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The Reality of the Loudness War in Japan -The Case Study on Japanese Popular Music-

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ABSTRACT

This paper focused on the loudness statistics of the songs, especially commercially succeeded albums of popular music in Japan during the year of 1989 to 2018. The purpose of this paper was to verify the existence of the “loudness war” in Japan. The statistical results showed there was a leap of loudness in the middle 1990s, which implies the existence of the loudness war was on in Japan. Moreover, the authors employed the time series analysis and estimated the average loudness from 2019 to 2028. The authors proposed the loudness estimation by using the ARIMA model. The model estimated the future average loudness would rise to -4 LUFS, in case of without any regulations.

1 Introduction

Recently, digital audio media have been more and more diverse. People can imagine media like CDs, MP3, streaming, and etcetera. In Japan, CDs still have been the primary medium for a long time. Co-developer of CDs was Sony, a Japanese company, accelerated rapidly prevalent and mass popularity in Japan. Another factor of CDs mainstreaming in Japan was thought to be the formats of sales in Japan, such as bundling free DVDs of the performer or pre-order invitation to the next live events. These sales strategies supported increasing additional value to CDs during the 2000s and 2010s. On the contrary, music streaming in Japan is not so much popular as in Europe and the United States.

2 Background

It is said that the loudness war from the 90s had raged with the rapid development of digital technology. It was promoted by the emergence of maximizing tools (like “L1 Ultra-maximizer” from Waves Audio) in the middle of the 90s. Katz[1] researched the loudness of digital audio in the United States and found out that the loudness grew 8.8 LU in thirty years, from 1979 to 2011 (Fig.1).

In 2010, however, people began to see it as a problem [3]. The high-compressed sound by using maximizing tools may cause the loss of its sound quality and musical expressions like excitement or emotional factors. Moreover, Vickers [4] suggested that

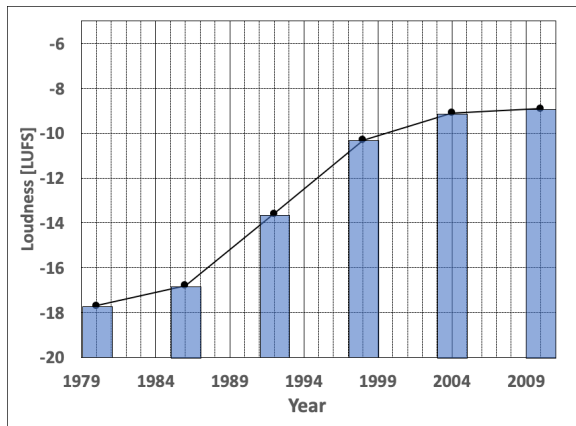


Fig. 1: Transition to the loudness value (figured by authors according to Katz [2]).

these sounds make people have listening fatigue. In Japan, few articles mention this problem, and this may be because there was no objective database to confirm how the loudness had behaved. The purpose of this paper is to verify the loudness war or not in Japan. The loudness of commercially succeeded songs in the past thirty years was measured in LUFS. The annual average loudness was calculated to examine the transition of the loudness year by year.

3 CD sampling and loudness calculation

Our research focused on the songs in the top ten albums in the annual hit chart from 1989 to 2018. Table 1 shows the example of the annual top chart.

Table 1: Album Top Chart in 1993

Rank	Title	Artist
1	Yureru Omoi	ZARD
2	Toki No Tobira	WANDS
3	The Bodyguard: Original Soundtrack Album	Whitney Houston
4	The Swinging Star	DREAMS COME TRUE
5	Tears and Reasons	Yumi Matsutouya
6	Friends	B'z
7	Memories of Blue	Kyousuke Himuro
8	Red hill	CHAGE & ASKA
9	Heart of Stone	T-BOLAN
10	Little Bit...	WANDS

The number of 5534 songs were listed to analyze. Each loudness value was measured by using the loudness measuring tool in Presonus Studio One 3. The measuring method was conformed to EBU 128[5] and the long-termed “Integrated” value was adopted [6].

At the first stage, we measured the loudness of each song. And the next stage, we calculated the average loudness of the whole album. Finally, we calculated the annual average loudness.

4 Results of calculated annual average loudness

The average loudness values calculated for each year are shown in Table 2.

Table 2: Annual loudness values

Year	Loudness [LUFS]	Year	Loudness [LUFS]
1989	-14.7	2004	-8.22
1990	-14.0	2005	-8.40
1991	-13.3	2006	-8.61
1992	-13.7	2007	-7.48
1993	-14.1	2008	-8.31
1994	-12.2	2009	-8.02
1995	-10.9	2010	-7.68
1996	-10.2	2011	-7.56
1997	-9.93	2012	-7.96
1998	-9.02	2013	-7.33
1999	-9.00	2014	-7.78
2000	-8.19	2015	-6.81
2001	-8.68	2016	-7.92
2002	-8.84	2017	-7.49
2003	-8.74	2018	-7.10

The graph in Fig.2 reflects the results of the calculation in each year. It shows the transition of the loudness. The loudness value has increased close to 8 LUFS from that of 1989.

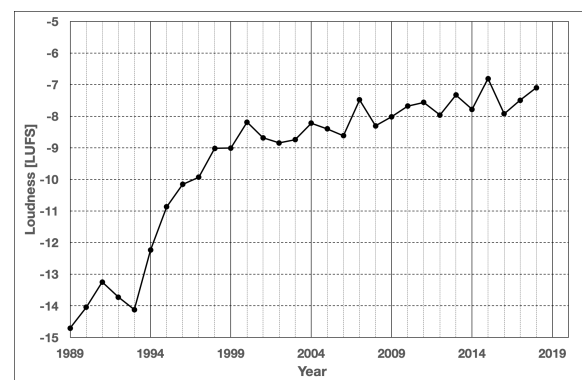


Fig. 2: The annual transition of the loudness (LUFS).

Furthermore, the author researched the unit of a single song. The same song titles by the same artist re-

leased in the different years are picked up and compared. When the old songs are reissued, they are often remastered. In the case of "Don't Leave Me" of B'z (Japanese Rock Band), the song's loudness value increased 5.3 LU in 19 years. (Table 3).

Table 3: The loudness of the same song by same artist.

Title	Year	Loudness [LUFS]
Don't Leave Me	1994	-12.1
	1998	-8.4
	2008	-7.5
	2013	-6.8

5 Discussion

5.1 The search for the cause of the Loudness War

From the results, the rising of the loudness occurred in the middle of the 90s. Following the survey of Katz, the loudness war was on in Japan. Here, some reasons why the rising of the loudness occurred can be suggested.

First, it is useful to know the background of the loudness wars in Europe and the United States to compare them with those in Japan. Orban and Foti [7] stated that the narrow frequency band of FM radio broadcasts in Europe and the U.S. caused the compression of the dynamics and the competition of the loudness of the sound sources on CDs.

The author's survey did not provide useful information about the impact of FM radio in Japan. When we go back to the era of records, there seems to be a difference in the mastering process between Japan and the West. In Europe and America, the mastering process was established as a pre-process of record cutting. On the other hand, in Japan, mastering was done simultaneously as the record cutting process. After that, the mastering process as it is called in Europe and the United States started to be done for the digital sound sources recorded on the CD. It was in the middle of 80s [8].

In the 90s, CD production and sales in Japan were at its peak (Fig.3). The growth of the CD industry in Japan may have increased competition. It's suggested

that these industrial backgrounds may have fostered a rise in loudness.

Second, as a background, Japanese popular music since the 80s has been mostly influenced by Western popular music. It has no longer reflected indigenous and ancient Japanese culture, like using Koto and Shakuhachi onto the traditional musical scale, Ritsu or Miyakobushi. Many of the formal elements of popular music were modeled after those of the West, as were the recording techniques and sound structure. As the growth of the CD industry mentioned above, many Japanese musicians earned so much money in the domestic that they smoothly go abroad and do their recording in there. They were able to touch with the music on the latest trend in the world. It is thought that these fashionable music and sound trends from the West have been imported and introduced to the Japanese music industry in real-time. This situation had led to a movement of loudness wars in Japan. It is very similar to that of Europe and the United States.

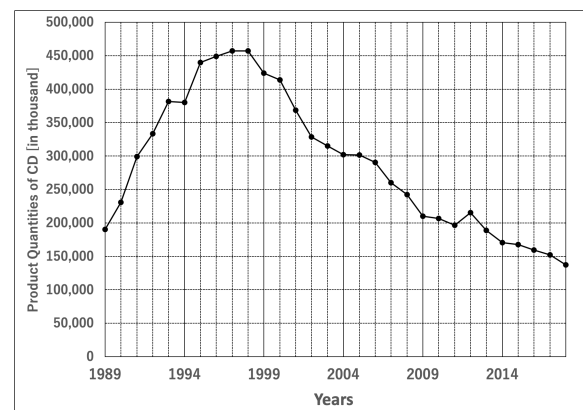


Fig. 3: CD product quantities in Japan [9].

5.2 Prospect the loudness values

It is hard to predict the trend in loudness values because the listeners' preferences can influence it. Although the genre of music is closely related to loudness, the genres and sounds of popular music that gain traction with listeners each year are different, making it a more complex issue. Therefore, the authors tried to estimate the loudness trend in the future only from the statistical data. Statistical estimate values of the loudness were calculated by using an autoregressive integrated moving average (ARIMA) model, one of the non-stationary time series models.

The ARIMA models are often used to estimate time-series data, for example, stock prices. These were compared to the actual measured value. Fig.4 shows the estimated loudness values of 2009 - 2018 which estimated from the data of 1989 - 2008. The order of AR and MA modeling were (1, 0). The predicted and measured values were approximated to a regression line by the least-squares method, respectively. The regression line of the predicted value has a slope of 0.06402, y-intercept: -136.52, and the regression line of the measured value has a slope of 0.06533, and y-intercept: -139.11. The two graphs are very similar. It is found that the graphs of the measured values are close to the predicted values based on the data from 1989 - 2008.

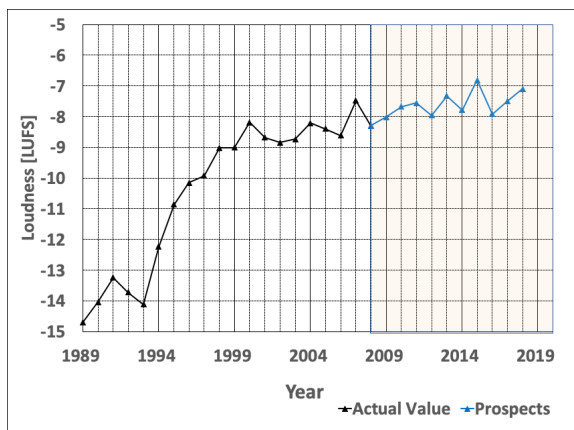


Fig. 4: The actual measured value ('89-'08) and the prospective value ('09-'18).

It is suggested that the 2009-2018 data statistically reflect the trend of historical data, and it indicates that the ARIMA model had better matching with the loudness trend estimation. The authors estimated values of the future, the year of 2019 - 2028 from data of 1989 - 2018 (Fig.5). The order of AR and MA modeling were (5, 4). Our ARIMA model estimated that the loudness average would rise to -4 LUFS. The accuracy of these predictions can only be determined by calculating actual measurements. A clue to this is the regulation of loudness introduced in broadcasting and other media. For example, ITU regulates at -23 LUFS, YouTube holds at -13 LUFS, and Spotify has at -14 LUFS. A sound source with an "Integrated" value of -4 LUFS for this criterion will be regulated more strictly than other sources because it is too loud. Vickers also suggests that extreme compression takes away the musical element [4]. Based on the actual measurements, the

maximum is about -8 LUFS. It indicates that -8 LUFS may be the limit value of the loudness value that does not destroy the musical element. From the above, the future loudness value may be lower than the predicted value.

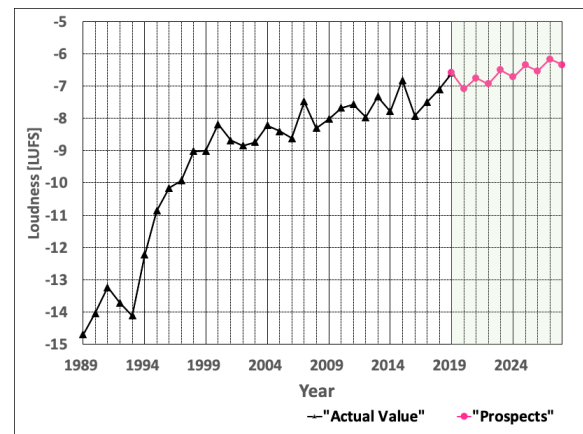


Fig. 5: The actual measured value ('89-'18) and the prospective value ('19-'28).

6 Conclusion

In this paper, the authors examined whether there was the loudness war or not in Japan by investigating the yearly transition of the loudness statistics. The results confirmed that the loudness war was on in Japan. Its putting the cart before horse to make the loss of musical elements by raising its loudness. Its also the case in Japan. As the author's opinion, all related persons in musical industry are highly recommended to deliver the music with its natural taste so that the listener could enjoy it. In 2019, AES proposed the recommendation for the loudness of digital audio as -16 LUFS. If the recommendation will influence on the loudness, our estimations will be out of the reality, the loudness annual average would fall to -16 LUFS.

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