ABSTRACT
A computer software program was developed for use in clinical settings that facilitates monitoring of certain parameters related to motor learning. The principles addressed include performance accuracy, as well as repetitive, random, and distributed practice. Measures include target accuracy, utterance accuracy, practice set size, practice set diversity, and level of cueing provided. Criteria for moving to new stimuli are established using the cumulative measures component of the software. Three case examples of implementation in a clinical research setting are illustrated.

BACKGROUND

- Repetitive opportunities to practice speech movements are necessary to realize progress (Magil, 1998, Schmidt, 1991).
- Motor performance and learning increases with multiple practice trials.
- Randomized practice maximizes learning by alternating stimuli to prevent anticipation of the next movement. When the order of stimulus presentation is randomly mixed, motor learning is facilitated.
- Treatment incorporating distributed practice in short, frequent sessions facilitates speech motor performance and as a result, learning (Fletcher, 1992).

An individual’s level of motivation influences the degree of motor learning (Schmidt, 1991) and increasing the level of success increases motivation. By incorporating accurate movements into new movement sequences, the individual experiences success with speech production, thereby increasing motivation and participation. When introducing novel speech movements, struggle to produce correct responses and errors are both reduced. Incorporating accurate movements into new sequences aids in establishing correct movement patterns. The goal of intervention is to facilitate accurate motor learning and establish motor plans and programs to execute speech.

Motor Learning in Treatment of CAS
To establish motor plans and programs in CAS, treatment approaches (Strand, 2004; Velleman & Strand, 1994) that incorporate principles of motor learning have been developed. However, few require performance at high levels of accuracy to establish accurate, automatic speech movements and maintain motivation. Although each approach is hierarchical, incomplete information is often provided regarding when to progress to the next level of complexity. Strand (2004) specified cumulative accuracy criteria to monitor progress. At this time, a limited number of computer software programs are available that facilitate data collection for monitoring motor learning principles in a clinical setting.

PURPOSE
The purpose of this study is to develop a computerized software system for monitoring and analyzing motor learning and performance. One essential feature was that it prove functional for use in online data collection during treatment for CAS. Use will be illustrated with a group of three children with CAS in a clinical research program that emphasizes principles of motor learning.

SOFTWARE FEATURES
Software was developed to address the following measures to determine motor learning of specific sequences.

Target Accuracy - % accuracy of targeted skill (movement pattern during speech production of target only). The goal of motor learning is to maximize target accuracy while performing challenging tasks, not allowing practice of errors.

Task Accuracy - % accuracy of entire task (movement pattern during speech production of target and all context, e.g., word). The goal of motor learning is to maximize task difficulty while maintaining accuracy, to identify new targets and progress.

Cumulative Accuracy - % accuracy for entire session, may also accumulate across sessions. This will enable a clinician to determine overall production accuracy across sessions to establish whether motor learning has occurred.

Set Size - Number of targets addressed in a given session, to enable the clinician to view progress through increased set size as well as production accuracy. The goal of motor learning is to maximize the set size in a session.

Set Diversity - % of different targets addressed in a given session, to enable the clinician to view how well they are complying with distributed practice. The goal of motor learning is to maximize the set diversity in a session.

RESULTS
For clinicians, T² software was used during each session. The software automatically calculated target, utterance, and cumulative accuracy online during treatment.

T² allowed monitoring of stimulus presentation order and displayed the number of repetitions obtained.

Pre-planned stimulus lists allowed control of syllable structure when planning sessions.

As new targets were identified, the “Add” feature was used to add stimuli during the session.

Cumulative percent correct calculations provided a dynamic measure of success across sessions.

DISCUSSION
- Many treatment approaches have been developed and implemented to remediate motor speech impairments.
- One difficulty in evaluating treatment effectiveness is the inability to quickly monitor accuracy levels instantaneously during treatment sessions.
- Inaccurate data collection decreases the ability to provide immediate feedback that builds on the most reliably accurate movement patterns.
- Poor data collection also decreases the ability to monitor the level of difficulty of a particular target and rapidly transition to different stimuli for success when indicated by errors.
- It is quite difficult to monitor adequate practice of stimuli (repetitive, random, and distributed) online during treatment sessions. T² software provides a reliable, fast alternative to paper and pencil data collection.
- The use of T² software that monitors accuracy and practice allows for more effective motor learning treatment.
- Expert clinicians reported using T² software to manage data, monitor stimuli.
- Student clinician reported using T² software to learn motor learning theory applications in treatment.
- The child with CAS used T² software as a motivational tool (am I at 80%?)
- Researcher saves data to excel file for analysis.