PEPPER GUIDE 7:

PEPANALYSES

Overview

As indicated in the PEPPER flowchart, the initial procedural step is to determine if one or more PepAnalyses outputs (i.e., from PepAssess or PepClass) might inform your specific educational, clinical, or research question or need. The focus in this guide is on that determination: which one or more of the dozens of PEPPER outputs might be helpful in your work? Each of the following three sections provides a different perspective on PepAnalyses options.

Section I

The first section of this guide is a slightly edited copy of Chapter 7 from the original PEPPER (1986) manual. Before approximately 1990, PEPPER did not include outputs that required users to complete prosody-voice coding and/or acoustic analyses. Because the computations in present PepAssess outputs that require only phonetic transcriptions have not changed from their original development, it was efficient to scan the information in this section from the 1986 text, reformat the text to be consistent with the present set of PEPPER Guides, and slightly update the text. Importantly, each of the sample outputs from the PepAssess tab in PepAnalyses can be completed using only broad or narrow phonetic transcription. All reference data (see Section III below) were obtained using narrow phonetic transcription.

Section II

The second section of this guide includes a table with references to some research that has used PepAssess and PepClass outputs. The reports have used finalized or nearly finalized versions of the Speech Disorders Classification System (Shriberg, Kwiatkowski, & Mabie, 2019). Some of the PepAssess data and all of the PepClass data were obtained from measures that require narrow phonetic transcription, prosody-voice coding, and acoustic analyses.

Section III

The last section of this guide contains the Tables of Contents from ten Phonology Project Technical Reports. These reports provide standardized reference data for measures in the PepAssess and PepClass outputs. The reference data include statistical information for typical speakers, speakers with idiopathic speech delay, and speakers with speech delay in the context of complex neurodevelopmental disorders. The page numbers in each table of contents should be helpful to locate within each reference, information by measure, age, and sex (see RESEARCH > TECHNICAL REPORTS on the Phonology Project website: https://phonology.waisman.wisc.edu/publications-and-presentations/technical-reports/).

SECTION I:

SOME BASIC PEPASSESS OUTPUTS

PEPPER_PepAnalyses tab:
PepAssess > Analyses > Phoneme Analyses: Structural Statistics

Description

The data in the sample Structural Statistics output and each of the other sample outputs in Section I were obtained from a group of 28 children, 3-6 years of age, with moderate to severe Speech Delay (SD) of unknown (idiopathic) origin (McSweeny et al., 2012). The Structural Statistics output is based on information in the Y and Z lines of each utterance in a Pepfile. The numbers and percentages of the ten word types (canonical forms) intended by the speaker are taken from the Y line and the numbers and percentages of word types obtained are taken from the Z line. The last two columns in the output are the numbers and percentages of words in which the word types in Y and Z match, i.e. Obtained=Intended. Hence, a child who says [dʌg] for the intended word *dog* produces the same word form (CVC) although the obtained vowel differed from the intended vowel.

Computational Notes

In all of the PepAssess outputs, it is important to know which words are included in the computations and which are excluded. For the Structural Statistics output, the only words in the Y or Z lines removed from consideration are words represented by or containing one or more asterisks. All other words in Y or Z are included, even those that are questionable, that is, a disregard, either/or, or an unsure in X or an unsure in Z. As long as words are represented entirely-by consonant and vowel/diphthong segments in both the Y and Z lines, their canonical forms will be included in each analysis. The reason all words are included is that the results of these analyses are meant to reflect structural-level speech information. Disregards, either/ors or unsures are removed from the phonetic/phonologic analyses because they may affect reliability and validity. In contrast, the reliability and validity of Structural Statistics requires that computations be based on all words the speaker intended within each utterance. That is why you should always enter a phonetic transcription in Y and Z, reserving asterisks only for completely unintelligible words. Sometimes a Structural Statistics output will include data on the number of words that do not contain at least one vowel or syllabic consonant. This information is printed at the bottom of the word form section of the output.

Word Types: Intended, Obtained, and Obtained = Intended

A speaker's percentage of occurrence of each Intended word type (Y line) may be interpreted as reflecting two alternative types of information. One interpretation is that the Intended Word Type percentages may indicate whether the speech sample is structurally representative of continuous speech. For example, if a speaker's percentage of CVC words is much higher than the approximately 30% expected (see Section III), perhaps there may be a problem related to the method used for speech sampling. The reference data for word types (see Section III) should provide a general guide to expected percentages. Speaker values above or below one standard deviation from the mean of typical speakers may be suspect. The source of any differences could be traced to a high frequency of occurrence of questionable words of a certain form. Or perhaps a large section of the transcript includes repetitive, non-questionable forms, such as those that occur with repeated use of a proper noun. If the percentages of intended forms do look

too high or too low, it is useful to inspect the transcript to see if the source of the differences can be identified before proceeding to the phonetic or phonologic analyses. Later, in the discussion of the Percentage Consonants Correct (PCC) analysis, we will see that the PCC itself includes helpful quantitative information for decisions about the representativeness of a speech sample (see following discussion of the PCC Word Summary output).

A second interpretation of structural statistics data taken from the Y line is that they accurately reflect phonologic information about the speaker. It is not some lexical bias in a particular speech sample as above, but rather that the speaker is selectively producing or avoiding certain word forms. For example, children who have lowered proportions of multi-syllable words could be avoiding such word forms. Moreover, a comparison of the actual forms used in Z to the intended forms indicated in Y might suggest a pattern of word form substitutions. For example, if the proportion of obtained CVCs to intended CVCs is low when compared to the proportion of obtained versus intended CVs, the speaker may be substituting CV forms for CVCs.

Especially for severely involved children, data on word forms can be informative and useful. Descriptively, such data allow for statements about level or stage of phonologic development. These structural phonologic data also have been used to determine which of the ten word forms should and should not be used in constructing stimuli for management programming. Relevant issues have been discussed in the clinical literature on management of children with phonologic disorders.

Average Words per Utterance (AWU)

The Average Words per Utterance section of the Structural Statistics analysis consists of three numbers that describe the Pepfile transcript: total number of words, total number of utterances, and total number of words divided by total number of utterances. Pepfile entries for this section of Structural Statistics are taken exclusively from the Y line. All words entered in the Y line are used, even those represented in part or whole by an asterisk, i.e. unintelligibles. The rationale here is that whether or not the word was intelligible or questionable, it was a word intended by the speaker. In the Percentage of Consonants Correct (PCC) output described later, information is provided that quantifies each of the questionable word categories included as 'words' in the AWU calculation. When computed for a grouped file, the Average Words per Utterance reflects the total of the average values divided by the number of Pepfiles in the group. Hence, each Pepfile contributes equally to the group average.

The AWU provides a measure of average total 'words' per utterance, even if some words were unintelligible to the transcriber. In previous work with this metric, it has correlated highly (high .90's) with Mean Length of Utterance (MLU). However, the high positive relationship between the two indices depends on how frequently AWU includes words that would not be included in an MLU count. As a structural statistic, AWU reflects the sampling context and the nature of the speech sample. For serial study of the same child, for example, you may want to require that samples have comparable AWUs before

proceeding to inspect the results of other analyses. Children with intelligibility problems may deliberately reduce their utterance length to help listeners understand them. Therefore, as with the other structural statistics, AWU may reflect either something about a particular sampling context or something stable about the speaker.

Type-Token Percentage (TTP)

The Type-Token Percentage (TTP) describes the percentage of word types in the speech sample. Following conventional use of these terms, a word type is a specific lexical item, whereas tokens, including all repetitions of word types, are all words in a sample. The first occurrence of a non-questionable word in the X line is considered a word type, and all non-questionable words are considered word tokens. Note that the program cannot differentiate words on the basis of their constituent morphemes, so *cat* and *cats* would each be considered a word type the first time they occurred in the sample. The program does ignore case, however, so the words *Cat* and *cat* are considered the same word type. A grouped file percentage, as with Average Words per Utterance, is calculated by summing the individual percentages and dividing by the number of Pepfiles in the grouped file. Hence, each Pepfile contributes equally to the group average percentage. As with the other Structural Statistics output, TTP can also be used to qualify a speech sample for further analysis. Does the TTP obtained suggest that the sample is biased--or does it reflect something about the speaker's typical distribution of word types? If the percentage of word types is too low, the sample might be unrepresentative either due to many word repetitions or because the sample continued too long on the same topic. Recall that the "90-70-225 rule" (PG2) for speech sampling was derived to obtain samples that were neither too short nor too long. In conjunction with the Word Lists output discussed later, you can quickly determine the source of a type-token percentage that appears to be either too low or too high.

PEPPER_PepAnalyses tab:
PepAssess > Analyses > Phoneme Analyses > Vowel/Diphthong Analyses

The outputs that comprise the Phoneme Analyses options in PepAssess provide comprehensive summaries of a speaker's speech errors. The error categories are those typically used in describing the articulation of speech sounds with reference to a normative standard. The outputs include separate tabulations for correct sounds by error types, error positions, and phonetic features. Other PepAssess outputs provide word lists aggregated by user interests.

In the following heading and all other headings in this section, we use the current titles found within the PEPPER menu.

Vowel/Diphthong Analyses_Phonemes

The format for the Phoneme Analysis: Vowels is similar to that for the Phoneme Analysis: Consonants. The twelve vowels are sequenced by place (front, mid, back), with vowel height arranged from high to low within each class. The five diphthongs are not ordered by place. Totals for each vowel and diphthong are given in percentages in the same way as described for consonants. Also, the three summary totals are percentaged by row, by column, and for each row x column cell. Initial and final vowels or diphthongs must be the first and last segment in the word, respectively. All other vowels or diphthongs are medial. Only sounds in non-questionable words are entered into the calculations.

Vowel/Diphthong Analyses_Features

The format for the Feature Analyses: Vowel is similar to that used in Feature Analysis: Consonants. As in the Feature Analysis: Consonants, only sound substitution errors are included, with summaries provided for each substitution as tabulated by feature class. Substitutions of diphthongs or vowels are printed to the right of the arrow. Place-height description of the 16 vowels are computed and displayed. The computer program calculates the percentage of occurrence of vowel feature substitutions for all non-questionable sounds and provides a ranked list of all feature substitutions that occurred at least once.

PEPPER_PepAnalyses tab:
PepAssess > Analyses > Phoneme Analyses > Consonant Analyses

Percentage Consonants Correct and Percentage of Consonants Correct-Split

PEPPER Guide 1 includes information on conversational speech sampling for the purposes of PCC and other speech, prosody, and voice analyses. The sample PCC and PCC-Split outputs are two formats that have been used for individual and group PCC data. It is important to keep in mind when formatting a Pepfile for PCC analyses that all Y-Z sound correspondences are inspected, except for sounds that occur in a word that is either questionable in the X line (a disregard or either/or word), or partially questionable in the X line (at least one segment in the word is an unsure or at least one syllable is 'unintelligible'), or sounds in the Z-line that are unsure.

The PCC output provides a Word Coding Summary, including an Intelligibility Index at the bottom of the form. The Intelligibility Index results from the following steps: (1) subtract from the total number of 'words' in the sample, all disregard words in the X line, (2) subtract from this result, the total of all either/or, unsure, and unintelligible words, and (3) divide (2) by (1) and multiply by 100. Essentially, the Intelligibility Index is based on the percentage of intelligible words, with disregards (fillers, false starts, repeated words, etc.) removed from both the numerator and the denominator.

The three-page output for the PCC-Split provides more detail than provided in the PCC analyses. Percentage of Consonants Correct information is tabled separately for each sound as it occurs as a singleton or as part of a cluster, by word position, and by monosyllable and multi-syllable words.

Consonant Analyses_Phonemes

The sample analysis output titled Phoneme Analysis: Consonants can be run on any type of speech behavior. It is perfectly appropriate to run Arctic Test analyses on speech samples consisting of syllables, phrases, sentences or utterances from continuous speech. The only restriction for the analysis to be computed is that each 'word' must contain a vowel. The four columns in the output provide number and percentage data for correct and incorrect segments. The 24 consonants are classified by manner, with place features within each class progressing anterior to posterior in the vocal tract, that is, from the lips to the glottis. The order of manner classes is consistent with most normative data on consonant acquisition. Summary percentages are given for consonants across each row. The three summary total areas are percentaged in three alternatives ways: by row, by column, and for each row x column cell. Only those sounds occurring in non-questionable words are entered into the computations.

Consonant Analyses_Features

The format for the feature analyses is generally similar to that used for the analysis of individual phonemes. The phonetic feature system selected to classify the consonant phonemes of English consists of the traditional six manner features (nasals, stops, fricatives, affricates, glides and liquids) and the six place features (bilabial, labiodental, lingua-alveolar, palatal, velar, and glottal). Sounds are also categorized by the higher-order linguistic concepts of obstruents (stops, fricatives, affricates) versus sonorants (nasals, glides, liquids) and by voiced versus voiceless. Summary formats for each feature category and a summary category are provided. Feature Analysis: Consonants also computes and presents, in ranked order, a Substitution Summary by features. The features corresponding to sound substitutions are computed, rank ordered, and arranged on the second section of the output for visual inspection. The computer program looks at the features for non-questionable sounds (main characters) in the Z line and calculates the percentage of occurrence of feature changes from those intended for the corresponding sounds (main characters) in the Y line. The summary ranked list includes all feature changes that occurred at least once in the speech sample. If the substituted sound is not another consonant, the program prints "other" to the right of the arrow.

PEPPER_PepAnalyses tab:
PepAsses > Analyses > Phoneme Analyses > Natural Process Analysis (NPA)

PEPPER's extensive series of natural process analyses have been retained in PepAssess primarily for their possible value for some contemporary educational, clinical, or research question.

SECTION II:

SOME ADDITIONAL PEPASSESS AND SOME PEPCLASS OUTPUTS

The second section of this guide includes a table with some references to research that has used PepAssess and PepClass outputs. The reports have used finalized (Shriberg, Kwiatkowski, & Mabie, 2019) or nearly finalized versions of the Speech Disorders Classification System.

Phonology Project Articles: Tables and Figures with PEPPER-related content.

Reference[a]	PepAnalyses		Domain or Measure[b]	Location			Output(s)
	PepAssess	PepClass		Figure	Table	No.	
Shriberg, Kwiatkowski, and Mabie (2019)	X	X	Consonants		X	1	**PCC** raw values (*M*, *SD*) for 415 participants with idiopathic Speech Delay
	X	X	Vowels & Consonants				**II** raw values (*M*, *SD*) for 415 participants with idiopathic Speech Delay
		X	Multiple		X	4	**DSI** percentile scores for 14 participants classified as CD from a group of 415 children with idiopathic Speech Delay.
		X	Multiple		X	5	**Prevalence estimates of Motor Speech Disorders** in 415 children with idiopathic Speech Delay
		X	Multiple	X		2	**SDCSS** for individual and Down syndrome group
		X	Multiple	X		3	**SDCSS** for group of 415 children with idiopathic Speech Delay
Shriberg, Strand, Jakielski, and Mabie (2019)		X	Multiple		X	3	**DI** and 5 **DSI** percentages for seven groups with Complex Neurodevelopmental Disorders
		X	Multiple	X		3	**SDCSS** for individual and group with Childhood Apraxia of Speech
		X	Multiple	X		4	**SDCSS** for participants in eight Complex Neurodevelopmental groups
		X	Multiple	X		5	SDCSS graphed findings of **three speech classification** percentages for participants in eight Complex Neurodevelopmental groups
		X	Multiple	X		6	SDCSS graphed findings of **five motor speech classification** percentages for participants in eight Complex Neurodevelopmental groups
Shriberg, Campbell, Mabie, and McGlothlin (2019)	X	X	Consonants		X	1	**PCC** raw values (*M*, *SD*) for 415 participants with idiopathic Speech Delay by Motor Speech classification status
	X	X	Vowels & Consonants				**II** raw values (*M*, *SD*) for 415 participants with idiopathic Speech Delay by Motor Speech classification status

Reference[a]	PepAnalyses		Domain or Measure[b]	Location			Output(s)
	PepAssess	PepClass		Figure	Table	No.	
	X	X	Consonants		X	2	**PCC** raw values (*M*, *SD*) for 14 longitudinal participants with idiopathic Speech Delay from the earliest available conversational sample
	X	X	Vowels & Consonants				**II** raw values (*M*, *SD*) for 14 longitudinal participants with idiopathic Speech Delay from the earliest available conversational sample
	X		Vowels		X	3	**PVC** raw values and z-scores (*M*, *SD*) for participant samples of idiopathic Speech Delay with high (Sample 1) and low (Sample 2) prevalence of Speech Motor Delay (SMD)
	X	X	Consonants				**PCC** raw values and z-scores (*M*, *SD*) for participant samples of idiopathic Speech Delay with high (Sample 1) and low (Sample 2) prevalence of Speech Motor Delay (SMD)
	X	X	Consonants - SRT				**SRT Performance, Encoding, and Memory** z-sores for participant samples of idiopathic Speech Delay with high (Sample 1) and low (Sample 2) prevalence of Speech Motor Delay (SMD)
	X	X	Vowels & Consonants				**II** raw values and z-scores (*M*, *SD*) for participant samples of idiopathic Speech Delay with high (Sample 1) and low (Sample 2) prevalence of Speech Motor Delay (SMD)
	X	X	Vowels & Consonants				**OII % Lowered Intelligibility** for participant samples of idiopathic Speech Delay with high (Sample 1) and low (Sample 2) prevalence of Speech Motor Delay (SMD)
	X		Phrasing				**Average Words/Utterance** z-sores for participant samples of idiopathic Speech Delay with high (Sample 1) and low (Sample 2) prevalence of Speech Motor Delay (SMD)
		X	PSI		X	4	Ten most frequent earliest available **PSI signs** for participant samples of idiopathic Speech Delay with

Reference[a]	PepAnalyses		Domain or Measure[b]	Location			Output(s)
	PepAssess	PepClass		Figure	Table	No.	
							Speech Motor Delay (SMD) and No Motor Speech Disorder (No MSD)
	X		Vowels		X	5	**PVC** raw values and z-scores (*M*, *SD*) for participant samples of idiopathic Speech Delay with Speech Motor Delay (SMD) and No Motor Speech Disorder (No MSD)
	X	X	Consonants				**PCC** raw values and z-scores (*M*, *SD*) for participant samples of idiopathic Speech Delay with Speech Motor Delay (SMD) and No Motor Speech Disorder (No MSD)
	X	X	Consonants - SRT				**SRT Performance, Encoding, and Memory** z-sores for participant samples of idiopathic Speech Delay with Speech Motor Delay (SMD) and No Motor Speech Disorder (No MSD)
	X	X	Vowels & Consonants				**II** raw values and z-scores (*M*, *SD*) for participant samples of idiopathic Speech Delay with Speech Motor Delay (SMD) and No Motor Speech Disorder (No MSD)
	X	X	Vowels & Consonants				**OII % Lowered Intelligibility** for participant samples of idiopathic Speech Delay with Speech Motor Delay (SMD) and No Motor Speech Disorder (No MSD)
	X		Phrasing				**Average Words/Utterance** z-sores for participant samples of idiopathic Speech Delay with Speech Motor Delay (SMD) and No Motor Speech Disorder (No MSD)
	X		Vowels		X	6	**PVC** raw values and z-scores (*M*, *SD*) for 11 participants with concurrent Speech Delay and normalized Speech Motor Delay (SMD) by 9 years of age and 3 participants with concurrent Speech Delay and persistent SMD after 9 years of age
	X	X	Consonants				**PCC** raw values and z-scores (*M*, *SD*) for 11 participants with concurrent Speech Delay and

Reference[a]	PepAnalyses		Domain or Measure[b]	Location			Output(s)
	PepAssess	PepClass		Figure	Table	No.	
							normalized Speech Motor Delay (SMD) by 9 years of age and 3 participants with concurrent Speech Delay and persistent SMD after 9 years of age
	X	X	Consonants				**PCCR** raw values and z-scores (*M*, *SD*) for 11 participants with concurrent Speech Delay and normalized Speech Motor Delay (SMD) by 9 years of age and 3 participants with concurrent Speech Delay and persistent SMD after 9 years of age
	X	X	Vowels & Consonants				**II** raw values and z-scores (*M*, *SD*) for 11 participants with concurrent Speech Delay and normalized Speech Motor Delay (SMD) by 9 years of age and 3 participants with concurrent Speech Delay and persistent SMD after 9 years of age
	X	X	Vowels & Consonants				**OII % Lowered Intelligibility** for 11 participants with concurrent Speech Delay and normalized Speech Motor Delay (SMD) by 9 years of age and 3 participants with concurrent Speech Delay and persistent SMD after 9 years of age
		X	PSI	X		1	Scatterplot of persistence of Speech Motor Delay (SMD) based on the **PSI** in 14 participants treated for idiopathic Speech Delay (SD).
Shriberg and Wren (2019)	X		Vowels		X	1	**PVC** raw values (*M*, *SD*) for three groups of speakers (i.e., two groups with idiopathic Speech Delay from the USA and England and a group with Complex Neurodevelopmental Disorders) with Speech Motor Delay (SMD) and No Motor Speech Disorder (No MSD) in two of the three groups
	X	X	Consonants				**PCC** raw values (*M*, *SD*) for three groups of speakers (i.e., two groups with idiopathic Speech Delay from the USA and England and a group with Complex Neurodevelopmental Disorders) with Speech Motor Delay (SMD) and No Motor Speech Disorder (No MSD) in two of the three groups

Reference[a]	PepAnalyses		Domain or Measure[b]	Location			Output(s)
	PepAssess	PepClass		Figure	Table	No.	
		X	PSI		X	2	**PSI** Sign No. 5 findings for participants in the USA and Complex Neurodevelopmental Disorder (CND) groups with idiopathic Speech Delay and Speech Motor Delay (SMD) compared to control participants with idiopathic Speech Delay and No Motor Speech Disorder (No MSD) in two speech tasks.
		X	PSI	X		1	**The Precision-Stability Index (PSI): Individual** output
		X	PSI	X		2	The 19 **PSI** acoustic signs of Speech Motor Delay in two groups with idiopathic Speech Delay from the USA and England and a group with Complex Neurodevelopmental Disorders
	X	X	Vowels & PSI	X		3	Average duration (ms) of the 11 phonemes in **PSI 5: Increased Duration of Mid-Vowels and Diphthongs** in the continuous speech tasks from participants with idiopathic Speech Delay and Speech Motor Delay compared to durations of these phonemes from the continuous speech of participants with SD and No Motor Speech Disorder
Wilson, Abbeduto, Camarata, and Shriberg (2019a)	X		Vowels		X	2	**PVC** raw values (*M*, *SD*, Range) for DS group
	X	X	Consonants				**PCC** raw values (*M*, *SD*, Range) for DS group
	X	X	Vowels & Consonants				**II** raw values (*M*, *SD*, Range) for DS group
	X		Phrasing				**Average Words/Utterance** raw scores (*M*, *SD*, Range) for 45 participants with Down syndrome (DS)
		X	Multiple	X		1	**SDCSS** for Down syndrome group
		X	Multiple	X		2	5 **DSI** subtype percentages and percentiles for participants with Down syndrome (DS)

Reference[a]	PepAnalyses		Domain or Measure[b]	Location			Output(s)
	PepAssess	PepClass		Figure	Table	No.	
Wilson, Abbeduto, Camarata, and Shriberg (2019b)	X		Phrasing		X	1	**Average Words/Utterance** raw scores (*M*, *SD*) for participants with Down syndrome by Ordinal Intelligibility Index classification
		X	Vowels & Consonants		X	2	**Ordinal Intelligibility Index** findings for a Down syndrome group classified by their speech and motor speech status.
		X	Vowels & Consonants		X	3	**Ordinal Intelligibility Index** findings for a Down syndrome group classified by their motor speech status.
	X	X	Vowels & Consonants	X		1	**Intelligibility Index** scores and **Ordinal Intelligibility Index** classification findings for a Down syndrome group.
		X	Multiple	X		2	Bar graphs of 5 **DSI** subtype percentages and percentiles for participants with Down syndrome by High and Low Ordinal Intelligibility Index classification
		X	Multiple	X		3	Bar graphs of **Motor Speech Classification** percentages from the **SDCSS** for three participants groups (Down syndrome, Complex Neurodevelopmental Disorders, and Idiopathic Speech Delay) by **Ordinal Intelligibility Index** classification (High, Moderate, and Low)
	X	X	Vowels & Consonants	X		4	Four measures of consonant and vowel production in Conversational Speech in a Down syndrome group by High and Low **Ordinal Intelligibility Index** classification
	X	X	Consonants	X		5	Sibilant distortions in Conversational Speech in a Down syndrome group by High and Low **Ordinal Intelligibility Index** classification
	X	X	Prosody& Voice	X		6	Inappropriate prosody and voice in Conversational Speech in a Down syndrome group by High and Low **Ordinal Intelligibility Index** classification

Reference[a]	PepAnalyses		Domain or Measure[b]	Location			Output(s)
	PepAssess	PepClass		Figure	Table	No.	
Baylis and Shriberg (2018)	X		Vowels		X	1	**PVC** raw values and z-scores (*M*, *SD*, Range)
	X	X	Consonants				**PCC** raw values and z-scores (*M*, *SD*, Range)
	X	X	Vowels & Consonants				**II** raw values and z-scores (*M*, *SD*, Range)
		X	Multiple		X	2	**SDCS** speech and motor speech classifications described
	X	X	Multiple		X	3	Transcription, **PVSP**, and acoustic analyses reliability estimates
		X	Multiple	X		1	**SDCSS** (22q and DS)
		X	Multiple	X		2	**SDCSS** (FXS and GALT)
		X	Multiple	X		3	Bar graphs for speech and motor speech classifications percentage of participants (22q, DS, FXS, GALT)
Shriberg et al. (2017a)		X	Multiple		X	3	**SDCS** speech and motor speech classifications described
		X	Multiple		X	4	**DI** and 5 **DSI** defined and described
		X	Multiple		X	6	8 subtypes of inappropriate pauses descriptions
		X	Multiple	X		1	**SDCS**
		X	Multiple	X		2	**SDCSS** for individual
Shriberg et al. (2017b)	X	X	Multiple		X	2	17 MSAP tasks
	X		Vowels		X	3	**PVC** raw values (*M*, *SD*, Range) for CAS groups
	X	X	Consonants		X	3	**PCC** raw values (*M*, *SD*, Range) for CAS groups
		X	Pauses		X	3	Opportunities; Inappropriate Type I; **PM** score for CAS groups
	X	X	SPMS		X	3	Rate, Stress, Transcoding data for CAS groups
	X		Vowels		X	4	**PVC** raw values (*M*, *SD*, Range) for AAS groups
	X	X	Consonants		X	4	**PCC** raw values (*M*, *SD*, Range) for AAS groups
		X	Pauses		X	4	Opportunities; Inappropriate Type I; **PM** score for AAS groups
	X	X	SPMS		X	4	Rate, Stress, Transcoding data for AAS groups
	X		Vowels		X	5	**PVC** raw values (*M*, *SD*, Range) for PM+/PM- groups
	X	X	Consonants		X	5	**PCC** raw values (*M*, *SD*, Range) for PM+/PM- groups

Reference[a]	PepAnalyses		Domain or Measure[b]	Location			Output(s)
	PepAssess	PepClass		Figure	Table	No.	
		X	Pauses		X	5	Opportunities; Inappropriate Type I; **PM** score for PM+/PM- groups
	X	X	SPMS		X	5	Rate, Stress, Transcoding data for PM+/PM- groups
Shriberg et al. (2017c)	X	X	Consonants		X	2	**PCC** raw values (*M*, *SD*, Range) for CAS, PPAOS, and SD groups
	X	X	Consonants - SRT		X	3	Performance, Encoding, Memory, and Transcoding raw and z-sores for CAS, AAS, and SD groups
	X	X	Pauses, PVSP		X	4	Groping, Repetition/revision pauses, and **PVSP** repetition/revision raw and z-scores for CAS, AAS, and SD groups
		X	PSI, DMI		X	5	**PSI** and **DMI** (place/duration/addition changes) raw and z-sores for CAS, AAS, and SD groups
	X		Rate		X	6	Speaking and articulation rate raw and z-scores for CAS, AAS, and SD groups
	X		Stress			6	Sentential stress raw and z-scores for CAS, AAS, and SD groups
		X	Multiple	X		1	**SDCS**
		X	Pauses	X		2	Bar graphs for Appropriate and Inappropriate Abrupt pauses for SD, CAS&CND, and AAS groups
Shriberg et al. (2017d)		X	PM		X	1	**PM** Non-marginal and Marginal counts for CAS, CND, AAS, Longitudinal participants, and SD groups
	X	X	Consonants		X	1	**PCC** raw values (*M*, *SD*, Range) for CAS, CND, AAS, Longitudinal participants, and SD groups
		X	SCI		X	2	Pearson r correlation coefficients for CAS and AAS participants with nonmarginal PM+ scores by CPSA and Transcription/PVSP/Acoustic methods of data reduction
		X	PSI		X	2	
	X	X	Multiple		X	2	
	X	X	SPMS		X	3	**SPMS** Signs scores and classification for Longitudinal participants
		X	PM			3	**PM** scores and classification for Longitudinal participants
		X	PM	X		1	**PM** scores plotted low to high for participants with CAS, DS, GALT, CNDs, AOS, and PPAOS

Reference[a]	PepAnalyses		Domain or Measure[b]	Location			Output(s)
	PepAssess	PepClass		Figure	Table	No.	
		X	PMI	X		3	Bar graphs of **PMI** categories for participants with CAS, CND, and AAS
	X	X	PVSP	X		4	**PVSP** Profiles for CAS participants by PMI category
	X	X	PVSP	X		5	**PVSP** Profiles for CND participants by PMI category
	X	X	PVSP	X		6	**PVSP** Profiles for AAS participants by PMI category
Carrigg et al. (2016)	X	X	SRT		X	5	Median and range scores on the **SRT** for Persistent and Resolved SSD groups
Vick et al. (2014)		X	Multiple	X		1	**SDCS**
Shriberg et al. (2012)	X	X	TLDA		X	2	**TLDA** signs for classification of CAS and DYS.
	X		Vowels		X	3	**PVC** raw values for participants with typical speech, SD, typical language, LI, and CAS
	X	X	Consonants		X	3	**PCC** raw values for participants with typical speech, SD, typical language, LI, and CAS
	X	X	Vowels & Consonants		X	3	**PPC** and **II** raw values for participants with typical speech, SD, typical language, LI, and CAS
	X	X	Phrasing		X	3	% Appropriate Phrasing raw values for participants with typical speech, SD, typical language, LI, and CAS
	X	X	Rate		X	3	% Appropriate Rate raw values for participants with typical speech, SD, typical language, LI, and CAS
	X	X	Stress		X	3	% Appropriate Stress raw values for participants with typical speech, SD, typical language, LI, and CAS
	X	X	Loudness		X	3	% Appropriate Loudness raw values for participants with typical speech, SD, typical language, LI, and CAS
	X	X	Pitch		X	3	% Appropriate Pitch raw values for participants with typical speech, SD, typical language, LI, and CAS
	X	X	Laryngeal quality		X	3	% Appropriate LQ raw values for participants with typical speech, SD, typical language, LI, and CAS
	X	X	Resonance quality		X	3	% Appropriate RQ raw values for participants with typical speech, SD, typical language, LI, and CAS
	X	X	SRT		X	4	Correlations for SRT Encoding, Memory, Transcoding, and Competence scores for participants

Reference[a]	PepAnalyses		Domain or Measure[b]	Location			Output(s)
	PepAssess	PepClass		Figure	Table	No.	
							with typical speech, SD, typical language, LI, and CAS
	X	X	Multiple and SRT		X	5	Correlations for SRT Encoding, Memory, Transcoding, and Competence scores with speech-prosody measures (PVC, PCC, II, Phrasing, Rate, Stress) for participants with typical speech, SD, typical language, LI, and CAS
	X	X	SRT		X	5	Pair-wise comparisons for SRT Encoding, Memory, Transcoding, and Competence scores for participants with typical speech, SD, typical language, LI, and CAS
		X	Multiple	X		1	**SDCS**
	X	X	SRT	X		2	Box plots for percentage of Encoding, Memory, Transcoding, and Competence for participants with typical speech, SD, typical language, LI, and CAS
Shriberg, Paul et al. (2011)	X	X	PVSP	X		2	**PVSP** Profiles for participants with ASD, Typical Development, SD, and CAS.
Shriberg (2010)		X	Multiple	X		1-2	**SDCS**
	X		Consonants	X		1-7	**PCCR** Profiles for two OME study groups

[a] See **REFERENCES** section.
[b] Ten Linguistic Domains (Shriberg et al., 2010).

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SECTION III:

SOME REFERENCE DATA FOR PEPANALYSES OUTPUTS

The last section of this guide includes Tables of Contents from ten Phonology Project Technical Reports. These reports provide standardized reference data for measures in the PepAssess and PepClass outputs. The reference data include statistical information for typical speakers, speakers with idiopathic speech delay, and speakers with speech delay in the context of complex neurodevelopmental disorders. The page numbers in each table of contents should be helpful to locate within each reference, information by measure, age, and sex (see RESEARCH > TECHNICAL REPORTS on the Phonology Project website:
https://phonology.waisman.wisc.edu/publications-and-presentations/technical-reports/).

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