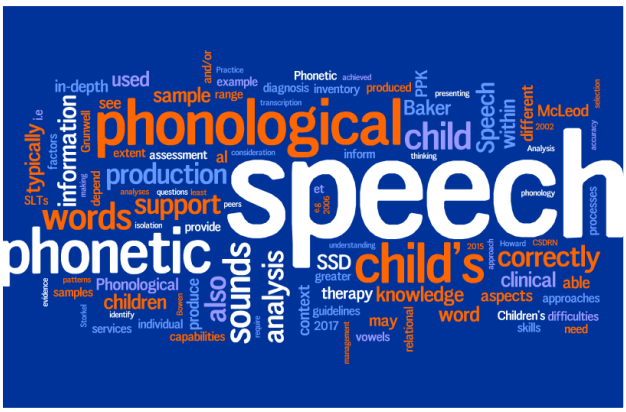


GOOD PRACTICE GUIDELINES

FOR THE ANALYSIS OF CHILD SPEECH

1: Introduction

1.1: Background

These guidelines have been developed by the UK and Ireland's Child Speech Disorder Research Network (CSDRN) to support Speech and Language Therapists (SLTs) in their analysis of disordered speech samples. They complement *The Good Practice Guidelines for Transcription of Children's Speech Samples in Clinical Practice and Research* (https://www.nbt.nhs.uk/sites/default/files/BSLTRU_Good%20practice%20guidelines_Transcription_2Ed_2017.pdf) (also developed by the CSDRN), which provide advice on the collection of speech samples and their phonetic transcription.

Phonetic transcription and phonological analysis of a speech sample are an integral part of the assessment process for children presenting with speech sound disorder and inform all aspects of clinical management (McLeod and Baker 2017, Bowen 2015, McLeod and Baker 2014, Howard and Heselwood 2002). For the purposes of these guidelines, the term Speech Sound Disorder (SSD) is used as an umbrella term to include all speech difficulties regardless of possible causative factors (see ASHA 2004b, McLeod *et al.* 2013). A speech sample that is representative and transcribed accurately is the first step towards diagnosis of potential SSD. Subsequently, careful consideration of the transcribed speech is fundamental to identify any issues with speech production and to place the child's speech abilities within the context of their typically developing peers. Synthesis of this analysis with findings from the child's case history ensures an appropriate differential diagnosis is reached and an individually tailored management plan drawn-up.

The CSDRN guidelines acknowledge the need for SLT services to clearly identify those children who require support with their speech development compared to those who do not. Importantly, commissioners need this type of relational, comparative information to justify provision of services. Currently, the only assessment standardised using speech samples from children in the UK and Ireland (and therefore suitable for this purpose), is the Diagnostic Evaluation of Articulation and Phonology (Dodd *at al.* 2006). However, SLTs can also refer to norm-based data on the ages of suppression of typical phonological processes combined with norms for speech sound acquisition to support their thinking (e.g., Grunwell 1987). Both these standardised and more informal norms-based approaches provide a valuable indication of service need, and can also act as a baseline against which to monitor progress.

These guidelines recommend supplementing this relational information (formal or informal) with further phonetic and phonological analyses depending on the nature and severity of the child's difficulties and the clinical questions being addressed. For example, more in-depth analysis is recommended in the case of

children with persisting speech difficulties at school-age and in moderate-to-severe and/or complex cases where there is evidence of atypical patterns, a major loss in contrastiveness and/or widespread variability in production (see Skahan *et al.* 2007).

A range of measures, tools and approaches exist to help the clinician capture independent factors unique to each child's presentation which may also include relational factors. Examples of tools that support phonetic/phonological analysis are: the Phonological Assessment of Children's Speech (PACS) (Grunwell 1985); PACSTOYS (Grunwell and Harding 1995); South Tyneside Assessment of Phonology (STAP) (Armstrong and Ainley 2012); the Phonetic and Phonological Systems Analysis (PPSA) (Bates and Watson 2012); and the Children's Independent and Relational Phonological Analysis (CHIRPA) (Baker 2016) (see McLeod and Baker (2017) and Bowen (2015) for a more in-depth discussion about different analytical approaches to SSD). Most importantly, whichever approach is favoured by individual SLTs and services, it must be able to capture phonetic and phonological aspects of the child's presenting SSD, including input and processing factors such as phonological awareness, in sufficient depth to inform clinical decision making i.e., diagnosis of SSD, and selection of target/s and intervention approach.

The CSDRN guidelines describe these key aspects highlighting when a more in-depth analysis is warranted and also informing clinical thinking to support interpretation of findings. In addition, they provide a 'checklist' (see Appendix A) which summarises this information in an accessible manner and which may be used as a support in auditing current practice and/or performing more in-depth analyses.

1.2: The importance of terminology – what is the difference between a child's phonetic inventory and productive phonological knowledge and why does this matter?

Speech development is two-fold, involving phonetic capabilities (potentially influenced by anatomical structure, hearing, articulatory and/or motor skills) on the one hand, and cognitive-linguistic phonological learning on the other (Stoel-Gammon and Vogel Sosa 2014, Ball and Müller 2011). Children failing to develop speech typically can present with difficulties in either one or both of these areas. Since children learn to recognise and produce sounds in words, the accuracy with which a given sound is produced will depend on a range of factors including the position it occupies within words (i.e., syllable-initial or final) and the adjacent phonetic context. For example, correct production of velar consonants may be facilitated in the context of back vowels and constrained in the context of front vowels. Critically, it will also depend on: the maturity of the child's speech processing skills at the time when they first 'learn'/encounter a word; the information they are able to lay down in their long-term memory about its phonological properties; and the extent to which they are able to refine this information as they gain greater experience of the word and as their speech perception and production skills mature (see Stackhouse and Wells 1997). Factors such as word frequency, familiarity, and the number of words that share similar phonological patterns (e.g., <juice> [ʤus], <goose> [gus], <loose> [lus]) within a child's lexicon, all influence the accuracy with which speech sounds are produced in words (Storkel *et al.* 2006, Storkel and Morrissette 2002). It is important to note that the nature of this learning extends beyond single words to encompass the phonetic and phonological processes that enable fluent production of words in multi-word utterances (Howard *et al.* 2008).

When assessing a child who is failing to develop speech typically, it is thus important to gather information on both their phonetic and phonological capabilities. Each of these can be measured in different ways and with a greater or lesser degree of detail. Throughout this document, particular notes of interest for clinical decision making will be highlighted by a red flag.

1.2.1: Phonetic Inventory

A phonetic inventory in its simplest form lists the speech sounds that a child can physically articulate irrespective of how he/she uses them in words. Thus, it will include speech sounds that are used both correctly and incorrectly by the child; for example, he/she may fail to produce target /s/, realising it as [t] 100% of the time but uses [s] in place of target /ʃ/. This 'puzzle phenomenon' (Smith 1973) nicely illustrates the difference between phonetic and phonological knowledge.

Any speech sounds which have not been tested in the current sample are typically checked by asking the child to produce them in isolation to imitation.

A more detailed understanding of a child's phonetic capabilities in relation to speech sounds not produced correctly can be achieved by completing a stimulability assessment where his/her ability to produce speech sounds in isolation, and a range of syllable positions is investigated with clinician support and scaffolding e.g., Powell and Miccio's (1996) Stimulability Assessment.

1.2.2: Productive Phonological Knowledge

A phonemic inventory lists the speech sounds that a child is able to use correctly in their speech and provides a basic measure of their productive phonological knowledge (PPK). A child is judged to have PPK of a speech sound if it is used correctly, at least once within the speech sample. PPK can be further analysed along a scale ranging from no knowledge (the phoneme is never used correctly in words) to full knowledge (the phoneme is always used correctly within words) (Gierut *et al.* 1987). Detailed understanding of the extent to which individual phonemes are realised correctly across different word positions and phonetic contexts can usefully inform selection and prioritisation of therapy targets. For instance, there is evidence that for some children, greater system-wide generalisation may be achieved by targeting speech sounds for which they have least PPK (e.g., Gierut 1989, 2005, Gierut and Champion 2001).

In the following sections, we highlight the key questions of interest in a phonetic and phonological analysis of a phonetically transcribed speech sample. These relate to the child's production of vowels as well as consonants (singletons and clusters), word structures and connected speech. The extent to which these different aspects of speech production require consideration will of course depend on the child in question and their individual speech profile.

2. Recommended Process for Phonetic and Phonological Analysis

(See Checklist for Speech Analysis in Appendix A)

2.1 Inventories

2.1.1 Consonants

Is the consonant system complete? i.e., what phonemes are represented in the child's system and are there any gaps? NB. Check that 'missing' phonemes have actually been sampled:

(a) Are all singleton consonants present?
(b) Are a representative range of consonant clusters present? For instance, can the child produce clusters word-initially as well as word-finally? Can they produce obstruent + liquid clusters e.g., /bl/, /pɹ/? Can they produce /s/-clusters?

Where the child presents with a severely reduced phonetic inventory and subsequent widespread loss of contrast within the system, it may be more pertinent to take a more wide-angled view and identify *emerging contrasts*. For example:

(a) Are all manner categories represented?
- plosives
- nasals
- fricatives
- affricates

- approximants

(b) Are all places of articulation represented?
- dental
- bilabial / labiodental
- alveolar
- post-alveolar
- palatal
- velar
- glottal

(c) Is there evidence of a voicing contrast?

A limited consonant inventory is considered a diagnostic indicator for moderate-to-severe phonological disorder and/or developmental verbal dyspraxia (DVD) (see Bowen 2015).

Age of acquisition of individual consonants can provide norm-based criterion against which to compare a child's speech development. For example, Shriberg's (1993) early-middle-late norms can support SLTs in identifying phonemes which may be particularly delayed, and facilitate therapy target selection – early-8: / m, n, j, b, w, d, p, h/; middle-8: / t, ŋ, k, g, f, v, tʃ, dʒ/; late-8: / ʃ, ʒ, l, ɹ, s, z, θ, ð / + clusters. However, these should not be considered definitive and should always be used alongside norms for suppression of phonological processes, other standardised scores as appropriate, and information about the child's overall speech sound system. See Baker and McLeod (2017), Bowen (2015), and Rvachew and Brosseau-Lapré (2012) for further in-depth discussion.

2.1.2 Vowels

Is the vowel system complete? i.e., what phonemes are represented in the child's system and are there any gaps? NB. Check that 'missing' phonemes have actually been sampled:

(a) Are all corner vowels present, e.g., /i, a, ɑ, u/?[1]
(b) Are the mid-vowels present. e.g., /ɪ, ɛ, ɜ, ə, ʌ, ɒ, ɔ, o/?
(c) Are diphthongs present?

A limited vowel inventory may also indicate either phonological disorder and/or DVD (Pollock 2013, Pollock and Keiser 1990):

The vowel system is traditionally reported to be fully developed by 3;00 years (see Donegan 2002). Importantly however, more recent evidence suggests that vowels are not fully mastered in polysyllabic words and connected speech until much later (see James *et al.* 2001, Wren *et al*. 2012).

[1] The examples given here relate to the Southern British Standard English vowel system.

2.1.3 *Word Structures*

Is the word structure preserved?

(a) Is the child using CV structures?
(b) Is the child using CVC structures?
(c) Is the child using clusters (initial, inter-vocalic, final)?
(d) Is the child using disyllabic words (e.g., 'baby')
(e) Is the child using polysyllabic words (e.g., 'umbrella')

Difficulty in production of polysyllabic words is a recognised area for alert in relation to more persistent phonological disorder and/or DVD (Masso *et al.* 2017).

2.2 Processes and patterns

2.2.1 What systemic (i.e., system-wide) patterns are evident in the sample? NB. These relate to difficulties contrasting speech sounds in terms of place and/or manner of articulation, and/or voicing. They therefore apply to natural classes of sounds, e.g., fronting of velar stops or backing of alveolar stops, stopping of fricatives and affricates, voicing of voiceless obstruents (i.e., fricatives, plosives and affricates).

(a) What natural phonological processes (e.g., stopping) are present?
- Which of these are delayed for the child's age?

(b) What atypical or idiosyncratic patterns (e.g., gliding of fricatives) are present?

The persistence of natural phonological processes beyond the expected age of suppression is associated with delayed phonological development. The presence of atypical and/or idiosyncratic processes indicates disordered development and/or DVD. Note that children can present with a mixed profile of both typical, i.e., delayed processes and atypical or 'deviant' patterns.

2.2.2 What evidence is there of variability in production and what are the patterns?

(a) For a given process/pattern, how many phonemes within the class are affected? For example with stopping are all fricatives affected or a sub-set (e.g., /s, z, ʃ, ʒ/) only? Similarly, with final consonant deletion, are all classes of phoneme affected or certain classes only (e.g., final fricatives and affricates are deleted but plosives, nasals and liquids are realised)? Within any one class affected are all phonemes deleted or a sub-set (e.g., /f, v/) only?

(b) For any given phoneme which word/syllable positions are implicated? For example, velars may be fronted syllable initially, e.g., /ki/ → [ti], /geɪm/ → [deɪm] but produced correctly syllable finally, e.g., <sack> realised as [sak], <bag> realised as [bag].

(c) What evidence is there of context-conditioning? For example, velars may be fronted preceding non-low front vowels e.g., /ki/ → [ti], /geɪt/ → [deɪt] but produced correctly in the context of non-high back vowels /kɑ/ → [kɑ], /gəʊt/ → [gəʊt] (see Bates *et al.* 2013).

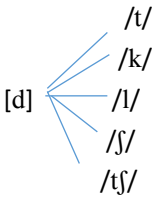
(d) What evidence is there of lexical conditioning? For example, later-acquired words are produced correctly or more accurately than words acquired earlier, reflecting greater maturity in speech perception and/or speech motor skills (see Stackhouse and Wells 1997).

This analysis allows the SLT to identify whether or not there is evidence of *progressive change* within the system, i.e., the fact that a phonological process or atypical pattern is not used universally within the sample is

evidence that it is already moving towards suppression (Stoel-Gammon and Dunn 1985). It thus also provides another more detailed measure of the child's PPK and can usefully assist case prioritisation as well as inform selection of targets and therapy approach (see the worked case example in Appendix B). It is essential to distinguish this kind of progressive variability from widespread unexplained variability (Grunwell 1987) and inconsistent production of the same lexical item (token-to-token variability), e.g., /katəpɪlə/ produced as [tatəpɪlə], [tapəkɪlə], [takəpɪlə], to avoid potential misdiagnosis and selection of an inappropriate intervention approach.

Progressive variability is a positive prognostic indicator whereas non-progressive variability suggests more disordered phonological development and a greater need for intervention. Token-to-token variability is considered to be a diagnostic indicator of Inconsistent Speech Disorder (ISD) (Dodd 2005) and is also associated with DVD (McLeod and Baker 2017).

2.2.3 What are the patterns of phoneme collapse? Multiple phoneme collapse (also referred to as use of a preferred sound or systematic sound preference) is where a single speech sound is used in place of several phonemes (see Williams 2000), e.g.,



Identifying patterns of multiple phoneme collapse assists selection of therapy targets and approach, e.g., multiple oppositions <dare, share, care, tear, chair>, maximal oppositions <lip vs dip>, empty-set <lip vs ship> (see worked case example in Appendix B).

2.2.4 What word-level error patterns are evident in the sample? NB. These include consonant harmony, sequencing errors and vowel or consonant insertion.

Consonant harmony (CH) is an assimilatory process, characteristic of early, typical development. It is a natural phonological process which reflects difficulty distinguishing sounds in terms of place or manner of articulation and/or voicing within specific words, e.g., <dog> /dɒg/ → [gɒg]. It is important not to mistake instances of CH as being examples of systemic patterns, e.g., backing, since this could lead to misdiagnosis, in this instance, phonological disorder. Sequencing errors and consonant/vowel insertions typically occur with greater frequency with increased processing demands, e.g., in longer, more articulatorily complex words and/or in connected speech and are associated with motor programming/planning difficulties.

2.2.5 What phonetic level errors (e.g., lateralised or dentalised sibilants, excessive nasalisation and lengthening of vowels) are evident in the sample?

Phonetic level errors, also referred to in the literature as 'articulatory errors', 'phonetic distortions' or 'non-system' sounds, relate to the mis-articulation or 'distorted' production of individual sounds rather than a difficulty contrasting sounds in terms of voicing, place and/or manner of articulation. However, depending on the nature of the error, they can also result in a loss of phonological contrast (see Harding-Bell and Howard 2013). They may also occur alongside systemic patterns in the speech of children with DVD or phonological impairment. For instance, weakly articulated consonants (or 'lax') articulations such as the realisation of /p/ as

the bilabial fricative [ɸ] are associated with DVD. Realisation of /tʃ, dʒ/ as [ts, dz] (non-system sounds in English) by children with phonological impairment can represent an intermediate stage between stopping of affricates (i.e., /tʃ, dʒ/ → [t, d]) and their correct production. (See also the following 'red flag' note on vowel distortions.)

It can be helpful to distinguish between articulation difficulties that are a secondary consequence of an anatomical, physiological or neurological condition such as, for example, hearing impairment, cleft lip/palate or developmental syndrome (e.g., Down Syndrome or Cerebral Palsy) and 'primary' difficulties which occur in the absence of any overt organic cause. Primary or 'unexplained' difficulties most typically involve dentalisation or lateralisation of the sibilant fricatives /s, z, ʃ, ʒ/, realisation of /ɹ/ as [ʋ][2] and, in rhotic accent systems, de-rhoticisation of /ə˞, ɜ˞/.

Systemic vowel error patterns such as vowel lowering e.g., <bed> /bɛd/ realised as [bad] or diphthong reduction e.g., <kite> /kaɪt/ realised as [kat] are associated with both phonological disorder and DVD (Pollock and Keiser 1990, Speake *et al.* 2012). Importantly, vowel 'distortions' such as excessive vowel lengthening and use of non-system vowels are specifically associated with DVD (Pollock 2013.)

2.2.6 What factors contribute to poor intelligibility in the child's connected speech?
Compare the child's performance at single word versus connected speech levels to identify:

- Greater prevalence of patterns evident at the single word level reflecting the increased processing demands/lack of generalisation.
- Atypical juncture effects:
    - Open juncture i.e., **not** using typical connected speech processes to achieve fluid transition across word boundaries:
        - Assimilation, e.g., <red book> /ɹɛd/ + /bʊk/ → [ɹɛbᵐbʊk]
        - Elision, e.g., <soft bread> /sɒft/ + /bɹɛd/ → [sɒf bɹɛd]
        - Liaison (non-rhotic accents), e.g., <far> /fɑ/ but <far away> /fɑ/ + /əˈweɪ/ → [fɑɹ əˈweɪ]
        - Coalescence, e.g., <miss you> /mɪs/ + /ju/ → [mɪʃu]
        - Glide insertion, e.g., <blow out > /bləʊ/ + /aʊt/ → [bləʊʷaʊt]. (NB. Glide insertion is a natural coarticulatory pattern.)

    The child may also separate words out from the speech stream through inappropriate use of pauses and glottal stops, also contributing to the perception of 'staccato-like' speech.

    - Close juncture i.e., over-use of segmental and syllable elisions and weakened articulatory realisations within utterances, e.g., <you can read my book> → [ju ʷãm wibˀmaɪ bʊk], <I didn't even> → [aɪ jɪjɪn]
      (see Howard *et al.* 2008, Wells 1994, Speake 2013)

2.2.7 What prosodic features is the child using successfully? Can they produce single words with the appropriate lexical stress, and is their prosody within utterances 'natural' i.e., pausing, focal point of the sentence, emphasis etc. are all expressed appropriately?

Disruptions in prosody are a key diagnostic indicator of severe phonological disorder and/or DVD. ASHA (2007) highlights the importance of inappropriate prosody, particularly in relation to lexical or phrasal stress as

[2] Note that production of /ɹ/ as [ʋ] is increasingly common among adult speakers of British English.

being one of three diagnostic indicators of DVD (the other two being: inconsistency for repeated productions of the same word, and longer/disrupted co-articulatory transitions between segments and syllables). Furthermore, persisting issues with the development of adult-like stress patterns in words such as frequent omission of weak syllables (particularly those in weak-strong patterns such as /bəˈlun/ → [ˈbun]) and strengthening of weak syllables i.e., underuse of schwa e.g., /dʒʌmpə/ → [dʒʌmpa]) may be indicative of issues at either the level of phonological representations and/or phonetic production.

2.2.8 Percentage Consonants Correct (PCC) scores can provide a useful indication of severity and hence means of monitoring progress and measuring outcome. The Diagnostic Evaluation of Articulation and Phonology (Dodd *et al.* 2006) includes a standardised measure of PCC based on a single word (SW) sample. However, PCC scores can be calculated for *any* speech sample by calculating the number of tokens produced correctly and expressing this as a percentage of the total number of tokens produced (correct and incorrect)? See worked case example in Appendix B.

Percentage correct scores can also be extended to vowels, word structure and phonological processes. These values can be used as a baseline against which to compare progress in therapy. Indeed, for a child presenting with difficulties across both consonant and vowel systems, you may want to calculate the overall Percentage Phonemes Correct (PPC) score.

Most importantly, when using percentage correct scores make sure that the speech sample is representative and that all baseline comparisons are made against the same (or similarly distributed) sample[3]. For example if 'Tom' is fronting velars word finally but not word initially it would be important to ensure that the initial assessment captures his pattern without bias i.e., targets velars equally across word initial and final positions. When collecting a post-intervention sample, the target stimuli must match the distribution of the pre-treatment sample i.e., in terms of the number of velar tokens both word initially and finally to avoid either under- or over-estimating his progress in therapy.

2.3 Further Assessment to Support Differential Diagnosis and Target Selection

Depending on the information provided by the analyses described above, the following supplementary assessments may be required to help support a differential diagnosis and selection of targets/intervention approach. The classification system adopted e.g., Dodd (1995, 2005), Shriberg *et al.* (2010) will dictate to some extent, the range of further assessments required (see Waring and Knight (2013) for a critique of different classification systems in SSD). A psycholinguistic framework such as the Stackhouse and Wells (1997) model of single word processing may also be used to supplement clinical thinking in more severe and complex cases.

2.3.1 Stimulability Assessment

This is important as children presenting with non-stimulable sounds are less likely to show spontaneous improvement. There is also some evidence to support prioritisation of non-stimulable over stimulable sounds in intervention. This has been shown to result in greater system-wide change and more efficient (and hence ethical) use of clinician time (Gierut and Champion 2001, Gierut 1989, 2005, Powell *et al.* 1991). However it is also important to note that with children under 4 years of age (and others not suited to this more complex approach, e.g., children with cleft palate related speech disorders) it may be more effective to target more stimulable sounds (Rvachew *et al.* 2001).

Stimulability is only assessed in the case of speech sounds for which the child has limited to no productive phonological knowledge (PPK) i.e., either not used in the child's system correctly, or used variably in only one syllable position (Gierut *et al.* 1987, Powell *et al.* 1991). Powell and Miccio's (1996) Stimulability Assessment is

[3] Note that Shriberg's (1982) guidance on severity ratings for PCC is only relevant for samples of ≥200 utterances obtained from a conversational speech sample and for age ranges between 4;1-8;6 yrs. However, PCC scores may provide a useful informal independent baseline measure at SW level when considered within these limitations.

recommended, where a speech sound is considered to be stimulable if it is produced at least twice out of 10 opportunities.

2.3.2 Non-speech oro-motor assessment (examination of the oral cavity/articulatory oro-motor skills).

For children with moderate-to-severe SSD, it is important to rule out any potential structural or physiological deficits e.g., sub-mucous cleft palate or even an unrepaired overt cleft of the soft palate, velopharyngeal insufficiency and/or limited range and strength of muscle movements. Issues around the timing and co-ordination of articulatory gestures can be investigated using both real and non-words (e.g., diadokinetic rates (DDKs)). Importantly, DDKs can be sensitive to the type of difficulties more characteristic of children with DVD (Williams *et al.* 1998).

2.3.3 Inconsistency assessment (formal or informal).

This relates to the consistency of speech production for the *same* word across three repetitions as opposed to variable production of the same phoneme across different words (see section in 2.2.2). The DEAP (Dodd *et al.* 2006) includes a standardised inconsistency assessment within its battery where inconsistent production of 10 or more words out of the sample of 25, leads to a diagnosis of Inconsistent Speech Disorder. However, an informal assessment may be easily developed following the same principles.

2.3.4 Psycholinguistic probes (e.g., real v non-word auditory discrimination, phonological awareness (e.g., phoneme segmentation and blending), real vs non-word repetition) (see Stackhouse and Wells 1997, 2007). These will help tease out the nature of the underlying deficit/s and guide appropriate weighting of input versus output tasks in intervention.

Children with persisting SSD often show multiple processing deficits (Speake 2013) and the psycholinguistic framework may help support further investigation of these.

2.3.5 Intelligibility assessment can make a valuable contribution to evaluation of a child's SSD (particularly when time is constrained in relation to gathering and analysing a connected speech sample). While there are a range of single word measures of intelligibility, these do not capture the functional impact of a child's SSD as comprehensively as measures considering connected speech. An example of an intelligibility measure considering connected speech is *The Intelligibility in Context Scale* (ICS) (McLeod *et al.* 2012b) which asks parents to rate the extent to which their child is understood by different people including themselves, immediate and extended family members, friends, other acquaintances, teachers and strangers on a five point scale: 'Always, Usually, Sometimes, Rarely, Never'. See Baker and McLeod (2017, chapter 8, pp. 246-249) and Bowen (2015, chapter 2, p. 98) for further detail and discussion about assessment of intelligibility.

While intelligibility ratings can provide a useful indication of functional speech ability, it is important to recognise their subjective nature, i.e., different listeners are likely to make different judgements. They should, therefore, not be used as a sole measure of severity.

2.4 Measurement of Outcome (impact-based)

There is increasing emphasis on the use of impact-based outcome measurements alongside traditional measures focusing more on impairment and activity for both adults and children with speech, language, communication and swallowing needs. In view of this, assessment of moderate-to-severe speech disorder should also include a measure of functional outcome such as the *FOCUS: **F**ocus on the **O**utcomes of*

***C**ommunication **U**nder **S**ix (FOCUS©)* (Thomas-Stonell *et al.* 2009). The FOCUS has been validated as an outcome measure and considers the impact of SSD on the child's communication from the perspective of the International Classification of Function: Children and Youth Version (World Health Organisation 2007). Pre and post intervention baseline assessment on the FOCUS can be compared to identify whether significant improvement has been made in therapy.

Conclusion

These guidelines outline the key components of a phonetic and phonological analysis of phonetically transcribed speech data. They are not intended to be exhaustive or prescriptive but are designed to support clinicians in taking a systematic and principled approach to analysis and, where appropriate, a more in-depth contrastive analysis, supporting evidence-based practice[4].

[4] This document will be subject to ongoing revision as the evidence-base for SSD develops.

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APPENDIX A

CHECKLIST FOR SPEECH ANALYSIS

NAME:	DOB:	DATE:

CONSONANTS

PHONETIC INVENTORY (PI) AND PRODUCTIVE PHONOLOGICAL KNOWLEDGE (PPK) -
Circle any sounds the child uses (whether correctly or incorrectly) (PI). Underline any sounds never used correctly by the child (providing more information on the child's PPK) NB. Sounds remaining will obviously not have been tested AND sounds that are both circled and underlined are those which are in the child's PI but never used correctly in words

Singletons:

p b t d k g m n ŋ f v θ ð s z ʃ ʒ h tʃ dʒ w ɹ l j other: (i.e.,/ʔ/)

Clusters:

Word initial: pl pɹ bl bɹ tw tɹ dw dɹ kw kl kɹ gl gɹ fl fɹ θɹ sp sm sw st sn sl sk spl spɹ stɹ skw skɹ

Word final: mp nt nd ŋk ft sp st sk lp lt ps bz ts dz ks gz pt bd kt ɹp ɹb ɹd ɹts ɹn other:

Word medial – consonant sequences that may or may not cross a syllable boundary (specify):

SUPPLEMENTARY STIMULABILITY ASSESSMENT FOR PHONES WITH LIMITED TO NO PRODUCTIVE PHONOLOGICAL KNOWLEDGE (list those that are stimulable and not stimulable):	STIMULABLE	NOT STIMULABLE

Optional: PCC (correct singletons/total singletons x 100 = %) = **%onset clusters correct =** **%final clusters corrects =**

List phonetic level errors i.e., dentalisation:

Patterns and Processes (with age of suppression if known, in parentheses (Grunwell, 1987))

Typical/Atypical Phonological Processes/Patterns (key to abbreviations is below table)	Redup(2;0)	WSD (4;0)	FCD (3;3)	H-del	V.Insert	Cl.Red(4;0)	CH (4;0)	Seq.err
	Voice (3;0)	Devoice (3;0)	Frontp (3;9)	Frontv (3;6)	Stop (3;0-5;0/~6;0)	Stopping of Affric (4;6)	Glide liq (5;0/~6;0)	L-voc (2;0)

<table>
<tr><td>May tick or make a tally count for all patterns evident</td><td>Deaffric</td><td>Diphred</td><td>Diphisation</td><td>Vow lowering</td><td>Vow raising</td><td>Vow fronting</td><td>Vow backing</td><td>Transposition</td></tr>
<tr><td rowspan="3"></td><td>Glottalisation</td><td>Backing</td><td>L.Features</td><td>Glidefric</td><td>Multiple Phoneme Collapse</td><td>I.C.del</td><td>C. Insert</td><td>Coal.features</td></tr>
<tr><td colspan="8">Other:</td></tr>
<tr><td colspan="8">Delay apparent (✔ /✖): Range of delay apparent (i.e., 6-37 months):
Atypical patterns apparent (✔ /✖):
Note any positional constraints e.g., velar fronting only in word initial position:
What patterns are most prevalent/dominant:</td></tr>
<tr><td>Systems of phoneme collapse for typical and atypical processes (outline)</td><td colspan="8">Phoneme collapse apparent (✔ /✖):
Identify key preferred substitution/s and the underlying adult targets i.e., [t] /k/ /s/</td></tr>
<tr><td>Variation</td><td colspan="8">Progressive variability (✔ /✖):
Widespread unexplained variation (✔ /✖):
Note any exceptions from general patterns for specific phonemes i.e., one example of stopping in a predominant</td></tr>
</table>

	pattern of gliding of fricatives: **Supplementary assessment: Token-to-token variation/variation across multiple repetitions of the same word i.e., inconsistency (✔ /✘):**
Non-system-wide, word level errors	**Present (✔ /✘):** **List types of errors i.e., metathesis, sequencing errors, consonant harmony:**
Connected Speech Patterns	**See separate analysis sheet**
OVERALL INTELLIGIBILITY RATING/RATING OF IMPACT	**Assessment, date and findings i.e., Intelligibility in Context Scale (McLeod, Harrison et al. 2012):**
ALERTS/WARNING SIGNS FOR DISORDER/PERSISTENT SSD/DVD (circle/highlight all that apply)	
SSD DATA (circle all that apply)	**Characteristics of Phonological Disorder (Stoel-Gammon and Dunn 1985):** • **Delayed development of phonological processes from early-on** • **Notable variability** • **Use of later acquired sounds alongside persistent errors of earlier acquired sounds** • **Atypical patterns** **Limited contrastiveness** • **Speech sound system that has become fixed at an earlier stage of speech sound development** **Characteristics of Developmental Verbal Dyspraxia (by Strand in Shriberg et al. (2012) table II, p. 453):** • **"Vowel distortions** • **Voicing errors** • **Distorted substitutions** • **Difficulty achieving initial articulatory configurations or transitionary movement gestures** • **Groping** • **Intrusive schwa** • **Increased difficulty with multisyllabic words** • **Syllable segregation** • **Slow rate** • **Slow diadochokinetic rates** • **Equal stress or lexical stress errors"** **A child must have vowel distortions and at least 3 of the other errors across 3 different types of speech task in**

	order to be differentially diagnosed with DVD
DIAGNOSIS AND SEVERITY (These classifications relate to primary SSD and are derived from Dodd (1995, 2005)) **Circle as appropriate**	**Phonological Delay (uses typical phonological processes but delayed for age)** **Consistent Phonological Disorder (systematic use of atypical/deviant patterns)** **Articulation Deficit (phonetic level errors which may or may not result in a loss of contrast)** **Inconsistent Speech Disorder (high degree of token to token variability without associated oro-motor deficits)** **Developmental Verbal Dyspraxia (see classification above)** **NB. Children may also present with a mixed profile** **<u>Severity:</u>** **Mild Moderate Severe**

Key to phonological processes/patterns and atypical patterns:

Typical Patterns/Processes: Redup – reduplication; WSD – weak syllable deletion; FCD – final consonant deletion; H-Del - h-deletion; V.Insert - vowel insertion (epenthesis); Cl.Red - cluster reduction; DR - diphthong reduction; D – diphthongisation; CH – consonant harmony; transposition - transposition/metathesis; Seq.Err - sequencing errors; Voice – voicing; Devoice – devoicing; Frontp - palatal fronting; Frontv - velar fronting; Stop - stopping; Stopping of Affric – stopping of affricates; Deaffric - deaffrication; Glide liq - gliding of liquids; L-voc - l-vocalisation; Vow lowering - vowel lowering; Vow raising - vowel raising; Vow fronting - vowel fronting; Vow backing - vowel backing

Atypical patterns: Glottalisation (if not dialectal and/or context appropriate); Backing - alveolar backing; Glidefric – gliding of fricatives; multiple phoneme collapse - systematic sound preference/phoneme collapse; I.C.Del - initial consonant deletion; C.Insert - consonant insertion; C.features - coalescence of features; L.features - linearization of features

Good practice guidelines for the analysis of child speech

SOUTHERN BRITISH STANDARD	
VOWELS (SBS SYSTEM)	
PHONETIC INVENTORY (tick if phones are present at all in the child's system (even if used incorrectly))	
CORNER VOWELS	i a ɑ u
MID-VOWELS	ɪ ɛ ɜ ə ʌ ɒ ɔ ʊ
DIPHTHONGS	**Closing (rising from open to closed)** eɪ aɪ au ɔɪ əu **Centring (ending in schwa)** iə ɛə uə
PRODUCTIVE PHONOLOGICAL KNOWLEDGE (circle phones used correctly at least once in the sample and highlight gaps)	
i a ɑ u ɪ ɛ ɜ ə ʌ ɒ ɔ ʊ eɪ aɪ au ɔɪ əu iə ɛə uə	
Optional: Percentage Vowels Correct (correct vowels/total vowels x 100 = %) =	

SCOTTISH	
VOWELS	
PHONETIC INVENTORY (tick if phones are present at all in the child's system (even if used incorrectly))	
CORNER VOWELS	i a ʉ
MID-VOWELS	ɪ e ɛ ə ʌ ɒ ɔ o
DIPHTHONGS	**Closing (rising from open to closed)** aɪ au ɔɪ
PRODUCTIVE PHONOLOGICAL KNOWLEDGE (circle phones used correctly at least once in the sample and highlight gaps)	
i a u ɪ e ɛ ə ʌ ɔ o aɪ au ɔɪ	
Optional: Percentage Vowels Correct (correct vowels/total vowels x 100 = %) =	

ULSTER																				
VOWELS																				
PHONETIC INVENTORY (tick if phones are present at all in the child's system (even if used incorrectly))																				
CORNER VOWELS	i		a		ɑ/ ɒ		ʉ													
MID-VOWELS	ɪ		ɛ		ɜ		ə		ʌ		ɔ		o							
DIPHTHONGS	**Closing (rising from open to closed)**								**Centring (ending in schwa)**											
PRODUCTIVE PHONOLOGICAL KNOWLEDGE (circle phones used correctly at least once in the sample and highlight gaps)																				
i	a	ɑ	ɒ	ʉ	ɪ	ɛ	ɜ	ə	ʌ	ɔ	o	ɛə	iə	ʉə	oə	ɔə	ai	ei	ɔi	ɒʉ
Optional: Percentage Vowels Correct (correct vowels/total vowels x 100 = %) =																				

WORD STRUCTURE	
INVENTORY OF WORD STRUCTURES (tick structures present (even if not correct) and circle those that are only used correctly)	
Monosyllables	**CV VC CVC CCVC CVCC CCVCC**
Disyllables	**CVCV CVCVC CCVCVC CVCCVC CVCVCC OTHER (provide structures):**
Multisyllables	**CVCVCV CVCVCVC CCVCVCV CCVCVCVC OTHER (provide structures):**
Clusters Used	**Initial Clusters consistent (✔ /✖): Final Clusters consistent (✔ /✖):** **Medial clusters (attempts to use more than one consonant within syllable boundaries):**
Optional: Percentage word structure used correctly (correct word structure/total word structures x 100 = %) =	

Connected Speech Analysis and observation of prosody	
Circle/highlight if and as appropriate	
Greater use of patterns than noted at single word level	**Yes No**
Presence of open juncture:	**1. Non-use of typical connected speech processes** **2. Inappropriate use of pauses/glottal stops between words**
Presence of close juncture:	**1. Overuse of segmental/syllable elisions** **2. Weakened articulatory realisations**
Additional Prosodic disruptions	**1. Lexical stress appropriate/not appropriate e.g., /ˈmʌmi/ > [ˈmʌˈmi]** **2. Sentence level stress appropriate/not appropriate e.g., focus, attitude, grammar etc are expressed meaningfully.**
Additional comments (further detail on observations as appropriate e.g., child is using syllable-timed speech):	

APPENDIX B

Stanley (5;6 yrs): a worked example

The following summary is based on an analysis of a single-word speech sample, elicited using the DEAP phonology assessment (Dodd *et al.* 2006). Stanley's responses were phonetically transcribed and the data was then charted on the PPSA (Phonetic and Phonological Systems Analysis) (Bates and Watson 2012). The PPSA from the child's realisations of the stimulus words are shown below. For further information about using the PPSA, please see the user manual at: http://www.qmu.ac.uk/ppsa/.

Phonetic and Phonological Systems Analysis-English Systems (PPSA). Target accent: SBS

Name: Stanley Date/Age:/5;6 Data used: DEAP screen + Phonology Assessment

PI	Target	Correct Realisation			Errored Realisation			Deletion			Place	Manner
		WI	WM	WF	WI	WM	WF	WI	WM	WF		
✔	p				b	b					Front→Back	Oral Stops/Plosives
✔	b											
✔	t				d b d							
✔	d					bb						
✔	k				d	??	ʔ					
✔	g					d						
✔	m										Front→Back	Nasals
✔	n											
	ŋ						nnnn					
	f				jjjjj	jjj					Front→Back	Fricatives
	v				j							
	θ				jj							
	ð				j	j						
✔	s				jjjj	j						
	z				j	jjj						
	ʃ				j	jjj						
	ʒ											
	h				jjj							
	ʧ					ʔ						Affricates
	ʤ				d							
✔	w				b						Front→Back	Approximants
	ɹ				w	jj						
✔	l				j	jjjjjjjjj						
✔	j											
	ɹ										Rhotic	

Other Errors (eg sequencing errors, consonant harmony)

THESE ARE ANALYSED ON THE SINGLETON AND CLUSTER TABLES IN BLUE:

['baɪbə] x3 = (CH), [bab] = (CH), ['bɔbi] = (CH and weak syllable deletion), [bɛb] = (CH), ['bubʌ] = (redup), [jʌm'bɛjə] x3, ['jɛjɪ'ʔɒbə] x 3, ['jɛjɪ'jənt] x3, ['jɒjm], [jɛ], ['jabəl], [jiə] = (consonant insertion), ['madəʊ] = (weak syllable deletion)

Phonetic and Phonological Systems Analysis-English Systems (PPSA). Target accent:SBS

Name: Stanley Date/Age /5;6 Data used: DEAP Screen + Phonology Ax

Some Clusters ([R] applicable for rhotic accents)

Word Initial		Word Medial	Word Final	
pl-	fl-	-ŋkj- nj nj nj	-mp	-ks
pɹ- b	fɹ- j	-pt- b b b	-nt nt nt nt	-gz
bl-	θɹ- j	-mbɹ- mb mb mb	-nd	-pt
bɹ- bb	sp- b b b	-sk- ʔ	-ŋk	-bd
tw-	sm-	-ŋk- nd	-ft	-kt
tɹ- d	sw- w	-θbɹ- b	-sp	-p[R]
dw-	st-	-th- j	-st	-b[R]
dɹ-	sn- n	-bɹ- b	-sk	-vz ∅ ∅∅
kw- d	sl-		-lp	-ndʒ- n
kl-	sk- g		-lt	
kɹ- b	spl- b		-lk	
gl- g g g	spɹ-		-ps	
gɹ-	stɹ- b		-bz	
	skw- d		-ts ∅	
	skɹ-		-dz	

Error Pattern Summary (shading denotes atypical error patterns)

Structural	(✓)	**Segmental**	(✓)	**Phonetic/Other**	(✓)
Reduplication	✔	Pre-vocalic voicing	✔	Dentalisation	
Weak syllable deletion	✔	Post-vocalic devoicing		Lateralisation	
Final C deletion	✔	Palatal fronting		Palatalisation	
Initial C deletion		Velar fronting	✔	Ingressive air stream	
h-deletion		Alveolar backing		Nasal emission	
Consonant insertion	✔	Stopping of fricatives		Clicks	
Vowel insertion (epenthesis)		Stopping of affricates	✔		
Cluster reduction	✔	Deaffrication			
Diphthong reduction		Gliding of fricatives	✔		
Diphthongisation		Gliding of liquids	✔		
Coalescence		Glottal replacement	✔		
Linearisation of features		Multiple phoneme collapse	✔		
Word level errors		l-vocalisation		**Variability / Further ax required?**	(✓)
Consonant harmony	✔	Vowel lowering		Progressive variability	✔
Transposition (metathesis)		Vowel raising		Context-conditioning	✔
Sequencing errors		Vowel fronting		Inconsistent production of same lexical items	
		Vowel backing		Multi-lingual influence	

NAME: *Stanley* DOB/CA: *5;6* DATE: *N/A* DATA USED: PPSA (using DEAP Screen and Phonology Assessment Data) PCC=24%: Standard Score=3; Percentile Rank=1%; severe consistent phonological disorder

CONSONANTS

PHONETIC INVENTORY (PI) AND PRODUCTIVE PHONOLOGICAL KNOWLEDGE (PPK) -
Circle any sounds the child uses (whether correctly or incorrectly) (PI). Underline any sounds never used correctly by the child (providing more information on the child's PPK) NB. Sounds remaining will obviously not have been tested AND sounds that are both circled and underlined are those which are in the child's PI but never used correctly in words

Singletons:

(p) (b) (t) (d) (k) (g) (m) (n) ŋ f v θ ð (s) z ʃ ʒ h tʃ dʒ (w) ɹ (l) (j) other: (ʔ)

Clusters:

Word initial: pl pɹ bl bɹ tw tɹ dw dɹ kw kl kɹ gl gɹ fl fɹ θɹ sp sm sw st sn sl sk spl spɹ stɹ skw skɹ

Word final: mp (nt) nd ŋk ft sp st sk lp lt lk ps bz ts dz ks gz pt bd kt ɹp ɹb ɹd ɹts ɹn other: ndʒ, vz

Word medial – consonant sequences that may or may not cross a syllable boundary (specify): (-nd-), (-ŋj-) (-mb-)
- ŋkj-, -pt-, -mbɹ-, - sk-, -ŋk-, -θbɹ-, -th-, -bɹ-

SUPPLEMENTARY STIMULABILITY ASSESSMENT FOR PHONES WITH LIMITED TO NO PRODUCTIVE PHONOLOGICAL KNOWLEDGE (list those that are stimulable and not stimulable):	STIMULABLE	NOT STIMULABLE

PCC (correct singletons/total singletons x 100 = %) = 26/107x100=24% **%onset clusters correct = 0% %coda clusters corrects = 38%**

List phonetic level errors i.e., dentalisation: N/A

Patterns and Processes (with age of suppression if known, in parentheses (Grunwell 1987))

Typical and Atypical Phonological Processes (key to abbreviations is below table)	Redup(2;0)	WSD (4;0)	FCD (3;3)	H-del	V.Insert	Cl.Red(4;0)	CH (4;0)	Seq.err
	Voice (3;0)	Devoice (3;0)	Frontp (3;9)	Frontv (3;6)	Stop (3;0-5;0/~6;0)	Stopping of affric (4;6)	Glide liq (5;0/~6;0)	L-voc (2;0)

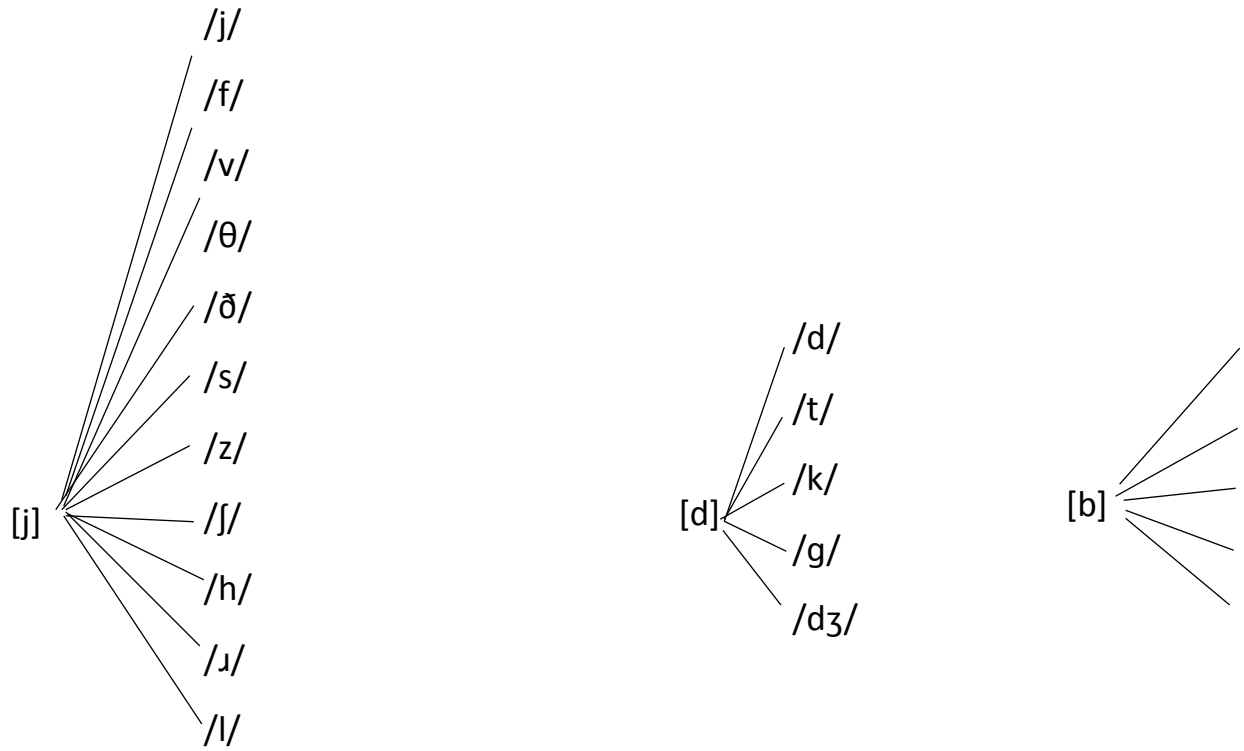
<table>
<tr><td rowspan="2">May tick or make a tally count for all patterns evident</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Deaffric</td><td>Diphred</td><td>Diphisation</td><td>Vowel lower</td><td>Vowel raise</td><td>Vowel front</td><td>Vowel back</td><td>Transposition</td></tr>
<tr><td rowspan="3"></td><td colspan="8">Glottal replacement | Backing | L.Features | Glidefric | Multiple Phoneme Collapse | I.C.del | C. Insert | Coal.features</td></tr>
<tr><td colspan="8">Other:</td></tr>
<tr><td colspan="8">Delay apparent (✔/✘): ✔ Range of delay apparent (i.e., 6-37 months): 6-30 mths

Atypical patterns apparent (✔/✘): ✔

Note any positional constraints e.g., velar fronting only in word initial position: fronting of /k/ resolving in word final position through use of the glottal stop; managed /g/ in onset cluster reduction realisation for /gl/ but not when the singleton was targeted; one incidence of fricative use in one syllable position (/s/). Note variable treatment of fricatives which reflects phontactic constraints i.e., gliding is only possible in syllable initial position.

What patterns are most prevalent/dominant:
Cluster reduction; gliding of fricatives; FCD</td></tr>
<tr><td>Systems of phoneme collapse for typical and atypical processes (outline)</td><td colspan="8">Phoneme collapse apparent (✔/✘): ✔

Identify key preferred substitution/s and the ıg adult targets i.e., [t] /k/ /s/
[n] /n/ /ŋ/ [ʔ] /k/ /tʃ/ [w] /w/ /ɹ/</td></tr>
</table>


[j]
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/t/
/w

Variation	**Progressive variability (✔/✘):** ✔ **Widespread unexplained variation (✔/✘):** ✘ **Note any exceptions from general patterns for specific phonemes i.e., one example of stopping in a predominant pattern of gliding of fricatives:** nothing of note **Supplementary assessment: Token-to-token variation/variation across multiple repetitions of the same word i.e., inconsistency (✔/✘):** ✘
Non-system-wide, word level errors	**Present (✔/✘):** ✔ **List types of errors i.e., metathesis, sequencing errors, consonant harmony:** Consonant harmony , consonant insertion
Connected Speech Patterns	**See separate analysis sheet (forthcoming)**
OVERALL INTELLIGIBILITY RATING/RATING OF IMPACT	**Assessment, date and findings i.e., Intelligibility in Context Scale (McLeod, Harrison et al. 2012):** Awaiting results of this
ALERTS/WARNING SIGNS FOR DISORDER/PERSISTENT SSD/DVD (circle/highlight all that apply)	
SSD DATA (circle/highlight all that apply)	**Characteristics of Phonological Disorder (Stoel-Gammon and Dunn 1985):** • **Delayed development of phonological processes from early-on** • **Notable variability** • **Use of later acquired sounds alongside persistent errors of earlier acquired sounds** • **Atypical patterns** **Limited contrastiveness** • **Speech sound system that has become fixed at an earlier stage of speech sound development** **Characteristics of Developmental Verbal Dyspraxia (by Strand in Shriberg et al. (2012) table II, p. 453):** • **"Vowel distortions [i.e. phonetic distortions not systematic substitutions]** • **Voicing errors** • **Distorted substitutions [i.e., phonetic distortions]** • **Difficulty achieving initial articulatory configurations or transitionary movement gestures** • **Groping** • **Intrusive schwa** • **Increased difficulty with multisyllabic words** • **Syllable segregation**

	• **Slow rate** • **Slow diadochokinetic rates** • **Equal stress or lexical stress errors"** **A child must have vowel distortions and at least 3 of the other errors across 3 different types of speech task in order to be differentially diagnosed with DVD**
DIAGNOSIS AND SEVERITY **(These classifications relate to primary SSD and are derived from Dodd (1995, 2005))** **Circle as appropriate**	**Phonological Delay (uses typical phonological processes but delayed for age)** **Consistent Phonological Disorder (systematic use of atypical/deviant patterns)** **Articulation Deficit (phonetic level errors which may or may not result in a loss of contrast)** **Inconsistent Speech Disorder (high degree of token to token variability without associated oro-motor deficits)** **Developmental Verbal Dyspraxia (see classification above)** **NB. Children may also present with a mixed profile** **<u>Severity:</u>** **Mild** **Moderate** **Severe**

Key to phonological processes/patterns and atypical patterns:

Typical Patterns/Processes: Redup – reduplication; WSD – weak syllable deletion; FCD – final consonant deletion; H-Del - h-deletion; V.Insert - vowel insertion (epenthesis); Cl.Red - cluster reduction; DR - diphthong reduction; D – diphthongisation; CH – consonant harmony; transposition - transposition/metathesis; Seq.Err - sequencing errors; Voice – voicing; Devoice – devoicing; Frontp - palatal fronting; Frontv - velar fronting; Stop - stopping; Deaffric - deaffrication; Glide liq - gliding of liquids; L-voc - l-vocalisation; Vowel lower - vowel lowering; Vowel raise - vowel raising; Vowel front - vowel fronting; Vowel back - vowel backing

Atypical patterns: Glottalisation (if not dialectal and/or context appropriate); Backing - alveolar backing; Glidefric – gliding of fricatives; phoneme collapse - systematic sound preference/phoneme collapse; I.C.Del - initial consonant deletion; C.Insert - consonant insertion; C.features - coalescence of features; L.features - linearization of features

SOUTHERN BRITISH STANDARD																			
VOWELS (SBS SYSTEM)																			
INVENTORY OF WORD STRUCTURES (tick structures present (even if not correct) and circle those that are only used correctly)																			
CORNER VOWELS	i ✔		a ✔		ɑ ✔		u ✔												
MID-VOWELS	ɪ ✔		ɛ ✔		ɜ ✔		ə ✔		ʌ ✔		ɒ ✔		ɔ ✔		ʊ ✔				
DIPHTHONGS	**Closing (rising from open to closed)** ✔							**Centring (ending in schwa)** ✔											
PRODUCTIVE PHONOLOGICAL KNOWLEDGE (circle phones used correctly at least once in the sample and highlight gaps)																			
i	a	ɑ	u	ɪ	ɛ	ɜ	ə	ʌ	ɒ	ɔ	ʊ	eɪ	aɪ	au	ɔɪ	əu	ɪə	ɛə	uə
Percentage Vowels Correct (correct vowels/total vowels x 100 = %) = 100%																			

WORD STRUCTURE																			
INVENTORY OF WORD STRUCTURES (tick structures present (even if not correct) and circle those that are only used correctly)																			
Monosyllables	**CV** ✔		**VC**		**CVC** ✔		**CCVC**		**CVCC**		**CCVCC**								
Disyllables	**CVCV** ✔		**CVCVC** ✔		**CCVCVC** ✔		**CVCCVC**		**CVCVCC**		**OTHER (provide structures):**								
Multisyllables	**CVCVCV** ✔		**CVCVCVC**		**CCVCVCV**		**CCVCVCVC**		**OTHER (provide structures):** CVCVCVCC, CVCVCVCV, CVCCVCV										
Clusters Used	**Initial Clusters consistent (✔/✘):** ✘ **Final Clusters consistent (✔/✘):** ONE EVIDENT – [nt] **Medial clusters:** evidence of attempts to use more than one consonant within syllable boundaries but none of these are correct.																		
Optional: Percentage word structure used correctly (correct word structure/total word structures x 100 = %) =																			

Connected Speech Analysis and observation of prosody	
Circle/highlight if and as appropriate	
Greater use of patterns than noted at single word level	**Yes No**
Presence of open juncture:	**3. Non-use of typical connected speech processes** **4. Inappropriate use of pauses/glottal stops between words**
Presence of close juncture:	**3. Overuse of segmental/syllable elisions** **4. Weakened articulatory realisations**
Additional Prosodic disruptions	**3. Lexical stress appropriate/not appropriate e.g., /ˈmʌmɪ/ > [ˈmʌˈmɪ]** **4. Sentence level stress appropriate/not appropriate e.g., focus, attitude, grammar etc are expressed meaningfully.**
Additional comments (further detail on observations as appropriate e.g., child is using syllable-timed speech): **Not Tested**	

Summary of information extracted using the guidelines/checklist

Phonetic Inventories

Consonant singletons produced: [p, b, t, d, k, g, m, n, s, w, l, j, ʔ]

Consonant singletons never produced correctly (no PPK): /ŋ, f, v, θ, ð, z, ʃ, h, tʃ, dʒ, ɹ/

Consonant singletons not tested: /ʒ/

Consonant clusters produced: [-nt] in word final position and some attempts at sequencing consonants word medially.

Consonant clusters never produced correctly: [pɹ, bɹ, tɹ, kw, kɹ, gl, fɹ, θɹ, sp, sw, sn, sk, spl, stɹ, skw, -ts, -vz, -ndʒ]

Observations

- Limited inventory of singleton consonants, particularly word-finally; fricatives and affricates most compromised (1 token only of /s/)
- No word-initial clusters and only 1 homorganic word-final cluster produced correctly (but limited opportunities).
- Some attempts at word-medial consonant sequences but none of these are correct.
- Percent Consonants correct: singletons 24%, initial clusters 0%, final clusters 38% (limited tokens)

Vowel inventory

- Complete

Word Structure inventory

Monosyllables: CV, CVC

Disyllables: CVCV, CVCCV, CVCVC

Multisyllables: CVCVCV, CVCVCVCC, CVCVCVCV, CVCCVCV

Observation

- Limited range of word structures exhibited (predominantly reflecting cluster reduction and final consonant deletion).

Processes/patterns

- Delayed natural phonological processes: reduplication, weak syllable deletion, final C deletion, cluster reduction, pre-vocalic voicing, velar fronting, stopping of affricates, gliding of liquids, glottal replacement, consonant harmony
- Atypical patterns: consonant insertion, gliding of fricative (resulting in multiple phoneme collapse).
- No positional constraints – although variable treatment of fricatives across word positions

Variability

Some evidence of progressive change, i.e., final C deletion moving towards suppression: correct tokens achieved word-finally for /p, b, k, m, n, s/, glottal stop produced word-finally in place of /k/

Voicing contrast emerging word-finally among plosives
Exceptions from general patterns:- one instance of /t/ → [b] word-initially, 2 instances of /d/ → [b] word-medially, and 1 instance of /w/ → [b]. Looking back at the transcription data, these can all be explained in terms of consonant harmony.

NB. **Sample insufficient to fully explore patterns.**

Implications for diagnosis

Delayed suppression of phonological processes (e.g., pervasive final consonant deletion (FCD) at 5;6 years of age)

Limited contrastiveness i.e., multiple phoneme collapse due to pervasive FCD and severely limited consonant inventory

Atypical patterns (gliding of fricatives)

Variability in production reflects some progressive change or consonant harmony. Token-to-token variability, i.e., variability in production of individual words across different repetitions not yet tested.

DIAGNOSIS: Severe consistent phonological disorder

Implications for Intervention

A phonological approach to intervention is necessary.

Given the severe loss of contrast within this child's system, it is important to consider which intervention approaches will lead to the greatest amount of system-wide change in the least amount of time.

This may involve use of one of the following approaches[5]

- Conventional minimal pairs (Weiner 1981): the child's segmental (or structural) phonological process/atypical pattern is contrasted with the target using sets of homonymous minimal pairs e.g., /jɒt/ versus /hɒt/ (where Stanley is substituting [j] for [h]), or /spaɪ/ versus /baɪ/ (where Stanley is reducing /sp/ → [b]). The selection of targets for this approach is dictated by the child's substitutions for the adult target forms and is often influenced by the use of more traditional selection criteria e.g., use of stimulable sounds. This approach is most appropriate for children under 4 years of age and those who may not be able to cope with more challenging targets (Rvachew and Nowak 2002).

- Multiple oppositions (Williams 2000) - like conventional minimal pairs, this approach addresses the loss of meaning distinction resulting from reduced contrastiveness within the child's system. However, it is designed especially to target the loss in meaning that results from multiple phoneme collapse. It would therefore be highly appropriate for Stanley considering his extensive use of [j] for all fricatives and liquids word-initially. This approach also attempts to increase the complexity for the child by encouraging SLTs to select targets that are as different from the child's substitution as possible (considering both phonetic feature differences, i.e., voice, place and/or manner and major class distinctions i.e., obstruent vs sonorant). Thus, for Stanley, an appropriate stimuli set would contain minimal pairs contrasting /j/ with /f, ʃ, tʃ, h/.

[5] Notably there are alternative options, e.g., phonotactic therapy (Velleman 2002) - see Williams *et al.* (2010), Bowen (2015) and McLeod and Baker (2017) for a review of intervention approaches for phonological SSD):

- The three complexity approaches developed by Gierut and her colleagues (e.g., Gierut and Champion 2001, Gierut 1989, 2005) do not address homonymy (the collapse in meaning for the child resulting from their SSD) but rather aim to produce more rapid and system-wide change by using complex targets (i.e., later acquired, less stimulable, maximally differentiated pairs) with a view to driving the child's speech system to undergo major reorganisation. These approaches are considered most suitable for children over 4 years of age and for those who are able to cope positively with the challenge of addressing areas of least PPK as opposed to building on success by consolidating emerging contrasts. It is recommended that SLTs wanting to use these approaches complete further reading/training as a support e.g., see Williams *et al.* (2010), chapter 4 and McLeod and Baker (2017), chapter 13. The approaches are listed below in order of difficulty (with the first one being the easiest, and the last one being the hardest (the hardest argued to drive most change)). While the 2-/3-element clusters approach may be felt to be too challenging for some children, there are still options to use the maximal oppositions or empty set approaches. It is also important to note that while we have used real word examples here, Gierut and her colleagues recommend using non-words to foster greater generalisability (it is important to be mindful that it would not be appropriate to use non-words for children with semantic weaknesses):

  For Stanley, the following targets would be appropriate:

  - Maximal oppositions – a sound not used is contrasted with a maximally different sound e.g., /jɒt/ versus /ʃɒt/.
  - Empty set – two maximally different targets that Stanley has not yet acquired are worked on in minimal pair sets e.g., /wɪŋ/ versus /wɪʃ/. Note that in order to get maximally different contrasts for Stanley here, we have chosen to work on targets in word final position. Remember that in order for a contrast to be maximally different, sounds must differ in terms of voicing, place and manner of articulation and major class distinction, i.e., obstruent vs sonorant distinction.
  - 2-/3-element clusters – a cluster is targeted for Stanley that considers his cluster realisations and selects the most complex for him, avoiding any adjuncts (/st, sk, sp/, e.g., /fl/.

Further Investigation

- A stimulability assessment
- Further data elicitation/analysis to confirm pattern. NB. The current speech sample is very limited. For example, word-initial /k/ is only tested once and word-initial /g/ is not tested at all. Many of the fricatives have only been tested once in each word position.
- A connected speech assessment

Summary note

Charting transcription data using a tool such as the PPSA clearly shows how many times a given phoneme has been tested across different word positions, highlighting where data is missing or limited and thus guiding further targeted probing. An understanding of the strengths and limitations of the speech sample is essential in order to be confident that the speech sample and subsequent analysis is representative of the child's abilities. For example, the sample should contain sufficient data to identify processes/patterns and explore variability. It should also include a margin of error for transcription inaccuracy (see Guidelines for the Transcription of Child Speech Samples in Clinical Practice and Research for advice regarding sampling).

A contrastive analysis also provides an overview of the child's system as a whole. It goes beyond a simple process analysis by highlighting the child's phonological *strengths* as well as weaknesses and identifying any progressive change within the system, i.e., phonological processes/patterns already moving towards suppression. This more detailed picture of the child's PPK facilitates choice of intervention approach and allows the clinician to make an informed selection of therapy targets using either traditional developmental criteria (i.e., greater PPK) or newer more complex criteria (i.e., less PPK). This is particularly important in

moderate-to-severe cases such as Stanley where there is a widespread loss of contrast and where greater system-wide gains may be made by taking a more complex approach.