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Examination of Soundscape-Quality Protocols in Japanese

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ABSTRACT

When assessing perceived soundscape quality, the Swedish Soundscape-Quality Protocol (SSQP) seems to have become a *de facto* standard. While the SSQP was recommended as a tool for assessing the perceived quality of soundscapes in ISO/TS 12913-2, the translatability of the affective attribute scales into other languages has not been fully validated. This study examines soundscape-quality protocols in Japanese from several viewpoints. Findings are as follows: (1) the SSQP scales cannot be fully translated into Japanese without modifications; (2) pleasantness and eventfulness emerge as fundamental components in many situations; and (3) when assessing soundscape qualities, the meanings of some adjectives in the scales vary according to context.

1. INTRODUCTION

Soundscape is based on perception by people, as the introduction of ISO 12913-1 clearly described[1]. Therefore, methods for assessing perceived soundscape quality are important for soundscape studies, and standardization of the method is a crucial issue in the standardization of soundscape research. At the present time, the Swedish Soundscape-Quality Protocol (SSQP)[2] seems to have become a *de facto* standard for assessment of perceived soundscape quality: in fact, the SSQP was recommended as a tool for assessing the perceived quality of soundscapes in ISO/TS 12913-2[3].

It has been pointed out that perceptions of people depend highly on the languages they use[4], and therefore, methods for assessing perceived soundscape quality are also closely linked to the languages: thus, the translatability of methods should be validated before use in other languages. However, as Jeon et al. pointed out[5], although the SSQP has been translated into some 10–15 languages, validations of those translations were discussed in only a handful of studies. Regarding Japanese, although there is some research focusing on perceptual assessments of soundscapes, no study using the SSQP has been done. For this reason, examination of soundscape-quality protocols in Japanese is needed, including examination of translatability of the SSQP into Japanese.

Thus, this study examines soundscape-quality protocols in Japanese from several viewpoints.

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2. TRANSLATABILITY OF THE SSQP INTO JAPANESE

First of all, translatability of the SSQP into Japanese was examined. The adjectives used in the evaluation scales in the SSQP were looked up in six popular English-Japanese dictionaries[6-11]. Table 1 shows the results.

The first point to notice is the translated words for 'uneventful' and 'calm'. The translated words for those two concepts overlap with each other, suggesting that it is difficult to distinguish between them in Japanese[12].

Regarding the six other adjectives of the SSQP, no overlap in meaning was found in the translated words in Japanese. The meanings of those adjectives could also be distinguished in Japanese. However, this is not the only point which determines translatability.

According to the Oxford Thesaurus of English[13], both 'comfortable' and 'enjoyable' are synonyms of the adjective 'pleasant'. Now, let us turn our attention to the Japanese translated words for 'pleasantness'. Those words were divided into two groups: the translated words for 'comfortable' (e.g. '気持ちのよい', '心地よい') and those for 'enjoyable' (e.g. '愉快な', '楽しい'). The important point here is that the meanings of the translated words for 'comfortable' and 'enjoyable' never overlap with each other. Therefore, if the adjective 'pleasant' in the SSQP only means 'comfortable' and there is no nuance of 'enjoyable', this adjective can be translated into Japanese with a single word; however, if this adjective includes both meanings, the word does not correspond to one Japanese word.

Regarding the adjective 'eventful', the meaning of the word seems to have a positive connotation: for example, the definition of the word in the Oxford Dictionary of English[14] is: "marked by interesting or exciting events". However, the Japanese literal translations ('出来事の多い', '多事な') are purely neutral words and other translated words in the English-Japanese dictionaries have slightly more negative connotations. This suggests that there are cultural differences in assessment of eventful situations.

For many years, the orthodox translated word for 'annoying' in the field of noise research has been 'うるさい' (urusai). However, as Namba et al.[15] pointed out, it is known that nuances of the word 'annoying' and 'うるさい' differ from each other.

Regarding other adjectives, although there are no definitive translated words, the translated words for the various adjectives looked up in this study were synonyms, and therefore, it is thought that those words are, at least literally, translatable.

3. STRUCTURE OF SOUNDSCAPE-QUALITY ASSESSMENT IN JAPANESE

Next, the structure of soundscape-quality assessment in Japanese is discussed.

The SSQP was composed from the results of the principal components analysis of the results of soundscape assessment using Swedish attribute scales[16]. The assessment structures of soundscape-quality in Japanese derive from Japanese attribute scales for the soundscape-quality assessments in three different situations, and are compared to the structure of the SSQP.

3.1 Attribute Scales to Assess Soundscape-Quality in Japanese

To select the attribute scales to assess soundscape-quality in this study, first, 23 Japanese adjectives were selected from papers regarding impressions of urban design, landscape design, environmental sounds and soundscapes. Those adjectives were then used in assessment 1 (described in the next subsection), and participants were asked to judge whether the adjectives were difficult to use for the assessment of

Table 1. Translated words for the evaluation scales in the SSQP

Dictionaries	pleasantness	vibrant	eventful	chaotic
reference 6	愉快な(yukai-na) 楽しい(tanoshi) 気持ちのよい (kimochi-no-yoi) いい感じの(ii-kanji-no) さわやかな (sawayaka-na)	ぞくぞくする (zokuzoku-suru) わくわくする (wakuwaku-suru) 震えるような(furueru-youna) 脈動する(myakudou-suru) 活気のある(kakki-no-aru) 生気にあふれる (seiki-ni-afureru) 力強い(chikara-dzuyoi)	できごとの多い (dekigoto-no-oi) 波乱の多い(haran-no-oi) 多事な(taji-na)	混沌とした(konton-to-sita) 無秩序な(muchitujo-na) 大混乱の(dai-konran-no)
reference 7	愉快な(yukai-na) 面白い(omoshiroi) 心地よい(kokochi-yoi) 気持ちのよい (kimochi-no-yoi)	活気の横溢する (kakki-no-ouitsu-suru) 力強い(chikara-dzuyoi) 固唾を飲むような (katazu-wo-nomu-youna) ぞくぞくするような (zokuzoku-suru-youna) スリリングな(suriringu-na)	出来事の多い (dekigoto-no-oi) 多事な(taji-na) 波瀾の多い(haran-no-oi)	混沌とした(konton-to-shita) 無秩序の(muchitujo-no) 大混乱に陥っている (dai-konran-ni-ochiitteiru)
reference 8	楽しい(tanoshi) 愉快な(yukai-na) 心地よい(kokochi-yoi) 気持ちのよい (kimochi-no-yoi)	[活気などで]みなぎる([kakki-nado-de] minagiru) 活気に満ちた(kakki-ni-michita) 鼓動する(kodo-suru) 脈動する(myakudo-suru) 活気に満ちた(kakki-ni-michita)	できごとの多い (dekigoto-no-oi) 多事な(taji-na) 波瀾に富む(haran-ni-tomu)	混沌とした(konton-to-shita) 無秩序の(muchitujo-no) 混乱した(konran-shita)
reference 9	愉快な(yukai-na) 面白い(omoshiroi) 楽しい(tanoshi) 気持ちのよい (kimochi-no-yoi) 天気のよい(tenki-no-yoi) 晴れて心地よい (harete-kokochi-yoi)	(活力などで)みなぎる ((katsuryoku-nado-de) minagiru) 脈打つ(myaku-utsu)	出来事の多い (dekigoto-no-oi) 多事な(taji-na) 波瀾万丈の(haran-banjo-no)	混沌とした(konton-to-shita) 大混乱の(dai-konran-no) 無秩序の(muchitujo-no) めちゃくちゃな状態の(mechakuchana-jotai-no)
reference 10	楽しい(tanoshi) 魅力的な (miryokuteki-na) 気持ちのよい (kimochi-no-yoi) 快い(kokoroyoi) <天候が>よい (<tenko-ga> yoi> 快適な(kaiteki-na)	活気に満ちた(kakki-ni-michita) 活気にあふれた (kakki-ni-afureta) ぞくぞくさせる (zokuzoku-saseru) わくわくさせる (wakuwaku-saseru)	出来事の多い (dekigoto-no-oi) 事件の多い(jiken-no-oi) 多事の(taji-no) 波乱に富んだ(haran-ni-tonda)	混沌とした(konton-to-shita) 混乱した(konran-shita) 秩序を欠いた (chitujo-wo-kaita)
reference 11	快い(kokoroyoi) 楽しい(tanoshi) 愉快な(yukai-na) <天候が>気持ちのよい(<tenko-ga> kimochi-no-yoi)	活気に満ちた(kakki-ni-michita) 精力的な (seiryokuteki-na) 活発な(kappatsu-na)	事件の多い(jiken-no-oi) 波乱に富んだ(haran-ni-tonda)	混沌とした(konton-to-shita) 無秩序な(muchitujo-na)

Table 1. Translated words for the evaluation scales in the SSQP (cont.)

Dictionaries	annoying	monotonous	uneventful	calm
reference 6	うるさい(urusai) 迷惑な(meiwaku-na)	単調な(tancho-na) 一本調子の(ippon-choshi-no) 変化のない(henka-no-nai) 退屈な(taikutsu-na)	たいした事件のない(taishita-jiken-no-nai) 波乱のない(haran-no-nai)	穏やかな(odayaka-na) 静かな(sizuka-na)
reference 7	うるさい(urusai) 迷惑な(meiwaku-na)	変化のない(henka-no-nai) 一本調子な(ippon-choshi-na) 千篇一律な(senpen-ichiritu-na) 退屈な(taikutsu-na) 単調な(tancho-na)	事件のない(jiken-no-nai) 多事でない(taji-de-nai) 波乱のない(haran-no-nai) 平穏無事な(heion-buji-na) 平凡な(heibon-na)	穏やかな(odayaka-na) 静かな(shizuka-na) 平穏な(heion-na) 太平な(taihei-na) 平和な(heiwa-na)
reference 8	いらいらさせる(iraira-saseru) うるさい(urusai) いやな(iya-na) うっとうしい(uttousi)	単調な(tancho-na) 一本調子の(ippon-choshi-no) 変化のない(henka-no-nai) つまらない(tsumaranai) 退屈な(taikutsu-na)	普通の(hutsu-no) きまりきった(kimarikitta) 平穏な(heion-na) 静かな(shizuka-na) これといった事件もない(kore-to-itta-jiken-mo-nai)	穏やかな(odayaka-na) 静かな(shizuka-na) 平穏な(heion-na)
reference 9	人を悩ます(hito-wo-nayamasu) いらいらさせる(iraira-saseru) 迷惑な(mwiwaku-na) 厄介な(yakkai-na)	変化のない(henka-no-nai) 単調な(tancho-na) (変化がなくて)退屈な((henka-ga-nakute) taikutsu-na)	事件のない(jiken-no-nai) 波乱のない(haran-no-nai) 無事平穏な(buji-heion-na) 不都合のない(futsugo-no-nai)	穏やかな(odayaka-na) 静かな(shizuka-na) 平穏な(heion-na)
reference 10	いらだたせる(iradataseru) やっかいな(yakkai-na) うるさい(urusai)	単調な(tancho-na) 一本調子の(ippon-choshi-no) (変化がなくて)退屈な((henka-ga-nakute)	事件のない(jiken-no-nai) これといった事が起こらない(kore-to-itta-koto-ga-okoranai) 平穏無事な(heion-buji-na)	平穏な(heion-na) 穏やかな(odayaka-na)
reference 11	いら立たせる(iradataseru) うるさい(urusai)	単調な(tancho-na) 一本調子の(ippon-choshi-no) 変化のない(henka-no-nai) 退屈な(taikutsu-na)	何事も(変わったことの)ない(nanigoto-mo(kawatta-koto-no)nai) 平穏無事な(heion-buji-na)	穏やかな(odayaka-na)

the impressions of soundscapes. As a result, five adjectives which more than ten people evaluated as difficult to use were omitted from the list. Table 2 shows the 18 adjectives used in this study and their literal translations. These adjectives were evaluated using a five-point unipolar scale (does not match at all – not match – neither – match – extremely good match).

3.2 Assessment Procedures

In this study, three sets of assessments (Assessment 1, 2, 3) were conducted in different contexts. The procedures were as follows.

3.2.1 Assessment 1

Soundscapes in a class, including some group work, were assessed by the university students[17]. The topic of the class was consideration of daily lives from the

Table 2. Adjectives used for soundscape-quality assessment in this study

1	楽しい	2	心地よい	3	快い
	(pleasant/enjoyable)		(comfortable/pleasant)		(comfortable/pleasant)
4	活気がある	5	賑やかな	6	無秩序な
	(vibrant)		(eventful/lively)		(chaotic/disordered)
7	雑然とした	8	騒々しい	9	単調な
	(chaotic/messy)		(noisy/annoying)		(monotonous)
10	退屈な	11	平凡な	12	落ち着いた
	(monotonous/boring)		(common/uneventful)		(uneventful/calm)
13	静穏な	14	親しみがある	15	身近な
	(tranquil/calm)		(familiar)		(familiar/close)
16	圧迫感がある	17	調和がとれた	18	情報量が多い
	(oppressive)		(congruent/harmonious)		(informative)

The numbers in this table correspond to the numbers in Figure. 1

viewpoint of health promotion. The topic was not directly related to acoustics or soundscape. The class consisted of four parts: 1. Introduction; 2. Completion of written worksheets; 3. Group work; and, 4. Concluding lecture.

At the end of the introductory part, students were advised that they would need to assess the sonic environments of the classroom four times during the class, using the assessment sheets. Then, for the first evaluation, they were required to provide their impression of the soundscape during the introductory session using the assessment sheet.

Next, students were required to quietly complete worksheets regarding their daily lives. Following this they were asked to provide an impression of the sonic environment during this part.

Then, all students walked around the classroom, and talked with other students about their daily lives using their worksheets. After this group activity, students assessed the soundscape during the group work.

Finally, at the end of the concluding lecture, students were asked to evaluate the soundscape after the lecture.

In the assessment sheets used for Assessment 1, there were 24 attribute scales using the adjectives shown in Table 2, plus five adjectives judged as difficult to use for the assessment by more than 10 students in this assessment, and the adjective '好き' （like）. In addition, checkboxes were placed next to the respective scales to check if participants judged any adjectives as difficult to use for the assessment of soundscapes.

The number of students in the class was 156 and valid assessments were obtained from all these participants.

3.2.2 Assessment 2

Assessment 2 was conducted as part of a laboratory experiment concerning the acceptable sound levels for road traffic noise in parks[18]. Participants watched videos of six parks, and were asked to provide their impressions of each location using the assessment sheets. All the videos were 90 seconds long and recorded by a head and torso simulator (HATS) and high-definition camera.

In the assessment sheets for Assessment 2, 24 attribute scales (the same as for Assessment 1) were used, but the checkboxes to express difficulty in using each adjective were not used. In this study, data obtained using the 16 scales listed in Table 2 were analysed.

Twenty-six participants took part in the experiments. No participant had ever been diagnosed with hearing loss.

3.2.3 Assessment 3

Assessment 3 was conducted as part of a soundwalk[19]. The main purpose of the soundwalk was the assessment of the soundscapes of six resting spaces around the central urban district in Fukushima city. These resting places included benches on sidewalks, in squares and in a park. Participants walked through the defined course with the leader of the soundwalk. When they reached the different resting spaces, they sat on the benches and assessed the soundscapes using assessment sheets.

The assessment sheet for Assessment 3 included 16 attribute scales listed in Table 2. The sheet omitted the checkboxes that had been used in the initial assessment sheet. Eleven participants took part in the soundwalk.

3.3 Results of the Assessments

Each dataset obtained from the three assessments was analysed by principal component analysis. In each analysis, three principal components with eigenvalues greater than 1 were obtained. The varimax rotation method was used to extract orthogonal factors. Figure 1 shows the results.

The results for Assessment 1 (Figure 1 (a)) show component loadings for the component 1 of '賑やかな' (**5**: eventful/lively), '騒々しい' (**8**: noisy/annoying), '活気がある' (**4**: vibrant), '雑然とした' (**7**: chaotic/messy), and '無秩序な' (**6**: chaotic/disordered) were highly positive, and that of '静穏な' (**13**: tranquil/calm), '落ち着いた' (**12**: uneventful/calm) and '単調な' (**9**: monotonous) were highly negative. Thus component 1 represents eventfulness. Component loadings for the component 2 of '心地よい' (**2**: comfortable/pleasant) and '快い' (**3**: comfortable/pleasant) were highly positive. This result was interpreted as component 2 representing pleasantness. Regarding component 3, component loading of '退屈な' (**10**: monotonous/boring) is highly positive and this was interpreted as component 3 representing boredom.

Figure 1 (b) shows the results of Assessment 2 with component loadings for component 1 of '活気がある' (**4**: vibrant), '賑やかな' (**5**: eventful/lively) and '騒々しい' (**8**: noisy/annoying) were highly positive, and that of '静穏な' (**13**: tranquil/calm), '落ち着いた' (**12**: uneventful/calm) and '単調な' (**9**: monotonous) were highly negative. These results were interpreted as component 1 represents eventfulness, similar to the results of Assessment 1. Also, component loadings for component 2 of '快い' (**3**: comfortable/pleasant) and '心地よい' (**2**: comfortable/pleasant) were highly positive, which means the result was interpreted as component 2 represents pleasantness, similar to Assessment 1. Regarding component 3, component loadings of '身近な' (**15**: familiar/close) and '親しみのある' (**14**: familiar) were highly positive and interpreted as component 3 representing familiarity.

Results of Assessment 3 are shown in Figure 1 (c). Component loadings for the component 1 of '静穏な' (**13**: tranquil/calm), '落ち着いた' (**12**: uneventful/calm), '快い' (**3**: comfortable/pleasant) and '心地よい' (**2**: comfortable/pleasant) were highly positive, and that of '騒々しい' (**8**: noisy/annoying), '賑やかな' (**5**: eventful/lively) and '活気がある' (**4**: vibrant) were highly negative. Thus component 1 represents both pleasantness and eventfulness. Regarding component loadings for component 2, '退屈な' (**10**: monotonous/boring) and '単調な' (**9**: monotonous) were highly negative. This result shows that component 2 represents monotonousness. Regarding component 3, component loadings of '身近な' (**15**: familiar/close) and '親しみのある' (**14**: familiar) were highly positive and this was interpreted as component 3 representing familiarity.
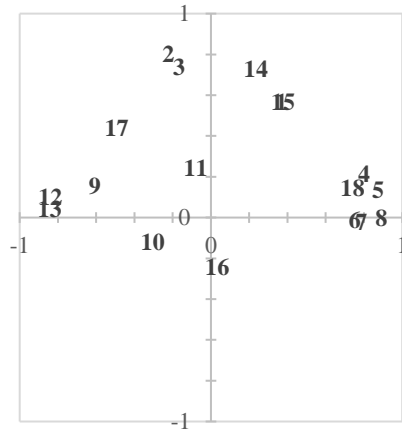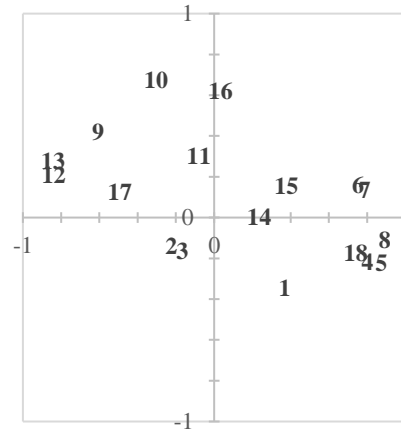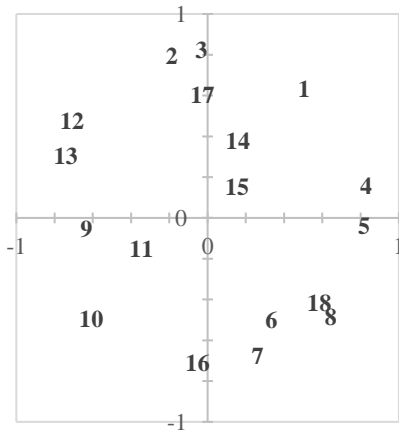
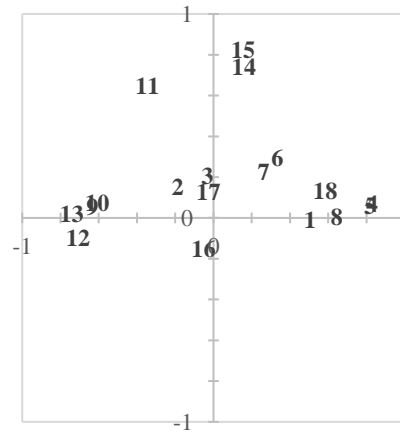component 1-2 plane   component 1-3 plane
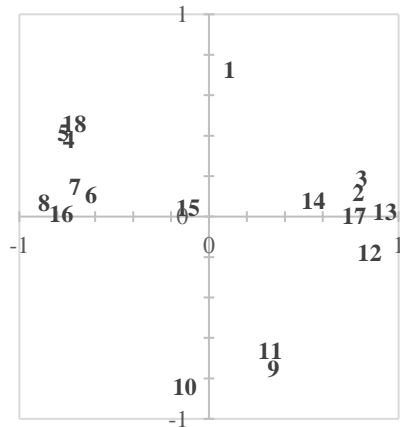
(a) Assessment 1

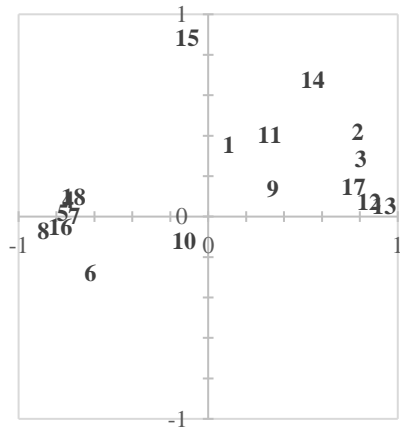component 1-2 plane   component 1-3 plane

(a) Assessment 2

component 1-2 plane   component 1-3 plane

(a) Assessment 3

Figure 1. Component loadings of the adjectives
The numbers in these tables correspond to the numbers in Table 2.

Comparing the results of the assessments, Assessments 1 and 2 have a similar basic structure, that is, where component 1 represents eventfulness and component 2 pleasantness. This structure also corresponds to the basic structure of the SSQP[2,16]. However, the structure of Assessment 3 differs from the others. For this assessment, participants clearly indicated that the less eventful a space, the more pleasant it was judged. This relationship between eventfulness and comfort and pleasantness, is thought to be because the sites selected for this study had main sound sources of road traffic, railway, and construction noises. In this situation, it is reasonable that the participants considered that the more uneventful an area, the more pleasant it was. Considering this reasoning, we can conclude that pleasantness and eventfulness are also the main components for the perceived quality of a soundscape in Japanese.

We can shed light on the positions of the adjectives on the pleasantness–eventfulness plane (component 1–2 planes) in the different assessments.

First, the adjectives concerning 'pleasant' are discussed. On the pleasantness–eventfulness planes in all assessments, '心地よい' (2: comfortable/pleasant) and '快い' (3: comfortable/pleasant), which mean 'pleasant as comfortable', were always closely linked, but '楽しい' (1: pleasant/enjoyable) was always located far from those adjectives. This result strongly supports the fact that there is no single Japanese word which means both 'pleasant as comfortable' and 'pleasant as enjoyable', as pointed out in section 2.

Next, '活気がある' (4: vibrant) and '賑やかな' (5: eventful/lively) are discussed. These two adjectives were located closely in all assessments. However, on the pleasantness–eventfulness plane in the SSQP[2,16] 'eventful' was located close to the eventfulness axis, and 'vibrant' was located midway between eventful and pleasant. This suggests that the nuance of '活気がある' (4: vibrant) and 'vibrant' (in English) are different for the two languages.

Regarding '雑然とした' (7: chaotic/messy), and '無秩序な' (6: chaotic/disordered), these two adjectives were closely linked in all the assessments in this study, but their positions on the planes varied for the different assessments. They were located as unpleasant and eventful in Assessments 2 and 3, but as eventful only (not pleasant or unpleasant) in Assessment 1. These results suggest that the nuance of 'chaotic' expressed on the pleasantness–eventfulness plane differs depending on the contexts of assessment.

A similar result was observed regarding '騒々しい' (8: noisy/annoying). This adjective was located as unpleasant and eventful on the pleasantness–eventfulness planes in Assessments 2 and 3, but located only as 'eventful' (neither pleasant nor unpleasant) in Assessment 1.

Concerning '単調な' (9: monotonous) and '退屈な' (10: monotonous/boring), although both words were located as uneventful, they were located separately and the distances varied between the assessments. Also, although '単調な' (9: monotonous) tended to be located as more pleasant than indicated by the location of '退屈な' (10: monotonous/boring) on the pleasantness axis, the position of those words in the direction of the pleasantness axis differed between the assessments. In addition, component loading for the component 3 of '退屈な' (10: monotonous/boring) in Assessment 1 was highly positive, and component loading for component 2 of '単調な' (9: monotonous) and '退屈な' (10: monotonous/boring) in Assessment 3 was very negative. These results mean that component 3 in Assessment 1 and component 2 in Assessment 3 were interpreted on the monotonousness axis, and that monotonousness is independent from pleasantness and eventfulness in some contexts.

Finally, the adjectives regarding 'uneventful' and 'calm' are discussed. In the results of all assessments, '落ち着いた' (12: uneventful/calm) and '静穏な' (13:

tranquil/calm) were closely located. This result supports that it is difficult to distinguish between 'uneventful' and 'calm' in Japanese, as pointed out in section 2. In addition, these two words were located as uneventful, and not pleasant or unpleasant, in Assessment 1; uneventful and a little bit pleasant in Assessment 2, and uneventful and pleasant in Assessment 3. This means the nuances of '落ち着いた' (**12**: uneventful/calm) and '静穏な' (**13**: tranquil/calm) expressed in the direction of pleasantness were different depending on the context of the assessments. Regarding '平凡な' (**11**: common/uneventful), the adjective was located at a totally different position from '落ち着いた' (**12**: uneventful/calm) and '静穏な' (**13**: tranquil/calm). This means that 'uneventful as common' and 'uneventful as calm and tranquil' have totally different meanings in Japanese.

4. CONCLUDING REMARKS

Our discussion clearly shows that the basic structure of the perceived soundscape quality in Japanese is the same as that of the SSQP. Pleasantness and eventfulness are the main components for the assessments. However, the meanings of some adjectives expressed on the pleasantness–eventfulness plane differ between assessment scales in Japanese and the SSQP. In addition, some adjectives in the SSQP are not translatable into Japanese. To ensure the ISO 12913 series adheres to truly international standards, we must solve these linguistic/translational problems.

Furthermore, the meaning of some adjectives in the assessment scales varies according to the context of assessments. This suggests that there are some adjectives that have rigid meanings and some whose meanings fluctuate depending on the contexts of the assessments. To develop more versatile assessment scales, we must be aware of this fact.

6. REFERENCES

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