



MyLynel – User Study Details

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Participation in the study required subjects to carry a recording device in the form of a Google Nexus Smartphone and to wear a Bluetooth headset with a microphone to capture audio signals. Recordings of subjects' speech were made during therapy and in everyday conversations and stored on the smartphone device. Specifically, subjects practiced their speech techniques taught by a speech-language pathologist, in conversations elsewhere with listeners of their own choosing. The subjects determined when to begin and end all outside recordings. At a date and time agreed to by both parties, recordings were downloaded by the investigators with the subjects present. Subjects direct the investigators to purge any unwanted recordings at that time. The audio data and measurements provided by the device were analyzed by the investigators.

The signal processing algorithms on the mobile device calculated speaking rate, amount of voicing, average intensity magnitude profile, and intensity of speech; these measures were used to monitor speech techniques learned in therapy. Although the subjects will be in possession of the recording devices for a week at a time, the total time commitment for recording is small; 1000 syllables of continuous conversation is needed per sample, which takes an average adult speakers less than a 5 minutes to produce. The participants also completed a brief six-item subjective survey after every recording on the device that took about one minute. These questions were be used assess speech-associated attitudes. The questions are listed below:

1. How would you describe your fluency in this session? (On a scale of 0- 5, where 0 = extremely dysfluent and 5 = fluent.)
2. Rate the frequency of stuttering. (On a scale of 0-5 where 0 = no stuttering and 5 = every word.)



3. Rate the amount of negative emotion (fear, tension, anxiety, etc.) you experienced. (On a scale of 0-5 where 0 = none and 5 = an extreme amount.)
4. Rate the amount of secondary behaviors you used. (On a scale of 0-5 where 0 = none and 5 = an extreme amount.)
5. Rate how well you were able you use techniques learned in therapy. (On a scale of 0-5 where 0 = never and 5 = consistently.)
6. What was the speaking situation? (This is a text entry box)

Results

Analysis of the stuttered audio collected through the pilot trial, showed that particular words with specific phonetic structures were stuttered more than others. This was a new finding that is not in any current technical publications in the field of stuttering. Figure 1 shows that phoneme /h/ was stuttered 25% of times. Phonemes that amounted to more than 5% of the total stutter are listed in the Figure 2. Using this phonetic information of the problematic words, we selected words with similar phonetic structure in voice impairment improvement algorithm. This proves that the voice impairment improvement algorithm is very important in the overall stuttering treatment device.

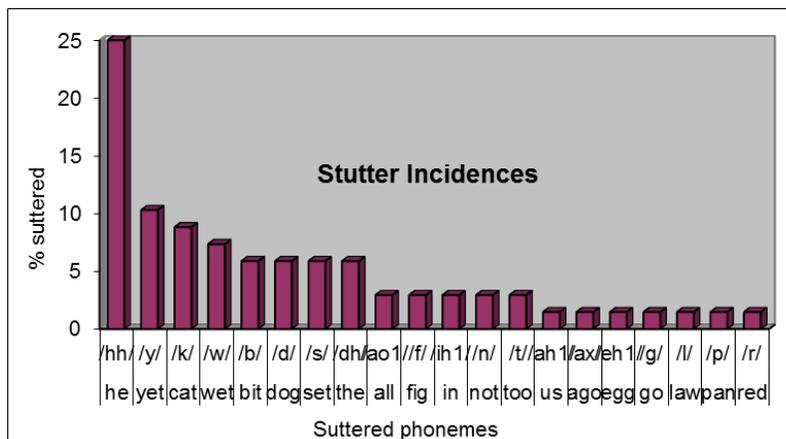


Figure 1: graph of phonemes stuttered,



Phoneme stuttered	% stuttered	Corresponding word stuttered
/h/	25	Harsh, Hash, He, He'll, History, Houses, How, Husband
/y/	10	Yeah, Yesterday, You
/k/	8	Call, Canada, 'Cause, Chemist, Columbia, Cross
/w/	7	We, Whereas, Why, With
/b/	6	Benedict, But, Buy
/d/	6	Dinner, Do, Dramatic, Drive
/s/	6	Send, Slam, So
/dh/	6	That, That's, The

Figure 2: Words associated with stuttered phoneme

Subjective Questionnaires

The pilot trial lasted three months from October through December. During the course of three months, fourteen recordings with 57 minutes of audio were captured from User 1 for analysis by the SLP. This included the seven recordings for which corresponding subjective questionnaire were recorded as shown in Figure 3. Audio recordings were not captured for User 2, but five subjective questionnaires were gathered from User 2 as shown in Figure 4. The amount of negative emotions went down via the use of MyLynel, the amount of secondary behaviors went down via the use of MyLynel, and Use of techniques learned also went up via the use of MyLynel. The Fluency level and frequency of stuttering remained the same during the three months, largely because the PWS's therapy goal was not to actively work on fluency. Another important outcome of the pilot was the user feedback on the usability and functionality of MyLynel.

Some key findings from the study were as follows:

1. When wearing the Bluetooth Headset, users made more conscious effort of using techniques and better managing their stuttering. This was happening even when MyLynel was not recording.

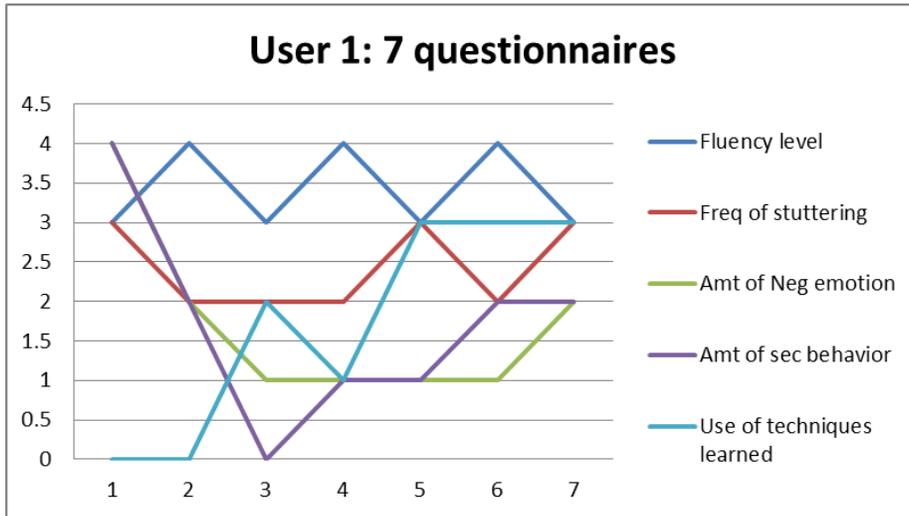


Figure 3: Subjective questionnaire summary for User 1

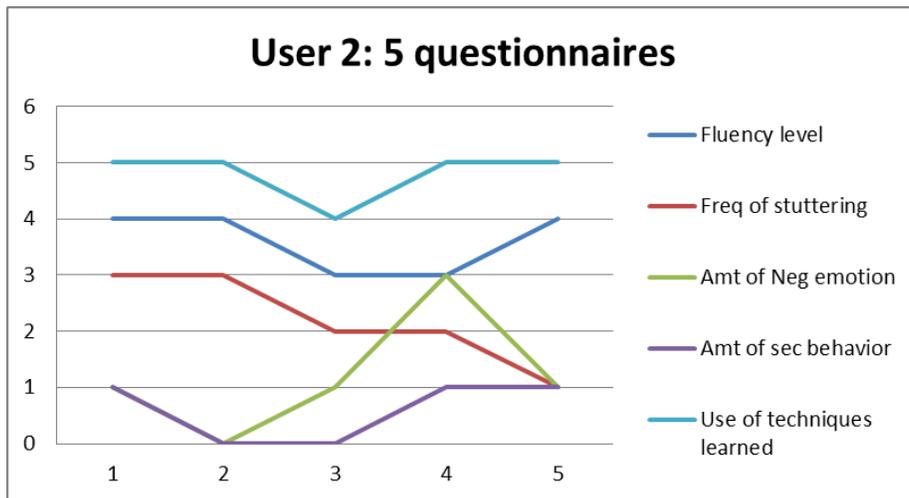


Figure 4: Subjective questionnaire summary for User 2