

2024

'Jamming' With the Computer: Artificial Intelligence and Jazz Music Education

Bert Johnson

*University of Calgary, School of Creative and Performing Arts, bert.johnson2@ucalgary.ca*Follow this and additional works at: <https://trace.tennessee.edu/jatmi> Part of the [Music Education Commons](#)

Recommended Citation

Johnson, Bert (2024) "'Jamming' With the Computer: Artificial Intelligence and Jazz Music Education," *Journal of the Association for Technology in Music Instruction*: Vol. 4 : No. 1 , Article 4.

Available at: <https://trace.tennessee.edu/jatmi/vol4/iss1/4>

This article is brought to you freely and openly by Volunteer, Open-access, Library-hosted Journals (VOL Journals), published in partnership with The University of Tennessee (UT) University Libraries. This article has been accepted for inclusion in *Journal of the Association for Technology in Music Instruction* by an authorized editor. For more information, please visit <https://trace.tennessee.edu/jatmi>.



‘Jamming’ With the Computer: Artificial Intelligence and Jazz Music Education

Bert Johnson
School of Creative and Performing Arts
University of Calgary

ABSTRACT

This article provides a preliminary discussion on the evolution of jazz music play-alongs in the individual practice of time feel. Within the history of jazz pedagogy, play-alongs have been a continual tool for learning repertoire and honing in on one’s ability to play with a harmonic and rhythmic vocabulary suitable to a variety of jazz genres such as swing, straight-feel and bossa nova. Due to the advancements in artificial intelligence and software development, new tools for individual music practice have emerged in the form of apps for computer and mobile devices. Apps such as iReal Pro (iRP) and Genius Jamtracks (GJT) demonstrate artificial intelligence technology that allows musicians to practice with accompaniment that has variable rhythmic and harmonic features mimicking the unpredictability that occurs in live performance. The article closes with a discussion on the potential uses these technological advancements have within jazz music education at a variety of age levels and settings.

Introduction

The study of jazz music is deeply rooted in building fluency in rhythmic style and demonstrating an inseparable tie to the unvarying pulse (Aebersold, 1973). According to Doffman (2018), the magic of performance goes beyond a metronomic notion of time feel. The author argues that understanding time feel within jazz music is about “how the performer

manipulates the feeling of the notes against the pulse” (p. 164). Doffman’s notion of how time is felt within jazz music performance is the beating heart of the journey a jazz musician takes as they practice and perform over many years. Jazz therefore is not a study of playing strictly in time, but the building of a relationship with the pulse of time itself. The pulse does not change, but how the jazz musician attacks notes around each beat, giving either a feeling of laying back or pushing slightly forward, serves as a sort of artistic signature that provides a convincing musical argument to the listening audience.

While a live ensemble is the prime setting for a jazz musician to hone their skills and come to a broader understanding and relationship with time feel, modern digital technology is providing new pathways for musicians to practice on their own off the stage (Ferguson, 2018). Artificial intelligence is modernizing the familiar jazz music play-along within modern software apps for devices. It has advanced to the point where the technology can now mimic the kinds of interactive and unpredictable grooves live musicians would provide to each other on the bandstand (Ramalho et. al, 1999). In this paper, I will discuss the evolution of the jazz play-along which has culminated into apps that allow musicians to practice varying time feels and simultaneously build on their harmonic and melodic skills while also learning more jazz standards.

A Brief History of the Jazz Play-Along

Much of the history of jazz music is tightly interwoven with the recording industry. Music historians such as Katz (2010) point out that since the very first jazz recordings were made in 1917, the evolution of jazz music “came to be inextricably bound up with the technology of sound recording” (p. 80). Since recording new songs has been the norm in jazz music since 1917, musicians have continued to reference the playing styles and improvised solos contained in recordings. This is true for young jazz music students in post-secondary institutions today where it is often an expectation that part of a student’s development is the ability to mentally compile a series of musical quotes pulled from well-known recordings across the history of jazz music when playing various songs from the jazz canon (commonly referred to as jazz standards). Music educators often praise recordings for their ability to demonstrate all facets of jazz performance and importantly how renowned players interpreted songs. For students, this

is a way to begin learning how to incorporate the feeling of jazz music into their playing in a very tactile way. Without this technological connection between recordings and those studying the jazz musical style, the essence of time feel would largely be an abstract concept. This is perhaps one advantage jazz music has over other musical forms with how students of the music can refer directly to recordings of the tunes they are studying to identify the composer's intentions on style and feeling.

As the jazz music genre gained wider acceptance in social circles in much of the world during the 20th century, the institutionalization of the music also grew (Thibeault, 2021). The growth in post-secondary jazz music education programming in the 1960s opened the door for play-along recordings to become a popular tool for reinforcing improvisational skills, harmonic knowledge, and stronger awareness of the pulse (Thibeault, 2021). Jamey Aebersold, a student at Indiana University during the 1960s, heightened the use of play-along recordings with a system of pedagogical sequencing through the volumes of recordings he soon produced and released. Due to the inclusion of printed scales and chord patterns that accompanied the jazz trio recordings, Aebersold's play-along method, called *A New Approach to Improvisation*, became a landmark pedagogical tool since the inception of *Volume 1* in 1966 (Thibeault, 2022, p. 73). Aebersold's *Jamey Aebersold Jazz, Volume 1: How to Play Jazz and Improvise* provides a backing band that includes no discernable melody where students of the music can apply their knowledge of harmonic and rhythmic language to particular sets of chord changes or a single modality. Researchers such as Thibeault (2022) suggest that Aebersold recordings have helped generations of jazz musicians find a "sonic space for discovery and exploration" (p. 73). I will now turn to a discussion on the advancement of technology in the 21st century and how it has expanded on the notion of musical self-discovery with play-along apps that use artificial intelligence to add complexity and unpredictability to the practice experience.

Modern Apps and the Use of Artificial Intelligence

Building on the successes of the jazz play-along, the development of digital software apps for computers as well as mobile devices has opened up new opportunities for budding jazz musicians to hone their craft in the practice room that more closely mimics the kinds of interactive and unpredictable settings found in live performance with human accompanists

(Ferguson, 2018). The use of artificial intelligence in particular drives this new wave of creative synergy between humans and machines. Though the play-along recording has a positive track record with helping aspiring jazz musicians to play in time more confidently, the limitation with recordings is that their static nature becomes predictable as one continues to put in hours of practice with the same recordings (Ostermann et. al., 2021). Modern apps, such as Genius JamTracks (GJT) which will be discussed later, use artificial intelligence technology that provides a dynamic accompaniment experience which helps users to work more intensely on improvisation skills. Since live performances with living human beings often have this feature of unpredictability and interactiveness, artificial intelligence is largely advantageous in better preparing jazz musicians for live performance settings while practicing on their own.

Artificial intelligence (or AI) has gained significant complexity since its inauguration into the world of music and computers back in 1960 (Zulić, 2019, p. 101). AI is generally described as “software used to perform tasks or produce output previously thought to require human intelligence” (Oxford, 2023). While largely attributed to John McCarthy as a pioneering figure in the 1950s, 21st-century definitions of AI are more diverse and nuanced (Anderson, 2024). For music applications this can imply that there are multiple ways and levels of human interaction with AI across different types of digital technology. There are more basic forms such as AI-curated song playlists on the app Spotify (van de Haar et. al., 2019) through to more complex levels in the case of music performance apps such as GJT. Researchers such as Zulić (2019) point out that while artificial intelligence lags in the area of music performance as compared to composition, it is nevertheless “slowly becoming a nucleus of computer music” (p. 107). This statement is observable in many facets of everyday life. When we stop to notice the commonly used software apps in our lives such as streaming music and video platforms, the AI technology used in the software automatically tracks our song searches and suggests the next song to play (van de Haar et. al., 2019). Some recent studies on algorithms within music software, be they apps or online websites, point out that the word “algorithm” itself has become more commonplace within everyday households of society (Chodos, 2019, p. 70). By extension, this is true within music communities as well such as the use of commonly used apps and how they become part of both the performing and individual practice norms (Ferguson, 2018). Researchers such as Du-Harper (2020) explain that this basic algorithmic level of AI is best referred to as

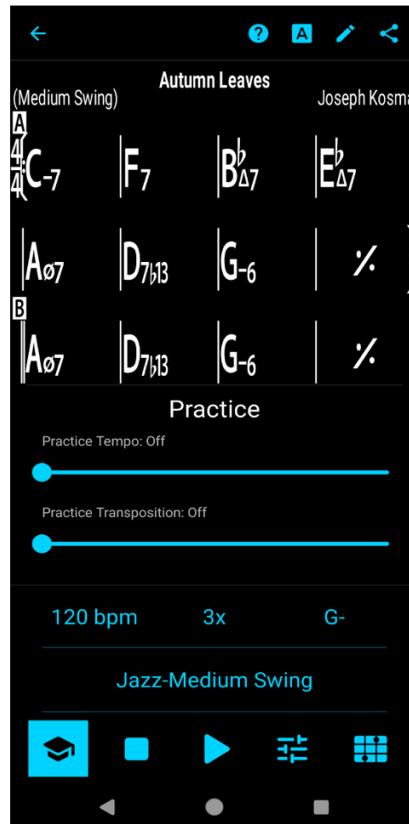
“machine learning” where algorithms are “programmed to learn from data, therefore recognizing and inferring patterns” (p. 424).

For this preliminary discussion on AI-powered play-along apps, the apps iReal Pro (iRP) and GJT will be discussed in detail on how they operate and how this applies to jazz pedagogy. The first app that will be discussed is iRP, which is available on both Windows and Apple computers and mobile devices and discussed here due to its popularity amongst jazz performers (Harasim et. al., 2020). (See Figure 1 for an example of an iRP screen.) iRP is an app that is primarily an updated software tool that emulates the traditional Aebersold recording but has a variety of parameters the user can select from while selecting each jazz song title (Ostermann et. al., 2021). The name ties back to *The Real Book* which is a series of books that contain jazz music lead sheets for many of the standard songs in the jazz canon (Koblick, 2013). One large difference with this app is that the user must download the digitized lead sheets and accompaniment tracks from online forum sites that are curated specifically for iRP. As a play-along tool, the app allows users to select from a variety of accompaniment styles such as bossa nova and slow swing and the default accompanying instruments are piano, bass, and drums (Ostermann et. al., 2021, p. 213). There are pedagogically useful features such as variable tempo increases for each repeat, and transposition changes at each repeat. Users can also make edits to the chord changes for each song on the app and adjust further parameters such as tempo, and key. Students would likely find the chord diagrams for piano, guitar, and ukulele useful as well. The ability to transpose is also incredibly useful in a live band situation where a vocalist for example may need to adjust the key of a song to suit their voice range. From my own experience as a performing keyboardist in jazz and popular music settings, iRP has become a commonly used app that not only saves space in one’s gig bag and a flexible interface that provides needed chord charts but is a powerful digital tool for preparing for performances.

The second software app that will be discussed in this paper is the Genius Jamtracks (GJT) app. Though limited publications exist on the use and features of this software thus far, it has some of its development founded within academic settings such as the Berklee College of Music (Genius Jamtracks, n.d.b). This app has been chosen due to its novel interactive features and as a contrast to iRP with how AI is continuing to evolve. According to its developers, the app is touted to use AI within its play-along features which are rich with complexity.

Figure 1

iReal Pro mobile app (iReal Pro, 2024)



The algorithms used in the app are “designed as a way to give formal coherence to practicing polyrhythms so musicians finally have a tool to practice within the pursuit of becoming improvisers” (Genius Jamtracks, n.d.a). Jazz drummer Terri Lyne Carrington has collaborated with the developers of GJT to continue to help improve the app and its arguably main feature: having a play-along trio that can randomly change time feels and use polyrhythms set against the beat on each repeat of a chosen song (Genius Jamtracks, n.d.a). In my own experiments with the software, I would agree that it has a wide range of complexity that the user can set within the app. A highlight of the app is that it tests one’s ability to track the pulse while unpredictable changes occur with the rhythmic feel during each pass of the song form. Users should however be aware that GJT can be demanding on processing power as the complexity settings of the app are set to the maximum levels available. An android Smartphone for example may have some

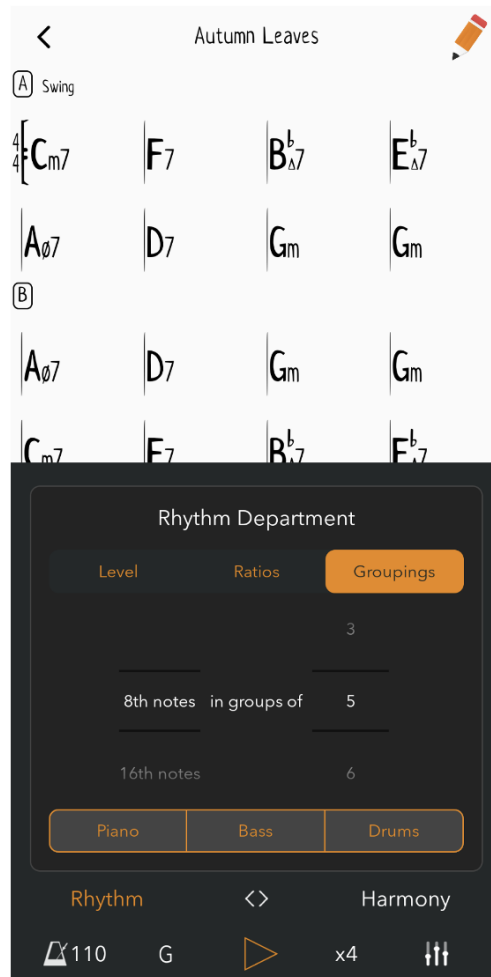
issues with processing requirements in running the app, though this issue will hopefully resolve itself through future software updates and development. After some use of the app, there are some obvious parallels to related software such as the iRP. Some examples include the visual display of chord charts for each song, and the ability to download a variety of new song charts from applicable online sites. The play-along complexity is what sets the iRP app apart from its cousin apps and this is likely due to the advanced algorithms used in the app's creation. From the GJT website, the developers state that the app is "designed as a way to give formal coherence to practicing polyrhythms so musicians finally have a tool to practice within the pursuit of becoming improvisers" (Genius Jamtracks, 2024). As a pianist using the app to practice jazz standards, the idea of the app being a playground of polyrhythmic unpredictability holds true and tests one's ability to feel the beat while changes in time evolve like a kaleidoscope in each pass of a song's chord changes.

GJT is an adjustable play-along app and lead sheet tool that can accommodate beginner and advanced jazz musicians. In version 8.3 of the app, two main parameters stand out: the rhythm and harmony components. These two elements can be adjusted on their own or in tandem to create a polyrhythmic play-along experience. Users can set up to five levels of rhythmic complexity once a song has been selected from the app library. During a play-through of a song, the algorithm within the app produces a randomness to the time feel of the accompaniment ranging from swing-feel, waltz and quarter note triplet for example. Anticipating rhythmic change at the fifth level of complexity demands an internal feeling of the quarter note pulse of your set tempo as change can occur in as little as one measure, or may be prolonged over multiple measures. At the same time, the harmonic complexity of the play-along accompaniment can be set at five different levels that include reharmonization of the set chord changes of the original lead sheet. Added to the two main elements of the app (the harmonic and rhythm menu options, see Figure 2) is time placement where the user can move the bass, drum, and piano accompaniment farther behind the beat or ahead of it to give a different overall feel to the entire play-along. The rhythm menu also has a subset of options as well including not only level of difficulty, but also ratios and groupings. The ratios allow for settings that put the rhythmic feel at a variety of settings including two against three, or even 5 against seven. Finally, the groupings portion of the rhythm menu allows users to set note division groupings such as eighth notes in groups of seven.

Figure 2

Genius Jamtracks mobile app

(Genius Jamtracks, n.d.c)



Taken together, these harmonic and rhythmic complexities provide significant musical challenges that can prove difficult even for the most advanced jazz musicians. Where emerging musicians sometimes struggle with the polyrhythmic changes that can sometimes be posed by fellow musicians in live performance settings, GJT can now help musicians prepare for ahead of performances and recording sessions.

While jazz standards play an important rationale behind this app and help to develop a jazz musician's rhythmic and harmonic dexterity in improvisation, GJT now also allows users to create their own new compositions in the form of chord charts. This is a powerful new feature that allows the established and aspiring jazz musician to input chord changes for an original song and practice playing it and improvising over the chord changes. Not only is the app a complex play-along tool, but it is also a creative one that allows users to work on original compositions and give themselves and potential ensemble members the opportunity to practice the song and develop it ahead of rehearsals and performances. Aside from creation of original songs, the editing abilities of the app allow users to edit songs from their downloaded song library and allow customization of chord changes.

How iRP and GJT Use AI

While similar in appearance and function as a jazz music practice tool, the level of AI complexity differs greatly between iRP and GJT. Where iRP uses a more basic algorithm to produce walking basslines, variable style settings, and automated transposition and tempo for practice purposes (Ostermann et. al., 2021), GJT uses more complex algorithms to offer a variety of polyrhythmic changes and harmonic embellishments that occur randomly during playback (Genius Jamtracks, n.d.b). Where both use AI similarly is with the automated production of accompaniment when new song chord charts are added to each app and the ability to change the style of the accompaniment for each individual song.

Final Thoughts and Discussion

Though static play-along tracks continue to be widely used and applicable to the learning process, artificial intelligence software programming has the potential for more intensive musical practicing. Play-along recordings such as those by Jamey Aebersold remain a quality learning tool, however the possibilities introduced by modern apps such as GJT provide a glimpse into how the individual practice experience for the novice and professional player may continue to evolve. Considering how Aebersold's development of play-along tracks helped to broaden the palette of learning tools available to the jazz music education community, apps fueled by

artificial intelligence algorithms will again continue to propel change within music education. There are potential uses for both individual learning as well as in classroom settings in identifying improvisational challenges and techniques while strengthening the student's feeling for the pulse.

In my own experience in using the GJT app as a lifelong student of jazz and popular music, I found the app to be a positive addition to my own arsenal of practice tools though with some caveats. The first challenge of the app's unpredictable implementation of rhythmic feel during playback is that rather than having the accompanying parts interact and assist in developing my soloistic ideas, I am forced to adhere to the app's imposed changes. This aspect is counter to most real-life performance settings where band members interact and support each other's ideas during improvised solos. It is therefore a dance where the computer leads and the user must follow. The user needs to acknowledge this fact and embrace the challenge of the unknown and working more strictly on implementing pre-planned musical concepts. Examples could include rhythmic figures through multiple key centres and chord changes while the overall rhythmic feel evolves with the app. The last challenge the app poses, at least in my own experience, is that there is the high possibility of technical glitches where the app can temporarily freeze during play-alongs. This seems to happen more frequently as the levels of complexity are set higher in the app. A more powerful computer with sufficient processing speeds is needed to use the app confidently. Due to this reality, experiences with the app likely varies depending on the device being used be it a Smart Phone, Chromebook, or more powerful laptop or desktop computer. As the app developers continue to make improvements, hopefully these issues will lessen over time.

Through the development of play-along recordings through to modern AI-powered apps, jazz music education continues to grow in terms of pedagogical tools available to the individual consumer and classroom instructor. Modern apps owe their place in music to the concept of the play-along developed in past decades and like their predecessors, continue to help musicians study the art of improvisation. While the app is founded on the jazz genre, hopefully, development on similar apps for other genres as well where the technology can be a source for practicing and composing.

References

- Aebersold, Jamey. (1973). *A new approach to jazz improvisation*. Aebersold.
- Aebersold, J. (1988). Music is for life. *Instrumentalist*, 43(9), 108.
- Alexandraki, C., Akoumianakis, D., Kalochristianakis, M., Zervas, P., & Cambouropoulos, E. (2022, July). MusiCoLab: towards a modular architecture for collaborative music learning. In *Proceedings of the Web Audio Conference*.
- Anderson, M. M. (2024). AI as Philosophical Ideology: A Critical look back at John McCarthy's Program. *Philosophy & Technology*, 37(2), 44-. <https://doi.org/10.1007/s13347-024-00731-1>
- Borgo, D. The Art of Improvisation In The Age of Computational Participation. *The Routledge Companion to Jazz Studies*, 411-421.
- Chodos, A. T. (2019). *Solving and Dissolving Musical Affection: A Critical Study of Spotify and Automated Music Recommendation in the 21st Century*. ProQuest Dissertations Publishing.
- Doffman, M. (2018). Time In Jazz. *The Routledge Companion to Jazz Studies*, 163-171.
- Du-Harpur, X., Watt, F. M., Luscombe, N. M., & Lynch, M. D. (2020). What is AI? Applications of artificial intelligence to dermatology. *British Journal of Dermatology* (1951), 183(3), 423–430. <https://doi.org/10.1111/bjd.18880>
- Ferguson, T. (2018). *Using Technology to Teach Jazz Improvisation to Community College Students*. ProQuest Dissertations & Theses.
- Friedman, W. J. (2000). The Development of Children's Knowledge of the Times of Future Events. *Child Development*, 71(4), 913–932. <https://doi.org/10.1111/1467-8624.00199>
- Genius Jamtracks. (n.d.a). *Introducing New Standards with Genius Jamtracks*. Genius Jamtrakcs. Retrieved February 18, 2024, from <https://geniusjamtracks.com/>
- Genius Jamtracks. (n.d.b). *The Inspiration Behind Genius Jamtracks*. Genius Jamtracks. Retrieved October 6, 2024, from <https://geniusjamtracks.com/gjtstory/>
- Genius Jamtracks. (n.d.c). *Genius Jamtracks* [Screenshot]. <https://geniusjamtracks.com>
-

-
- Herzig, M. (2019). The ABCs of Jazz Education Rethinking Jazz Pedagogy. *Jazzforschung heute*, 181.
- Harasim, D., Finkensiep, C., Ericson, P., O'Donnell, T. J., & Rohrmeier, M. (2020). The jazz harmony treebank. In *Proceedings of the 21st International Society for Music Information Retrieval Conference* (pp. 207-215). Ismir.
- iReal Pro. (2024). *iReal Pro* [Screenshot]. <https://irealpro.com>
- Jamey, A. (1966). *Jamey Aebersold Jazz, Volume 1: How to Play Jazz and Improvise*. Jamey Aebersold Jazz, Inc.
- Johansen, G. G. (2014). On my own. Autonomy in learning practices among jazz students in higher education. *Finnish Journal of Music Education*, 17(2), 1-25.
- Johnson-Laird, P. N. (2002). How Jazz Musicians Improvise. *Music Perception*, 19(3), 415–442. <https://doi.org/10.1525/mp.2002.19.3.415>
- Katz, M. (2010). *Capturing sound: how technology has changed music*. Retrieved from <https://hdl-handle-net.ezproxy.lib.ucalgary.ca/2027/heb09000.0001.001>.
- Koblick, R. (2013). Jazz fake-books as a resource in the general library. *Collection Building*, Vol. 32 No. 4, 139-144. <https://doi.org/10.1108/CB-01-2013-0001>
- McCormack, J., Gifford, T., Hutchings, P., Llano Rodriguez, M. T., Yee-King, M., & d'Inverno, M. (2019, May). In a silent way: Communication between ai and improvising musicians beyond sound. In *Proceedings of the 2019 chi conference on human factors in computing systems* (pp. 1-11).
- Mazzone, M., & Elgammal, A. (2019). Art, Creativity, and the Potential of Artificial Intelligence. *Arts (Basel)*, 8(1), 26-. <https://doi.org/10.3390/arts8010026>
- Ostermann, F., Vatolkin, I., & Rudolph, G. (2021). Evaluating Creativity in Automatic Reactive Accompaniment of Jazz Improvisation. *Transactions of the International Society for Music Information Retrieval*, 4(1).
- Oxford. (2023). Artificial Intelligence. In *Oxford English Dictionary*. <https://doi.org/10.1093/OED/7359280480>.
-

-
- Ramalho, G. L., Rolland, P.-Y., & Ganascia, J.-G. (1999). An Artificially Intelligent Jazz Performer. *Journal of New Music Research*, 28(2), 105–129.
<https://doi.org/10.1076/jnmr.28.2.105.3120>
- Saba, D., Sahli, Y., Maouedj, R., Hadidi, A., & Medjahed, M. B. (2021). Towards artificial intelligence: concepts, applications, and innovations. *Enabling AI Applications in Data Science*, 103-146.
- Soo, V.-W., Huang, C.-F., Su, Y.-H., & Su, M.-J. (n.d.). AI Applications on Music Technology for Edutainment. *Innovative Technologies and Learning*, 594–599.
https://doi.org/10.1007/978-3-319-99737-7_63
- Thibeault, M. D. (2022). Aebersold's mediated play-a-long pedagogy and the invention of the beginning jazz improvisation student. *Journal of Research in Music Education*, 70(1), 66-91.
- Thom, B. (2003). Interactive improvisational music companionship: A user-modeling approach. *User Modeling and User-Adapted Interaction*, 13(1-2), 133-177.
- van de Haar, I., Broberg, C. P., & Doshoris, I. (2019). How Artificial Intelligence is changing The Relationship Between The Consumer and Brand in The Music Industry. *LBMG Strategic Brand Management-Masters Paper Series*.
- Zulić, H. (2019). How AI can Change/Improve/Influence Music Composition, Performance and Education: Three Case Studies. *INSAM*, 2, 100–114. <https://doi.org/10.51191/issn.2637-1898.2019.2.2.100>
-

ABOUT THE AUTHOR

Bert Johnson is a music educator, pianist, and electronic music enthusiast based out of Winnipeg, Manitoba, Canada. Bert has performed as a keyboard player across Canada and has performed in venues such as the Yardbird Suite in Edmonton and the Cabaret du Mile End in Montreal. While staying active as an educator directing a middle school band and choir program in Winnipeg, Bert is also a PhD student in music education through the University of Calgary with research interests in the area of music technology in education.