

Supplementary material: questionnaire

This document describes the details of the questionnaire that we used in our user study. The section numbers here, e.g., “(section 4.2),” refer to those in the submitted paper.

1. Influence of musical factors (section 4.2)

1.1. Instructions

You are listening to music on a music streaming service that you use regularly. Imagine listening to a newly released song for the first time, or to a song that the service recommended for the first time.

When you listen to a song for the first time and decide whether you like or dislike it, how important is each of the following 10 musical factors? Please answer on a 5-point scale from “not important” to “very important” for each one.

10 musical factors: melody, rhythm, harmony, instruments, mood, lyrics, danceability, sentiment, tempo, and singing voice

The meaning of each factor is explained below. If you do not understand the meaning of a factor after reading the explanation, please answer “not important.”

For each factor, if you answer “somewhat important,” “important,” or “very important,” please describe at least one criterion for judging that you like or dislike a song according to that factor, by referring to the sample responses below. You may give more than one criterion.

Example 1: The respondent answered “important” for the factor “lyrics” and gave both “like” and “dislike” criteria, with two criteria for liking a song (“positive” and “sympathetic”).

Factor: **lyrics**

How important are the “lyrics” in judging whether you like or dislike a song on first listen?

- ☐ Not important
- ☐ Hardly important
- ☐ Somewhat important
- ☒ Important
- ☐ Very important

Criteria for judging that you like a song

Positive and sympathetic

Criteria for judging that you dislike a song

Violent

Example 2: The respondent answered “very important” for the factor “tempo” and gave only a “dislike” criterion.

Factor: **tempo**

How important is the “tempo” in judging whether you like or dislike a song on first listen?

- ☐ Not important
- ☐ Hardly important
- ☐ Somewhat important
- ☐ Important
- ☒ Very important

Criteria for judging that you like a song

Criteria for judging that you dislike a song

Too slow

For each factor, if you answer "not important" or "hardly important," please describe the reasons why the factor is not important, by referring to the sample response below. You may give more than one reason.

Example 3: The respondent answered “not important” to the factor “lyrics” and gave a reason for this answer.

Factor: **lyrics**

How important are the “lyrics” in judging whether you like or dislike a song on first listen?

- ☒ Not important
- ☐ Hardly important
- ☐ Somewhat important
- ☐ Important
- ☐ Very important

Reasons why it is unimportant

I don't pay attention to the lyrics when I listen to a song.

Note again that this questionnaire assumes a situation in which you are judging whether you like or dislike a song that you are listening to for the first time, not a song that you have listened to previously.

1.2. Explanations and a question for each musical factor

Factor: melody

“Melody” means the main theme of a song that you would sing while listening to it (e.g., I sing the melody of a certain song as “la la la la”). In a song with lyrics, the lead vocalist sings the melody.

How important is the “melody” in judging whether you like or dislike a song on first listen?

Factor: singing voice

“Singing voice” means the quality of the singer's voice and the way the singer sings a song.

How important is the “singing voice” in judging whether you like or dislike a song on first listen?

Factor: rhythm

“Rhythm” means the pattern of intensity or accent that you perceive when you listen to music. When a drum sound is played, you perceive rhythm from the drum sound or pattern.

How important is the “rhythm” in judging whether you like or dislike a song on first listen?

Factor: lyrics

“Lyrics” mean the words that are sung by a song’s lead vocalist. For this factor, please exclude songs without lyrics or songs sung in a foreign language; instead, assume a situation where you listen to a song with Japanese lyrics for the first time.

How important are the “lyrics” in judging whether you like or dislike a song on first listen?

Factor: mood

“Mood” means the emotional impression that you get from a song as a whole, such as sad, happy, joyful, wild, calm, or romantic.

How important is the “mood” in judging whether you like or dislike a song on first listen?

Factor: tempo

“Tempo” means the speed of a song.

How important is the “tempo” in judging whether you like or dislike a song on first listen?

Factor: harmony

“Harmony” means the sound given by series of chords changing one after another, where a chord consists of several notes sounding simultaneously. It is equivalent to a chord progression. Some chords sound harmonious, while others don’t: such chords have the effect of lightening or darkening the impression of a song.

How important is the “harmony” in judging whether you like or dislike a song on first listen?

Factor: sentiment

“Sentiment” means the feelings that you have when you listen to music, which are influenced by whether the lyrics and tune of the music are positive or negative. This question asks

whether you consider it important for music to change your emotions/feelings. Please note that, although the words are similar, it does not refer to whether music is sentimental.

How important is the “sentiment” in judging whether you like or dislike a song on first listen?

Factor: instruments

“Instruments” mean the types of instruments that are used in a song and their sounds.

How important are the “instruments” in judging whether you like or dislike a song on first listen?

Factor: danceability

“Danceability” means whether or not a song makes you want to dance to it. It also includes the idea of whether a song is a “dance song.” There are also songs that make you want to move your body even if they are not necessarily meant for dancing.

How important is the “danceability” in judging whether you like or dislike a song on first listen?

2. Personality traits (section 5.1)

2.1. Instructions

Below are 29 items that describe people’s personalities. For each item, please rate how strongly you agree or disagree with it as a quality to describe yourself (1: strongly disagree; 2: disagree; 3: somewhat disagree; 4: neither agree nor disagree; 5: somewhat agree; 6: agree; 7: strongly agree).

Items

- Quiet
- Outgoing
- Talkative
- Extraverted
- Cheerful
- Hasty
- Irritable
- Genial
- Generous
- Egoistic
- Kind
- Sloppy
- Not punctual
- Haphazard
- Lazy
- Organized
- Careless
- Thorough
- Nervous
- Anxious
- Timid
- Tense
- Depressed
- Progressive
- Imaginative
- Smart
- Multitalented
- Widely interested
- Curious

3. Musical sophistication (section 5.2)

3.1. Instructions

For each of the following nine questions regarding your musical experiences, please select the one response that best applies to you. For the questions about live music, karaoke, and dancing, which have become less frequent or impossible because of the COVID-19 pandemic, please answer according to your life before the pandemic.

3.2. Questions

I engage in regular, daily practice of a musical instrument:

1. Never
2. Less than 1 year
3. 1-2 years
4. 2-4 years
5. 4-6 years
6. 6-10 years
7. 10 or more years

I engage in regular, daily dancing:

1. Never
2. Less than 1 year
3. 1-2 years
4. 2-4 years
5. 4-6 years
6. 6-10 years
7. 10 or more years

I can tell when people sing or play out of time with the beat:

1. Strongly disagree
2. Disagree
3. Somewhat disagree
4. Neither agree nor disagree

5. Somewhat agree
6. Agree
7. Strongly agree

I can tell when people sing or play out of tune:

1. Strongly disagree
2. Disagree
3. Somewhat disagree
4. Neither agree nor disagree
5. Somewhat agree
6. Agree
7. Strongly agree

I listen to music (i.e., music that you choose to listen to, not background music that you unconsciously listen like that played in stores):

1. Less than 15 minutes per day
2. 15-30 minutes per day
3. 30-60 minutes per day
4. 1-1.5 hours per day
5. 1.5-2 hours per day
6. 2-4 hours per day
7. More than 4 hours per day

I listen to music that is new to me (i.e., music that you choose to listen to, not background music that you unconsciously listen like that played in stores), including both newly released songs and songs that were previously released but are new to you for some reason (e.g., recommended by an acquaintance, recommended by a streaming service, etc.):

1. Less than 1 song per month
2. 1-3 songs per month
3. 4-6 songs per month
4. 7-10 songs per month
5. 11-20 songs per month

6. 21-30 songs per month
7. More than 30 songs per month

I view lyrics while listening to music (i.e., lyrics that you choose to see, not lyrics that you unconsciously see like those displayed on TV singing programs):

1. Less than 1 song per month
2. 1-3 songs per month
3. 4-6 songs per month
4. 7-10 songs per month
5. 11-20 songs per month
6. 21-30 songs per month
7. More than 30 songs per month

I sing karaoke (including both public karaoke and singing at home or in other places by using a smartphone or game console):

1. Less than 1 time per year
2. 1-2 times per year
3. 3-5 times per year
4. 6-11 times per year
5. 1-3 times per month
6. 1-3 times per week
7. More than 3 times per week

I attend live concerts as an audience member:

1. Less than 1 time per year
2. 1 time per year
3. 2 times per year
4. 3 times per year
5. 4-6 times per year
6. 7-10 times per year
7. More than 10 times per year

4. Functions based on musical factors (sections 6.1 and 6.2)

4.1. Instructions

Here are three possible functions that could be implemented by using the aforementioned 10 factors. For each function, please read its description and answer how willing you would be to use it if it were implemented on the music streaming service that you use regularly.

4.2. Explanation and question for function 1 (section 6.1.1)

With this function, you register the importance of each of the 10 musical factors on a 5-point scale when judging whether you like or dislike music on first listen (just like the first part of this questionnaire).

The registration process only needs to be done once, and the registered information can be changed later. It is not necessary to register the importance of all factors. For instance, the importance of “rhythm” is not registered in the example below.

	Not important	Hardly important	Somewhat important	Important	Very important
Melody	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rhythm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lyrics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
⋮					
Tempo	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If you register the importance of each factor as shown in the figure, the function would provide the following benefits.

- Suppose that you are listening to your favorite song (“SHAKE” by “MAPS”). You have registered “lyrics” as “very important” and “tempo” as “hardly important.” Hence, among songs that are new to you, we can recommend songs that have a variety of tempos and similar lyrics to your favorite song, as shown below. By listening to the recommended

songs, you can find new favorite songs.



How willing would you be to use this function, on a 5-point scale (“unwilling,” “not very willing,” “undecided,” “reasonably willing,” and “willing”). Please also provide a free response on your willingness. You may give more than one reason.

4.3. Explanation and question for function 2 (section 6.1.2)

This function allows you to rate your song preferences on a factor-by-factor basis for each of the 10 musical factors, as shown by “YOUR evaluations” below.

The ratings are not mandatory: you only need to rate the songs that you want to rate, and you do not need to rate them in terms of all 10 factors. In the example shown on the left, you gave high ratings for “lyrics” and “tempo” because they matched your preferences, a low rating for “melody” because it did not match your preferences, and no rating for “mood.”

Even if you never rated a particular song, by computing the averages of all users' ratings for each factor, we can display others' evaluations (averaged ratings) like that shown on the right.

YOUR evaluations

Angel Baby / Betty				
Lyrics	★	★	★	★
Melody	★	★	★	★
⋮				
Mood	★	★	★	★
Tempo	★	★	★	★

EVERYONE'S evaluations

Angel Baby / Betty				
Lyrics	★	★	★	★
Melody	★	★	★	★
⋮				
Mood	★	★	★	★
Tempo	★	★	★	★

This function would provide the following benefits.

- Suppose that you are interested in an artist named “Betty.” Because “melody” is an important musical factor for you when you judge whether you like or dislike a song, you can sort songs by “Betty” in order of the average ratings for “melody” and listen to the top-ranked songs.



- Suppose that your favorite song “SHAKE” by “MAPS.” By looking at the results of averaging other users' ratings of the song, you can learn how other users perceive it and

even notice new aspects of it.



How willing would you be to use this function, on a 5-point scale ("unwilling," "not very willing," "undecided," "reasonably willing," and "willing"). Please also provide a free response on your willingness. You may give more than one reason.

4.4. Explanations and questions for function 3 (section 6.1.3)

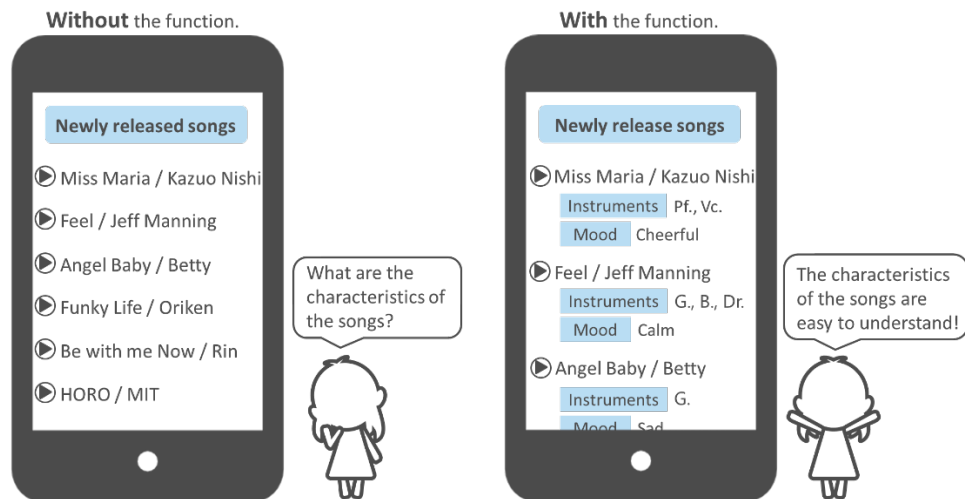
This function displays information on the factors that you want to know for a song, as shown below. The information on each factor is automatically estimated. This example displays information on the four factors of "lyrics," "instruments," "sentiment," and "tempo" for "I love you" by "Makiko Hattori." The function does not require you to input any information.

I love you / Makiko Hattori

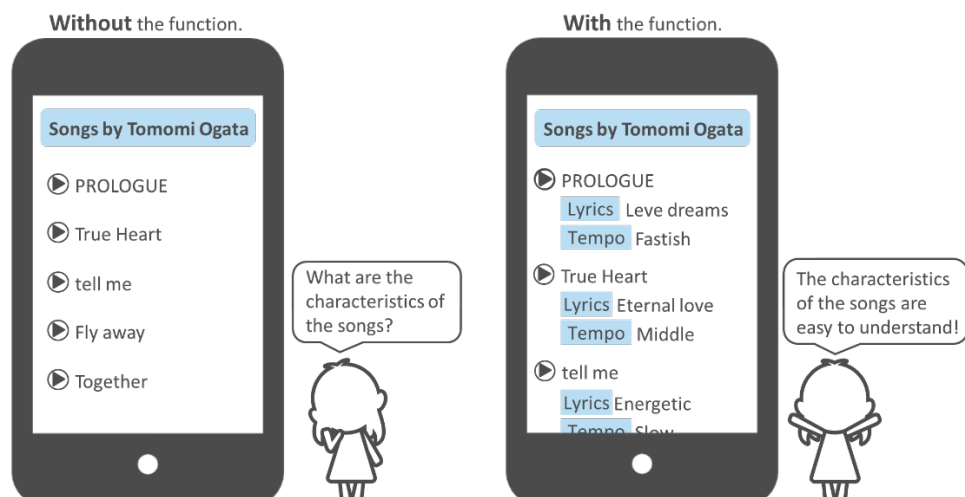
Lyrics	Eternal love
Instruments	G., Pf.
Sentiment	Positive
Tempo	Fastish

This function would provide the following benefits.

- When you check a list of newly released songs on a music streaming service, it usually displays only basic information such as the artist and title for each song, as shown on the left below. This function also displays information on the musical factors for each song, such as information on the “instruments” and “mood” on the right. Hence, if you prefer songs with a quiet mood, you can listen only to such songs by referring to the displayed information on “mood” (e.g., “calm” and “sad”).



- Suppose that you are interested in an artist named “Tomomi Ogata” and want to check a list of the artist’s songs. Usually, only the titles are displayed, as shown on the lower below. This function can also show information on factors like “lyrics” and “tempo,” as shown on the right. This enables you to check for songs with, for example, a fast tempo.



How willing would you be to use this function, on a 5-point scale (“unwilling,” “not very willing,” “undecided,” “reasonably willing,” and “willing”). Please also provide a free response on your willingness. You may give more than one reason.