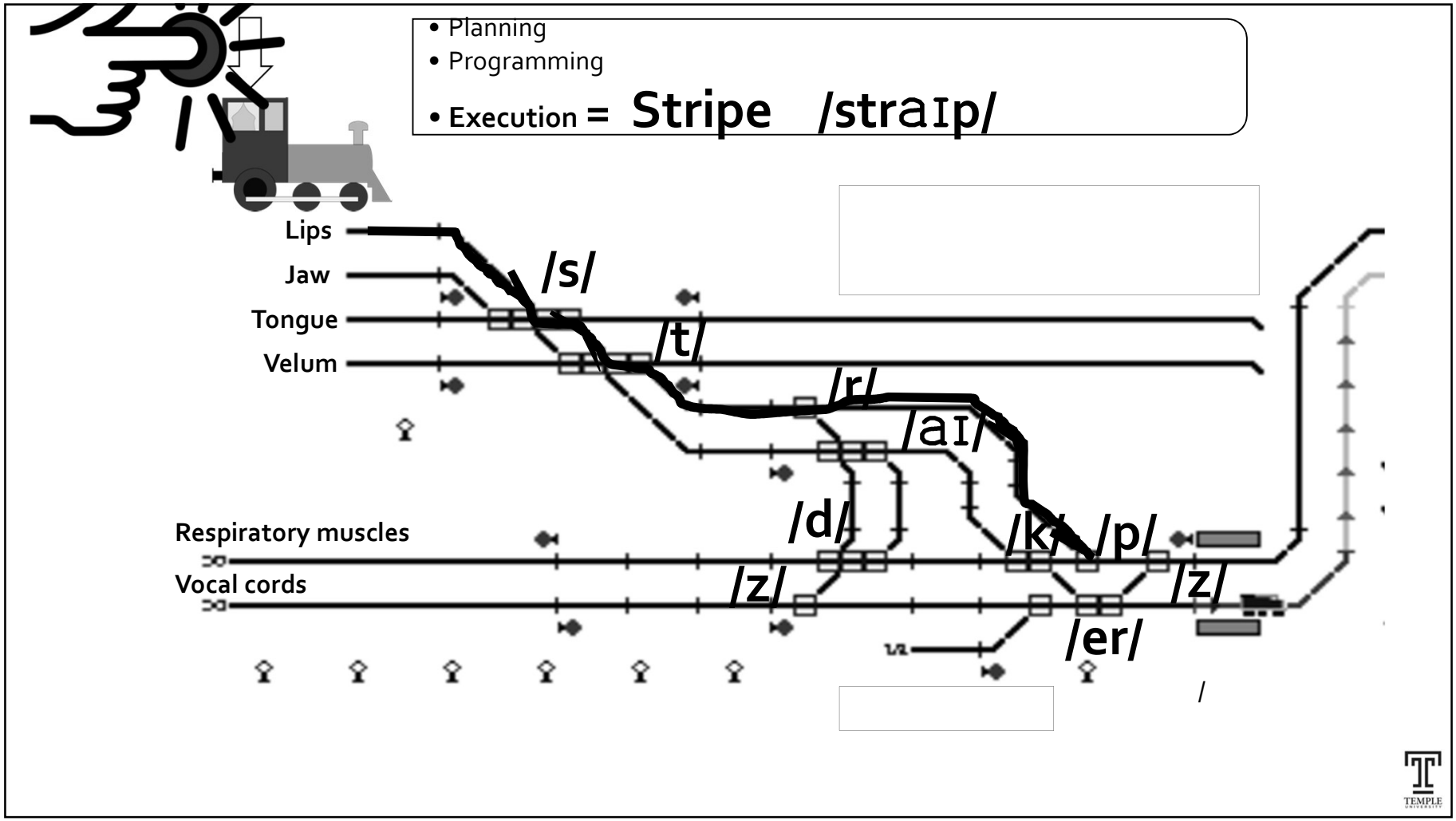
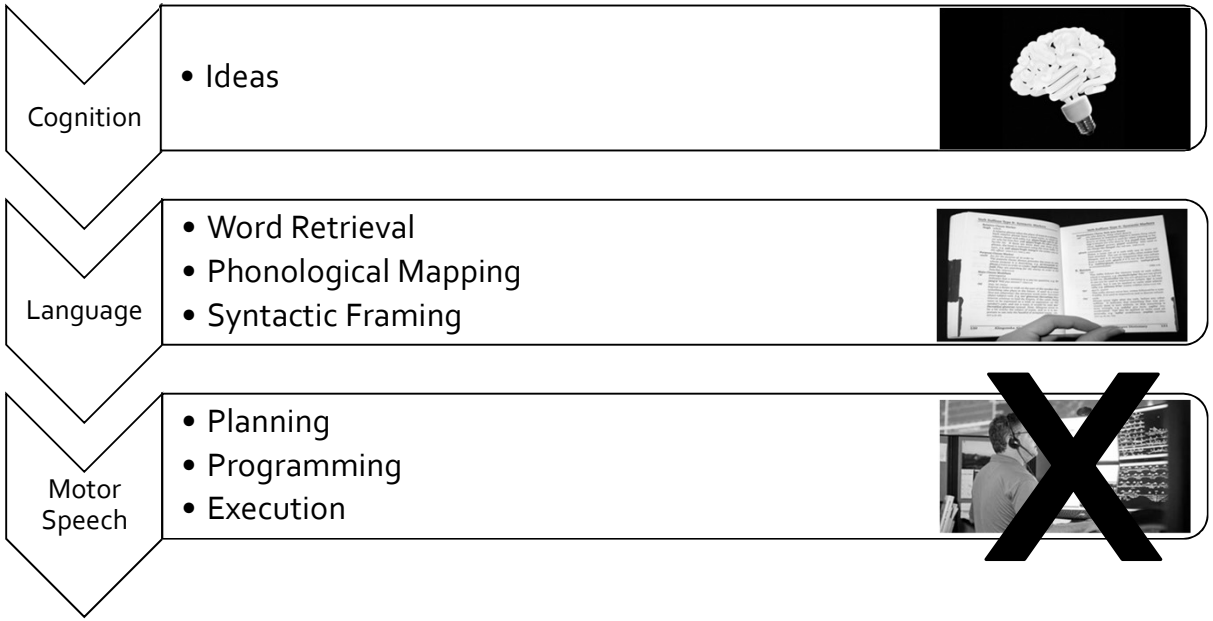


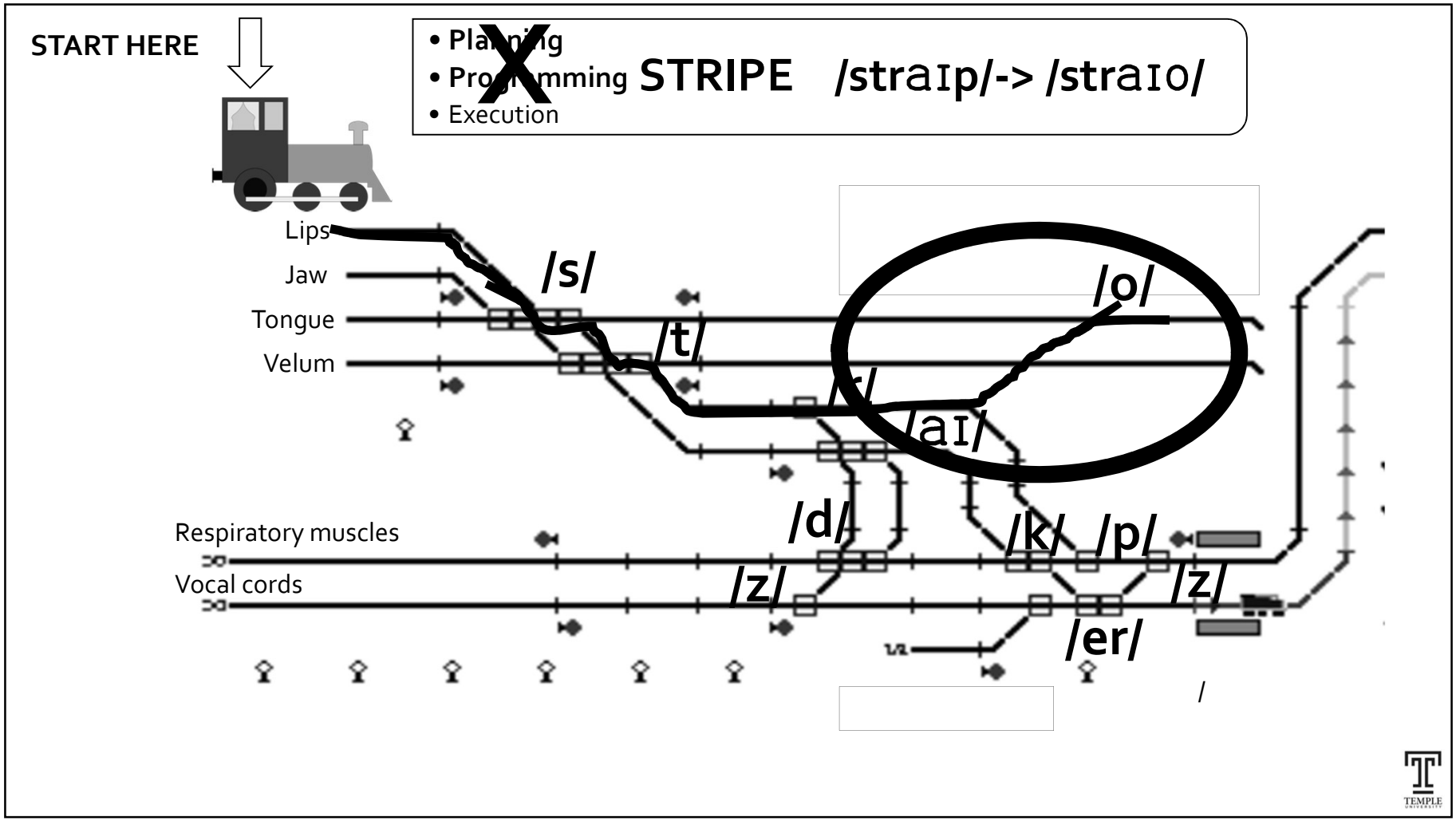
In CAS

When it goes wrong . . .

Model of Speech Production

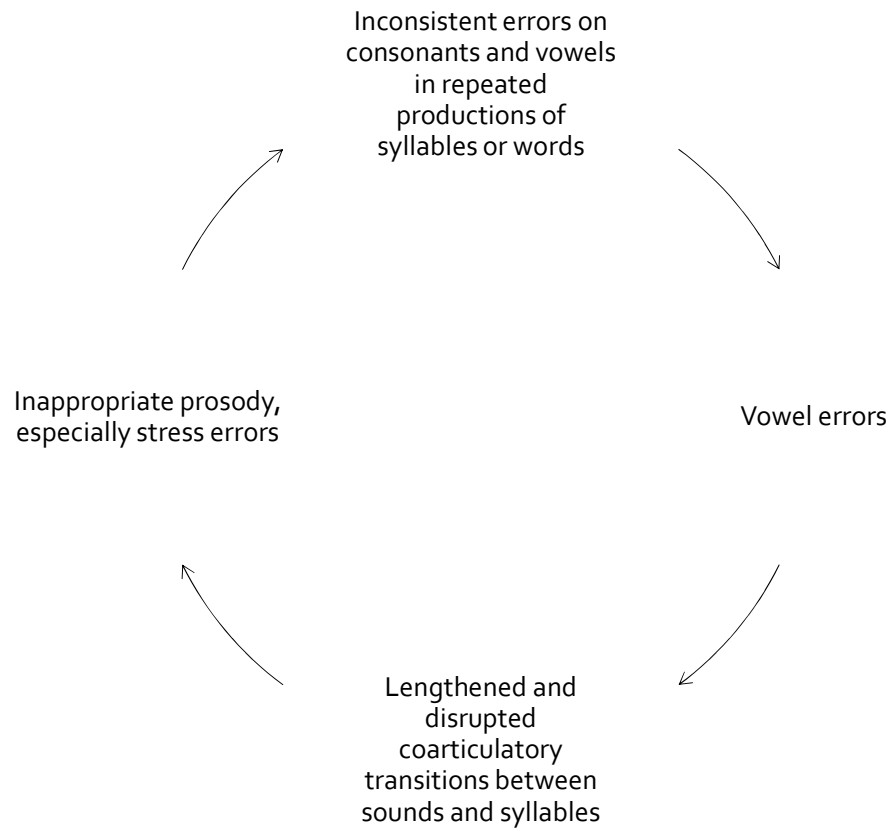


(Caruso & Strand, 1999)



CAS definition

- "The core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody"(ASHA, 2007)



Key features of CAS

(ASHA, 2007)

Critical component in CAS assessment

Motor Speech Assessment

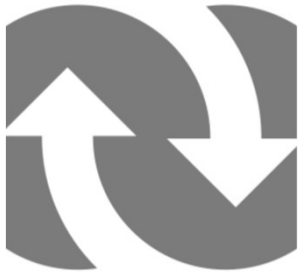
- Describe discriminating characteristics
- Make a differential diagnosis
- Specify severity of disorder
- Determine length and complexity level at which the child's motor speech system is breaking down – where to begin in treatment

Motor Speech Assessment

- ***Dynamic Motor Speech Assessment***
  - ***Dynamic Evaluation of Motor Speech Skill (DEMSS)***
- Syllable Repetition Task (SRT)
- Maximum Performance Tasks (MPT)
- Pause Marker (PM)
- Pediatric Adaptation of the Mayo 10

What is Dynamic Assessment?

Static Assessment – evaluates the system without support



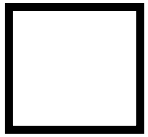
Dynamic Assessment – evaluates the system when given support

(Vgotsky, 1978; Bain & Olswang, 1995)

Static Assessment documents established skill

"Say /pa/"

Cannot Produce



Accurate Independently

/pa/

However, the skill may be newly established or long established

Dynamic Assessment helps determine how close to "established" learning is

"Say /pa/"

Cannot Produce	Accurate with Max cues	Accurate with Mod cues	Accurate with Min cues	Accurate Independently
☐	☐	☐	☐	/pa/

By manipulating the amount of cues

Dynamic Assessment

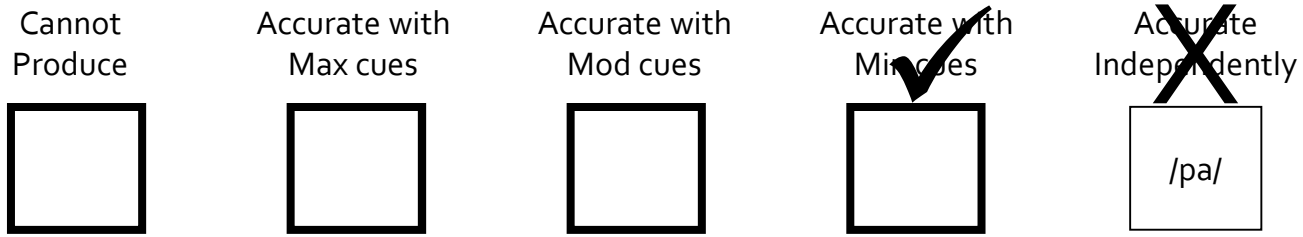
"Say /pa/"

Cannot Produce	Accurate with Max cues	Accurate with Mod cues	Accurate with Min cues	Accurate Independently
☐	☐	☐	☐	✓ /pa/

= established skill

Dynamic Assessment

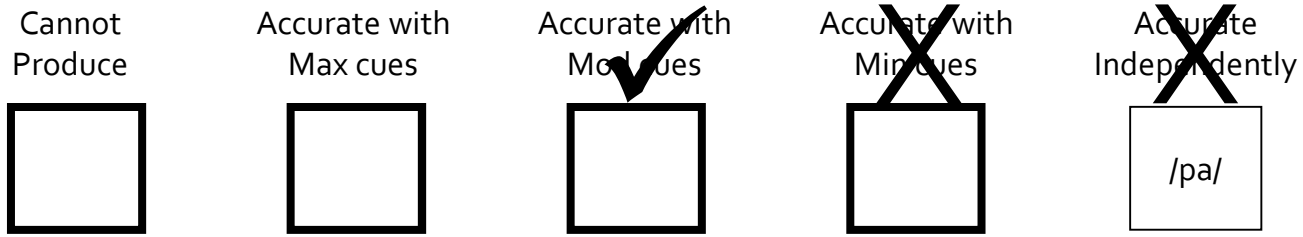
"Say /pa/"



= rather easily learned

Dynamic Assessment

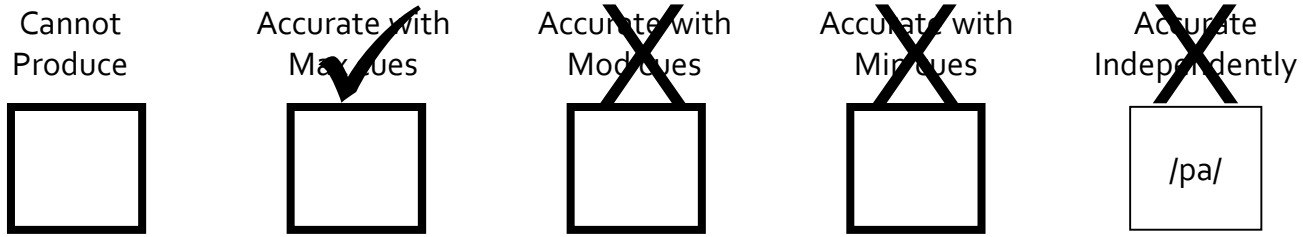
"Say /pa/"



= learning is further from established and may take more time/effort to improve

Dynamic Assessment

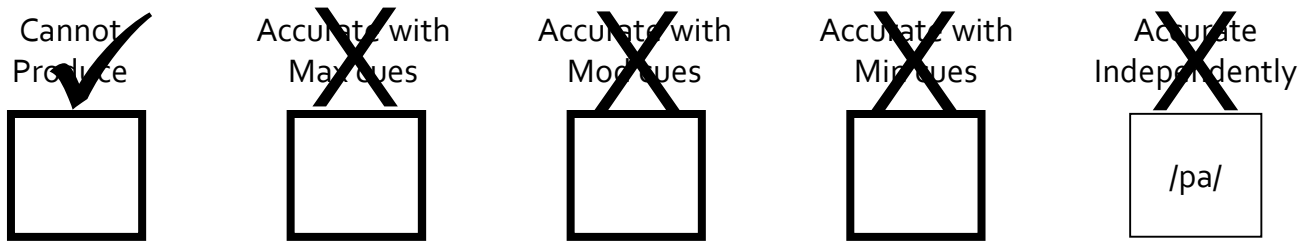
"Say /pa/"



= learning is even *further* from established & may take even more time/effort to improve

Dynamic Assessment

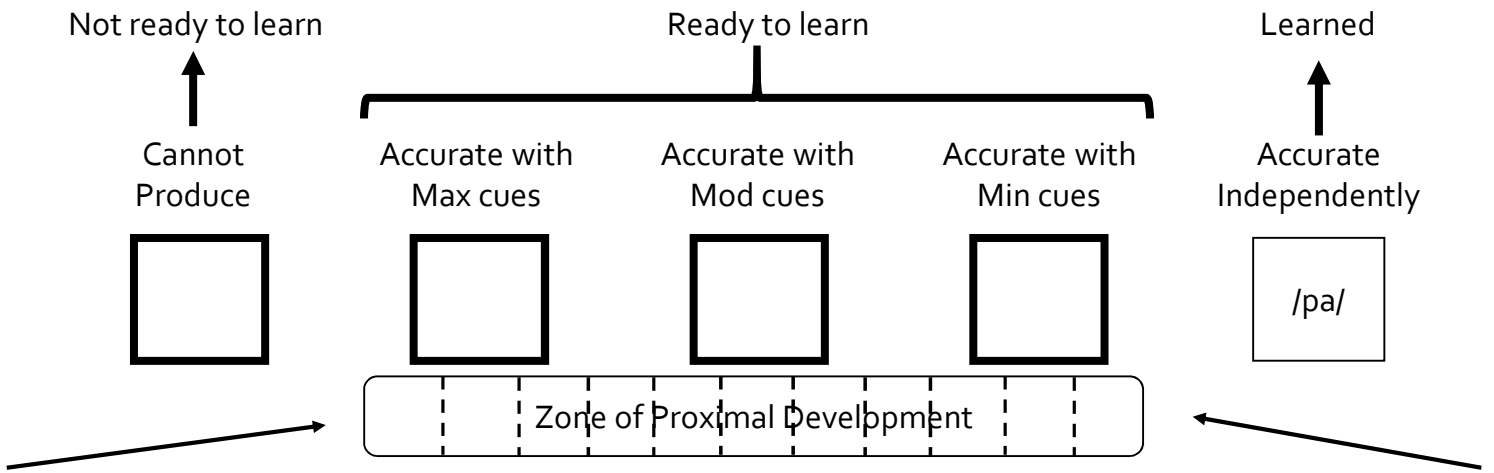
"Say /pa/"



= may not be ready to be learned

Dynamic Assessment helps determine "readiness" to learn

"Say /pa/"



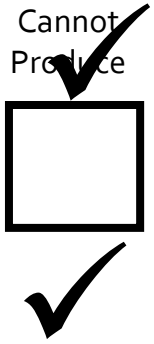
Our Job = find area in which the child can best learn

(Vgotsky, 1978; Bain & Olswang, 1995)

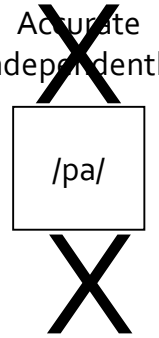
Static Assessment

"Say /pa/"

Cannot Produce

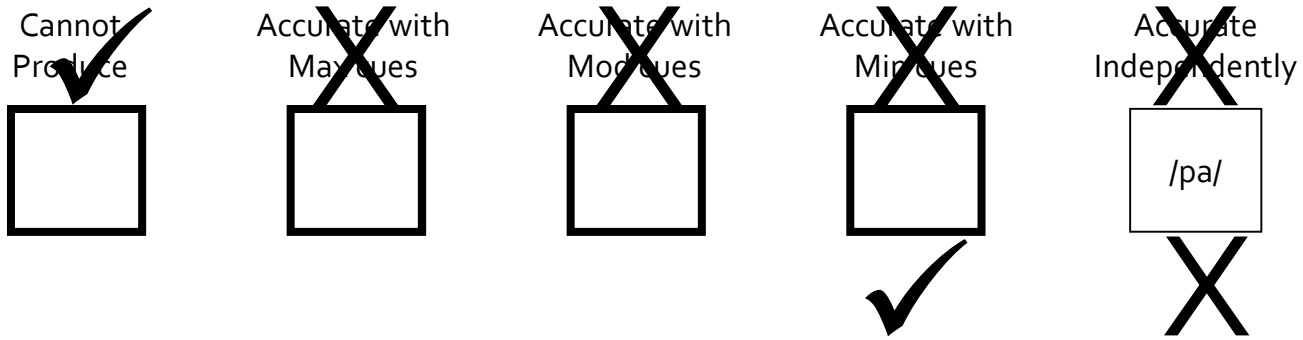


Accurate Independently



Dynamic Assessment

"Say /pa/"



Even though two students can perform the "same" on static assessment, they may have very different learning "potentials."

Dynamic Assessment

- Which boy has the greatest learning potential?

A

Cannot produce even with Max cues

☐

B

Accurate with Min cues

☐

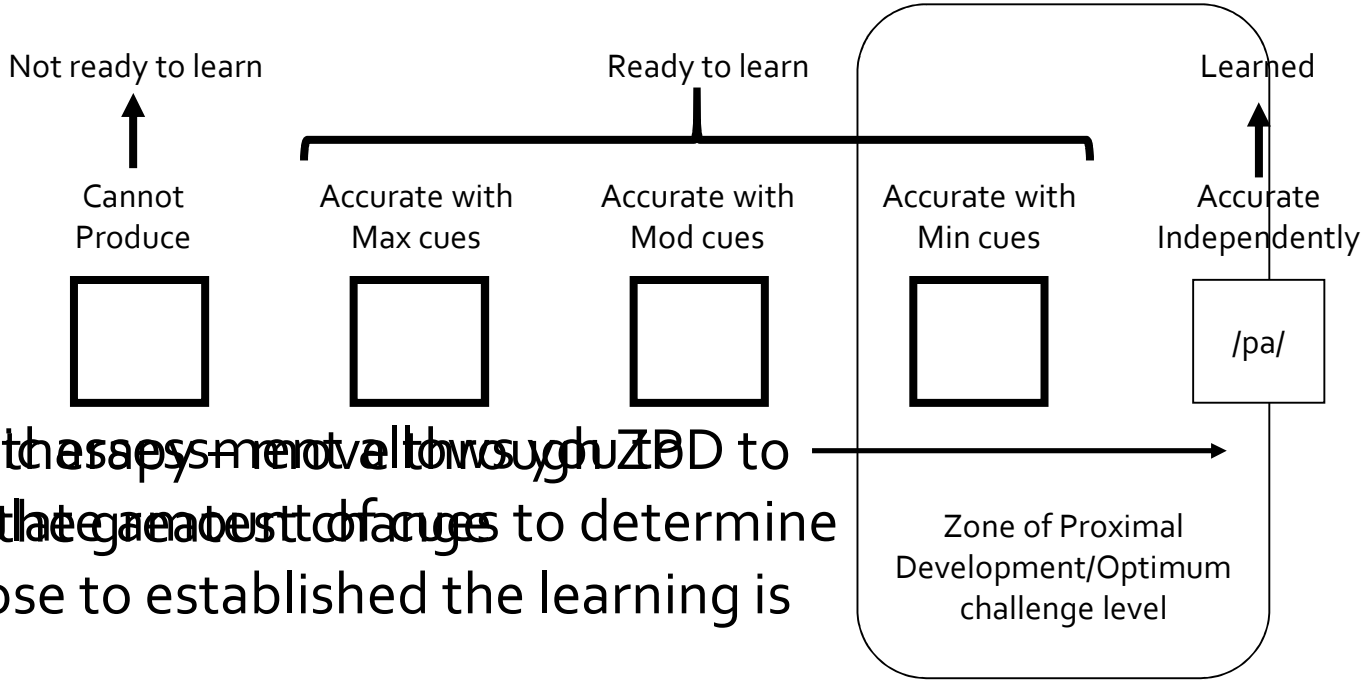
suecaspari.participoll.com

A | B | 0

vote at suecaspari.participoll.com

Dynamic Assessment

"Say /pa/"



Goal in therapy – move through ZPD to induce the greatest change

Goal in assessment – move through ZPD to induce the greatest change to determine how close to established the learning is

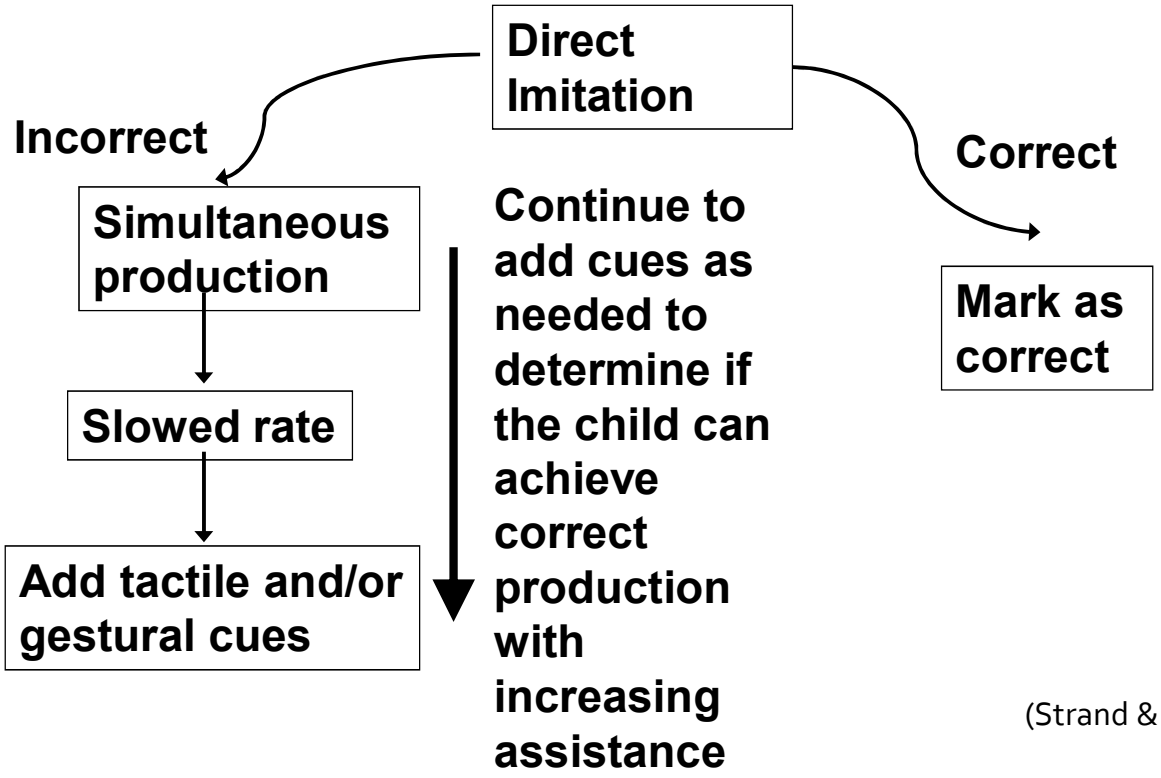
Dynamic Assessment

- In our field, dynamic assessment has been used for language, cognition, & phonological disorders
  - Scaffolding Scale of Stimulability (Glaspey & Stoel-Gammon, 2007)

CUES LINGUISTIC ENVIRONMENTS	Level 0	Level 1 *Instructions*	Level 2 *Instructions, verbal model*	Level 3 *Instructions, verbal model, segmented, simultaneous production, tactile cues*
Not Stimulable				21
Isolation				20
Word	16	17	18	19
Carrier Phrase	12	13	14	15
Novel Phrase	9	10	11	
One-target sentence	6	7	8	
Two-target sentence	3	4	5	
Connected Speech	1	2		

Figure 1. The Scaffolding Scale of Stimulability: Cues and Environments.

Dynamic *motor speech* assessment



(Strand & McCauley, 2019)

Why use a *dynamic* motor speech assessment?

Dynamic Motor Speech Assessment

- Describe discriminating characteristics
- Make a differential diagnosis
- Specify severity of disorder
- Determine length and complexity level at which the child's motor speech system is breaking down – where to begin in treatment
- Helps with prognosis/stimulability for treatment
- Select targets at an optimum challenge level - likely to make improvements
- Understand what cues are helpful to that child to use in treatment

Dynamic *motor speech* assessment

- Make your own – do NOT need a "test"
- List of syllables and syllable sequences at increasing levels of length and complexity
- Taylor to the child's level
  - Simpler syllable shapes for more impaired child
  - Longer syllable shapes for less impaired child
- Score for key features of CAS
  - Vowel errors
  - Inconsistencies
  - Prosody errors
- Make note of other features observed
- Make a judgement about severity and prognosis based on weight of evidence

Pattern 1: CV; C=voiced stops and nasals V= monophthong or diphthong

Target	IPC	Vowel	Overall accuracy	Consistency	Comment	Transcription
Me	0					
Bye	0					
Do	0					
No	0					
Nah	0					
TOTAL SCORE						

Three-syllable words Level 2: Syllables are open syllables; consonant nasals, fricatives; no consonant clusters

Target	IPC	Vowel	Overall accuracy	Consistency	Prosody	Comment
Potato	2					
Obama	1					
Video	2					
TOTAL SCORE						

Pattern 6: CVC; first consonant is voiced stop, nasal, glide or fricative and

Target	IPC	Vowel	Overall accuracy	Consistency	Prosody	Com	
Done	1						
Boom	1						
Some	3						
Dim	2						
Mom	1						
TOTAL SCORE							

Thank you Christy Galloway

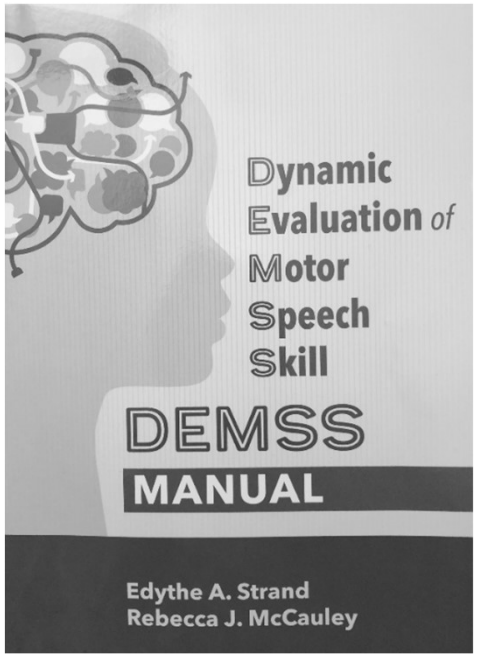
Spanish Assessment

V			**Attempt 1**								**Attempt 2 and on**	
Word (IPC)	Attempt 1	Attempt 2	Overall Accuracy	Vowel Accuracy	Prosody						Consistency	Helpful Cues
					Acc	Seg	Equ	Inc	Del	Add		
Hay (0)												
Y (0)												

Reduplicated Syllables (C1V1C1V1)			**Attempt 1**								**Attempt 2 and on**	
Word (IPC)	Attempt 1	Attempt 2	Overall Accuracy	Vowel Accuracy	Prosody						Consistency	Helpful Cues
					Acc	Seg	Equ	Inc	Del	Add		
Bibi (0)												
guagua (wawa) (0)												

Thank you Monica Buccieri

DEMSS (Strand, et al, 2013; Strand & McCauley, 2019)



Just Published

Dynamic Evaluation of Motor Speech Skill (DEMSS) (Strand, et al, 2013; Strand & McCauley, 2019)

- 3+ years (with severe impairment)
  - Suspect they will have difficulty producing words between 1-3 syllables in length
- Repeat real words 1-3 syllables in length (VC, CV, CVC, CVCV, 3 syllable)
  - Mostly early- & middle-developing consonants and all vowels & diphthongs
    - No /w, ŋ, ʤ, ʧ, θ, z, ð, ʒ, r, ɝ/
  - No consonant clusters
- Listen for key features of CAS
  - Inconsistencies, vowel errors, prosodic errors, and judge overall articulatory accuracy
- Criterion referenced assessment
  - Calculate a "score" and compare it with a range of scores associated with increasing likelihood that performance is consistent with CAS
- Probability of correct classification of CAS (average sensitivity) – 94%
  - Unlikely to over-diagnose, but a few children with CAS may not be identified)

Dynamic Evaluation of Motor Speech Skill (DEMSS) (Strand, et al, 2013; Strand & McCauley, 2019)

- Use a moderate to slightly slow, but natural, rate and natural prosody
- Direct the child's attention to your face
- Give specific instructions: "Watch my face and then try to say what I say. I will help you if it is a hard one."
- Provide systematic cueing as child makes repeated attempts at productions of words
- Score for key features of CAS

Dynamic Evaluation of Motor Speech Skill (DEMSS) (Strand, et al, 2013; Strand & McCauley, 2019)

- When you are finished - you have profile of child's abilities at different syllable lengths

Summary Scores

	(Number of words/items)	Vowel Accuracy	Prosodic Accuracy	Overall Accuracy	Consistency
A. Consonant-vowel	(10)	18		34	8
B. Vowel-consonant	(10)	20		39	10
C. Reduplicated syllables	(4)	7	3	14	
D. CVC1	(6)	12		15	2
E. CVC2	(10)	20		37	8
F. Bisyllabic 1	(6)	10	1	21	
G. Bisyllabic 2	(8)	14	8	25	
H. Multisyllabic	(6)	12	5	9	0
Number of items		(60 items)	(24 items)	(60 items)	(42 items)
Range of scores		(0-120)	(0-24)	(0-240)	(0-42)
Totals		113	17	144	28
Overall Total Score				352	Total possible score = 426

DEMSS Advantage - 1

- See characteristics you may NOT see in connected speech or in static assessment
  - In connected speech and static assessment, the child says what they can say or what has habituated with errors
  - In dynamic assessment, when cued, the child may more actively attempt the correct movement – revealing groping, segmentation, timing errors or other CAS characteristics

DEMSS Advantage - 2

- Better judge severity and prognosis
  - Mild severity and good prognosis
    - If child produces accurate movements with min-mod cues
    - Evidence they can quickly benefit from therapy
  - More severe and more guarded prognosis
    - If child requires max cues to accurately produce target or fails to improve even with cueing

DEMSS Advantage - 3

- Helps with treatment planning
  - Learn types of cues that are likely to facilitate improvements in treatment
  - Helps with choice of targets/optimum challenge level
    - Syllable length where child is breaking down
    - Sounds the child has in their phonetic inventory (including vowels)
  - Informs how the principles of motor learning will be applied in treatment
    - Small stimulus set for more severe impairment
    - Frequent feedback for severe impairment
    - Etc.

How to do the DEMSS

- Ask the child to imitate each word
- Score for key features of CAS:
  - Vowel accuracy
  - Prosody – note sound additions, stress errors, sound/syllable segmentation
- If errored, cue up to 6 times to try to obtain a correct production
- After cueing, score for
  - Overall accuracy
  - Consistency – note if any inconsistencies across trials

How to score the DEMSS

- Vowel accuracy – scored on first attempt
  - 2 = you are sure the vowel is produced accurately
  - 1 = you are unsure if it was accurate
  - 0 = you are sure it was a vowel distortion

How to score the DEMSS

- Prosodic accuracy – scored on first attempt
  - 1 = correct
  - 0 = incorrect

Prosodic Error Types

1. Segmented	
2. Equal stress	
3. Incorrect stress	
4. Weak syllable deletion	
5. Added syllable	

Strand & McCauley, 2019

How to score the DEMSS

- Overall articulatory accuracy – scored after all cued attempts
  - 4 = accurate on first attempt
  - 3 = consistent developmental substitution error on first attempt (e.g., /t/ for /k/; /w/ for /r/) without slowness or distortion of movement gestures
  - 2 = correct after one cued trial or after immediate self-correction
  - 1 = correct in direct imitation after additional cued trials
  - 0 = incorrect in direct uncued elicitation after all cued attempts

Strand & McCauley, 2019

How to score the DEMSS

- Consistency – scored after all cued attempts
  - 1 = consistent across all trials
  - 0 = inconsistent across any 2 or more trials

Strand & McCauley, 2019

Other observations on the DEMSS

Note

Inconsistent voicing errors		Trial or error		Difficulty with multisyllabic words	
Groping		Vowel or consonant distortion		Awkward movement transitions	
Intrusive schwa		Lexical stress errors			
Slow rate		Segmentation			

Strand & McCauley, 2019

Practice scoring the DEMSS
7 year old male – CV, CVCV, 3-syll

- Practice
  - Have child say target
  - Score vowel/prosody
  - Dynamic cueing up to 6 more trials (any cues allowed)
  - Score consistency and accuracy after all trials

Practice scoring the DEMSS 7 year old male - CV

A. Consonant-Vowel

	Initial attempt		After cueing	
	Vowel Accuracy (score 2, 1, or 0)	Articulatory Accuracy (score 4, 3, or 2)	Articulatory Accuracy (score 2, 1, or 0)	Consistency (score 1 or 0)
Me				
Hi				
Toy				
Day				
Show				

Strand & McCauley, 2019

Practice scoring the DEMSS
7 year old male – 2 syllable words

G. Bisyllabic (more varied syllabic shapes)

	Initial attempt			After cueing
	Vowel Accuracy (score 2, 1, or 0)	Prosodic Accuracy (score 1 or 0)	Articulatory Accuracy (score 4, 3, or 2)	Articulatory Accuracy (score 2, 1, or 0)
Bunny				
Happy				

Strand & McCauley, 2019

Practice scoring the DEMSS
7 year old male – 3 syllable words

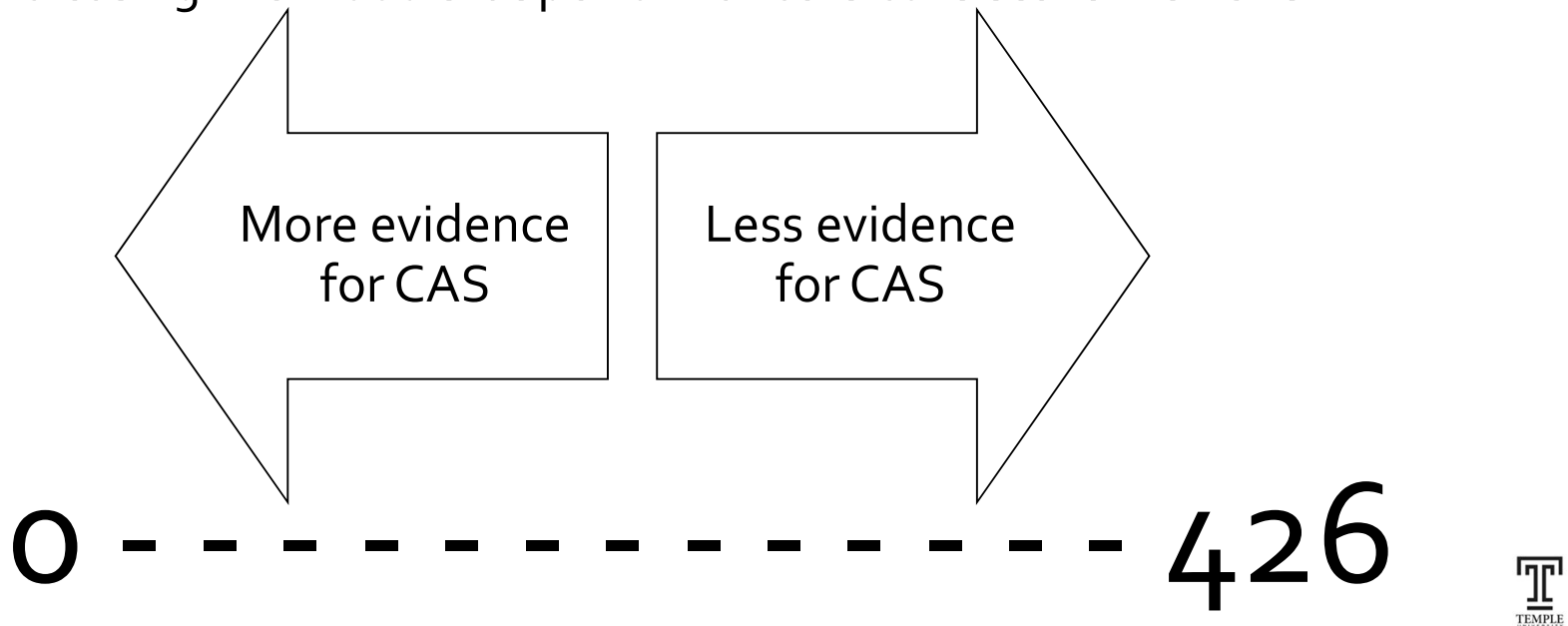
H. Multisyllabic Words

	Initial attempt			After cueing
	Vowel Accuracy (score 2, 1, or 0)	Prosodic Accuracy (score 1 or 0)	Articulatory Accuracy (score 4, 3, or 2)	Articulatory Accuracy (score 2, 1, or 0)
Ba**na**na				
Po**ta**to				
Video				

Strand & McCauley, 2019

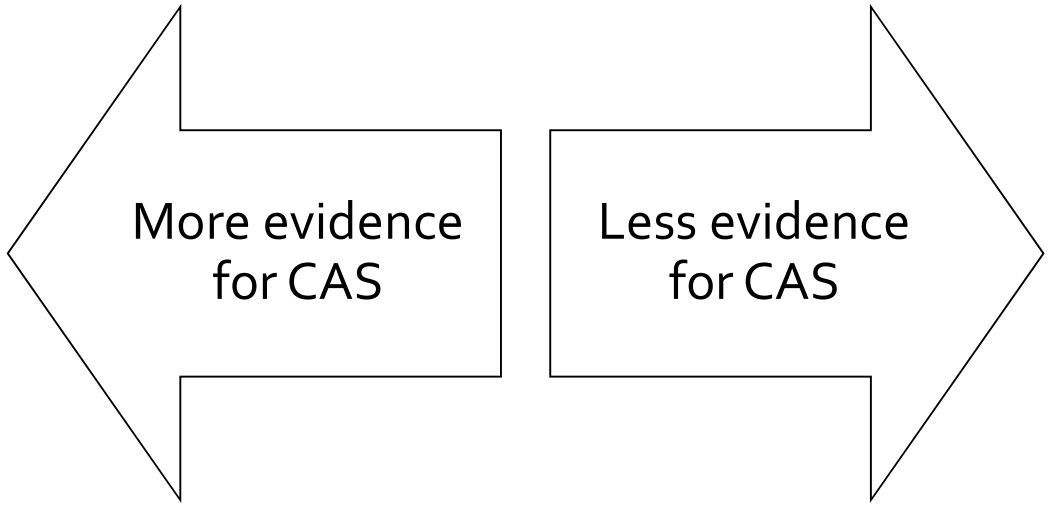
Scoring Range

- Compare child's SCORE with a range of scores associated with increasing likelihood that performance is consistent with CAS



Scoring Range

- "Some evidence for at least mild CAS"



Observations for Additional Evidence to Consider in Diagnosis

Mark each subtest in which observations of the characteristic were made.

Observation \ Subtest	A CV	B VC	C RS	D CVC1	E CVC2	F Bisyllabic 1	G Bisyllabic 2	H Multisyllabic	Total number of subtests	Spontaneous speech
voicing errors				X			X	X	3	
Groping							X	X	2	
Intrusive schwa					X			X	1	
Slow rate								X	1	
Trial and error								X	1	
Vowel or consonant distortion	X	X	X			X	X	X	6	X
Lexical stress errors										
Segmentation			X			X	X	X	4	
Difficulty with multisyllabic words								X	1	X
Awkward movement transitions			X		X		X	X	4	X

Observations of speech characteristics across context: Number of features noted 9 Number of subtests on which features noted 8

Comments on severity of any pertinent characteristics Voicing errors and segmentation were mild; vowel and consonant distortions ranged from mild to moderate. He improved easily from cueing.

Strand & McCauley, 2019

Observations for Additional Evidence to Consider in Diagnosis

Mark each subtest in which observations of the characteristic were made.

Observation \ Subtest	A CV	B VC	C RS	D CVC1	E CVC2	F Bisyllabic 1	G Bisyllabic 2	H Multisyllabic	Total number of subtests	Spontaneous speech
Inconsistent voicing errors				X			X	X	3	
Groping							X	X	2	
Intrusive schwa					X			X	1	
Slow rate								X	1	
Trial and error								X	1	
Vowel or consonant distortion	X	X	X			X	X	X	6	X
Lexical stress errors										
Segmentation			X			X	X	X	4	
Difficulty with multisyllabic words								X	1	X
Awkward movement transitions			X		X		X	X	4	X

Observations of speech characteristics across context: Number of features noted 9 Number of subtests on which features noted 8

Comments on severity of any pertinent characteristics Voicing errors and segmentation were mild; vowel and consonant distortions ranged from mild to moderate. He improved easily from cueing.

Strand & McCauley, 2019

Observations for Additional Evidence to Consider in Diagnosis

Mark each subtest in which observations of the characteristic were made.

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Inconsistent voicing errors				X			X	X	3	
Groping							X	X	2	
Intrusive schwa					X			X	1	
Slow rate								X	1	
Trial and error								X	1	
Vowel or consonant distortion	X	X	X			X	X	X	6	X
Lexical stress errors										
Segmentation			X			X	X	X	4	
Difficulty with multisyllabic words								X	1	X
Awkward movement transitions			X		X		X	X	4	X

Observations of speech characteristics across contex

Number of features noted 9 Number of subtests on which features noted 8

Comments on severity of any pertinent characteristics

distortions ranged from mild to moderate. He improved easily from cueing.

Strand & McCauley, 2019

Dynamic motor speech assessment Summary

- Use the DEMSS or make your own
- List of syllables and syllable sequences at increasing levels of length and complexity
- Taylor to the child's level
- Ask the child to imitate each word
- If errored, cue several times to try to obtain a correct production
- Score for key features of CAS
  - Vowel accuracy
  - Prosodic Accuracy
  - Consistency

Dynamic motor speech assessment Summary

Strengths

- Helps identify key features of CAS
  - Differential diagnosis
- Supports treatment planning
  - Enables you to identify the syllable length at which the child is breaking down
  - Determine what cues are most helpful
- Enables you to determine how stimulable the child is
  - Prognostic indicator

Weaknesses

- Can take a long time
- Requires the child to "work" – you need to provide reinforcers to keep them going

Motor Speech Assessment

- Dynamic Motor Speech Assessment
  - Dynamic Evaluation of Motor Speech Skill (DEMSS)
- ***Syllable Repetition Task (SRT)***
- Maximum Performance Tasks (MPT)
- Pause Marker (PM)
- Pediatric Adaptation of the Mayo 10

Syllable Repetition Task (SRT)

- Syllable Repetition Task (Shriberg et al, 2012)
  - 3+ years
  - Repeat nonsense syllables /n, b, d, m/ plus schwa
  - 2-4 syllables
  - Count sound additions = transcoding score
  - Cutoff - <80% likely CAS
  - Diagnostic Accuracy – 78.4% (Shriberg, et al, 2012)

Syllable Repetition Task (SRT)

No. of Syll-ables	Item No.	Response	Transcription	Number of Consonants Correct	Additions [a,b]
2	1	bada			
	2	dama			
	3	bama			
	4	mada			
	5	naba			
	6	daba			
	7	nada			
	8	maba			
				SRT-2 = ____% (___/16)*100	
3	9	bamana			
	10	dabama			
	11	madaba			
	12	nabada			
	13	banada			
	14	manaba			
				SRT-3 = ____% (___/18)*100	
4	15	bamadana			
	16	danabama			
	17	manabada			
	18	nadamaba			
				SRT-4 = ____% (___/16)*100	
Notes:				SRT = ____% (___/50)*100	Total____

Syllable Repetition Task (SRT)

"nada" = "na**m**da"

"mada" = "ma**n**da"

"dabama" = "dama**n**da"

"madaba" = "**na**mada**n**da"

Additions

Syllable Repetition Task (SRT) Summary

Strengths

- Quick & fun
- Some info about where the child might break down - length and complexity
- Can listen for features of CAS beyond additions - vowel errors, segmentation

Weaknesses

- Not strong dx accuracy 78%
- Not a lot of info about stimulability for prognosis
- No info about what cues might help

Motor Speech Assessment

- Dynamic Motor Speech Assessment
  - Dynamic Evaluation of Motor Speech Skill (DEMSS)
- Syllable Repetition Task (SRT)
- ***Maximum Performance Tasks (MPT)***
- Pause Marker (PM)
- Pediatric Adaptation of the Mayo 10

Maximum Performance Tasks (MPT)

- Maximum Performance Tasks (Rvachew et al., 2005; Thoonen et al., 1996, 1999)
  - 6+ years
  - Maximum vowel and fricative durations
  - DDK – AMR & SMR
  - Criteria for *dysarthria vs. apraxia*
  - Diagnostic accuracy – 95.2%

Maximum Performance Tasks (MPT)

- MPD (maximum phonation duration)
  - Average longest production of /a/ and /mama/

	TRIAL 1	TRIAL 2	TRIAL 3
[a]	1.76	2.44	2.49
[mama]	1.34	Not valid	2.67
MPD Score: 2.58			

Maximum Performance Tasks (MPT)

- MFD (maximum fricative duration)
  - Average longest production of [f], [s] and [z]

	TRIAL 1	TRIAL 2	TRIAL 3
[f]	1.15	1.38	1.79
[s]	2.34	2.69	1.64
[z]	1.79	2.22	2.03
MFD Score:	**2.32**		

Maximum Performance Tasks (MPT)

- MRRmono
  - Average fastest (syllables per second) of the fastest [pa…], [ta…], and [ka…]

	TRIAL 1	TRIAL 2	TRIAL 3
[pa] /pʌ/	3.85	3.80	3.30
[ta] /tʌ/	3.62	3.80	3.85
[ka] /kʌ/	3.30	3.05	3.08
MRRmono Score:	**3.66**		

Maximum Performance Tasks (MPT)

- MRRtri Score
  - Average fastest (syllables per second) /pataka/ (all three syllables must be sequenced accurately 5X within the trial)
- Sequence Score
  - Score 1 if at least one correct repetition of /pataka/; Score 0 if no correct repetition of /pataka/
- Attempts Score
  - Count the number of additional attempts (beyond the first three) that are required for the child to achieve a correct repetition of /pataka/.

Maximum Performance Tasks (MPT)

	TRIAL 1
[pataka] /pʌtʌkʌ/	pakabakabakababababageega

	TRIAL 1	TRIAL 2	TRIAL 3
[pataka] /pʌtʌkʌ/	pakabakabakababababageega	pukakakakagagagaga	papapababababagaba
Additional trials	pakakagagabagabagee	pakakagakabakakeega	papatabeegagogobaba

MRRtri Score: unable	**Sequence: (0= none correct): 0**	**Additional Attempts: 3**

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Maximum Performance Tasks (MPT)

Dysarthria Score	Dyspraxia (CAS) Score
0 MRRmono > 3.5	0 MRRtri ≥ 4.4
1 MRRmono 3.0 < > 3.5 & MPD > 7.5	1 MRRtri 3.4 < > 4.4 & MFD > 11 sec & Attempts < 3
2 MRR mono < 3.0 or MRRmono 3.0 < > 3.5 & MPD ≤ 7.5	2 MRRtri ≤ 3.4 or Sequence = 0 or Criteria for 0 or 1 not met

Summary MPT
7 year old male

Dysarthria Score	Dyspraxia (CAS) Score
0 MRRmono > 3.5	0 MRRtri ≥ 4.4
1 MRRmono 3.0 < > 3.5 & MPD > 7.5	1 MRRtri 3.4 < > 4.4 & MFD > 11 sec & Attempts < 3
2 MRR mono < 3.0 or MRRmono 3.0 < > 3.5 & MPD ≤ 7.5	2 MRRtri ≤ 3.4 or Sequence = 0 or Criteria for 0 or 1 not met

MPT Summary

Strengths

- Differentiates DYS from CAS
- Concrete

Weaknesses

- Found in our clinic is that this is exhausting – give breaks so they don't hyperventilate
- Not fully operationalized – so have to make decisions that aren't specified – ie do you accept voicing badaga…

Motor Speech Assessment

- Dynamic Motor Speech Assessment
  - Dynamic Evaluation of Motor Speech Skill (DEMSS)
- Syllable Repetition Task (SRT)
- Maximum Performance Tasks (MPT)
- ***Pause Marker (PM)***
- Pediatric Adaptation of the Mayo 10

Pause Marker (PM)

- Pause Marker (PM) (Shriberg & Strand, 2014, Shriberg et al., 2017a, 2017b)
  - 3+ years
  - The Type I "Pause Marker" provides a "single sign marker that likely can be used cross-linguistically to discriminate CAS from speech delay, and to scale the severity of CAS"
  - Type I = atypical pause - *abrupt, alone, change, grope*
  - NOT Type II = more typical addition, repetition/revision, long, breath

Pause Marker (PM) (Shriberg, et al, 2017a, b)

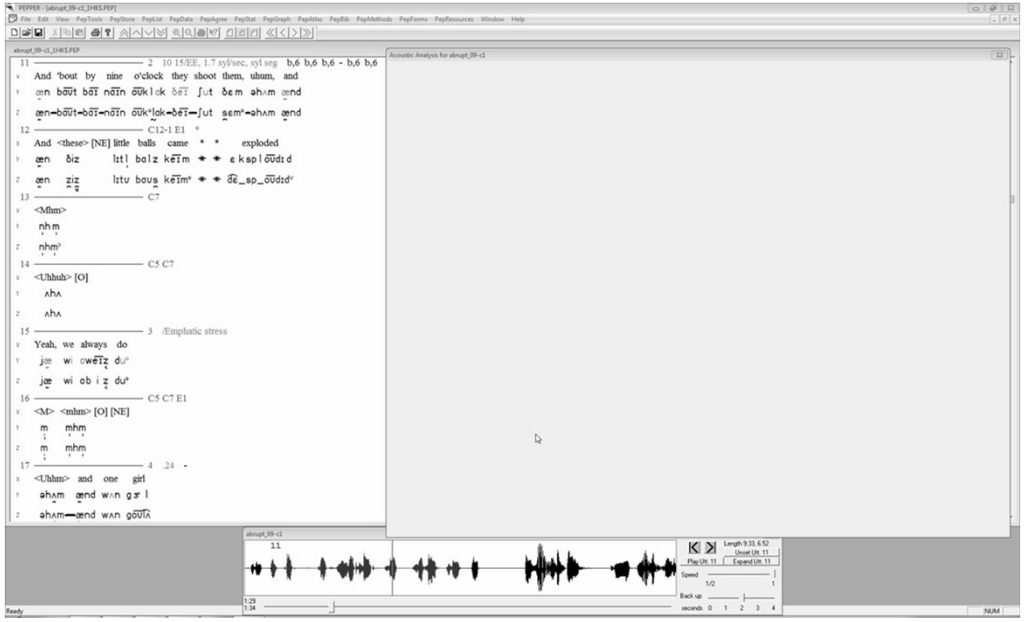
- Between-Word Pause = Any between-words period of at least 150 ms (.15 sec) in which there is no speech.
- Inappropriate pause - "a between-words pause that occurs either at an inappropriate linguistic place in continuous speech and/or has one or more inappropriate articulatory, prosodic, or vocalic features within the pause or in a sound segment preceding or following the pause."

Table 6. Auditory–perceptual and acoustic descriptions for eight subtypes of inappropriate between-words pauses.

		Locus of inappropriate behavior		
		Within pause	Within adjacent sound(s)	
Type I	Abrupt		X	A pause immediately preceded or followed by a phoneme that includes a sudden strong onset of energy or sudden offset of energy. Steep-amplitude rise/fall time is the best current visual and acoustic correlate of the percept of an abrupt phoneme.
	Alone	–	–	A pause that occurs at a linguistically incorrect position in an utterance, is not one of the other seven subtypes of inappropriate pauses, and does not have any identifiable auditory or acoustic feature.
	Change		X	A pause immediately preceded or followed by a phoneme or word that includes a significant change in amplitude, frequency, or rate.
	Grope	X		A pause that includes visible acoustic energy in the spectrogram consistent with a lip or tongue gesture or inappropriate voicing. The gestures may include formant traces of sounds or traces of incompletely realized stop bursts.
Type II	Long	X		A pause that has a lengthened duration that is unusual for the linguistic context (usually > 750 ms).
	Breath	X		A pause that includes audible inhalation not associated with excessive length of the utterance or emotional excitement.
	Repetitions/ revisions		X	A pause immediately preceded or followed by a dysfluent word or syllable repetition or revision.
	Additions		X	A pause immediately preceded or followed by an added speech sound.

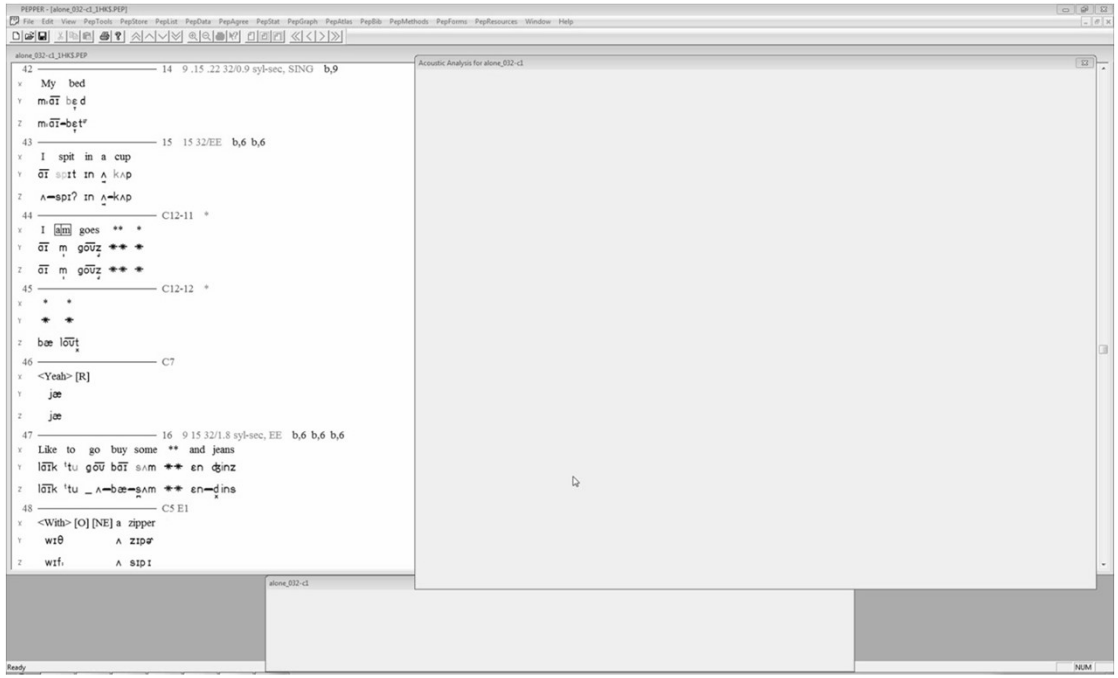
Note. See text for rationale for dividing the subtypes into two classes termed Type I and Type II. The four subtypes of inappropriate pauses within Type I and within Type II are each listed in decreasing frequency of occurrence in the present sample of participants with childhood apraxia of speech.

Shriberg, et al, 2017a



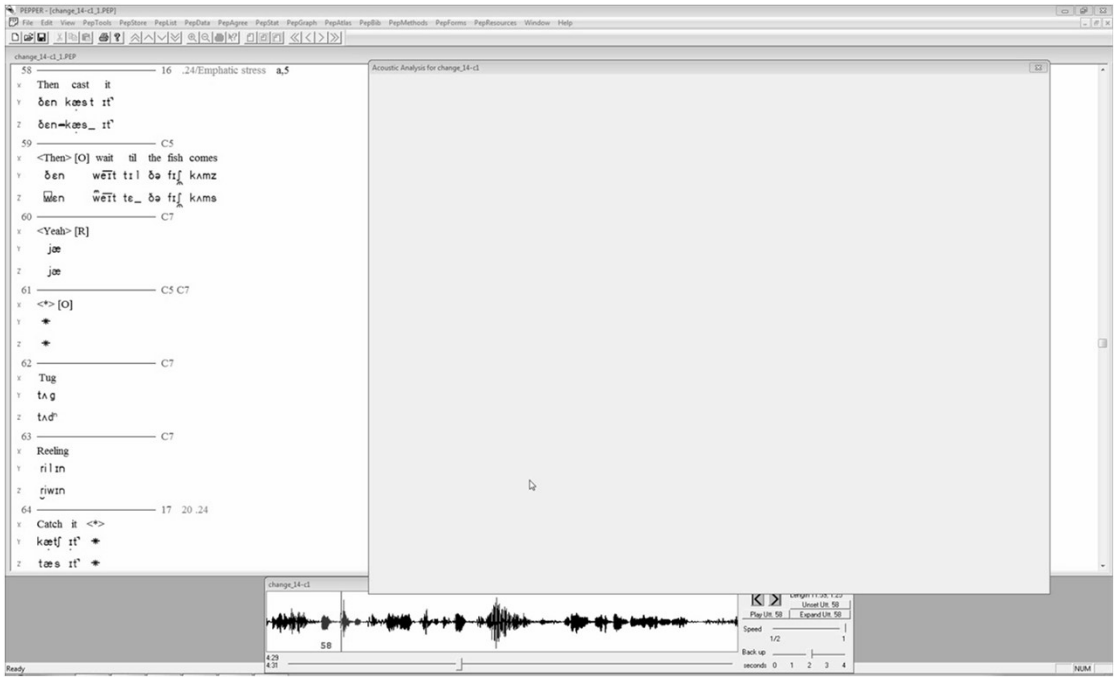
(Tilkens, et al, 2017)

Abrupt 7 year old male.
The utterance was glossed as: "And 'bout by nine o'clock they shoot them, uhum, and"
All of the several pauses but one are inappropriate "abrupt" pauses.
Note the halting nature of the utterance and sudden loud onsets following the inappropriate pauses.
The appropriate pause (blue) occurs between the words "o'clock" and "they."



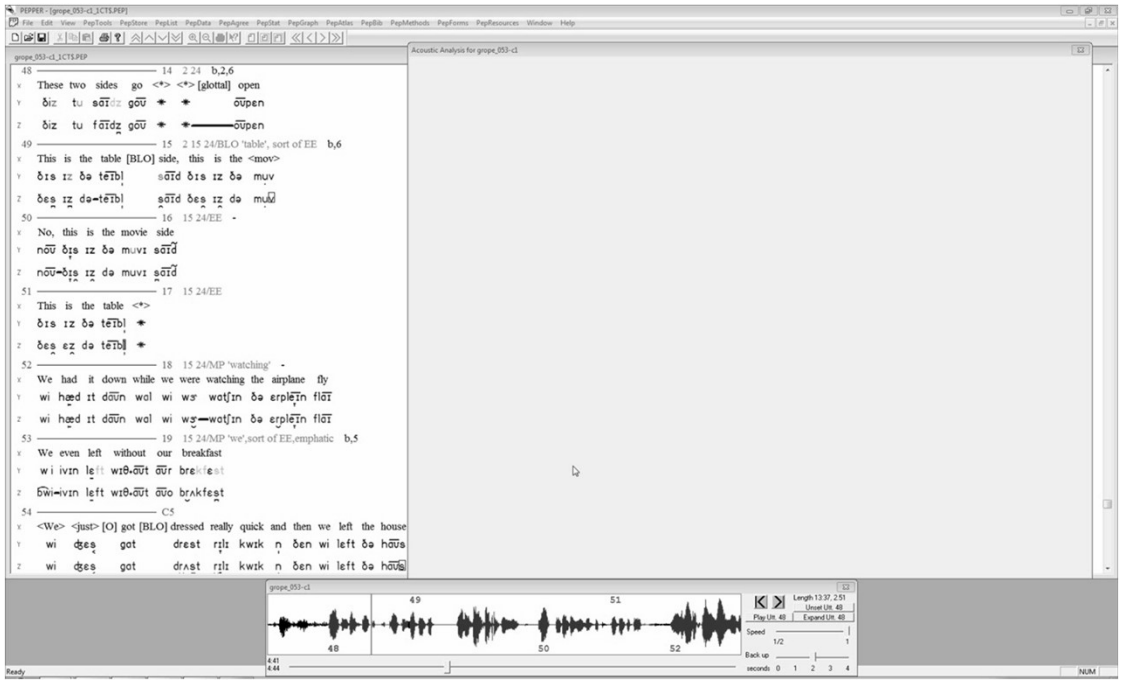
(Tilkens, et al, 2017)

Alone: 13 year old female.
The utterance was glossed as: “My bed”
There is one inappropriate pause and is between the words “my” and “bed.”
Not one of the other atypical pauses – and no identifiable acoustic or auditory feature



(Tilkens, et al, 2017)

Change: 7 year old male. The utterance was glossed as: “Then cast it”
There is one inappropriate pause between “then” and “cast.”
Note the change in amplitude for the initial consonant and vowel in “cast”



(Tilkens, et al, 2017)

Grope: 7 year old male. The utterance was glossed as: "These two sides go <*> <*> open"
There is one inappropriate pause between the words "go" and "open."
Note the spectrographically visible gestures, perceptually transcribed as * * in the utterance.
There is also an abrupt (sudden, loud) onset of glottal pulsing for "open."

Pause Marker (PM) (Tilkens, et al, 2017)

OVERVIEW OF STEPS

1. Obtain a conversational speech sample (page 3).
2. Complete transcription and prosody-voice coding to yield 24 usable utterances (page 5).
3. Complete acoustic analyses to identify occurrences of Type I (abrupt, alone, change, grope) and Type II (addition, repetition/revision, long, breath) between-words pauses in each utterance (page 13).
4. Calculate the Pause Marker Index (PMI) (page 17).
5. Classify CAS Status (page 18).

WARNING:
The PM is a complex assessment that requires a fair amount of auditory-perceptual training and audio-processing skill. This manual is not intended as a substitute for the acquisition of these skills, but as a helpful reference once those skills have been established. We recommend that you read through this manual, first, and then read through the entries listed in the **References** section below. Read through this manual once more, before administering the assessment.

Thank you to my students:
Phil Mahoney and
Alyssa Treiber

Pause Marker (PM) (Tilkens, et al, 2017)

- Determine Severity (Tilkens, et al, 2017)
  - "Mild" CAS = PM percentages 90.0% to 93.9%
  - "Mild-Moderate" CAS = PM percentages 85.0% and 89.9%
  - "Moderate-Severe" CAS = PM percentages 80.0%-84.9%
  - "Severe" CAS = PM percentages below 80.0%

Pause Marker (PM) Summary

Strengths

- Single marker has appeal
- Linked to critical indicator of CAS – sound and syllable segmentation
- Can obtain from speech sample – no testing

Weaknesses

- Needs instrumentation – acoustic spectrogram
- Requires *extensive* training to learn how to technically code and distinguish the pauses
- Requires significant analysis time

Motor Speech Assessment

- Dynamic Motor Speech Assessment
  - Dynamic Evaluation of Motor Speech Skill (DEMSS)
- Syllable Repetition Task (SRT)
- Maximum Performance Tasks (MPT)
- Pause Marker Method (PM)
- ***Pediatric Adaptation of the Mayo 10***

Pediatric Adaptation of the Mayo Clinic System

- Gold Standard: CAS Classification using a Pediatric Adaptation of the Mayo Clinic System (Shriberg & Strand, 2014)
  - Vowel errors
  - Consonant distortions
  - Difficulty achieving initial articulatory configurations or transitionary movement gestures
  - Lexical or phrasal stress errors
  - Syllable or word segregation
  - Groping
  - Intrusive schwa
  - Voicing errors
  - Slow speech rate and/or slow DDK rates
  - Increased difficulty with multi-syllabic words
- ≥ 4 signs over ≥ 3 speech tasks = CAS

Adapted Mayo 10 Clinical Signs for Childhood Apraxia of Speech across Several Speech Tasks

≥4 signs in ≥3 Speech Tasks = CAS **Instructions:** **If a 'sign' (below) is seen at least two times within a 'task' (on right), put check in the corresponding box**	Repeat 1-Syllable Words	Repeat 2-Syllable Words	Repeat 3+ Syllable Words	Artic Test	Phono Test	Connected Speech Sample	DDK	Other	**TOTAL SIGNS: If a row has at least one check mark, put + sign in corresponding box in this column.**
Vowel distortions									
Distorted substitutions									
Difficulty w/initial artic configurations or transitionary movement gestures									
Lexical or phrasal stress errors									
Syllable segregation or word segregation									
Groping									
Intrusive Schwa									
Voicing Errors									
Slow speech rate and/or slow DDK									
Increased difficulty with multi-syllabic words									
Inconsistent errors on repeated productions of same word									
TOTAL SPEAKING TASKS: If a column has at least one check mark put + sign in corresponding box in this row. (Adapted from: Shriberg & Strand, 2014)									**TOTAL SIGNS = ____ (total +'s in column)** **TOTAL TASKS = ____ (total +'s in row)**

Adapted Mayo 10 Clinical Signs for Childhood Apraxia of Speech across Several Speech Tasks

≥4 signs in ≥3 Speech Tasks = CAS **Instructions:** **If a 'sign' (below) is seen at least two times within a 'task' (on right), put check in the corresponding box**	Repeat 1-Syllable Words	Repeat 2-Syllable Words	Repeat 3+ Syllable Words	Artic Test	Phono Test	Connected Speech Sample	DDK	Other	**TOTAL SIGNS: If a row has at least one check mark, put + sign in corresponding box in this column.**
Vowel distortions	✓	✓	✓	✓					+
Distorted substitutions									
Difficulty w/initial artic configurations or transitionary movement gestures			✓	✓					
Lexical or phrasal stress errors									+
Syllable segregation or word segregation		✓		✓		✓			+
Groping			✓						+
Intrusive Schwa									
Voicing Errors			✓	✓					+
Slow speech rate and/or slow DDK									
Increased difficulty with multi-syllabic words			✓	✓					+
Inconsistent errors on repeated productions of same word		✓	✓	✓		✓			+
TOTAL SPEAKING TASKS: If a column has at least one check mark put + sign in corresponding box in this row. Adapted from: Shriberg & Strand, 2014)	+	+	+	+		+			**TOTAL SIGNS = 8 (total +'s in column)** **TOTAL TASKS = 5 (total +'s in row)**

8 signs in 5 tasks +CAS

Pediatric Adaptation of the Mayo Clinic System (Mayo 10) Summary

Strengths

- Comprehensive look at a child's motor speech system across several speech tasks
- Identifies and quantifies features most discriminative of CAS
- Provides some guidance regarding confidence in CAS diagnosis
- Can use with *every* child you assess for CAS

Weaknesses

- Validity and reliability have not been studied

Summary

- Speech is a complex motor task
- CAS is a breakdown in speech motor skill
- Motor speech exam is a critical component to assessment when trying to rule out CAS
- Observe speech across a variety of contexts to assess CAS – several tools available
  - Dynamic Assessment – including the NEW Dynamic Evaluation of Motor Speech Skill (DEMSS)!
  - Syllable Repetition Task
  - Maximum Performance Tasks
  - Pause Marker Method
  - Adaptation of the Mayo 10

Questions

References Assessment

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