CSI

Instructional Manual for the Cluttering Severity Instrument

Klaas Bakker
Missouri State University

Florence Myers
Adelphi University

Note

The CSI software is available only in PC format and is developed with Microsoft C# (and using DirectSound for the player). The code of the software is shareware as well. Anyone with Mac or iPad programming experience is encouraged, on a volunteer basis, to help translate the CSI for those platforms, and help more potential users and members of the ICA have benefit from this product. A paper and pencil version of the test should als be available in the near future and will be listed on this same webpage.

Disclaimer

The CSI software and code are available to anyone as freeware without any restrictions. Code is available upon request from Klaas Bakker. The authors, and the ICA, cannot be held responsible in any way for anyone using the Cluttering Severity Instrument.

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CLUTTERING SEVERITY INSTRUMENT: THE MANUAL
(CSI, version 1, October 2011)

In the following you will find all necessary information about, and instructions for, using the Cluttering Severity Instrument (CSI) for the purpose of cluttering severity assessments. We have deliberately assumed that this tutorial would be used for clinical practice, although use for scientific purposes would be highly similar. In this manual you will learn about:

Introduction:
- What is cluttering
- The need for cluttering severity assessment instruments such as the CSI
- The rationale for our choice of a perceptual approach to the CSI

Administering the CSI:
- Installing the CSI from the ICA website
- Preparing for assessments using the CSI
- What are the assessment components of the CSI
- Optional training for improving performance in using the CSI
- Unique and helpful additional uses of the CSI:
      .. multidimensional assessment and treatment planning
      .. use of the CSI for self-report measures
- What is the scientific status of the CSI

INTRODUCTION

What is cluttering?

Cluttering is a fluency disorder that is characterized by a rate perceived to be excessively fast and/or irregular.   While measured syllable rates may not exceed normal limits, it is posited that people who clutter (PWC) execute their messages faster than they are able to manage. We deduce that they are speaking faster than their optimal rate because their speech often becomes clearer and easier to follow when delivered more attentively and deliberately. Typically, the listener has difficulty fully understanding the speech and following the messages of people who clutter. This may be due to non-phoneme-specific misarticulations, such as the deletion of sounds and syllables, the neutralization of vowels, and cluster reduction. Additionally, the message may be executed in an inefficient manner due to nonstuttering disfluencies including interjections and false starts, such as incomplete words followed by revisions. The message may also be characterized by language disorganization, as many PWC indicate that they have difficulty sequencing multiple competing thoughts and controlling their impulses to temper their output. The presence of the nonstuttering disfluencies, especially when these disruptions in the flow of the message occur frequently or in clusters, gives rise to a

speech rhythm that is perceived to be choppy and erratic. Behaviors such as these influence the 'prosody' of speech. Some PWC have difficulty self-monitoring and self-modulating their output. Thus, they may not be fully aware that listeners cannot understand their speech. Others may be aware--or, more likely have been told by family members and friends that they cannot understand the PWC. The pragmatic roots of these conversational breakdowns stem largely from not monitoring and modulating one's speech and language in order to repair the conversational breakdowns. A fuller explanation of the behaviors, with examples, is provided below.

The need for a cluttering severity instrument such as the CSI:

One of the primary roadblocks to progress in demonstrating treatment efficacy as well as in conducting basic research into cluttering is the lack of a means to measure cluttering severity. It is likely that most clinicians therefore make clinical decisions in very subjective and individualistic ways. However, in order to demonstrate that a treatment plan works, we need to be able to quantify degree of improvement made using procedures that are generally accepted, and have known levels of reliability and validity. Work to establish intra- and inter-rater reliability of the CSI is planned while aspects of validity are limited by the lack of other measures for comparison. Aspects of face and content validity are suggested by the fact that the present version of the CSI encompasses one popular definition of cluttering (St. Louis et al 2007; St. Louis & Schulte, 2011). It also reflects other fluency specialists' conceptualizations of cluttering regarding relevant clinical symptoms for this multifaceted disorder. Obviously, empirical approaches that determine construct validity for the present selection of assessment components will be needed as well.

The quantified nature of results from the CSI allows clinicians to determine baseline severity as well as degree of gains made for the eight separate clinical dimensions that are assessed, as therapy progresses. It should be noted that improvements in one dimension can have a beneficial effect on another dimension as cluttering is a systemic disorder (Myers, 2011). Slowing down rate, for example, can improve speech intelligibility and reduce disfluency. Further, the clinician can examine changes in the client's cluttering profile in order to consider refinements in a treatment protocol. The CSI, on the one hand, produces a severity value that represents *overall cluttering severity*, which is its primary objective. Nevertheless, it also provides the option to analyze the severity of individual dimensions of cluttering and to consider how they interact in producing an overall severity result. Basic research into cluttering has been handicapped because of the lack of a means to capture cluttering severity. Even if the purpose of an investigation were to refine the parameters that go into this unique and multifaceted diagnostic entity, we nonetheless need an instrument that allows for the quantification of overall severity as well as severity of the constituent components, to arrive at collective as well as detailed itemized cluttering profiles.

The rationale for our choice of a perceptual approach to the CSI:

The CSI, as an assessment tool, is built around the assumption that cluttering cannot be captured by simply measuring physical behavioral characteristics such as percent syllables disfluent, or speech rate expressed in syllables per minute. As cluttering is a multifaceted disorder, we further believe that assessment of individual dimensions is necessary but not sufficient for determining cluttering severity as a whole. The various components, and their interactions, feed into the judgment of cluttering severity. Cluttering cannot be dissected into discrete instances of cluttering, in contrast to "moments of stuttering." It is a "package deal," reflecting its multifaceted nature that contributes to a *cluttered manner of speaking*. Importantly, cluttering is a perceptual phenomenon when the quality of speaking deteriorates and reveals intervals of speech that are judged to be spoken in a cluttering manner. In summary, the CSI is built on the assumption that cluttering needs to be measured by (1) using perceptual assessment procedures, (2) addressing the multifaceted attributes of the problem, and (3) being sensitive to individually different severity patterns.

ADMINISTERING THE CSI

Installing the CSI from the ICA website:

The CSI software (and support tools and materials) is made available through the website of the ICA (http://associations.missouristate.edu/ICA). Click on the "Resources (and links)" tab for locating "Software downloads." The download and installation instructions will be described on the website, and may vary slightly depending on the version that will be needed. The CSI scoring software will work on most current Windows operating systems (XP, Vista, and Windows 7; 32 or 64 bit operating systems). At present, the CSI is available in English and Spanish. Training samples, so far, are only available in English (separate samples are posted for UK and USA users). Please inform us about any unexpected issues you may experience. It is our hope that we can reach each potential user with a working program (for support or feedback email to: KlaasBakker@missouristate.edu). The makers of the CSI would appreciate any volunteer help in translating the software to other computer platforms; it would appear that use of the CSI would be particularly convenient on tablets.

Necessary preparations for using the CSI:

Some experience with communicating with the client in natural speaking situations is a helpful prerequisite for assessing cluttering severity. This experience will be useful especially in making perceptual ratings of the client's discourse management skills. Additionally, observing the client's communication in naturalistic contexts provides a more valid measure of severity as cluttering is often most evident in spontaneous, unguarded, and informal settings. For purposes of using the CSI, a digital audio recording of the client's speech needs to be available. Although no strict sample duration is recommended, it is best if the speech sample consists of multiple

samples of at least one minute of continuous speech--preferably taken from naturalistic settings--so that the cluttering as it manifests itself may be considered representative of how the symptoms occur in real life communication situations. A clinician may judge that much longer sample durations are needed for some clients. As the sample will need to be evaluated three times over, recordings that are excessively long are likely to be counterproductive.

Recommended specifications for digital audio recordings for CSI scoring are:
- Mono, or stereo, recordings may be used; recording in mono has as the advantage that the files may also be processed by other clinical software systems (e.g., CSL, Visipitch, or most online available acoustic speech analysis products)
- Sampling rate: at least 22,050 Hz (44.1kHz typical)
- 16 bits or more
- Recording format: "*.wav" which is the most typical recording format on PC computers; "*.mp3" works well in the CSI but would limit further work on many commercially available software products (e.g., CSL, Visipitch, or most online available acoustic speech analysis products).

These specifications ensure that the sound quality of the samples will be clear enough to interpret the sometimes subtle clinical or perceptual characteristics of cluttering. *Cluttered speech often seems to be rapid and unclear and presents perceptual challenges for the listener.*

What are the assessment components of the CSI?

The CSI represents a two-pronged approach to severity. The instrument begins with eight perceptual rating scales of behavioral characteristics often considered compromised in cluttering. These ratings are based on a speech sample as a whole. However, for the last rating dimension, discourse management, additional experience with the client would be necessary. While this dimension is typically not available from recorded monologues, other interactions with the client (for example during the interview or observations in everyday situations) could permit assessment of discourse management.

An additional component of the CSI involves identifying how much of a speech recording is considered cluttered. This is the component for which the digital audio recording is necessary. As cluttering tends not to be a very discretely discernable characteristic, the recording is played three times over to approximate the measure of prevalence of cluttering in the sample. To be sure, unlike in the previous version of this assessment approach (CLASP 2.0), speech does not have to be demarcated by the clinician. This is done automatically by the software.

Description of the CSI startup screen:

At startup, the following screen emerges which contains all necessary controls for a CSI assessment. There are nine "radio buttons" which allow access to the assessment options that all need to be completed in order to obtain the overall CSI severity result. It should be noted here that the order of the perceptual ratings was determined by the results of a survey among cluttering specialists. Also based on results of this survey among cluttering specialists, weights were determined for how much each dimension should reasonably contribute to the final score. The following assessment options will need to be administered in the order presented:
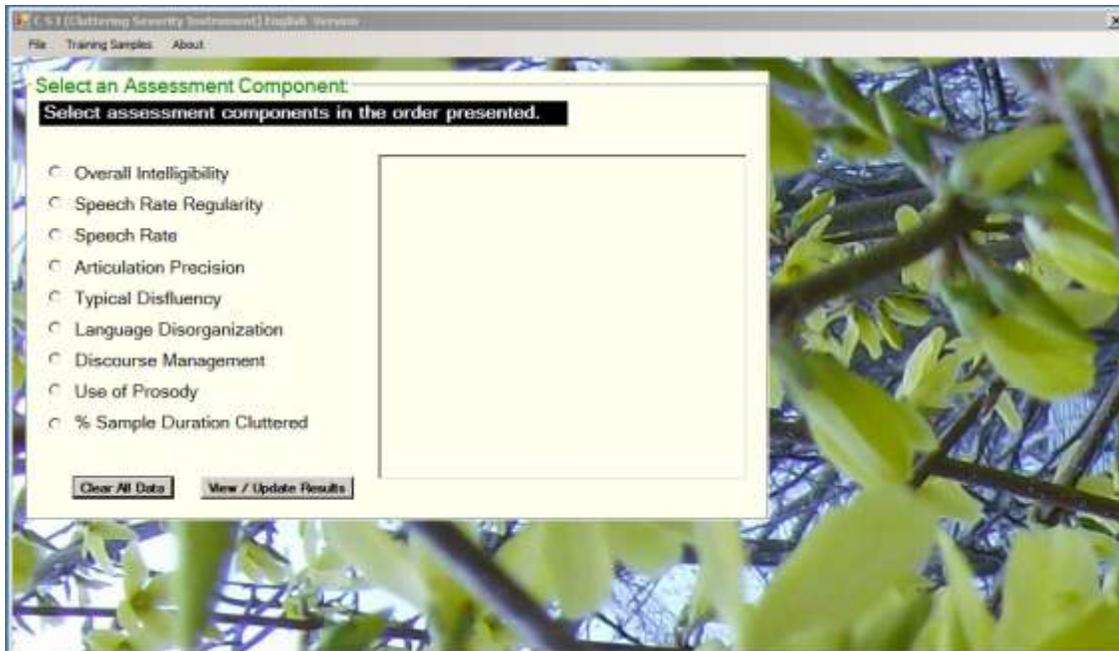
Figure 1. Startup screen of the CSI.

There are two buttons below these assessments options. The left *Clear All Data* button clears all the data to prepare for a fresh start (assuming the CSI was just used in a previous recording session). The *View/ Update Results* button to the right pulls up a summary of the data obtained so far, both in graphical and numerical form. Following completion of all assessment options the final results are obtained with the same *View/Update Results* button. It is recommended not to view the results until all assessment options have been completed. This maximizes the prospect of paying full attention to the rating at hand, so that perceptual judgments can be made as independently of each other as possible (e.g., not letting rating of disfluency influence one's ratings of articulatory precision).

The Menu Bar of the program shows three options. Under "File" is an option to save an assessment report in *.rtf form. This generic format allows the file to be opened in many word processing programs. It also makes it easy to insert the results in other documents being prepared by the clinician, or simply to print them for filing purposes. Selecting "Training" in the menu bar makes options available for becoming more familiar with cluttered speech as well as the features to be evaluated with the CSI program. That is, the clinician either listens to a speech sample with cluttered speech, or actually practices using this assessment software on one of two practice samples of cluttered speech (Menu under "Training") while being able to compare one's results to assessments prepared by the authors. Additional training options allow the user to listen to samples that illustrate the features to be evaluated during the CSI severity assessment procedure. Due to the multi-faceted nature of cluttering it is very difficult to obtain selected samples that demonstrate these features singly and exclusively. So the samples provided in our judgment show the prevailing characteristic embedded in speech that may also demonstrate other features to be attended to (e.g., disfluencies embedded in segments with poor speech intelligibility). Plans exist to obtain additional varieties of speech samples and expand the online repository. It is our intention that ultimately these speech samples will be used to develop a training system for cluttering assessment independent of the CSI. Samples

from different languages or dialectical variations will be needed also to provide experiences that are relevant for one's geographical or cultural background. The authors hope to be able to provide such examples with translated versions of the CSI software but, at this time, we are only able to provide UK and USA English training samples.

We don't have a "help button" within the program, but provide this online manual as support for using the CSI. The credits for the program are listed in the "About" tab of the program. These credits include the fact that this software is dedicated to the late Peter Kissagizlis who had been an inspiring pioneer who promoted the recognition of consumer issues for people who clutter and stammer worldwide, and along with others has served on the Consumer Issues Committee of the International Cluttering Association.

The CSI assessment system was developed by the authors at no cost to the user. The program has been donated to the ICA so it can be disseminated among speech language pathologists who work with people who clutter worldwide. Attempts will be made to provide the CSI in multiple languages, and thanks to the help of Ana Tapia (Graduate Student at Missouri State University) and Laura Busto Marolt (Speech Language Pathologist in Argentina) a Spanish version of the software has been released concurrently with the English version. Of course, translations of the software, manual and access to practice stimuli are limited by the availability of help from qualified translators.

The CSI was developed for PC computers and at this time is not available for Macintosh computers or tablets. Perhaps Macintosh developers with an interest in cluttering can be found that are willing to volunteer time to creating Apps for Macs for the ICA.

The Perceptual Ratings:

Here the clinician rates dimensions of the communication system that can be compromised during intervals with cluttered speech. Our system prompts the user to provide ratings (on "point and range estimate" Visual Analog Scales) on the following characteristics: overall speech intelligibility, speech rate regularity, speech rate, precision in articulation, typical disfluency, language organization, discourse management, and prosody.

Overall Intelligibility

"Overall intelligibility" can be influenced by a number of variables. Disorganization or disintegration of speech (and, to a degree, language) processes influences how well we can understand the speaker.

Overall intelligibility--or how well we can understand the speaker--is reduced in cluttered speech. This is influenced by the compromised nature of articulatory precision, the unnatural or impaired prosodic patterns, the multiple disfluencies, a rate that is perceived to be too fast or jerky or even unusual resonance qualities of speech. For example, if the speaker does not exercise optimal excursion of the articulators as during vowel neutralizations, resonance can be affected.   This separate rating of 'overall intelligibility' is used to express the degree to which the clinician judges speech to be ineffective, difficult to understand or follow, due to deficits in conveying intelligible, meaningful, well organized messages. Individual variations that feed into this rating are likely to occur. On occasion, a sample may be judged largely unintelligible. Unless the sample is entirely unintelligible, we encourage the clinician nonetheless to assign perceptual ratings to the other seven dimensions when possible.

Speech Rate Regularity

"Rate regularity" refers to the degree to which the speaker's rate is perceived to be spurty and erratic. The ongoingness of the speech is perceived not to be entirely "in synchrony" or coordinated with the semantic or syntactic output of the message.

Many clinicians perceive cluttered speech to be spurty and irregular in cadence. This can be due to inconsistencies in the rate of speech itself, as well as the presence of disfluencies that disrupt the syntactic and semantic flow of the message. These disruptions occur at locations in an utterance that are not expected. All these and other factors may contribute to the perception of rate irregularity in cluttered speech. The unpredictability of the message, due to spurty rate (as well as poor speech/language intelligibility), contributes to our perception of cluttering.

Speech Rate

"Speech Rate" refers to the degree to which the speech rate is perceived to be fast. The listener experiences difficulty in "keeping up" with the processing of the speaker's message output.

Cluttered speech is often fast or perceived to be fast. The perception of a rate that is too fast may be influenced in part by the fact that the message contains articulatory (e.g., deletions of sounds) and/or linguistic incoherencies (e.g., unresolved episodes in story grammar and linguistic maze behaviors such as incomplete phrase + revision).

During the rate evaluation the clinician focuses on the *perception* of speech rate. It will not be necessary to actually determine number of syllables per minute as this may be only one of the factors that contribute to the perception of rate. Further, it is possible that speech perceived as fast actually is not fast in a physical or articulatory rate sense. The listener's perception of a fast speech rate may be associated with difficulties in decoding the message and, in that sense, finds it difficult "to keep up" with what is being said.

Articulation Precision

Precision of articulation refers to the degree to which the articulatory gestures achieve their target. Cluttering is often marked by nonphoneme-specific misarticulations of sounds, especially in multisyllabic words.

Many PWC exhibit imprecise articulation, especially on multisyllabic words. The misarticulations associated with cluttering are not phoneme-specific, which means that they do not express difficulty in producing the phonemes per se. (However, some PWC may also have a phoneme-specific articulation problem in addition to the cluttering.) Imprecise articulation---sometimes called "over coarticulation"--is manifested by symptoms such as deletion of sounds and syllables (e.g., weak syllable deletion as in "tephone" for "telephone," cluster reduction, and final consonant deletion), vowel neutralization, and distortions of phonemes. The lay person would regard the speech of cluttering as "mumbling."

Typical Disfluency

"Typical disfluency" refers to the degree to which the speech is perceived to contain disfluencies that are shared by "typical"or nonstuttering speakers (e.g., interjections,

incomplete words and phrases, revisions), spoken without perceived physiological tension, effortfulness or struggle.

Pure clutterers exhibit nonstuttering or "typical" disfluencies. That is, the disfluencies are similar to the types of disfluencies that typical speakers exhibit. These include interjections, incomplete words or phrases, revisions, word and phrase repetitions. The disfluencies are not produced with perceived physiological tension, nor do they consist of the intramorphemic effortful fragmentations associated with stuttering. Some individuals may exhibit symptoms of both cluttering and stuttering. In those cases, the clinician should focus on typical disfluency (only) while using the CSI. Notations and evaluations about the stuttered speech should be done separately, as differentiating typical and stuttering-like disfluencies is important for diagnosis and assessment.

Language Disorganization
"Language disorganization" refers to the degree to which the "story line" of the speaker's message flows. The "flow" of the message is related to the degree to which the ideas conveyed are easily understood (coherent), well organized and logically linked (cohesive).

PWC often say that they experience difficulties in organizing their thoughts. Multiple thoughts come to mind at once, and they find it difficult to sequence them or know which thoughts are more important and which are tangential. These intuitions may reflect certain deficits in executive functions which facilitate organization and execution of thought and language. Here is a quote from a PWC that reflects such difficulties: "*I [have] disorganized thoughts....[I am/tend to be] rambling [and] talkative....[I have] difficulty getting to the point." Ultimately this difference in cognitive processing can affect the quality of linguistic expression and the coherency of information conveyed.   The degree to which language appears to be disorganized may, or may not, be captured by standardized language tests which tap relatively short utterances removed from naturalistic contexts. This is analogous to differential skills required when a student takes a short-answer exam such as fill-in-the-blank, compared to answering essay questions that require organization, coherence and cohesion of expression. Linguistic maze behaviors such as revisions may reflect momentary disintegration in the linguistic organization of the message.

Discourse Management
"Discourse management" consists of inappropriate disruptions or breakdowns in the pragmatic fluency of a conversation. These breakdowns include interrupting the partner's conversational turn, inability to detect and repair conversational breakdowns, not being able to judge appropriately the amount and type of information conveyed in discourse, and so forth.

Many PWC indicate that they have a propensity to rush. This urge to do things quickly may influence their turn taking skills, manifested as interruptions of someone else's turn, or a tendency to speak about what comes to mind even if it is not strictly on topic. PWC may also be unaware that their listeners do not fully or easily understand what they say. Because of this reduced awareness of verbal and nonverbal feedback from their conversational partner, both the PWC and the listener may become frustrated because of the communication breakdowns. Clearly, this characteristic cannot be judged from listening to monologues alone but depends on

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other interactive experiences with the client. The weakened or disorganized structure of discourse, like language disorganization, should be judged by the clinician to be a result of the incoherent flow, and control, of information relevant for the moment rather than necessarily a basic lack in capacity to exercise such pragmatics. It is likely to reflect a deficiency in "performance" more than a basic deficit in capacity.

Prosody
"Prosody" refers to the perceived appropriateness of the various suprasegmental features of speech. In addition to rate, the suprasegmentals include pitch and loudness variations or intonation patterns. The latter is intrinsically tied to the linguistic and pragmatic intents of a message. Suprasegmentals influence the perceived naturalness with which one speaks.

Prosody reflects most of the characteristics of speech related to "how you are saying things" rather "what it is you are saying." Others explain prosody as the "musical aspects" of speech in contrast to what is expressed. Evaluating prosodic performance of a speaker involves listening for the client's use of:
- Intonation (mostly pitch variations)
- Stress, and stress patterns, of syllables (again mostly pitch variations, but also variations in loudness or how distinct and complete syllables are produced)
- "Punctuations" in the form of pauses and hesitations, which mark the boundaries of linguistically significant parts of speech (for example "content units")
- The flow and rate of speech, rhythm or cadence (which are separately rated in the CSI)

In the case of cluttering, prosodic differences in the speech of people could constitute:
- Monotony (or lack of prosodic expression)
- Unusual prosodic patterns that do not conform to the listener's expectations
- Unexpected ways to "punctuate" utterances, or the placement of pauses relative to linguistic expectations of the listener
- Very unclear, not stressed, or nearly not present, syllable productions
- Analogous to 'overall intelligibility,' prosodic expression may reflect side effects of other failures in expression, as prosody constitutes the *supra*segmental aspects of speech. This may be in addition to reduced ability to produce effective prosodic variations in speech such as appropriate variations of pitch.
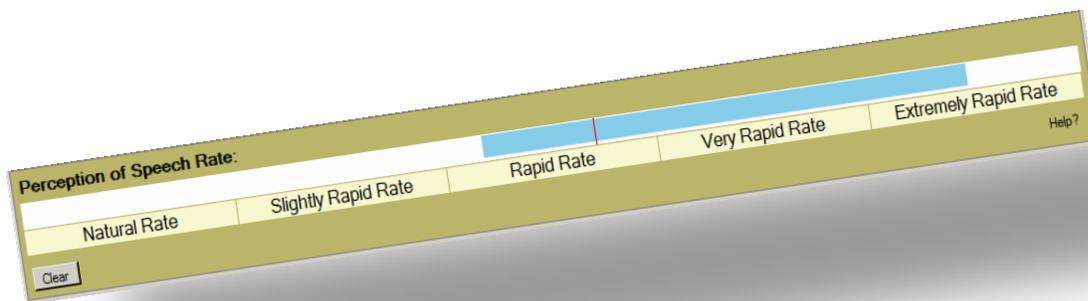
Figure 2. Sample of a point and range evaluation scale to express perception of speech rate

Providing the behavioral ratings: "point and range estimation"; how to use the scales

Each scale is selectable from a radio button. This pulls up the visual analog scale at the bottom of the program window. The characteristic at hand is rated in two specific ways. The user can click the left mouse button anywhere in the rating area to express the degree to which the characteristic matches the communication behavior of the client. This leaves a red vertical line which will be automatically translated (by the program) into a percentage of the scale length. The location of the line may be adjusted by clicking in the location which the clinician judges to be most representative of the speech sample. Bear in mind that a red line "point estimate" will be needed for all ratings in order to be able to complete the CSI.

Because a cluttering characteristic is often variable for the client, or for a specific speaking sample, the CSI allows the user to also provide a "range estimate" to express this variability. This is accomplished by dragging the right mouse cursor from left to right expressing the range of the behavior as perceived by the clinician. This leaves a blue area on the visual analog scale to represent the observed variability. This blue area can be edited by simply redoing the selection. It will not affect the red "point estimate" already made.

The range rating (as conveyed by the blue area) is optional and for descriptive purposes only. It does not affect the comprehensive cluttering severity score obtained with the CSI scoring tool. Nevertheless, it may provide helpful clinical information about the client that could play a role in the planning of treatment, and allows the clinician to consider the client's behaviors in considerable detail. The "range estimate" information will be included in the report provided afterwards.

Associated with each of the rating scales are five descriptive anchors to aid the clinician to interpret the scale. For example, these anchors could be: Normal, Slightly Deviant, Deviant, Very Deviant, and Extremely Deviant. This is different from using traditional visual analog scales in which descriptors are provided only at the extremes. This use of descriptors is believed to enhance the reliability of the use of the scale. Some research supports the notion that providing multiple anchors along the scoring can increase inter-rater reliability. It is very important, in order to use the evaluation scales optimally, to *consider the entire range of the scale*, and not to feel obligated to mark evaluations close to or at, the visual anchors. By using the entire scale one can express one's evaluation in a very detailed and hopefully more accurate manner.

The same point and range estimation process applies to each of the behavioral dimensions rated in the CSI. If uncertain about the meaning of a scale, the definition can be obtained by clicking on the "help?" link at the right bottom portion of the rating area. In some cases links for playing examples are provided as well in the training section (which is accessible from the menu bar). Finally, a scoring area may be conveniently cleared with the "Clear" button in the left bottom area. This only clears the rating at hand.

End of the assessment: determination of % Sample Duration Cluttered (SDC):

It is assumed that a digital speech sample is available on the computer on which the CSI software will be used. This sample should have minimal silence at the beginning or end of the sample or these silences will be included in the sample duration reported. If one isn't sure about this there are excellent freeware sound editing programs available online (Note 1).

Select the SDC scoring option by clicking on the last radio button. This opens the player for determining the % Sample Duration Cluttered (SDC). The player looks like the following:
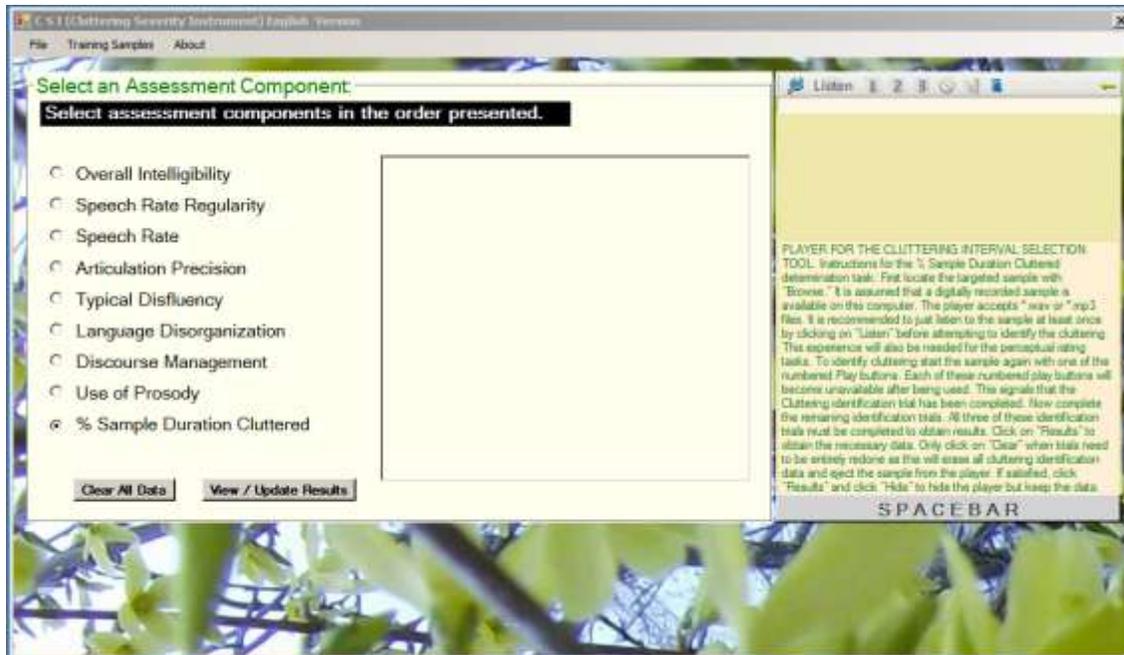

Figure 3. Screenshot of the CSI with the % SDC player open.

The %SDC player is used to determine prevalence of cluttering in ongoing speech produced by the client. In other words, this function is to determine the proportion of a speech sample that reveals the characteristics of cluttered speech as judged by the clinician. The menu bar of the player itself reveals the steps of this process moving from left to right.

1. A "magnifying glass" icon is available for locating and opening a speech sample desired for the assessment.
2. The "Listen" button is used for playing the sample, as many times as needed, to familiarize oneself with the speaker. Previewing the sample this way is *highly* encouraged to adequately prepare for the %SDC measure and all cluttering behavior ratings that follow (selectable with the remaining eight radio buttons).

3. When one feels prepared and ready for the actual %SDC determination, the selected sample is played three times consecutively (buttons 1 thru 3) for marking the portions that are judged by the clinician to be cluttered. Cluttering is marked by pressing down the spacebar for the duration of perceived cluttering. Following each trial the cluttered speech segment becomes locked for editing (a rectangle appears around the button to indicate this trial was completed already). This process is conducted two more times to strengthen the reliability of the cluttering identification results. After the third run the % is obtained by clicking on the "Results" button. Don't forget to click on the results button in order for the results to be completed.
4. At this point the decision is made by the user to either accept the results (click on the back arrow button all the way on the right) or to redo the entire cluttering identification session by clicking the "Reset" (garbage can) button.

Final results of the CSI are obtained by clicking the "Update/View Results" button. As can be seen in the following screenshot this produces the overall weighted CSI score as well as a graph showing the individual results obtained. The information in this graph allows the clinician to make comparisons across the behavioral ratings which in some cases may provide insights helpful in preparation of treatment plans.

In addition to showing the exact point and range estimates for the behavioral ratings, the graph also shows % Sample Duration Cluttered with a green bar, and the overall weighted CSI score near the bottom of the display with a red bar. It should be noted that these weights were determined by the results of a survey among 31 fluency specialists who have had a minimum of 8 years in cluttering (mean experience was 19.4 years, while the range was from 8 to 45 years). Based on their input, we have determined a preliminary set of 'weights' associated with the 9 scoring components of the CSI. While this is a first significant step in obtaining the proper weights, more comprehensive empirical research should occur to support weights used for this purpose.
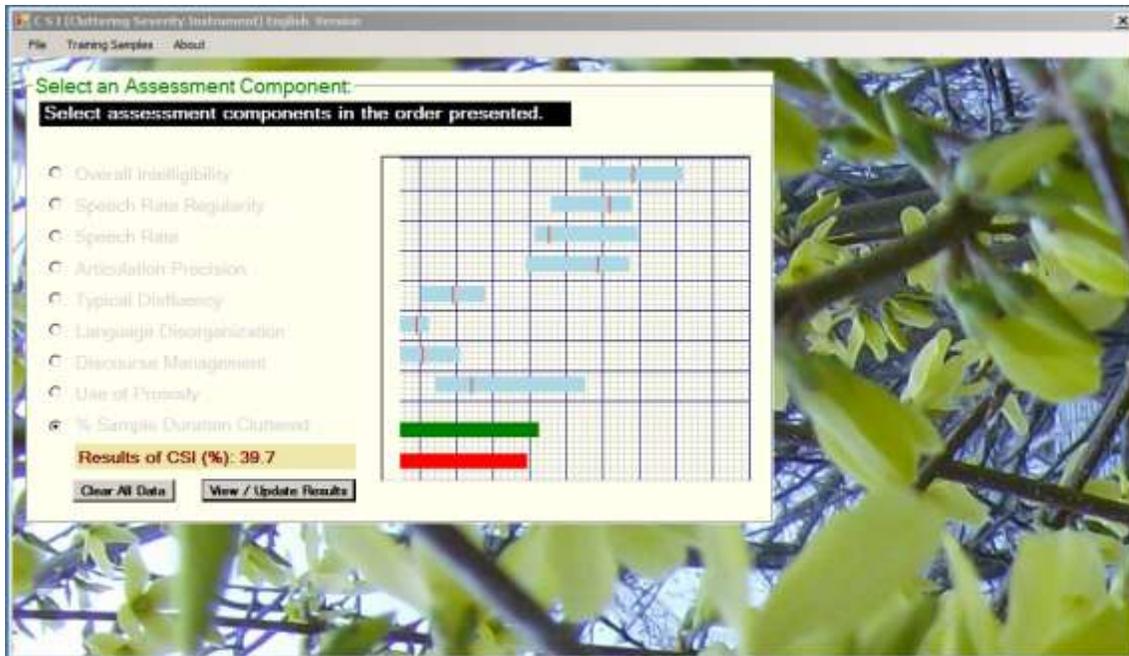
Figure 4. Final CSI in graphic form results following completion of the evaluation procedures.

Options for training and improving one's performance in using the CSI:
The CSI program provides anchors for how severity on the individual dimensions could be rated. These may be accessed through "training" in the menu bar. Simply navigate to the samples that were downloaded with the program. By downloading the samples separately from the program it becomes possible to later include new anchoring or practice samples as they become available. Presently, only British English samples are available; American English samples for purposes of training will be available soon.

Additional uses of the CSI for assessment and treatment:
The CSI is typically used to establish baseline severity, by providing the client's unique profile of severity ratings on the eight dimensions as well as the prevalence of cluttering. It is best to supplement baseline recordings obtained during the evaluation by recordings obtained in the client's everyday speaking situation. Obtaining multiple speech samples is important as we have found cluttering severity for some clients to be most pronounced when the individual is speaking in informal, less guarded, conversational settings. The potential contrast in severity ratings may also serve as a positive prognostic indicator. That is, the less severe ratings obtained in a formal speaking situation may be used as evidence that--with increased awareness and concerted and systematic therapy--the less severe cluttering can generalize to other speaking tasks and contexts. Of course, a major asset of this instrument is that the client's personal CSI profile provides therapy implications unique to that client. There are other uses of this instrument. For example, the CSI can serve as a vehicle to heighten awareness of the various dimensions associated with cluttering by training the client to evaluate relative severity of select dimensions (e.g., overall intelligibility, presence of typical disfluencies). Self-awareness

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and self-monitoring skills are crucial for progress in treatment. Additionally, the CSI profile unique to the client provides insights regarding which dimension or dimensions to work on first. For example, the dimension that impacts most on the client's cluttering severity should be considered high on the therapy hierarchy. The CSI can also be useful to document clinical efficacy. In addition to progress made for the dimension targeted, for example, the client's CSI profile may show improvement on one or more other dimensions-- given the systemic nature of cluttering. For example, treatment focused on modulating speech rate and rate regularity may also improve severity ratings for overall intelligibility and articulatory precision.

> _The scientific status of the CSI as a whole and the tools included in the product_:

It would be desirable for results of the CSI to be compared to established normative references for 'cluttering severity'; however, the field does not presently have such normative references. Because cluttering is multidimensional, the CSI allows users to rate severity for individual dimensions of speech and language behaviors that contribute to cluttering severity. We feel this is a step in the right direction toward operationalizing the constituent dimensions of cluttering, rather than simply providing one overall cluttering severity rating

No work has been done to test the present version of the CSI in typical treatment contexts and across users. There are no estimates of intra- or inter-rater reliability of any of the components evaluated in the CSI. This is considered the next logical step in further development of the CSI.

Finally, validity for representing cluttering severity will require empirical testing. For the time being, however, this is not an option as there are no other established measures for comparison.

A preliminary version of the CSI has been in existence for about six years of this writing (Bakker et al 2005). However, this pilot version required users to (1) identify "talking time" and "cluttering time" simultaneously in real-time, and (2) the perceptual ratings could be expressed in the form of point estimates only. In sum, the current protocol has the following added benefits compared to the earlier version:

- Acoustic sample duration is determined automatically, allowing a clinician to focus on cluttering identification only. This should have at least some positive effect on the inter- and intra-rater reliability of the CSI.
- To further improve reliability, cluttering identification now occurs three times consecutively while the results of these trials are averaged to provide a relatively stable estimate. While not empirically tested, this too should benefit intra-rater reliability at least to some extent.
- Use of digital recordings (*.wav or *.mp3) permits the clinician to listen to a sample multiple times conveniently to familiarize oneself with the nature of the sample; this is an improvement as in the initial version the instrument was used in real time while listening to the client (or a recording played simultaneously while using the software).

- We have found that cluttering for some individuals tend to be more pronounced in naturalistic speaking situations. It is recommended that clinicians obtain digital recordings from naturalistic communication situations (e.g., made by family members) to supplement digital recordings made during the formal evaluation session. It is expected that representative daily life recordings would boost the validity of results. For this reason, a recording option is not provided within the CSI program. For those who don't have options to make digital recordings the previous version (CLASP) may continue to provide a useful alternative, but it would not lead to a comprehensive severity score such as available in the current version (CSI). A paper and pencil version of the scoring system should be made available fairly soon.
- The perceptual rating mechanism has been extended to a "point and range" type scoring system; through this the clinician can identify the most prevalent value, as well as how this value may vary throughout a speech sample. While range scoring is not made part of the composite overall cluttering severity measure, it does help with interpreting the results in more detail than was possible before.

While the original version of the CSI (the CLASP, 2005) made users mark "talking time" (that is, time during which there is audible speech), the current version of the CSI takes into consideration the entire sample duration (that is, including pauses and silences that occur in the sample). The reason is that often pauses, silences, may be perceived to be part of the cluttering while there is no audible evidence of speech in these situations. During pilot testing, furthermore, it became evident that in speech samples that occur in the form of a monologue, the difference between the durations marked as "spoken" by the clinician and overall sample duration (that is, with the pauses left in) were fairly minimal (Bakker et al 2010). Thus by determining the proportion of a speech sample (pauses left in) perceived to be cluttered by the clinician, a cluttering prevalence estimate is obtained that is more consistent with the perceptual emphasis of the CSI as a whole. When preparing the digital version to be scored, it is recommended that the user eliminate any pauses before or after the sample, as well as intervals during the sample that do not belong to the sample being judged (e.g. moments when the clinician interrupts or prompts the client). When such editing is not possible on one's recording device, useful freeware editors are available online that may help to prepare a sample for the CSI scoring process (Note 1).

Initial estimations of the reliability of cluttering identification were obtained in a pilot study involving identification of cluttering intervals in the speech samples of five individuals who clutter (Palmer, 2009.) Intra- and inter-rater reliability were found to be satisfactory for the durational, and interval count, data. Furthermore, absolute durational and counting-related data were not statistically significantly different from one moment to the next or from one rater to the next. When the interval selections were specifically scrutinized, it became apparent that despite reliability between and among observers, there could be marked differences in their selections of such intervals. This is an issue that warrants further research.

Notes

Note 1.

Two commonly used freeware software programs with good editing capabilities are:

1. Audacity (http://audacity.sourceforge.net) and

2. PRAAT (http://www.fon.hum.uva.nl/praat).

See the online information and support materials for instructions for how to use these programs.

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