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Exploring the Potential of Sound Leakage for Sharing Music

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Abstract

While music recommendation systems effectively deliver music tailored to individual preferences, they face challenges such as filter bubbles, where users are recommended only music matching their preferences, and a reduction in serendipitous musical encounters. In this research, as an approach to these challenges, we reinterpret the Music Leak system in today's music streaming environment, which we originally proposed at WISS2007 in 2007, focusing on the phenomenon of "sound leakage" in daily life. Music Leak is a system that automatically shares the music a user is listening to with nearby people using the same system via FM radio waves. In evaluation experiments, 75% of users expressed interest in using the system, and 71% showed interest in music from people they did not know. Additionally, all test subjects were able to identify songs even in environments where different genres of music were playing simultaneously.

The distinctive feature of this system is that it provides a music sharing experience with a sense of physical distance, creating qualitatively different musical encounters from algorithmic recommendations by sharing information with strong reality—music that 'someone' is listening to 'now' and 'there'. This research proposes a new approach to promote 'unexpected discoveries' in music recommendation, demonstrating the potential of musical experiences through 'unintentional sharing' through implementation and evaluation.

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Keywords: Sound Leakage; Music Sharing; Music Recommendation System; Serendipity; Music Experience; Proximity-based Sharing;

1. Introduction

In recent years, with the proliferation of music streaming services and the development of music recommendation systems, there has been an increase in opportunities for users to receive music recommendations tailored to their preferences. However, this has led to a tendency where only top-ranked songs or music biased toward individual preferences are consumed, resulting in a decrease in encounters with "unexpectedly discovered music."

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The widespread adoption of music streaming services has enabled us to access more than 100 million songs of our choice at any time. Nevertheless, subscription-based music streaming services tend to recommend songs by artists users frequently listen to or similar music, tailoring recommendations to users' preferences. Sales charts are dominated by trending artists' songs, and television music programs often feature top-ranked artists' music, leading to frequent exposure to the same songs. Even when attempting to explore new music on streaming services, users are often recommended top-ranked songs that are frequently heard on television or music by familiar artists and similar tracks, resulting in a lack of "unexpected music" recommendations. That said, it could be argued that the music of artists we regularly listen to might constitute "unexpected music" for "others". Music streaming services rarely recommend classical music from over a century ago to individuals who typically listen to pop or rock music, yet this might actually align with their tastes despite never having been exposed to it before. In fact, classical music continues to be performed at concerts and piano recitals, and has been enjoyed by many people for years. The author personally continues to listen to music from 20 years ago during their student days on Spotify.

Here, we would like to focus on the phenomenon of "sound leakage" in daily life. While sound leakage itself is often considered a nuisance, could it not be viewed as an "unexpected music recommendation" from "others sharing the same space"? In fact, a survey conducted in Japan asking "What do you do when you hear someone's music leaking on a train?" reported that "Listen and move to the rhythm" ranked 5th (10.3%), "Sing along to the leaking music" ranked 6th (7.4%), and "Listen to the leaking sound" ranked 9th (3.7%), indicating that approximately 21% of people actively enjoy sound leakage[1]. These survey results suggest that sound leakage could potentially serve as a means of discovering new music from others.

Focusing on this phenomenon of "sound leakage", we proposed and demonstrated the "Music Leak" system at WISS (Workshop on Interactive Systems and Software) in 2007[2]. At that time, subscription-based music streaming services were not as widespread as they are today, and the filter bubble issues caused by recommendation algorithms were not as prominent. However, the way music is consumed has changed significantly, and the challenges we point out in this paper have become more serious. Therefore, this research aims to reinterpret the Music Leak system proposed in 2007 and explore its potential. Specifically, we will examine the possibilities of sound leakage for music sharing through the design, implementation, and evaluation of a Music Leak system that "leaks" not through sound waves but through radio waves, as well as through discussions during demonstrations.

2. Related Work

2.1. Music Recommendation Systems & Music Experience

With the proliferation of music streaming services, music recommendation systems that suggest songs suited to users' preferences from vast music libraries have come to play an important role. Existing music recommendation systems primarily use collaborative filtering, content-based filtering, or hybrid approaches combining these methods to recommend songs aligned with users' preferences[3]. For example, Spotify analyzes users' listening history and preferences, while also considering acoustic characteristics of music and artist information when making recommendations[4]. However, these methods make recommendations based on users' past behavioral history, leading to a problem known as the filter bubble[5], where users are presented with information biased toward their interests and concerns.

To address this issue, recommendation systems incorporating serendipity have been developed. Herlocker et al.[6] emphasize the need for multifaceted evaluation metrics in recommendation systems, not just accuracy. They state that serendipitous recommendations help users find surprisingly interesting items that they might not have otherwise discovered. Furthermore, Zhang et al.[7] implemented "Auralist," a music recommendation system that emphasizes "chance" and "unexpected encounters" using this concept. Their empirical research demonstrated that while recommendations with enhanced serendipity may involve a slight decrease in accuracy, overall user satisfaction improves. Notably, many users who experienced unexpected discoveries showed higher satisfaction with serendipity-focused recommendations than with traditional accuracy-focused ones. Highly serendipitous music recommendations are expected to enrich the music experience by promoting encounters with new music without being constrained by users' existing preferences.

Additionally, Chang et al.[8] found that serendipity in music streaming depends on users' context and tasks, aligning with Liu et al.'s[9] identification of contextual factors in serendipity. Ziarani et al.[10] highlighted emotional aspects and subjectivity in recommender systems, noting that users' opinions are influenced by contextual data and mental states. These findings support the potential of Music Leak's approach to create music experiences that include environmental factors such as "now", "there", and "someone" listening to music.

Traditionally, users' music information-seeking behavior for discovering new music has been conducted through search engines, browsing music information sites, and word-of-mouth[11][12]. However, these methods require users to actively search for information themselves, making chance encounters less likely. Tsukuda et al.[13] proposed "Kiite World" addressing the lack of social perspective in music exploration, placing 500,000+ songs on a map for avatar-based exploration. While users must actively visit others' playlists or synchronize playback, Music Leak enables users to "overhear" others' music without special operations, representing a shift from active to passive music discovery.

Music Leak realizes a form of "social music recommendation" [14][15] by sharing the music being played with those nearby, even without users consciously broadcasting their musical preferences. This provides opportunities for users to unintentionally convey their music preferences to others and learn about others' music preferences. According to Park et al.[16], social music recommendations hold special meaning for users compared to algorithmic recommendations. Music recommendations from friends carry more layered meanings, and users tend to show "willingness to like" music recommended by friends. Extending this insight, there may be potential for similar music affinity or interest even among people who are not friends but share the same physical space. This suggests that Music Leak could promote new social connections through music between strangers.

2.2. Music Sharing and Discovery Systems Utilizing Proximity

Several music sharing and discovery systems that utilize physical proximity have been proposed. Unlike conventional online recommendation systems, these systems aim to promote more natural and serendipitous encounters with music by taking into account users' physical locations and surrounding environments.

Push!Music, developed by Hakansson et al.[17], is a mobile application that automatically shares music wirelessly with nearby users. This system features functionality to automatically recommend and share songs based on users' music preferences and listening history, allowing users to learn about the musical preferences of people around them and discover new music. Similarly, BluetunA by Stephan et al.[18] uses Bluetooth technology to share music preferences with nearby people. The distinctive feature of BluetunA is that it expresses users' music preferences as a "musical identity" and shares this with surrounding people. This enables users to connect with others through their music preferences and experience encounters with new music.

Sound Pryer, developed by Ostergren[19], is a system that allows users to stream and listen to music from nearby vehicles during "traffic encounters" such as traffic jams or while waiting at traffic lights. In this system, drivers can "peek" at music being played by nearby cars, with playback automatically ending when vehicles move apart. This provides opportunities for discovering new music during daily commutes. FolkMusic by Wiberg[20] is a peer-to-peer (P2P) music sharing and playback system using mobile devices. This system aims to create collaborative music experiences by directly sharing music between users. FolkMusic proposes a form of music sharing that emphasizes direct connections between people while utilizing technology.

What these systems have in common is that they promote serendipitous encounters with music in the real world, not just in digital spaces, by leveraging physical proximity. The approach utilizing "sound leakage" proposed in this research, like these systems, mimics serendipitous encounters in daily life and proposes a new form of music discovery. However, the uniqueness of our approach lies in virtually reproducing actual sound leakage, where volume changes with distance between users, allowing users to hear others' music depending on physical distance.

Furthermore, while previous research simply provided mechanisms for listening to songs shared by others, a distinctive feature of this research is that others' music is heard superimposed on the music the user themselves has selected and is currently listening to.

The benefit of this superimposed playback design, which might initially seem "disruptive," lies in the fact that each user simultaneously plays both roles of music "transmitter" and "receiver". In conventional systems, there is a clear distinction between those who provide music and those who receive it, but in Music Leak, all users transmit their own music while simultaneously receiving music from others. This enables bidirectional music recommendation

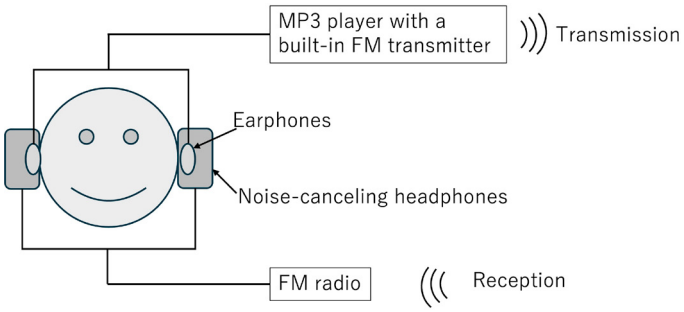

Fig. 1. System Configuration Diagram

rather than one-sided recommendation. Furthermore, users have the flexibility to choose whether to pay attention to surrounding music depending on the situation, while maintaining their own music as the primary focus. Users can actively listen to their chosen music while passively attending to music "leaking" from others. When interesting music is heard, they can focus their attention on it, or ignore it if they don't like it. This flexibility to freely move between active and passive modes respects users' autonomy while providing serendipitous music discovery experiences.

3. Design and Implementation of Music Leak

3.1. System Overview

Music Leak is a mechanism that allows only those who want to hear sound leakage to do so by "leaking" sound through radio waves rather than sound waves. Since radio waves can only be received by those who tune in, only people who want to hear the sound leakage can hear it. Therefore, unlike actual sound leakage, it does not constitute a nuisance to others.

Music Leak was realized by combining a portable MP3 player with a built-in FM transmitter, an FM radio, and noise-canceling headphones (Figure 1). When users play music on the MP3 player, they simultaneously broadcast that audio via FM radio waves to the surrounding area. Other users can receive these radio waves with an FM radio and listen to the music through noise-canceling headphones. This structure creates a situation similar to sound leakage through sound waves without actually leaking sound to the surroundings, allowing users to experience music sharing with a sense of physical distance.

3.2. Detailed Functions

3.2.1. Music Playback Function

Users select and play songs from the music library stored on their portable MP3 player. The music being played is heard by the users themselves through earphones while simultaneously being broadcast as FM radio waves via the FM transmitter.

3.2.2. Sound Leakage Simulation Function

This function provides an experience similar to real sound leakage by utilizing the characteristics of analog FM radio waves. The closer the distance between users, the stronger the FM radio wave reception strength becomes, resulting in louder volume through the headphones. Conversely, as the distance increases, the reception strength weakens, and the volume decreases. This volume change is natural and continuous, similar to actual sound leakage.

3.3. Implementation

The Music Leak system is implemented by combining existing devices, thus requiring no special software. Users can experience the Music Leak system simply by preparing a portable MP3 player with a built-in FM transmitter (Toshiba gigabeat MEU202), an FM radio, and noise-canceling headphones.

4. Evaluation of the Music Leak

In evaluating Music Leak, we conducted investigations from mainly three perspectives. First, we evaluated the discomfort and acceptability in situations where multiple songs are heard simultaneously. This is an element related to the basic user experience of the system. Second, we investigated the ability to identify individual songs in an environment where multiple songs coexist. If "leaked" songs are perceived merely as noise, the purpose of this concept—encountering music through sound leakage—cannot be realized. Therefore, whether users can appropriately identify individual songs is important in determining the effectiveness of the concept. Third, we evaluated the social acceptability of the system. Specifically, we conducted a questionnaire survey on the degree of interest in songs that others are listening to and the psychological resistance to "leaking" one's own songs.

4.1. Evaluation of Physical and Auditory Discomfort

We evaluated the comfort of wearing the Music Leak system and auditory discomfort with 12 male and female subjects in their 20s. The subjects were asked to use the Music Leak system for about 10 minutes and were questioned about any physical discomfort from wearing headphones over earphones, and any auditory discomfort from hearing two types of audio simultaneously. Furthermore, considering the subjects' musical experience, those with more than 5 years of instrument practice or composition experience were classified as musically experienced, while others were classified as musically inexperienced (Table 1). The number of musically experienced and inexperienced subjects was 6 each.

The results of the survey showed that most subjects evaluated physical discomfort as not problematic. On the other hand, regarding auditory discomfort, 6 out of 12 subjects responded that it was uncomfortable, with 3 of them stating that noise introduced due to the use of analog radio waves was the cause. The noise issue can be improved through system enhancements such as using Bluetooth. Overall, 75% of the subjects responded that they would like to use this system. The remaining 3 subjects expressed discomfort with hearing multiple music sources simultaneously. This result suggests that this system is not suitable for all users and specifically targets users who do not mind listening to multiple sound sources simultaneously.

Table 1. Discomfort with wearing the system (n=12).

	Musically experienced	Musically inexperienced	Total
Physical discomfort	0%	33%	17%
Auditory discomfort	50%	50%	50%

4.2. Evaluation of the Ability to Distinguish Different Songs Played Simultaneously

Next, we evaluated the ability of the same 12 subjects to distinguish between different songs played simultaneously through earphones and headphones. Using four songs of different genres from Japanese music textbooks that subjects would be familiar with ("Sekai ni Hitotsu Dake no Hana" (J-POP), "Yesterday" (Western music), "Donguri Korokoro" (children's song), and "Symphony No. 5" (classical)), we randomly output two songs simultaneously and asked subjects to identify the song titles and whether they were being played through earphones or headphones. We also conducted the same experiment under conditions allowing movement within a 2-meter radius. The results showed that regardless of musical experience, subjects were able to accurately identify the titles of the two songs heard simultaneously. However, particularly for musically inexperienced subjects, it was difficult to determine which sound was being played from earphones versus headphones. When movement within a 2-meter radius was allowed, the correct answer rate improved as the sound quality and volume from the headphones changed (Table 2).

However, the songs used in this experiment were selected from distinctly different genres, and in actual usage environments, there is a higher possibility that songs with more similar genres or characteristics may "leak" simultaneously. In such situations, song identification is expected to be more difficult, and this point needs to be considered as a topic for future research.

Table 2. Result of music identification experiment (n=12).

	Musically experienced	Musically inexperienced	Total
Song title identification	100%	100%	100%
Output destination identification without movement	67%	17%	42%
Output destination identification with movement	83%	100%	92%

Fig. 2. Demonstration Scene at WISS2007.

4.3. Evaluation of Social Acceptability

Finally, to evaluate the potential for social adoption of this system, we conducted a questionnaire survey with 14 men and women in their 20s. When asked if they were interested in the music others were listening to, 100% responded affirmatively for romantic partners and friends, while 71% expressed interest even for people they were not well acquainted with. When asked if they wanted to recommend their songs to others, 86% responded affirmatively for romantic partners and friends, while 36% wanted to recommend to people they were not well acquainted with. In response to the question of whether they minded others hearing the songs they were listening to, all respondents answered that they "don't mind" regardless of acquaintance level. These results revealed that even when targeting people they are not acquainted with, many people are interested in what kind of music others are listening to and have no problem with others hearing the songs they are listening to. However, there is a tendency that they are not necessarily eager to actively recommend their music to others.

4.4. Summary

In the evaluation experiments of Music Leak, we conducted investigations from three perspectives: physical and auditory discomfort, song identification ability, and social acceptability. The results suggested that there was little physical discomfort, making the wearability generally acceptable; users showed interest in others' music and had no resistance to others hearing the songs they were listening to. Furthermore, it was demonstrated that users could distinguish leaked songs even of different genres. However, the noise problem due to the use of FM radio waves emerged as an important issue to be resolved for the practical implementation of the system.

5. Observations from Demonstrations at WISS2007

When we conducted a demonstration of Music Leak at WISS2007 (The 15th Workshop on Interactive Systems and Software)[2], many interesting reactions were received from visitors(Figure 2). Through having visitors experience the system, there were numerous insights and discussions about the positioning, design philosophy, and effects of this system. These included potentially useful insights for designing interfaces related to communication and music listening. Therefore, in the next chapter, we organize and analyze these discussions.

5.1. Encounters with Music

With the proliferation of subscription-based streaming services like Spotify[4] , the foundation has been laid for freely listening to music from an enormous library of over 100 million songs. In such an environment, many users can listen to all the songs of artists they know within the first few months, yet they still seek new songs without being satisfied. There should be many unknown songs in a library of 100 million that could satisfy users, and how to encounter such songs has become a challenge in music listening systems.

Goto et al. have analyzed "encounters with music"[21]. In their paper, they mention existing ways of encountering music: (1) chance encounters through broadcasts from mass media such as radio and television, (2) encounters from hit charts, recommendations from friends, or recommendation systems using collaborative filtering or content-based filtering, (3) encounters from music searches using bibliographic information such as titles and artist names, and (4) encounters through browsing hierarchical categories such as genres. They point out that these existing methods make it difficult to satisfy users' desire to "listen to something different that suits my taste," and have constructed the system "Musicream", which proposes "encounters with music" that do not belong to any of the categories of broadcasting, recommendation, search, or hierarchical structure.

This interface features discs corresponding to each song flowing out of a faucet one after another, and users can select and listen to them. Each disc is colored according to the similarity of songs, allowing users to search for songs with reference to these colors. As a simple means of "encountering" music from an enormous music library, there is the idea of random selection. The once-sold iPod shuffle was precisely a device that proposed selecting and transferring songs randomly from the library for listening. However, while random song selection certainly increases opportunities for "chance encounters", these haphazard encounters lack persuasiveness. In contrast, Goto et al.'s Musicream uses coloring backed by a sophisticated algorithm calculated from 30-dimensional feature vectors, thus increasing the persuasiveness of these encounters. The "way of encountering music" suited to a music listening style that accommodates vast music libraries might be one that is serendipitous yet feels somehow inevitable.

Considering encounters with music through Music Leak, the music that leaks through would differ depending on whether it's used on a morning train, in a university cafeteria, in a hospital waiting room, or before a concert at a live music venue. While the type of music one can encounter varies depending on when and where it's heard, if that space is familiar to the user, there's a high possibility that the music is suitable for listening in that space (for example, in a university cafeteria, there's a high chance of encountering songs popular among university students), making it more than just a random encounter with music. Moreover, the music that leaks through is undeniably music that "someone" is listening to "now" and "there", and this selection carries strong reality and persuasiveness. Compared to impersonal recommendations, the degree of interest shown by users could be quite different. Subscription-based streaming services like Spotify have features that allow users to publish and share playlists, and many users are eager to publish these or search for them. This might be because one can sense the presence of another person's taste or thoughts behind these playlists.

Among those who experienced this system at the actual demo exhibition, several expressed opinions that they would rather actively "leak" their favorite songs or original compositions. Upon reflection, among the nuisance sound leakages, there might be cases where people turn up the volume with a meddlesome aspect of wanting those around them to hear. In any case, the desire to have others know about one's favorite music is common to many people. While we have mainly discussed the benefits for those listening to leaked music, the system also has the potential to provide psychological satisfaction to those leaking music. Looking at it this way, Music Leak provides a way of encountering and enjoying music that has been relatively rare until now. At the very least, these encounters with music have more inevitability and are more intriguing compared to mere random presentations. It could be said that this is not just a useless invention aimed at being eccentric, but one that provides a new option for our evolving music listening habits.

5.2. Encounters with People

Another topic of discussion arising from the Music Leak proposal relates to encounters with people. We heard an interesting episode from a WISS2007 visitor: While listening to Bon Jovi's music on a train, the sound apparently leaked, and the woman sitting next to them passed a note asking, "Do you like Bon Jovi?" This became the starting point of their acquaintance. Other visitors also commented that if someone nearby was listening to music by the same artist, they would want to talk to that person. We believe this is not because they want to exchange information about

that particular artist. If one wanted information about a specific artist, they could obtain more detailed and reliable information from various sources, including the internet. Also, just because people happen to be listening to the same artist's music simultaneously doesn't guarantee they will get along. Nevertheless, humans seem to show strong interest in such minor coincidences as listening to the same artist's song at the same time in the same place, even while recognizing it as somewhat anecdotal.

Tsujita et al., in their preliminary survey for designing a long-distance relationship support system, pointed out that a "sense of synchronization with the partner" is desired, and proposed SyncDecor[22], a system where furniture placed in remote locations synchronizes. Chung et al.'s Lover's cups[23] is a similar system proposing remote communication where when one person puts their cup to their lips, an LED lights up on the other person's cup. The popularity of the communication service X, which connects users with just short posts about "what they are doing now", vividly demonstrates how the sense of sharing the same time connects people. Additionally, the research on speculative know-who systems by Nishimoto et al.[24] states that even seemingly "trivial" matches between individuals can actually have significant meaning and bring high value in company organizations. In the proposed system, an attempt is made to use the degree of impression toward trivia from the popular Japanese TV program "Trivia no Izumi" as profile information.

Several systems have also been developed to facilitate interaction between people who are physically proximate. In the past, there was the "Lovegety", a matchmaking device that sold over 400,000 units. Additionally, the StreetPass function on the Nintendo DS has been utilized in titles such as "Animal Crossing: Wild World" and "Nintendogs", allowing users to send message bottles with items in the former and interact with other users' dogs in the latter. Many other portable game consoles and software are designed to have devices communicate without the users' awareness, leading to communication opportunities. Similarly, in the field of instrument development, the wearable instrument Costune[25] is equipped with a mechanism to automatically detect when people with the same musical tastes approach and start an "impromptu session" instantly through an ad hoc network. This provides an opportunity for communication through music, a universal language, even between people from countries where verbal communication is impossible.

Facilitating interaction between people who are physically proximate not only makes individuals enjoy themselves but also has the effect of accelerating work efficiency in the organizations and societies that encompass these individuals. In the consideration of sociotechnical information environments for intellectual creative work proposed by Nakakoji[26], the necessity of referring to physical and departmental proximity in constructing expert identification mechanisms that consider social relationships is mentioned. This is because humans tend to find it easier to ask questions to people who are physically closer, and physical proximity also affects the speed of responses. Music Leak could be positioned as a medium that connects people, alongside such research and systems. That is, while Music Leak is simply a system where people broadcast what music they are currently listening to, it strongly evokes mutual interest and can serve as a medium that promotes encounters and interaction between strangers.

In the questionnaire results regarding Music Leak, in response to the question "Do you mind others hearing the songs you are listening to?", everyone responded that they didn't mind, regardless of their acquaintance with the person. Therefore, it can be considered that from a privacy perspective, the leakage of information about currently playing songs is deemed acceptable. Typically, when constructing media that promote encounters, opinions are divided on the extent of information to be obtained from individuals and disclosed to others, but in this sense, this system could be said to have found an effective compromise. When proposing the system, we thought that becoming interested in strangers encountered on trains or wanting to get to know them would be rare in modern society, which is becoming increasingly dangerous, and that this tendency might be particularly strong in Japan. However, based on the feedback from subjects and visitors at conferences in Japan, such desires were surprisingly common. From the perspective of enriching human society and life, facilitating encounters between people in physical space has a strong possibility of having a positive effect, so perhaps we need to properly address this demand and consider support beyond the dimensions of games and dating.

5.3. Music Leak: From 2007 to Today

In the approximately 18 years since Music Leak was proposed in 2007, the music listening environment has changed dramatically. In 2007, music listening was primarily done through portable players such as iPods, and subscription-based streaming services were not common. Today, subscription-based streaming services such as Spo-

tify have become mainstream, allowing users to instantly access over 100 million songs. These changes have led to the following developments:

1. Enhanced Personalization and Filter Bubbles: Users tend to become enclosed in their preference ”bubbles” due to personalized recommendations. The “serendipitous encounters with others’ music” provided by Music Leak may have increased in value in the present day compared to 2007.
2. Evolution of Music Sharing Culture: Services like Spotify have made playlist sharing common, and Apple introduced SharePlay in 2021, indicating growing interest in music sharing. However, Music Leak’s “music sharing with physically proximate strangers” offers a qualitatively different value from contemporary digital sharing.
3. Smartphone Proliferation and Technological Evolution: Nearly everyone now owns a smartphone, making it technically easier to implement Music Leak with higher quality using technologies such as Bluetooth and Wi-Fi.

Considering these changes, the Music Leak concept holds significant importance in the contemporary context. In today’s world where personalized music experiences have become the norm, “serendipitous encounters with music” based on physical proximity can serve as a means to restore the diversity of music experiences that is being lost.

6. Conclusion

In this research, we reinterpreted the Music Leak system, focusing on the everyday phenomenon of “sound leakage” that we originally proposed at WISS2007 in 2007. In response to challenges faced by conventional music recommendation systems, such as filter bubbles and the decrease in serendipitous encounters with music, this system demonstrated the potential to promote encounters with new music by providing a music sharing experience with a sense of physical distance. Through evaluation experiments and demonstrations at WISS2007, the following insights were obtained:

1. Users showed high interest in music that others were listening to, and it was confirmed that there was low psychological resistance to sharing their own musical preferences.
2. By reproducing “sound leakage” through radio waves, music sharing became possible without causing a nuisance, creating encounters with music qualitatively different from algorithmic recommendations. In particular, information sharing with the strong reality of music that “someone” is listening to “now” and “there” can provide value not found in conventional recommendation systems.
3. The distinctive feature of this system—allowing users to listen to their own music superimposed with others’ music—was demonstrated through evaluation experiments showing that users could distinguish between different music genres even when played simultaneously. Furthermore, 75% of participants in the evaluation experiment expressed a desire to use this system, and during the WISS2007 demonstration, attendees were observed enjoying the “leaked” music from others while listening to their own selections. These results indicate that the superimposed playback characteristic of the system may be acceptable to users.
4. This system was found to have potential not only as a music recommendation tool but also as a social medium that promotes encounters and interaction between people with common musical interests.

However, This research has several limitations. First, the evaluation experiments involved a limited number of participants, necessitating verification with participants from more diverse age groups and cultural backgrounds. Additionally, since the experiments were based on short-term usage, the effects of long-term use and potential habituation remain unclear. From a technical perspective, the current implementation using FM radio waves presents challenges such as noise issues and limited transmission range, with future improvements potentially leveraging technologies like Bluetooth. Furthermore, considerations regarding privacy aspects, music copyright issues, and potential collaboration with commercial music streaming services require further exploration.

This research demonstrates that the approach we proposed in 2007 to expand the diversity of ways to encounter music still has potential in today’s music listening environment, creating serendipitous music experiences through “unintentional sharing.” We hope that the concept of Music Leak can contribute as a new approach to balancing algorithmic optimization and human serendipitous discovery in future music listening environments.

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