

Innovations in Music for Performers with Disabilities

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In the winter of 1984, Rick Allen, drummer of Def Leppard, experienced a serious car accident, which led to the amputation of his left arm. After the accident, Allen was most concerned about how he would continue his main passion - drumming. He then began working on a custom drum-kit, which would meet his needs as a now one armed drummer. His kit is electronic based, besides the cymbals, and includes foot pedals for kick, snare, and floor drum, and triggers on certain drums to make certain sounds. This kit has allowed him to play live again with the band and has rejuvenated his love for drumming. He stated, "Not being able to play again never really crossed my mind. I was never going to be a brain surgeon or anything, so I figured that playing drums was the only thing I could do. But it's like anything: When you're thrown in at the deep end, you really have to swim, and this was a classic case of *having* to do that. I don't think I ever doubted that I could do it. I was just being as positive as I could" (Modern Drummer).

One of the most famous musicians with a physical disability was Ludwig van Beethoven, who despite his challenges, did not let his deafness stop him from becoming a successful composer. Tom Wiggins was an African American slave who was blind and autistic and was a famous composer and pianist. Itzhak Perlman is a violinist, conductor, and polio survivor, who plays sitting down. Evelyn Glennie is a deaf percussionist who listens to sound with her body instead of her ears. Stevie Wonder is one of the world's best known singers, who has been blind, almost since birth. There are countless musicians who have suffered accidents or diseases that have left them unable to continue playing in the way they used to, or people who are born with disabilities or diseases who love music or could benefit from playing music. These are the people

who have served as the inspiration for adaptations to musical instruments and electronic programs of the past, present, and future to allow them to use their musical abilities.

The electronic age of music has opened up many opportunities for musicians with disabilities. Where previously people with more severe disabilities needed to give up playing music or were never able to play, recent technology has made it possible. One method is to use “adaptive gear” for instruments to allow nontraditional playing, as in the case of Rick Allen’s one-armed drum-kit. These adaptations are not always electronic. Leslie Thompson was a talented flute performance student when she suffered a car accident which left her with severe arm and shoulder injuries. She was able to get a “swan neck headjoint” piece for her flute, which has enabled her to play without raising her arms too high (Greenman). John Rinaldo lost his ability to play bass due to muscular dystrophy but uses a rigged stand in order to stand behind the instrument and play it without having to bear its weight (Adaptive Gear).

Andrew Tkaczyk, drummer of the Ghost Inside, lost his right leg in an accident, and his father built a device they call “The Hammer” to aid the use of his kick drum pedal. Recorders have been created for players with finger disabilities, which can accommodate missing or less functioning fingers. The One-Handed Woodwinds Program custom designs woodwind instruments for those who can only use one hand. There have been special violin bow prostheses using 3D printing. A Day’s Work creates instrument holders for recorder, percussion, and other instruments. There are also adaptive mallets with different and shorter handles. Straps can be used with certain instruments to distribute the weight of an instrument on the player differently.

The Chapman Stick plays notes by tapping strings on the fretboard of a guitar with one hand instead of using both hands to hold down a fret and then pluck the string. The Cello Stand

allows a cello to be played with the performer's feet. The stand lets a seated musician use the bow and play the strings using their feet instead of their hands and arms. There is a Trombone Mount as well as a Trombone Stand that lets the trombone be played with one hand. The Chromatic Tuba Machine consists of a tuba in a stand with the valves linked by a cable to a mechanism operated by foot instead of by hand.

Within the last decade, many devices, interfaces, and programs have been created for the benefit of disabled musicians or the incorporation of music therapy into disabled people's lives. Through new technology, there have been new instruments created such as the "Jamboxx," which is an electronic, hands-free device that uses breath expression to play a variety of instrument timbres. The Wekinator is software created in 2009 by Rebecca Fiebrink which allows its users to create their own new musical instruments, gesturally-controlled programs, or audio detecting programs.

SkoogMusic has created the Skoog and the Skwitch which connect to a computer, iPad, or iPhone to make music more accessible for children and people with disabilities. The Skoog is a cube that can be programmed to sound a certain instrument and certain notes and encourages learning through play. Founder, Ben Schogler, said: "The key thing that is different about Skoog in relation to traditional instruments is that traditional instruments have all the notes inside them, and you have to learn how to get them out. With Skoog, what you do is you say, 'What notes do you need right now?' because you don't need them all all the time. I mean, the way that we teach and learn music is all back to front. When we learn to speak, we learn through play. We speak with other people, and we are constantly improvising together, but when we teach and learn music, we have to learn to read music and learn the instrument first before we get to play with

other people. With Skoog we turn that back around to the natural way, where we let kids play first, learn through play, and make music together.” Their other program, Skwitch, is an app and device that connects to an iPhone to become a one button instrument.

Soundbeam is a program that uses ultrasonic sensors to turn movement into sound. The program is customizable to be able to use different sounds or instruments. It includes a touch screen, recording and filming capabilities, and an unlimited library of sounds. There are also wireless switches that can be used with the program. Beamz was created by Jerry Riopelle and consists of computer software and an instrument with laser beams. Each laser beam corresponds with a certain sound and is played by interrupting the beam.

The Mi.Mu musical glove uses sensor technology to register gestures as musical parameters on the computer. The glove can be used with one hand and has since been adapted to use other parts of the body. The P-bROCK Digital Bagpipe Chanter is an electronic instrument to allow playing with only one hand. The bagpipe uses sensors inside the holes to distinguish finger placement.

Tongue Music was released in 2010 and uses a magnet on the tongue to create different magnetic fields with tongue movement. Brainfingers in 2013 is a computer control that measures signals from facial muscles, eye movements, and brain waves. Programs such as the Actuated Guitar and RoboTar helps with strumming or holding down the strings on the frets for chords.

Dave Meckin began a project called “moosikMasheens” to create electro-mechanical instruments for those with disabilities or impairments. There are three instruments, software, and an iPad interface to play the instruments. There is a glockMasheen, guitarMasheen, and

beaterMasheen. The EyeHarp is a gaze-controlled or head-controlled digital instrument, allowing its users to make music hands-free.

Eye Conductor is a musical interface with facial recognition that creates music through eye movements and facial expressions. Its creator, Andreas Refsgaard, stated the purpose of creating the program, which accurately sums up the purpose of creating any musical adaptation:

1. “Regardless of physical abilities music is a major interest, which has the ability to connect people (abled or disabled) through a shared activity.
2. The ability to create music functions as an important identity marker and a channel for expressing deep emotions, but often requires aid or execution by others.
3. The technology and the hardware exists, but tools for creating music in real time for people who cannot use their arms and fingers are missing.”



Figure 1.

Leslie Thompson’s adapted flute (top left). Andrew Tkaczyk’s “The Hammer” (top middle). The Skoog (top right). The British Paraorchestra (middle left). Inner Vision orchestra (middle right). Rick Allen’s electronic based drum-kit (bottom left). Jamboxx (bottom middle). Deaf Rave (bottom right).

MindMIDI turns brainwaves into sound by using similar technology as radio. The program changes electrical impulses of the brain into music, “with each individual spectrum able to control a different electronic instrument or channel. That means you can form music based on intention, or control an entire ensemble of instruments - from synthesizers to drums”...with only your mind.

3D-printed synth modules allow hearing-impaired people to “hear” using vibrations. DJ Robbie Wilde, also known as “The Deaf DJ,” uses different tools such as a customized tactile audio device to feel the sensations of the music he plays.

Unhappy with the limitations of most assistive tools for performers with disabilities, Brendan McCloskey, Brian Bridges, and Frank Lyons performed case studies of people with cerebral palsy in 2015 to develop artifact magnification in a digital musical instrument interface that allows users to have more creative independence. Users have access to pitches through sensors on the interface. Diatonic intervals appear horizontally, while vertically users can play perfect fifths. The duration of their contact initiates vibrato, and the force of the contact determines the intensity. The participants testing their prototypes were very excited to have a sense of ownership over their music-making through this tool. The program is still being developed but is making great strides towards improving the level of improvisation and composition for people with disabilities.

Samuel Thompson Parke-Wolfe, Hugo Scurto, and Rebecca Fiebrink created a new “software toolkit” for music educators and music therapists to create customized and individualized musical interfaces for children with disabilities that they work with. Through a series of workshops with music educators, therapists, and children with a diversity of both

learning and physical disabilities, their team created Sound Control which allows users to create music through the use of a webcam, a mouse, a headset with a microphone, and a few other methods of touch and physical positioning.

The integration of this technology to make disabled musicians more “normal” and mainstream has created new opportunities for the disabled community. Baluji Shrivastav is a well-known sitar player and founded the Inner Vision Orchestra in 2010. The Inner Vision Orchestra is made up of all blind musicians who play in sync without relying on eye contact or a conductor. Baluji created the orchestra to provide more opportunities for blind musicians and to help restore their confidence. The orchestra has been able to advance the music community to be more open minded and accepting of what may not be a “traditional” ensemble.

The British Paraorchestra is the world’s only large-scale ensemble made up of all disabled musicians. This orchestra was created by Charles Hazlewood in 2011, inspired by his youngest daughter who has cerebral palsy, and is made up of virtuosic musicians. Hazlewood spoke of the orchestra, “You get a sense of it, though, by the fact that, at the end of one rehearsal, one of the musicians was chatting to me and he said, ‘I’ve no idea what disability any of the other players have, and I’m really not that interested in knowing’. The key thing for all of us is that we are judged by the highest standards of musicianship. That’s what matters” (Stanford). The orchestra played with Coldplay for the closing ceremony of the 2012 Paralympics. The members play a variety of instruments including tablets and other assistive technology created by Rolf Gelhaar. Its members currently include Nicholas McCarthy, a one-handed pianist, Clarence Adoo, who is paralysed below the shoulders from a car accident and plays an instrument called “Headspace,” and Lyn Levett, who uses a computer to play electronic music.

After working with the British Paraorchestra, Rolf Gelhaar and his son created the Human Instruments Company, through which they create adaptive instruments. Their first creation was a keyboard with a mouthpiece, so that anyone can create sound with it even if they cannot use their hands to press the keys. They also created the doosephone, which was made for Clarence Adoo in the Paraorchestra. This instrument allows Adoo to create music with his breath. They have also developed Typhoon, a mouthpiece that plays notes according to a person's head position (Mullen).

Troi Lee created Deaf Rave in 2003 in London, specifically for deaf people who wanted to enjoy music at clubs. Lee said, "You can literally feel the beat, on your feet, in your chest. In the vibration of the floor or speakers. So we crank the bass up and people get down to it." They also have sign-song artists, deaf dancers, and deaf DJs perform. The space is inclusive to hearing and non-hearing alike. "It's important to have these spaces because deaf people are really marginalised in society, simply because there's a lot of stuff that we've missed," said Lee in an interview. "Deaf Rave and the wider community around making music accessible to deaf people are essential because it gives us a space to feel like we belong, a space to learn new things, but also a space to just have good times together!" (Bakar).

Unfortunately these creations are very expensive to make, which makes them very expensive to purchase for students, therapy patients, or individual use. There are grants available for this use, but these programs are still very expensive, which makes them less accessible to those who need them.

All of these innovations in music have vastly improved the lives of those with disabilities in order to follow their passion of music; however, it is important to remember that there is still a

way to go in expanding accessibility in music and dispelling stigma around disability. With music education being one of the first programs to be downsized or cut in schools, music education for disabled students is even more likely to be dismissed. Music-making should be encouraged in all people, not just the able bodied, and can benefit everyone. Playing music can grant people a sense of identity, individualism, independence, and can develop physical and mental skills. It also opens up a community to those who may be isolated or unable to find like-minded individuals due to their disability. Performers can regain a sense of confidence by being able to play their own music. In order to help make music accessible for everyone, we can speak against stigma surrounding disability and take disabled musicians seriously. People with disabilities are just as capable of creating beautiful music as able bodied people and have just as much right to it.

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