

Wii-habilitation to Enhance Auditory Processing Skills

Addie J. Dowell, B.A.
Brittany Milligan, B.A.
D. Bradley Davis, Au.D.
Annette Hurley, Ph.D.

Louisiana State University Health Sciences Center
 New Orleans, Louisiana

Auditory training programs are often included as part of the remediation plan for children with (central) auditory processing disorder [(C)APD]. Training improves performance and usually includes formal therapy; however, it may also utilize informal activities. These informal activities specifically target deficit areas of auditory weaknesses and may include “edutainment” activities, such as board games, computer games, or recorded audio books. This brief report will review Wii video games that target specific auditory processing skills (auditory blending, processing speed, short-term memory, etc.) and which may be utilized during play for specific age groups. This information can be useful for audiologists, speech-language pathologists, early interventionists, or parents who wish to engage listening and auditory processing skills during play.

Introduction

In the past few years, there has been a renewed interest in the diagnosis and treatment of (central) auditory processing disorder [(C)APD]. A (C)APD refers to “difficulties in the perceptual processing of auditory information in the central nervous system and the neurobiologic activity that underlies that processing and gives rise to the electrophysiologic auditory potentials” (ASHA, 2005). This diagnosis is usually made by a qualified audiologist after the patient has completed a comprehensive test battery (AAA, 2010; ASHA, 2005). Treatment of (C)APD generally focuses on three areas: environmental changes to ease communication difficulties, introducing compensatory skills and strategies for the disorder, and remediation of the auditory deficit (AAA, 2010). Auditory training is one type of direct remediation of (C)APD. It is known that the brain retains a lifelong capacity for plasticity and adaptive reorganization. Therefore, auditory deficits or weaknesses may be at least partially reversible through a deficit-specific training program.

Auditory training programs strengthen specific auditory skills. These include localization and lateralization, sequencing of sounds, phoneme/syllable discrimination, auditory memory, sound blending, frequency and intensity discrimination, temporal processing training (including temporal ordering, temporal gap detection and discrimination), improving speech discrimination in noise, and an improvement in interhemispheric transfer of information (ASHA, 2005).

Auditory training relies on plasticity in the central auditory system for improved performance. Auditory training is defined as, “a set of (acoustic) conditions and/or tasks that are designed to activate auditory and related systems in such a manner that their neural base and associated auditory behavior are altered

in a positive way” (Musiek, Chermak & Weihing, 2007, p. 78). Auditory training activities may be formal or informal. Formal therapy activities are often completed in a clinical setting with a professional who has control over the presented stimuli. Formal therapy activities may include computer mediated programs, localization training, phoneme discrimination training, speech in noise training, or frequency and intensity discrimination training, etc. (Musiek, et al., 2007).

Informal activities may be done at home and are usually recommended to supplement formal training. These activities may include computer games, board games, music training, or video games that target specific auditory deficit areas. For example, the Simon® game may be useful for temporal processing training and for auditory memory training (Musiek, 2005). This game has four lighted, colored buttons, with a corresponding audible tone when activated. During play, the buttons will light up in a random pattern. The player must replicate the pattern. The number of buttons in the random sequence increases in length as the game continues.

Everyday games and activities can improve auditory processing skills in children with (C)APD (Ferre, 2002) and should be initiated whenever there is a suspicion of (C)APD (AAA, 2010). Ferre (2002) listed several board games that targeted specific auditory skills, as described by the Bellis-Ferre profiles of (C)APD (Bellis, 2003). (The reader is referred to Bellis, (2003) for a comprehensive description of the Bellis-Ferre (C)APD profiles, as this is beyond the scope of this report.) A very brief description of the Bellis-Ferre profiles, characteristic auditory deficits, and suggested examples of activities for auditory specific enrichment are provided in Table 1.

Kuster (2009) compiled a list of free listening games and activities, available on the Internet. This list of activities ranged in a hierarchy of auditory skills from detection, discrimination,

Table 1. Profiles of (central) auditory processing disorder and associated deficits.

Primary Profile	Deficits	Targeted Skills for Remediation	Suggested Games & Activities
Decoding	<ul style="list-style-type: none"> ●Listening in background noise ●Spelling and reading difficulty ●Sound/symbol association ●Sound discrimination 	<ul style="list-style-type: none"> ●Phoneme identification ●Phonological awareness ●Sound discrimination ●Sound blending ●Word attack skills 	<ul style="list-style-type: none"> ●Red Light-Green Light ●Telephone ●Wheel of Fortune® ●Scrabble®
Integration	<ul style="list-style-type: none"> ●Combining multi-modality information ●Reading comprehension ●Following auditory directions 	<ul style="list-style-type: none"> ●Interhemispheric transfer ●Binaural skills ●Sound localization ●Auditory & visual information 	<ul style="list-style-type: none"> ●Scrabble® ●Bopit® ●Simon® ●Simon says ●Card games
Prosodic	<ul style="list-style-type: none"> ●Understanding the meaning ●Comprehending main idea ●Frequency & temporal discrimination 	<ul style="list-style-type: none"> ●Perception ●Temporal patterning ●Pragmatics 	<ul style="list-style-type: none"> ●MadGab® ●Singing ●Dramatic arts

identification, to comprehension. The Ferre (2002) “Games We Play” and Kuster’s (2009) listening activities are useful resources available to parents of children diagnosed with (C)APD.

To date, we are unaware of a review of video games that would enhance auditory processing skills. This review will be useful for clinicians and parents who wish to enhance auditory processing skills during informal therapy times, outside of the formal therapy environment.

The genesis of computer games can be traced back to the early 1950s (Kent, 2001). Since this time, these games have evolved with technology, increased in complexity and sophistication of graphics, narratives, and storylines and have grown in popularity over the last five decades (Kent, 2001). Many of the early video games were not specifically designed for educational purposes, but for “fun.” However, most games promote incidental learning as they are built around rule-based strategies, logic, memory, adaptability, and motivation.

During the recent market growth of “edutainment” (education through entertainment), video games and video gaming systems are a fixture in most homes. Educational video games appeal to young children, as well as their parents, because they make learning fun.

One popular gaming system that many families have in their homes is the Nintendo Wii. Since its launch in November, 2006, the Wii has sold more than 86 million units, with over 41 million in the United States alone, making it the best selling gaming system (Sloan, 2011).

The interactive Wii Nintendo games have received positive attention for their role in physical and occupational therapy (Deutsch, Borbely, Filler, Huhn, Guarrera-Bowlby, 2008). However, there is little information about the use of this popular gaming system for improving listening or auditory processing skills. This report (a description of a clinical need) reviewed the

potential use of Nintendo Wii games as an auditory training tool, for informal (C)APD therapy.

Method

We defined the criteria for inclusion in this report. (*Again, we define report not as scholarly research project, but as a description of our research activity to fulfill our clinic’s need.*) Initially, because of its popularity, we limited our review of video games to the Nintendo Wii format. Secondly, we reviewed games appropriate for use for children over the age of 6 years. Thirdly, the Entertainment Software Rating Board (ESRB) ratings were also reviewed to ensure appropriate content of the video game for children. Lastly, we also adopted the popular Bellis-Ferre subprofile model of (C)APD (Bellis, 2003) as the framework for reviewing video games to target specific auditory deficits. In this model, there are three primary (C)APD profiles: Decoding, Integration, and Prosodic. These profiles are based upon an individual’s auditory behavior and (C)APD behavioral and electrophysiological test results. (See Table 1 for a brief description).

We began our search using popular Internet search engines to locate video gaming manufacturing Web sites, parental information Web sites, and multinational electronic commerce company Web sites (i.e., Amazon.com, GameStop.com) and searched for games marketed or advertised as ‘educational,’ parent-recommended, and/or listed as top-selling video games. We compiled a list of potential video games.

From this list, we researched the video game by reviewing the game publisher’s synopsis and consulting consumer reviews. We “sampled” each game by playing a demonstration version on the manufacturer’s Web site, to determine if auditory processing related skills were incorporated in the game. Video games were selected if they targeted at least two skills of a (C)APD subprofile. Some video games are referred to as families. Therefore, we did not list each individual video game title. For example, Guitar Hero Family would be inclusive of such games as Guitar Hero I, II, III, IV and V, Guitar Hero World Tour, and Guitar Hero: Warriors of Rock. We did not track the initial number of video games reviewed; many were quickly eliminated by the mature ESRB rating and not appropriate for children.

Results

Based on our inclusion criterion, a total of 11 Wii games were found to be appropriate for use by individuals with Decoding

Discussion

Table 2. Video games that target deficit skills associated with the Decoding Profile of (central) auditory processing disorder.

Video Game	Ages
Reader Rabbit (Family)	≥ 6 years
Nickelodeon Fit	≥ 6 years
Word Jong	≥ 6 years
Story Hour (Family)	≥ 6 years
Story Book Workshop (Family)	5-10 years
Jump Start Games (Family)	5-6 years
My Word Coach	≥ 6 years
Margot's Word Brain	≥ 10 years
Wheel of fortune	≥ 6 years
Dance Dance Revolution (Family)	≥ 6 years

Table 3. Video games that target deficit skills associated with the Integration Profile of (central) auditory processing disorder.

Video Game	Ages
Sesame Street Counting Carnival	≥ 3 years
Reader Rabbit (Family)	≥ 6 years
Nickelodeon Fit	≥ 6 years
Jump Start Games (Family)	≥ 6 years
Dance Dance Revolution (Family)	≥ 6 years
We Cheer (Family)	≥ 10 years
Hasbro Family Game Night	≥ 6 years
Family Think Smart	≥ 6 years
Pictionary	≥ 6 years
Big Brain Academy	≥ 6 years
Disney's Think Fast	≥ 6 years
Cosmic Family	≥ 6 years

Table 4. Video games that target deficit skills associated with the Prosodic Profile of (central) auditory processing disorder.

Video Game	Ages
Disney Sing It (Family)	≥ 3 years
Wii Music	3-10 years
Guitar Hero (Family)	≥ 6 years
Rock Band (Family)	≥ 6 years
Dance Dance Revolution (Family)	≥ 6 years
Kidz Bop (Family)	≥ 6 years
Lets Tap	≥ 6 years
We Sing Down Under	≥ 6 years
Jump Start Games (Family)	≥ 6 years
Karaoke Revolution Games (Family)	≥ 6 years
High School Musical (Family)	≥ 6 years
We Cheer(Family)	≥ 10years
Michael Jackson the Experience	≥ 6 years

characteristics of (C)APD (see Table 2). These games targeted skills, such as sound recognition, sound blending, vocabulary, and following directions. Twelve Wii video games were found to address deficit skills associated with Integration characteristics of (C)APD and are listed in Table 3. These games addressed skills, such as combining auditory and visual information, following oral directions, auditory and verbal learning, and auditory and visual memory. Twelve Wii video games addressed auditory deficits associated with Prosodic characteristics of (C)APD. These are listed in Table 4. These games addressed such auditory skills as auditory discrimination and temporal patterning.

Many Wii video games target auditory processing skills and may be incorporated as a valuable informal auditory training tool for (C)APD. Video games can be recommended to target the specific auditory deficits or weaknesses. It is important to note informal therapy or video games should not replace formal rehabilitation techniques but should instead be used as a supplement to therapy.

A disappointing finding of this investigation was the short release time for a video game. Several of the Wii video games in Tables 2 through 4 have been discontinued by the gaming manufacturer. However, all of the games listed are available in new and used condition through multinational electronic commerce company Web sites and popular game retailers, (i.e., Amazon, GameStop).

Although this report reviewed games specific to the Wii format, many of these games are available for other formats or gaming systems such as Xbox™, and PlayStation™. Further research is needed to determine the effectiveness of Wii video games as an informal therapy option.

Many households have a Wii gaming system already. Therefore, deficit specific auditory games may be an affordable and feasible way for parents to encourage and support children “at risk” for (C)APD. By incorporating deficit-specific auditory activities into everyday activities, auditory remediation may improve these auditory deficit skills. The use of popular, interactive games may be useful and convenient for audiologists, speech-language pathologists, early interventionists, or parents who wish to engage listening and auditory processing skills during play.

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