

## Chapter 42

# Assistive Technologies at the Edge of Language and Speech Science for Children with Communication Disorders: VocalID™, Free Speech™, and SmartPalate™

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### ABSTRACT

*About two million individuals in the United States use augmentative and alternative communication (AAC) devices with text-to-speech (TTS) synthesis to speak on their behalf. In this chapter, two specific systems are introduced and evaluated as potentially significant emerging tools for children with communication disorders. The VocalID™ project was developed to provide unique voices for children who otherwise speak through standard adult voices. Free Speech™ is an image-based system designed to address grammatical concepts perceived as abstract by children with language disorders. This chapter also reviews the latest developments in electropalatography (EPG): biofeedback technology, which enables the visualization of tongue to palate contact during speech production. SmartPalate™ has developed cutting-edge hardware and software technology to make EPG more intuitive and more accessible in the therapy room and at home.*

### INTRODUCTION

Imagine a young girl who is not able to speak with her own voice, but instead speaks with the voice of a grown man. How would she feel when trying to communicate with other girls she is trying to befriend? Imagine a boy who is not able to understand anything that is abstract; how could he use language to communicate? Imagine a child having to receive occupational therapy, whereby the therapist cannot

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show him the movements and cannot manipulate his body because the fine motor skills that he struggles with are in a part of his body that is hidden: his mouth. How would he be able to learn? The following chapter will introduce three developing technologies that are attempting to help children who encounter these difficulties, because of various communication disorders. Starting with a brief introduction on the classification, forms, and causes of communication disorders in children, each of the three assistive technologies presented will then be introduced and reviewed.

## **1. COMMUNICATION SCIENCES AND DISORDERS: AN OVERVIEW**

The field of speech language pathology and audiology is now also becoming known by its more inclusive appellation of communication sciences and disorders (CSD), as its breadth and depth of research and practice are continuously expanding to include the wide variety of elements that comprise human communication. In 1925, a few teachers of theater, debate, and rhetoric founded a scientific organization to study “speech correction” (American Speech-Language-Hearing Association, 1997-2014). Today this organization, The American Speech-Language-Hearing Association (ASHA), studies not only speech, but also language, hearing, and swallowing disorders. ASHA also explores the underlying mechanisms of all forms of communication and is involved in developing alternate modes of communication when typical mechanisms fail. Before delving into the description of three different assistive technologies (AT) that could revolutionize the lives of children with communication disorders, a brief overview of the various branches of the field will clarify the discussion to follow.

### **a. A Few Words about Communication**

It is estimated that 40 million Americans have a communication disorder (Ruben, 2000). While the hallmark of human communication is the use of this organized system of arbitrary symbols we call language, people also use non-linguistic forms of communication. Communication includes all information transmitted between a sender and a receiver of a message, and, therefore, can include facial expressions, gestures, body language, etc. (Plante & Beeson, 2013). For the majority of people, language is transmitted through speech, which involves the vocalization and articulation of the message we wish to transmit. When using speech, it is usually necessary that the sender and receiver of the message be able to hear in order to code and decode that message appropriately. Language can, however, also be written, or signed in the form of sign language.

It is not until we find ourselves struggling to express or comprehend a thought that we realize we take our ability to communicate for granted; human language and speech are nothing short of miraculous. Communication disorders are either acquired after an injury or illness, or are developmental, caused by congenital conditions such as genetic syndromes, childbirth-related complications, autism, or idiopathic etiologies. A breakdown in communication can occur at any of the various stages of message transmission, starting from the formulation of the thought in the sender’s mind to the decoding of that message in the receiver’s cortex, passing by the use of our vocal folds and articulators, among other processes.

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