Comparison of Music Composing Software: Audacity, REAPER and FL Studio

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Abstract: As a matter of fact, with the digital technology continuing to evolve, music composition software has become an essential tool for musicians and producers especially in recent years. With this in mind, this paper explores three prominent music composing software, i.e., Audacity, REAPER, and FL Studio. By analysing their functionalities, application scenarios, and practical results, this study highlights the strengths and limitations of each software respectively. To be specific, results reveal that while all three offer comprehensive features for music production, they cater to different user needs and preferences according to the analysis. In detail, Audacity excels in comprehensive music composition, REAPER offers advanced recording and editing capabilities as well as good synchronization, while FL Studio is known for its intuitive interface and extensive plugin support. Overall, this comparison provides valuable insights for choosing the most suitable software based on individual requirements and future trends in music production and offer a guideline for software selection at the same time.

1 INTRODUCTION

The advent of computer technology has revolutionized music composition, offering unprecedented tools and techniques for creators. The history of computer music can be traced back to the mid-20th century, with early developments such as electronic synthesizers and digital audio workstations (DAWs). The rudimentary direct digital synthesis program developed by Max Mathews, in 1957, established the fundamental support for the music composition by computer in the current days. From the beginning, only simple synthesis techniques were employed. However, after the expansion in flexibility, elasticity, and generality of comprehensive development, fully-fledged languages began to emerge in the field of computer music. Along such development, several typical synthesis techniques were proposed, including table-lookup oscillator. Moreover, many of the basis for the field were introduced by Mathews in MUSIC. One specific principle could be the principles of unit generator, which was still frequently being used as a crucial module and compiler to contemporary systems, introduced by Mathews in MUSICIII (Lazzarini, 2013). To be specific, the beginning of the discoveries in music composition occurred between 1950s - 1960s. The first attempt was investigated by American musician Joseph Schillinger. Next Max Mathews provided a new technical platform for music composition. From 1970s on, more and more ranges of digital breakthrough came into the public, such as the MIDI protocol and the first working station with music (DAW). Overtime, these tools have evolved from rudimentary systems to sophisticated software capable of complex music creation and manipulation (Roads, 2015; Collins, 2017). In the modern period, many of the softwares, including FL Studio and Ableton Live, experiment with more innovative ideas and real-time processing, making the composition of music more practical and interactive.

Contemporarily, music composition software plays a critical role in the industry, providing both amateur and professional musicians with the ability to compose, record, and produce music efficiently. Many Software represent some of the leading solutions in this domain. These platforms offer varied functionalities and user experiences, each with its strengths and limitations (Brønnick, 2019; Browne, 2020). Although many of the current technologies had been appeared in decades before, as for the idea of interactive function for music composition, it still has a high potential for us to explore the nature of

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composition to improve the algorithms and also softwares. Moreover, in the current days, huge degrees and facets of the field are being carried out for researches to incorporate many of the original ideas with the advanced technology, resulting in a comprehensive development (Eigenfeld, 2007).

Recent advancements in music composition software have introduced a range of innovative features. Ableton Live is renowned for its live performance capabilities and loop-based composition. By choosing such software, it is especially helpful for improvision work as well as giving the user more freedom: from real-time function to MIDI processing. Logic Pro X is favoured for its robust recording and editing tools as it contains a huge library providing a range of virtual or digital instruments and audio plug-ins, while FL Studio is celebrated for its user-friendly interface and extensive sound library. Moreover, FL Studio's function is extremely outstanding for its synthesizer and sequencer (McCormick, 2021; Garcia, 2022). Research in this field has focused on comparing these software tools based on their functionalities, ease of use, and suitability for different music production environments. Several studies have highlighted the unique features of each software, revealing their impact on music creation and production (Jensen, 2018; Wong, 2023). Additionally, in order to understand deeper into the basics and radical details behind musical composition, many of the elements are taken into account to evaluate the advances and researches. By taking into considerations, much of the music composition is composed of rhythm, melody, accompaniment, and also these factors could be applied to computerized technologies as well. In detail, starting with rhythm, it represents the structures between the notes and frequently results into certain patterns. In the path, dealing with rhythm is a huge problem as a computerized rhythm involves particular arrangements of notes. However, along with great expansion of academic studies and researches carried recent years, many researchers raise the general understanding to access rhythms, for instance, Wang et al. combined statistics with fitness algorithm. Furthermore, in responding to more understanding of rhythm, researchers also delved into the work of creating automatic processing, for instance, filling the gap between drum beats. Moving onto the melody and accompaniment, according to recent researches, more appealing and intriguing melodies were created by randomization currently, and both of the features could be enhanced by imitation and mimicking without the disruption of original structures (Fu,2021).

This paper aims to provide a comprehensive comparison of music composition softwares in different areas, Audacity, REAPER, and FL Studio, addressing the need for an informed decision-making process when selecting music composition software. The research will examine the basic principles of music composing software, detailed descriptions of each software, and their respective strengths and limitations. The final section will explore future prospects and improvements in this technology, as well as giving potential limitations of current state to provide a more critical projection of the future development of the area. To sum up, this paper could generate a more direct and apparent distinction of the software for giving a more visualized view to choose these electronic applications as well as raising the awareness of future directions.

2 DESCRIPTIONS OF MUSIC COMPOSING BASED ON SOFTWARE

Music composition software enables users to create and manipulate music through digital interfaces. The basic principles involve digital audio workstations (DAWs), which integrate various tools for recording, editing, and mixing audio tracks. These platforms typically feature virtual instruments, MIDI sequencing, and audio effects (Chadabe, 2017; Hughes, 2019). Going back to concept and reasoning of choosing computer to compose music,digitalized processing gives several attractive supports for musicians, that is the large storing capacities of memory and the capability of sequencing instructions with high speed and precision. These essential part of computer composition could be attributed to memory and central processing unit-the fundamental parts of computer based music software. To be more understandable, the CPU could resemble nerves in human. Consequently, it takes up the major role to transmit certain signals and communication between various components, as well as monitoring the rests. Nevertheless, it is important to distinguish between the conceptions of languages and devices,and the computer as a whole (Willian & Buxton, 1977). Besides, when it comes to analog and digital differences, one of the principle is the method in converting musical signals into digital format. In particular, sampling and quantization are involved: sampling is a way that use a simulation of signal to monitor and record the value at a specific rate to transfer analog information digitally, and

quantization. Moreover, taking u as the role in the conversion and estimation of simulated value into discrete data. Another, significant section is the MIDI, which is a standard protocal to define details of digitalized musical transportation, e.g., note, pitch, and melody. In addition, a further theory is music generation. Particularly, two prevailing techniques are randomizing algorithms (involving randomizor to create distinctive and highly-varied music), and GANs (a method of using AI technology to generate sound that versimillitude real musical sections). Along with basic generation process, the technology of synthesization could give higher standard of altercation. Synthesis, involving subtractive, additive synthesis, and frequency, amplitude modulation, are applied to form complex music qualities and tones for further shift in parameters and adjustments.

These days, there are a series of unique programs and programming languages for music composition, creating a platform for users to operate on the control panel. Currently in the mainstream, there are those of high-level languages that broaden the criteria from acoustic levels to musical levels. They offer more functionalities, from real-time operation to more advanced composition and synthesis. In comparison to previous programming languages decades before, many of the high-level languages give necessary operation of flow paradigms,fitting them more directly. For instance, they give convenience of handling flow of time and construct a hierarchy system to organize some of the parameters structurally. Using illustrations, Pla is a highlevel music programming language written in SAIL (Gareth & Curtis, 2009). Pla is a suitable illustration of programs as it minimizes the power dissipation and provides reliance to guarantee the stability of hardware.

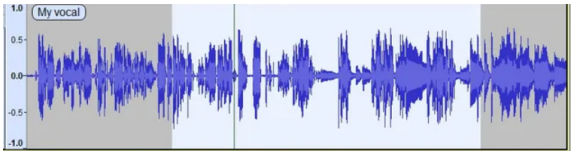

Figure 1: A sketch of sound loading for Audacity (Franklin, 2006).

3 AUDACITY

Audacity is a software to record and edit sound file with its particular features of cross-platform, and it is an open source and beneficial for communicator to utilize the technical functions (Franklin, 2006). A typical example is shown in Fig. 1To begin with, Audacity offers a wide range of functions. Firstly, recordings. Audacity has multitrack recording, which refers to the ability to record multiple audio tracks simultaneously. It enables capturing various sources,including instruments and vocals, to create a complex piece of audio work. Along with it is the real-time monitor, it helps adress the input volume and sound quality during the whole recording. Secondly, audio edition is extremely direct as it provides simple edition techniques,such as copy, cut, paste, trim and merger. Thirdly, for effect processing, Audacity offers the changes in the volume by using compression and advanced technique. Furthermore, the application of sound effect is widely introduced as well. For instance, shifts in pitches and speed as well enhancing certain features to make the sound more distinctive and interesting are all effective methods for producing a nice piece of project. In addition to the direct interface and visualized platform for user to control, the interface also display a wave diagram of sound to allow the user to investigate and monitor the changes and observe the results in a more apparent basis. According to the aforementioned characteristics and advantages of utilizing Audacity, it is noticeable that this software could be applied to a broad range of music compositions and adjustments in the sound. Audacity not only could be used to generate simple sounds and shifting music qualities, but also getting into the field of more technical areas. For instance, even in those movie or game, Audacity could allow the user to make certain notes and sounding to create corresponding atmosphere. Even more, in a more contemporary application, people benefit from Audacity by including the composition of broadcasting using Audacity, and begins using such devices for education purposes (Williams, 2020). To be specific with educational ends, Audacity has a positive impact on innovation of musical education and cooperation. In a study, Pedagogy of Primary and Pre-school Education successfully utilizes Audacity and other music composition interfaces to provide more cognition of children to study the music around the nature and their environment.Besides,using participants from kindergarten and primary school students, students effectively studied the use of the software to shift the pitches and also create sound stories, such as “little mermaids” (Todea-Sahlean, 2017). In conclusion, many of the practical application of Audacity show a positive influence regardless of fields of application and age generations. Such software include a comprehensive design in order to match a demanding nature of music composition and also generate outcome that benefit society as a whole.

4 REAPER

REAPER is a DAW work station developed by American company Cockos which provides a series of function including sound recording,editing,and producing.In particular and in comparison to other music composition softwares, REAPER has a relative benefit of being extremely flexible in order to make an accurate composition. Moreover, this software is highly customized according to the users' needs. For instance, the user of REAPER could alter the arrangements of layouts and platforms according to personal needs,allowing mutual view modes as well, such as track, mixing, time-line visuals for convenient management and editing of programs. In other words, the specific functions brought by REAPER could expand and attract the interests from particular fields: especially in game industries.For designing the sound, REAPER could easily rely on multi-tracks recording to produce the environment sounding,interacting sound effects and speeches by characters in games. Moreover, many of the video games, like those this science fiction background, require special music effect. Fittingly, REAPER supports the corresponding needs, as it could import libraries of various instruments and plugs-in of sound effect, hence featuring the characteristics of several sound effects. Besides, REAPER gives strong MIDI editing for the background music. To solve the problems of inharmonious between music and animation, the software's technology enables it to synchronize the sound and animation themselves, which results in a more perfect coordination. Along with synchronization, a time line edition of REAPER also enhance the fluency of whole composition. Furthermore, the control of versions give permission to monitoring the content of audio's changes and updates. In summary, game companies rely a lot on REAPER to create a more appealing audio effects, and currently developers and audio engineers discuss gaming audio project and provide examples of the use of REAPER in blogs and communities. In expansion to the aforementioned plugins, REAPER gives support for spatial sound processing, including the plugins for ambisonic processing. Specifically, by using encoding and decoding, many of the processing is strengthened by using cross-platform and conversion into other formates (Lossius & Anderson, 2014). For many scenarios apart from video games, REAPER could be proposed to be utilized in several activities incorporated with music. For a good illustration, REAPER is used in an activity called Musical collage where students gave a presentation related to themselves using a collage made by composition with REAPER. As one could see from these typical softwares, many of them are suitable for educational ends which indicated the convenience and ease regarding the softwares (Belibou, 2021). Overall, REAPER software provides a perfect perform for music and sound engineers to create specific musical tunes. Besides being regarded as practical for producing fine outcomes, REAPER also generates huge supports in researching and development processes. Taking the research of making a media playback with surround sound system. The investigation using REAPER empowers the researchers to obtain enough details either in a software and hardware basis (Anwar et al., 2022). The scheme is shown in Fig. 2.

5 FL STUDIO

FL Studio is celebrated for its intuitive interface and pattern-based workflow, making it particularly popular among electronic music producers and beat-makers. Its step sequencer and piano roll are designed for quick and efficient creation of drum patterns and melodic sequences (Clark, 2020). FL Studio also offers a wide range of plugins and effects, enhancing its flexibility and creative potential.The software's visual layout and easy-to-use tools make it accessible

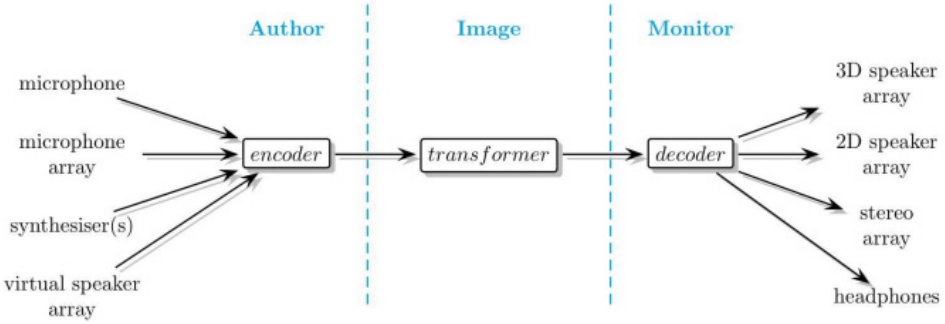

Figure 2: Ambisonic Toolkit Paradigm for REAPER (Anwar et al., 2022).

for beginners, while its advanced features cater to more experienced users. FL Studio's lifetime free updates and extensive online community support further contribute to its popularity (Miller, 2021). Despite its strengths, some users may find its interface less suited for complex audio recording and editing compared to other DAWs. Regarding the application scenarios for FL Studio, besides being capable of generating certain music composition and audio effects, FL studio particularly involves the technique of mastering, which includes EQ, compression and limiting used for finalization. Another superiority of choosing FL Studio is its employment in live performances. The users could real-time manipulate freely the control panels to change certain musical sound conditions. This advantage is used regularly in DJ sets. Furthermore, the general platform also undoubtedly could be carried in teaching scenario to convey ideas of musical engineering concepts (Garg, 2021). Lastly, many of the positive outcomes brought by FL Studio could be evidenced by release of popular music,where musicians and song composers, like Avicii & Martin Garrix, use chartopping tracks from the software. Moreover, with the unrestricted imagination and innovation, users using the technology could experiment with the extensive library to develop special compositions.

6 LIMITATIONS AND PROSPECTS

In the current status, every musical composition softwares have common and also specific limitations that need to be changed. When it comes to the three aforementioned softwares, many of them are easy and convenient to master for beginners or students. However, they are generally not well compiled enough for more advanced and complex compositions, especially with high-standards professional music work. Moreover, these softwares display significant problems with the hardware or the systems:to be specific, many of the applications are incompatible with certain plugins from third party, and they occupy on huge memory and resources from processor, weakening the computer's performance.

Future prospects in music composition software include the integration of machine learning and artificial intelligence to enhance composition and sound design. These advancements could lead to more personalized and adaptive tools, improving the overall creative process. Additionally, increasing cross-platform compatibility and user-friendly interfaces will likely drive future developments in this field. Furthermore, programmers could design more complicated softwares for experts to take advantage of, as well mitigating the negative effect of operation of soft ware on computer performance. With the advancement in technology and more development in the concept of automation, more and more automatic manipulation and operation of certain process should be carried out by AI, which is one of the primary focus.

7 CONCLUSIONS

To sum up, this research has compared three leading music composing software, i.e., Audacity, REAPER, and FL Studio. Each software offers unique features suited to different aspects of music production, from live performance and video game-based programming to professional recording and tutorial needs. As technology continues to advance, these tools will likely incorporate new innovations, such as AI-driven features, to further enhance their capabilities. Understanding the strengths and limitations of each software can guide users in selecting the most suitable tool for their needs, ultimately contributing to more effective and creative music production. In the future, there should be greater number of brand-new technologies and softwares coming up in the vision. However, it is important to comprehend the improvements and advancements that could be done for a more convenient and comprehensive developments of such softwares. It could be the responsibility of both developers and users to continuously monitor the advantages and limitations of using certain applications for a more direct communication. This paper aims to research into and make comparison of some of the currently available music composing softwares. Making proposals of future prospects and limitations as well, this paper hopes a better understanding of this topic and give a more apparent demonstration of the distinctions.

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