SPEECH SKILL BUILDER FOR CHILDREN

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This paper uses voice-activated game-like tool to provide real-time reinforcement of a client's attempts to produce changes in pitch, loudness, voiced/unvoiced phonation, voicing onset, maximum phonation time, sound and vowel tracking. Children, in particular, enjoy therapy with this colorful, interactive, video game because they receive immediate feedback on their performance. Clinicians will enjoy the versatility and unique features of this technique. For example, while a child is playing a game, you can quickly review the graphical display or statistical data of the child's performance. This technique is divided into two groups: 1) Awareness teaches children about the attributes of their voice, and (2) Skill Builder gives the user goals to achieve for a given range and time. The examples of comprehensive user logs and tracking client's progress are provided. Best of all, real-time recording and playback gives you the tools you need to maximum your client's therapy.

Introduction

Innovative computer technologies are not only helping the needs of persons with speech disorders, but also serving the laryngologists and speech pathologists to perform a more accurate and professional service. This paper provides you a tool to start this challenge in a more efficient way. Not only for your needs to perform a better report or make therapy efficient, but also for the clients who are counting on you and your ability to treat them in the best way. With a PC desktop or laptop computer, a 16-bit sound card, a microphone and speakers, the clinician has met the simple requirements for starting and operating a speech laboratory in the clinical practice.

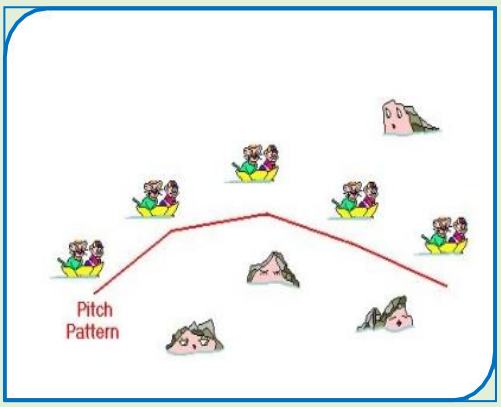
Methods and Procedures

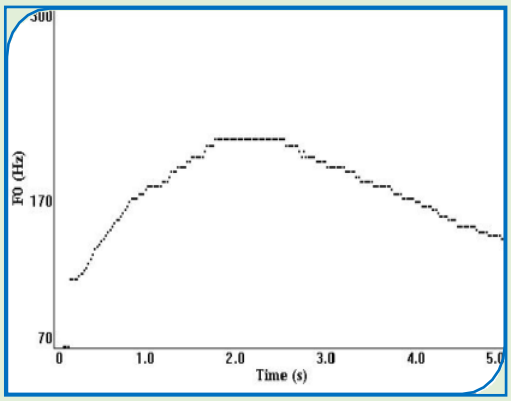
Speech is a product of the interaction of respiratory, laryngeal and vocal tract structures. The larynx functions as a valve that connects the respiratory system to the airway passages of the throat, mouth and nose. The vocal tract system consists of the various passages from the glottis to the lips. It involves the pharynx, oral and nasal cavities, including the tongue, teeth, velum, and lips. The production of speech sounds through these organs is known as articulation.

For speech skill builder, it is necessary for us to focus on the acoustical and physiological phenomena in both laryngeal and vocal tract systems. The parameters, such as, pitch, loudness, voicing, voicing onset, phonation time and formants, are closely related to these two systems. This paper employs Speech Therapy program, a clinical software from Tiger DRS. This software provides real-time cartoon displays of continuously varying pitch, loudness, voicing, voicing onset and phonation time displays so the children can receive immediate feedback on his/her performance with fun. In other words, the acoustical and physiological phenomena from the children can be evaluated from this technique. Clinical application of this technique will be described in the following experiments for details.

Experiment 1: Pitch Skill Builder

Using pitch module, clinicians could help the children refine pitch control and develop smooth modulation of pitch contour. Certain patients are unconsciously or consciously making an effort to higher or lower their pitch. The clinician should teach patient to target optimum pitch by the control of vocal fold vibration. For example, one of the best way to refine pitch control is to use rise-fall pitch technique. In the Figure 1 (a), by extending /a/ in front of microphone, the boat moves around the rocks based on a rise-fall pitch pattern. With this game, the children receive immediate feedback on their pitch performance. After the game, the clinicians can look at objective information of the pitch control, as shown in the Figure 1





a) Real-time cartoon display b) Objective Information of the pitch curve

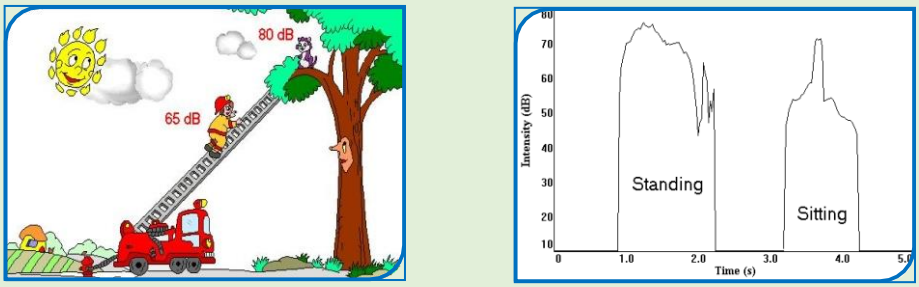
Fig. 1. Pitch controls how the boat moves around the rocks (target: rise-fall pitch pattern)

Pitch measure provides information about intonation. The pitch is mainly decided by the rate of vocal fold vibration. In the Pitch Skill Builder, the clinicians should help the patients to find the optimum pitch and pitch range and how to maintain this optimum situation. In clinical practice, a complete statistical report before or after therapy is important. The Table 1 lists the pitch changes during three-week therapy by pitch skill builder technique for the male patients with female voices. The result of speech therapy is obviously.

	Patient1 (Male, 5 Y)	Patient2 (Male, 9 Y)	Patient3 (Male, 13 Y)	Therapy Technique
Ave. Pitch (Week - 1)	482 Hz	425 Hz	408 Hz	
Ave. Pitch (Week - 2)	353 Hz	387 Hz	381 Hz	• Warm - up • Flat - pitch
Ave. Pitch (Week - 4)	332 Hz	362 Hz	357 Hz	• Warm - up • Rise -fall pitch

Experiment 2: Loudness Skill Builder

Using loudness module, clinicians could help the children lower the loudness level of speech when the usual level is higher, and higher the loudness level when the usual level is lower. The clinician should teach the patient to control his/her loudness change by the correct control of breathing. For example, one way to control loudness is to use correct control of breathing and body position. In the Figure 2 (a), by increasing the loudness through a good body position, the fireman climbs higher toward the top target. With this game, the children receive immediate feedback of loudness changes with their different body position (standing vs. sitting). After that game, the clinician can look at the different loudness data (standing vs. sitting), as shown in the Figure 2 (b). The top target corresponds to a certain loudness level that can be modified by the clinicians.



(a) Real-time cartoon display (b) Objective information of loudness curve

Fig. 2. Loudness controls how higher the fireman climbs (target: top).

Loudness measure provides information about syllable stress. The intensity of vocal fold vibration is decided mainly by the loudness. In the Loudness Skill Builder, the clinicians should find the best way for the patients to make a target. The Table 2 lists the loudness changes during seven-week therapy by loudness skill builder technique for the patients with right RLN paralysis. The result of speech therapy is obviously.

Table 2: Loudness changes during seven-week therapy

	Patient 1 (Male, 4 Y)	Patient 2 (Male, 7 Y)	Patient 3 (Male, 8 Y)	Therapy Technique
Ave. Loudness (Week - 1)	61.1 db	66.5 db	68.2 db	
Ave. Loudness (Week - 3)	63.4 db	67.1 db	69.1 db	• Warm - up • Standing Phonation by turn-head left • Loudness Skill Builder Correct Control breathing
Ave. Loudness (Week - 8)	66.2 db	67.8 db	71.3 db	• Warm - up • Sitting Phonation by turn-head left • Loudness Skill Builder Correct Control breathing

Experiment 3: Voicing Skill Building

Using voicing module could help the children assess their voiced and unvoiced phonation from the computer screen. Voicing refers to the vocal behavior by which the conversion of continuous airflow into a series of glottal pulses is regulated. Voiced phonation, such as /z/, is regulated by the vocal fold vibration, while voiceless phonation. such as /s/, is not regulated by the vocal fold vibration. For example, one way to feel voicing is to produce a pair of phoneme /s, z/, /f, v/ etc. In the Figure 3, when you phonate a voiced sound, a mouse (red) will come from left side; when you have a voiceless sound, a mouse (green) will appear from right side.

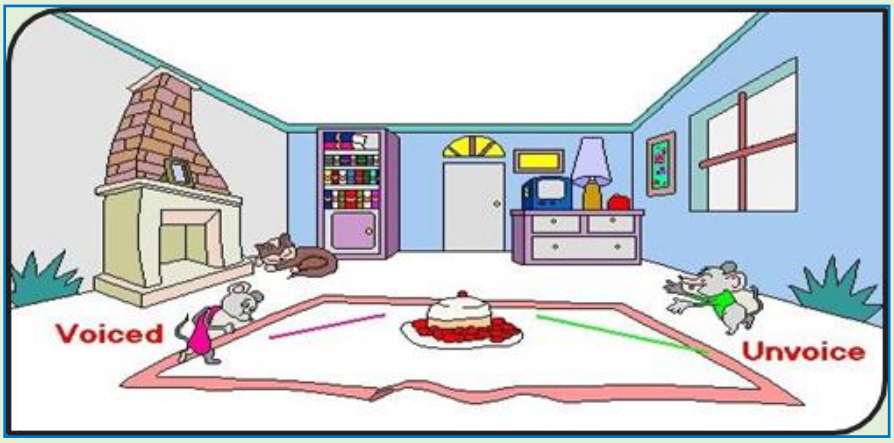


Fig. 3. Voicing mode determines which of the mice will run.

Voicing measure provides information about phonatory pattern. Using voicing onset module, clinicians could assist the children with modification of glottal attacks before the appearance of supraglottal articulatory event.

Experiment 4: Voicing Onset Skill Building

Using voicing onset module, the clinician can help the children to control the vocal fold attacks correctly, for example, soft glottal attack vs. hard glottal attack, as shown in Figure 4 (a). In the Figure 4 (b), when you initiate a voiced phonation, a flower will open. If you saw /ba/, /po/, the first flower will open at the beginning of /b/, and the second flower will open at the beginning of /o/ because /p/ is a voiceless phoneme.

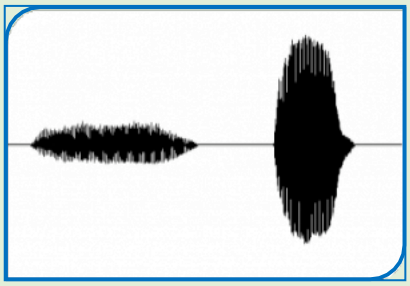


Fig. 4 (a) Soft glottal attack glottal attack controls

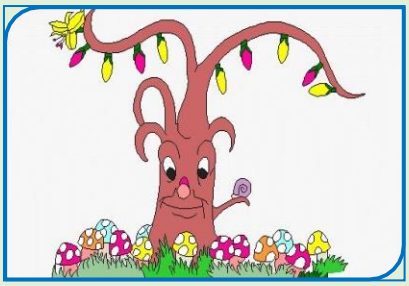


Fig. 4 (b) Voicing onset mode vs. hard how the flower opens around the tree.

Voicing onset provides information about glottal attacks. How fast can you make the ten flower open ? What happens if you extend a vowel, but have voice breaks? All these cases depend on the voicing onset.

Experiment 5: Phonation Time Skill Building

The term, Maximum Phonation Time (MPT), implies such abilities in voice production as how long one can sustain phonation. The patients are instructed to sustain vowel /a/ or other vowel as long as possible following deep inspiration. MPT is decreased in many pathological states of the larynx, especially in cases with incompetent glottal closure. MPT values smaller than 10 seconds should be considered to be abnormal. For example, the clinicians should provide the patients the best way to make the respiration and phonation correctly. In the Figure 5, the strawberry moves from left to right when you keep phonation after deep inspiration. The target for you to reach is at right side. The target setting can be changed for the needs of patients.

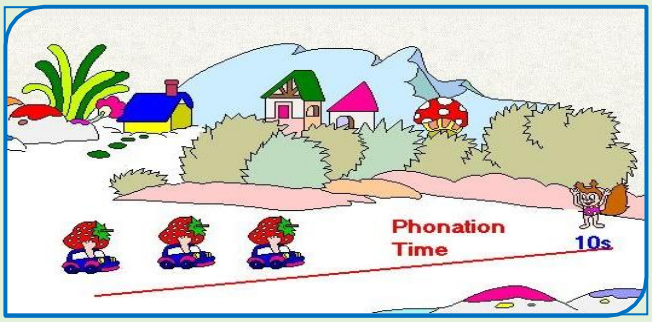


Fig. 5. Keeping phonation moves the strawberry from left to right.

Experiment 6 : Sound Awareness

In Sound Awareness module, the children should understand normal speech level. Another important thing is to have children to understand difference among non-speech, speech, whistle and hiss. In the Figure 6, the clinicians can help patients to understand how much loudness or effect is necessary to move the graphic. The sound can be set to indicate a normal. conversational speech level. If you set it too high, you might not get the object to move at all.

Fig. 6. A seesaw moves when there is a sound over silence setting.

Conclusion

The speech therapy demands from a hospital require the implementation of simple and well-defined therapy and assessment technique. Where pitch, intonation, stress, loudness and articulation are of primary interest, a good and efficient speech therapy tool, such as Speech Therapy software, is essential in clinical practice.

Further Details

Voice Tech

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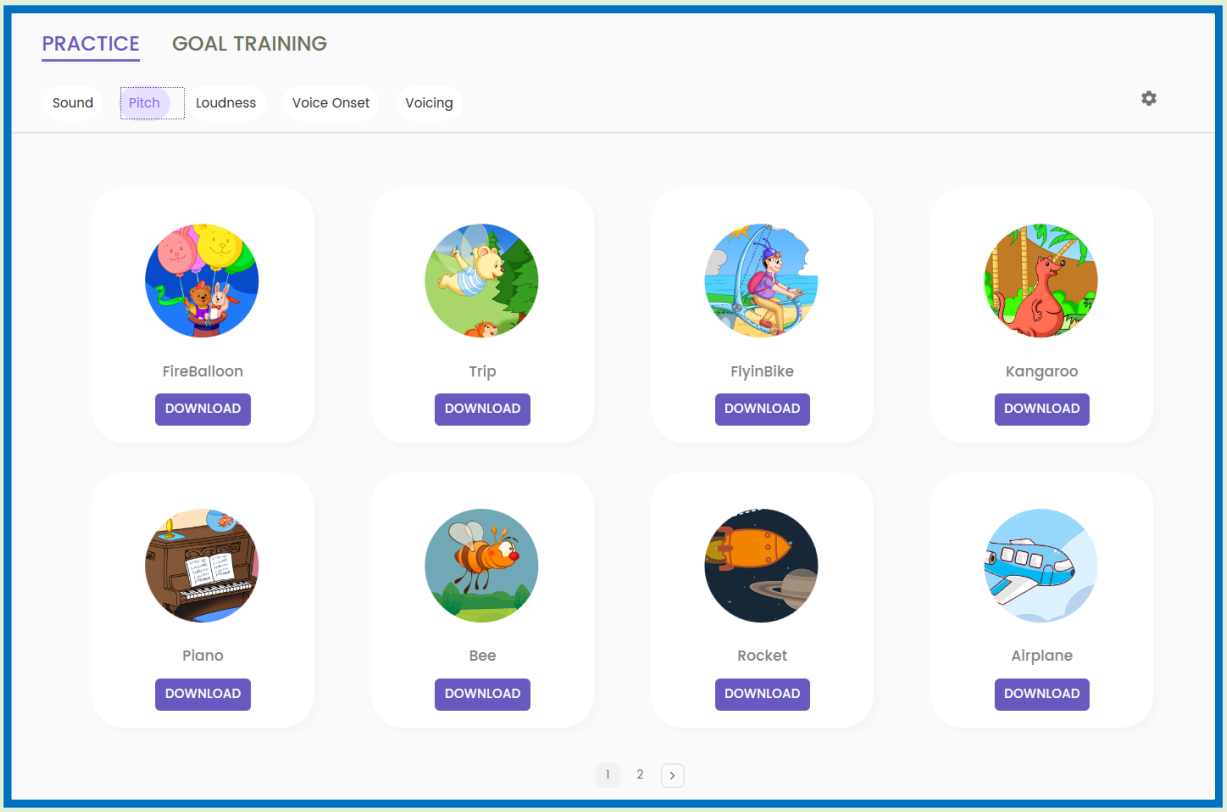
Mobile: 9821330996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Pitch
Loudness
Voice Onset
Voicing
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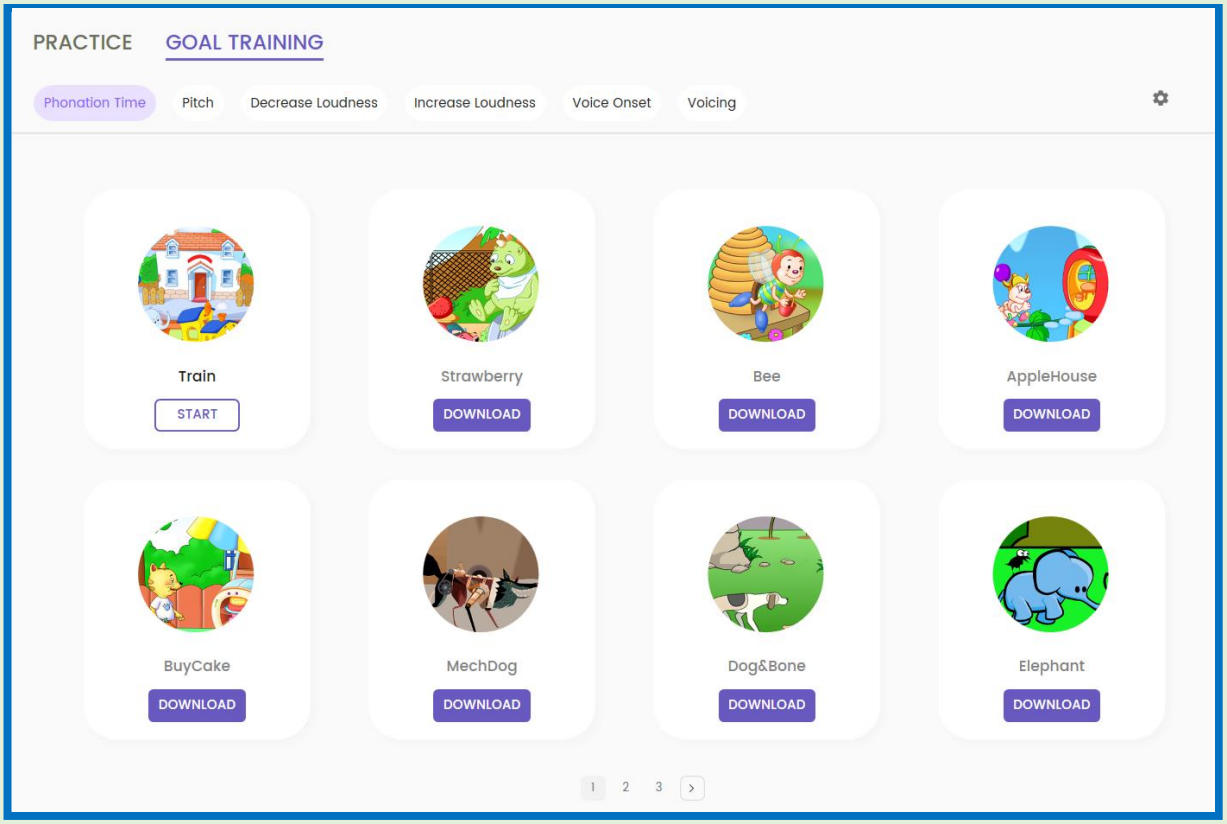
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Pitch
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Increase Loudness
Voice Onset
Voicing
Train
START
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Bee
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AppleHouse
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BuyCake
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MechDog
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Dog&Bone
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Elephant
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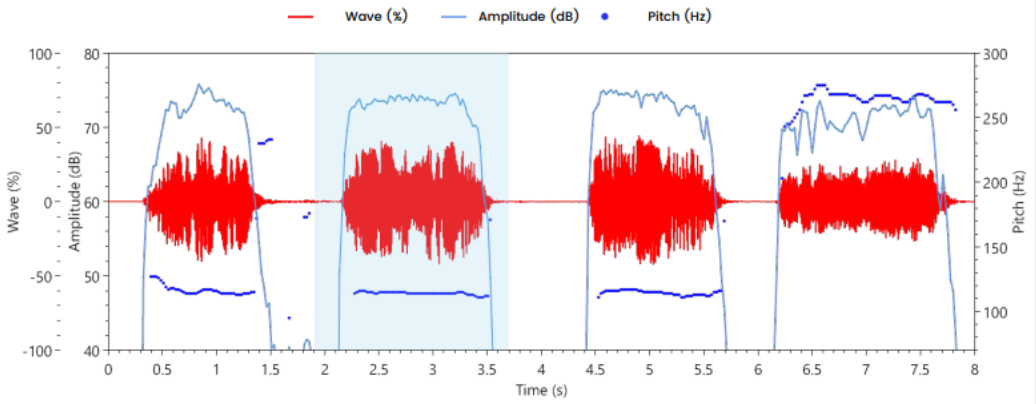
Name:	Deven Vartak	Evaluation Date:	2024/02/07
Date of Birth:	2024/02/06	Therapist:	TrialUser30



Waveform Length		Amplitude		Pitch		Mark Time	
Time Length:	1.8s	Average Value:	72dB	Average Value:	115Hz	Time Length:	0.0s
Start Time:	1.9s	Highest Value:	74dB	Highest Value	171Hz		
End Time:	3.7s	Lowest Value:	49dB	Lowest Value:	111Hz		
		Standard Dev:	4.5dB	Standard Dev:	7.7Hz		

Notes

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