

HANDOUT

Pushing the Envelope: Assessing Cluttering Severity with Computers

Klaas Bakker
Missouri State University

Florence L. Myers
Adelphi University

Abstract: Cluttering requires a new approach to severity assessment. Our Cluttering Severity Instrument (CSI) contains tools for conveniently determining % sample duration cluttered, and point/range visual analog scales for the perceptual assessment of speech rate, rate regularity, prosody, disfluency, articulation precision, intelligibility, linguistic organization, and discourse management. If conditions permit it, the CSI will be demonstrated.

Background

Bakker and Myers (2008) proposed a protocol for the assessment of cluttering severity. The components of the proposed cluttering severity assessment tool have been developed since that time and now are available in the form of a prototype that is ready to be tested for assessment (determination of cluttering severity, as well as qualitative analysis of clinical features), determination of treatment progress, generalization of treatment progress to out of clinic situations, and measurement of cluttering in research of this unique enigmatic and multidimensional speech fluency disorder. Our poster discusses the features of the protocol and during our assigned presentation time, if conditions permit this, we will demonstrate use of the CSI with a laptop computer with digitally recorded samples of cluttered speech.

Although the assessment components proposed at the time remain the same today we now promote that all components are included in any cluttering severity assessment. In other words, we believe that simple assessments using the % sample duration cluttered measure, once suggested as a quick assessment, may not sufficiently capture the essence of the problem.

Also, the perceptual ratings portion of the system has slowly become a dominant feature in the system. The current system is entirely a perception driven system. It is a guide that helps you systematically gather perceptual information thought to be important in reflecting severity, as well as needing attention in therapy.

The need for a cluttering severity measure

One of the primary roadblocks to progress in research as well as the treatment of cluttering is the lack of the ability to measure it. It is likely that most clinicians, who work with cluttering clients right now, are making decisions about severity in very subjective and individually different ways. Yet, in order to demonstrate that a treatment works, we need to quantify degree of improvement and with procedures that have known levels of reliability and validity.

Research into cluttering is also handicapped because of the inability to measure cluttering. Even if the purpose of the research is to refine this unique diagnostic category, we still need to research it through quantifiable means. When, as a result, cluttering is understood better this way this should have implications for how it should be measured in the future. A tool for cluttering assessment needs to be flexible, and sensitive for such changes, as it will need to grow with its moving target.

Our tool is mostly consistent with how cluttering is represented by one popular and current definition (St. Louis et al 2007; St. Louis & Schulte, in press). But also frequently expressed opinions as to what are obligatory and possible clinical signs of cluttering have contributed to the selection of the rating scales now part of the CSI.

Why does assessment of cluttering severity requires a perceptual approach?

Cluttering manifests itself as a "manner of producing speech" rather than in the form of a finite set of discretely identifiable clinical signs. Cluttering does not manifest itself in the form of "clutterings." The essence of cluttering escapes approaches such as typical in the assessment and treatment of stuttering. Stuttering can be assessed by identifying specific behaviors and counting or measuring their length and duration.

The nature of cluttering requires a descriptive and perceptual approach. Such an approach does still need to meet the expectation of producing valid and reliable quantifiable clinical data. We believe that this points to a set of measures that are perceptual in nature, and address cluttering in a broad and comprehensive way.

What is assessed in the Cluttering Severity Instrument (CSI)?

The CSI represents a two pronged approach to severity. On the one hand it provides a procedure for the assessment of the prevalence of cluttered

speech (% of a speech sample that is judged to be cluttered by the clinician). The second part of the instrument consists of 8 perceptual rating scales of behavioral characteristics often considered compromised in cluttering. The latter ratings involve the speech sample as a whole.

The % sample duration cluttered (%SDC) measure. The CSI determines sample duration automatically from a digitally recorded speech sample. It removes the durations of leading and trailing silences. Users are responsible for removing other periods of silence that don't belong to the sample ahead of time (for example in a wave form editor). This is a change of our earlier approach which was dependent on measuring "talking time" exclusively (time during which speech is acoustically present). The adjustment was made because pauses in the sample could be considered a perceptual part of the cluttering and this differentiation cannot be made by computers. Moreover, the cluttering intervals that are perceptually identified by the clinician also contain pauses which would be very difficult to remove.

So, while listening to a digital recording, the clinician marks portions that are judged to be cluttered (by pressing down the spacebar of the computer keyboard). Before the actual cluttering identification process, the clinician can "Just listen" to the sample as much as needed to interpret it with regard to the presence of cluttering. Three consecutive cluttering identification sessions follow, and cluttering time is averaged from these sessions and converted to the % sample duration (%SDC) cluttered measure.

It should be noted that even though the %SDC is quantitative in the way it is reported, it essentially represents the clinician's perception of the presence of cluttering. It does not reflect specific physical details about what led to the cluttering identifications. This measure, then, involves a perceptual prevalence measure for cluttering in speech. Unfortunately, in this process varying levels of severity from one cluttering interval to the next are not systematically tracked. To enhance the ability to describe severity more comprehensively a series of perceptual ratings of the communication behaviors follows.

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 combined point and range estimate Visual Analog Scales) on the following characteristics: speech rate, rate regularity, prosody, typical disfluency, precision in articulation, overall speech intelligibility, linguistic organization, and discourse management.

A scale is marked by pressing down the right mouse button and dragging it from left to right to reflect a perceived range for a characteristic at hand. This draws a blue rectangle to represent the range as to the variability of the characteristic throughout the sample. Now with the left mouse button the perceived center point (most representative value) for the characteristic is marked by clicking in the appropriate location of the blue rectangle.

Improvements over previous versions.

A preliminary version of this approach has been in existence for about five years (Bakker et al, 2005) but required users to (1) identify talking time, and cluttering time, simultaneously in real-time, while (2) the perceptual ratings could be expressed in the form of point estimates only. In sum, the new protocol has the following practical improvements:

- Acoustic sample duration is determined automatically, allowing the clinician to focus on cluttering identification only
- To ensure reliability cluttering identification occurs three times in a row
- Use of digital recordings (*.wav or *.mp3) permits the clinician to listen to a sample multiple times to familiarize oneself with the nature of the sample
- Use of digital recordings also doesn't require samples to be recorded in realtime during therapy, which often leads to PWC to produce speech that is more fluent than usual and not representative for the problem such as it is encountered in real life situations. This does expect that the ability exists that naturalistic recordings can be made digitally and shared with the clinician
- 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

What is still needed? The CSI protocol at this time does not have an empirically supported composite severity result. The CSI severity score at this time is based on weights provided by 4 specialists. The ultimate weights for the components will need to be derived from empirical research to determine the unique contributions to the concept of severity of each of its components to the "overall perception of severity". Such research would help determine weights to properly assign how much each component should contribute to the composite cluttering severity measure. Of course a limitation in this process would be the fact that no absolute standards for cluttering severity exist, and the CSI is the first available tool.

As cluttering judgments may be difficult at first, the system will soon have an integrated training for cluttering identification. It will have the option to listen to exemplars of different levels of cluttering severity. These exemplars can serve as anchoring points for making the judgments of the presence of cluttering, or the perceived levels of disorganization in speech, consistently. The training system is presently in development.

The use of the tool as an instrument for analyzing the interactions between components of a cluttering problem will depend on clinician experiences. We

anticipate that this secondary aspect of using the CSI will greatly improve the validity of cluttering treatment protocols.

Finally, a built in limitation to cluttering severity assessment is the difficulty to obtain representative recordings. Often, when a recorder is used, speech of a PWC markedly improves (though not always). For the CSI to be an effective assessment tool, there will need to be a procedure for securing representative digital recordings. The recordings will need to be made with the understood purpose of capturing the problem such as it is seen as a problem today. In addition to judgments by the client, this may involve judgments of significant others around the client and clinician as well. The ability to make digital recordings (e.g., MP3 players) may not be available to all who need it.

How will the CSI be made available? Rights for the CSI protocol will be donated to the International Cluttering Association. Most likely the program when formally released will be downloadable from the "Resources and Links" section of the ICA website. At this point we welcome volunteers to "beta test" the protocol with their clients and help us refine the protocol for a formal release soon.

References

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