Comparing soundscape evaluations in French and English across three studies in Montreal

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ABSTRACT

Soundscape evaluations rely heavily on verbal descriptors often using Likert-type scales such as the Swedish Soundscape Quality Protocol (SSQP). While these scales have been validated in Swedish and English, the French-speaking soundscape community has struggled to find suitable French equivalents. Questionnaires (N = 485) were gathered in French and English in 3 urban locations (small and large park, a restaurant) using the SSQP, noise sensitivity (NSS) and restorativeness scales in addition to open-ended questions. A principal components analysis revealed that the French translation of the SSQP yielded similar components to the English translation, with one main difference concerning the "monotonous" scale. In line with previous studies using the SSQP, the first components refer to "pleasant" and "eventful" respectively for both French and English. The third component however was different across languages ("monotonous" only in English, "monotonous" and "calm" in French). Regarding NSS, both languages produced one component; however, minor, albeit significant differences, were explained by the age of the respondents. This across-study analysis, aided by Montreal's unique status as a bilingual city, supports future uses of French-language materials for soundscape evaluations, especially the SSQP and NSS.

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1. INTRODUCTION

Soundscape evaluations rely heavily on verbal descriptions of the acoustic environment made by people in the languages they speak. The sizeable French soundscape community has struggled to find French equivalents to soundscape scales developed and tested in English. This problem applies to both established and new measures/scales.

1.1 Established Scales

With the objective to reliably measure soundscape quality, Axelsson et al. (1) developed the Swedish Soundscape Quality Protocol (SSQP), which presents perceived affective quality attributes. From their experiments, they developed a model with three dimensions of soundscape quality: pleasantness, eventfulness, and familiarity. Subsequently, they refined their model to remove familiarity and incorporate appropriateness (2). The SSQP includes an item with 8 unidimensional Likert scales, and has been validated in English and other languages, but not in French (3). To the best of our knowledge, a French translation was included in a questionnaire study in the context of the HOSANNA (HOlistic and Sustainable Abatement of Noise by optimized combinations of Natural and Artificial means) EU-funded project but the results have not been published.

In addition to soundscape descriptors, individual noise sensitivity levels have also been observed to be a factor in emotional and behavioral responses to noise. Weinstein (4) created and tested a scale, the Noise Sensitivity Scale (NSS) that measures noise sensitivity and reliably probes affective reactions to noise in different settings. Notably, they found that noise annoyance is correlated with individual noise

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sensitivity. This is corroborated by more recent studies, both in indoor and outdoor environments (5). Weinstein (4) also found a significant influence of personality traits, specifically the degree of extraversion, on noise sensitivity and annoyance. Again, this has been supported by recent work (6) that correlated noise sensitivity to introversion and neuroticism. The literature is less consensual about the influence of age on noise sensitivity, but whenever there is a significant effect, noise sensitivity positively increases with age (7).

The original NSS was deployed with 21 judgments, but a 5-point index has been demonstrated to be nearly as effective (correlations between .86 and .91 between the original and short form) (6), and is more readily deployed in questionnaires. Other scales for assessing global noise sensitivity have been developed and validated in a number of languages and countries, such as the NoiSeQ (8), with more complex models. As such, they explore more aspects of noise sensitivity but take longer to complete.

When translating scales, difficulties may occur due to the influence of geographical context and culture on meaning (9). Montreal, an important bilingual city, offers a unique opportunity for a French-English bilingual comparison of the same environment due to a high number of fluent long-term residents of multiple languages, especially in a setting where the quantities of natively speaking participants of two languages were comparable (10). Contextually, it offers the opportunity to conduct a study in a truly bilingual context, both with bilingual participants and as a co-location of fluent French and English speakers. As a further point, results with Canadian French might also differ from previous studies conducted largely in France (e.g. *écoeurant* roughly means "disgusting" or "sickening" in European French, while it can mean "delicious" in Canadian French-Canadian, particularly in slang.)

In this paper we collapse survey results collected in three separate environments in Montreal in the summer 2015: an indoor restaurant and two urban parks, further described below. While the locations compared are very different at first glance (i.e. indoor v. outdoor), they all exhibit high degrees of socialness, musicality, and conviviality and are situated in the cultural center of Montreal.-This paper focuses only on the comparison of the quantitative results between French and English responses.

2. METHODS

The main data collection instrument was the questionnaire. Numerous versions of the same questionnaire were deployed with contextually appropriate differences in various conditions, but they were based on a common template. For a further discussion of the quantitative scales and why they were selected, see Steele et al (11) in these same proceedings . We only report here the questions that are common across the three conditions.

2.1 Questionnaire

The questionnaire template was constructed from a number of validated protocols and scales, namely Likert scales on the participants' soundscape perception (including the SSQP)(3), demographics (age, sex)(4), noise sensitivity (NSS)(6), and personality (extraversion)(12). In addition, new questions formulated by the research team were included as appropriate, namely questions on the participants' mood and further perceptions of the soundscape. The questionnaires combined closed-ended questions (reported here) and open-ended questions (beyond the scope of this paper).

All versions of the questionnaire took participants fewer than 10 minutes to complete. It was conducted on a double-sided page, which we offered either entirely in French or entirely in English depending on their preference (i.e. not side-by-side translations). The questions pertained to the participants' evaluations of soundscape descriptors, and its appropriateness, as well as judgment on sound level, frequency of visits to the location, number and type of people with them, simple demographics (age, sex), place of living, the 5-item NSS, and the extraversion item from the five-item personality inventory.

Our team members, all fluent in both French and English translated the scales from English to French and piloted the translations with native French speakers from Quebec. We included our own versions of these translations because previous versions had not been validated. In response to the pilot, we adapted the standard SSQP and further removed one descriptor (uneventful) due to the difficulty of finding a unique and appropriate translation (*tranquille, calme*) that did not encroach upon the meaning of other items of the scale.

The seven SSQP descriptors used were therefore, in order:
- Pleasant (*Agréable*)
- Unpleasant (*Désagréable*)

- Eventful (*Animé*)
- Vibrant (*Dynamique*)
- Monotonous (*Monotone*)
- Calm (*Calme*)
- Chaotic (*Chaotique*)

To this established scale, we added questions about the participants' perception of the soundscape, namely Likert scales regarding soundscape appropriateness, sound level, and sound level appropriateness (see Table 1).

Table 1 – Additional sound-related questions

Item	Question - English	Question - French	Scale
Soundscape Appropriateness	"The soundscape I hear is appropriate for my activity."	"*L'environnement sonore est approprié pour mon activité.*"	7-point Likert scale from "Strongly disagree" ("*Pas du tout d'accord*") to "Strongly agree" ("*Tout à fait d'accord*")
Sound Level	"The sound level of the park is…"	"*Le volume sonore du parc est…*"	5 labels from "very quiet" ("*très bas*") to "very loud" ("*très élevé*")
Sound Level Appropriateness	"I find that level to be…"	"*Je trouve le volume sonore…*"	5 labels from "much too quiet" ("*beaucoup trop faible*") to "much too loud" ("*beaucoup trop fort*")

We also used a reliable shortened version of the Weinstein Noise Sensitivity scale (NSS), with 5 self-administered Likert scales, instead of the 21 items of the original scale (see Table 2).

Table 2 – 5-item Noise Sensitivity Scale

English translation	French translation
"I am sensitive to noise."	"*Je suis sensible au bruit.*"
"I find it hard to relax in a place that's noisy."	"*Je trouve difficile de me relaxer dans un endroit bruyant.*"
"I get mad at people who make noise that keeps me from falling asleep or getting work done."	"*Je me mets en colère contre les personnes qui font du bruit qui m'empêche de m'endormir ou de travailler.*"
"I get annoyed when my neighbors are noisy."	"*Je m'énerve quand mes voisins sont bruyants.*"
"I get used to most noises without much difficulty."	"*Je m'habitue à la plupart des bruits sans difficultés.*"

2.2 Conditions

Similar questionnaires (N = 485) were gathered across 3 locations (Parc du Portugal, Parc La Fontaine, Restaurant de l'Institut ITHQ).

2.2.1   Parc du Portugal

The Parc du Portugal is a small urban park with a gazebo characterized by a noisy urban soundscape (cars, buses, passersby) due to its location on a big boulevard. It is also located in a lively, musical neighborhood, partially rooted in Portuguese culture. The questionnaires were taken in conjunction with a soundscape intervention with participants before the intervention and during, which included both users and non-users of the system that was included. This intervention was called Musikiosk and is explained in more detail in Steele et al. (13) – technical aspects – Steele et al. (11) deployment of the questionnaire – and Bild et al. (14) – sociological implications.

Participants were recruited simply by asking them if they were willing to fill out a short, 5-minute questionnaire while they were using the park. We tried to collect data at every hour of activity every day of the week. Some participants were neither English nor French speakers, and filled out the questionnaires in the language of their choice, sometimes with help from the researchers.

We obtained 88 questionnaires (60 in French, 28 in English) before the installation of the Musikiosk, 41 (22 in French, 19 in English) with users of the device, and 68 (45 in French, 23 in English) with non-users after its installation in the Parc du Portugal.

2.2.2   Restaurant

This questionnaire was deployed in a Montreal restaurant (Restaurant de l'Institut de Toursime et d'Hôtellerie du Québec). The restaurant was selected in order to study the relationship between its noisy environment and convivial character. Participants were approached at the end of their meal and asked to fill out our questionnaire in the language of their choice as part of a larger research project on the influence of soundscape on diners' experience. All 247 participants were given a small food gift for their time, 216 completed the questionnaire in French, and 31 in English.

2.2.3   Parc La Fontaine

This questionnaire was administered in a lively and popular Montreal park that the researchers presumed would maximize soundscape pleasantness. This study was conducted as a "pleasant" control for comparison with other studies described here. This questionnaire was identical to the Musikiosk pre-installation questionnaire. In the Parc La Fontaine, we collected 41 (30 in French, 11 in English) questionnaires. A further description of this study will be available in Steele et al. (15).

2.3   Statistical analyses

The statistical analyses consisted in non-parametrical mean comparisons (Mann-Whitney tests) between the French and English ratings and Principal Component Analyses (PCAs) on the SSQP and NSS scales since the assumptions for parametric tests were not met. The number of data points may vary between tests and items, due to non-answers, or illegible answers.

3   RESULTS

3.2   Mann-Whitney Comparisons of Mean

The Mann-Whitney tests between French and English ratings revealed that French ratings are significantly lower for the "chaotic" item ($p=0.001$) of the SSQP than the English ratings. They are significantly higher for the "eventful" item ($p=0.026$) of the SSQP, sound level appropriateness ($p=0.002$), extraversion ($p=0.001$), frequency of use ($p=0.011$), age ($p=0.000$), and the time (in years) they've lived in Montreal ($p=0.000$); as well as for the following NSS items: "sensitive to noise" ($p=0.000$), "hard to relax" ($p=0.000$), and the total NSS score ($p=0.033$).

3.3   Principal Components Analyses

The PCAs on the Soundscape Quality Protocol ratings (see Figure 1) for both languages share similarities. They both yielded 3 similar dimensions explaining 74% variance in French, and 77% in English. Their first component is a pleasantness – unpleasantness axis, the second one, eventfulness, and the third one, monotony. For both PCAs, the "vibrant" and "eventful" ratings are always grouped together very closely.

The main difference is that "monotonous" is close to "calm" on the third component in French, going in the same direction, mildly opposite on the first; while "monotonous"; stands alone and only on the third dimension in English, "calm" weighing on the first component only. Another notable difference is that "pleasant" and "chaotic" can be found on the first and second components in English, but only on the first in French.
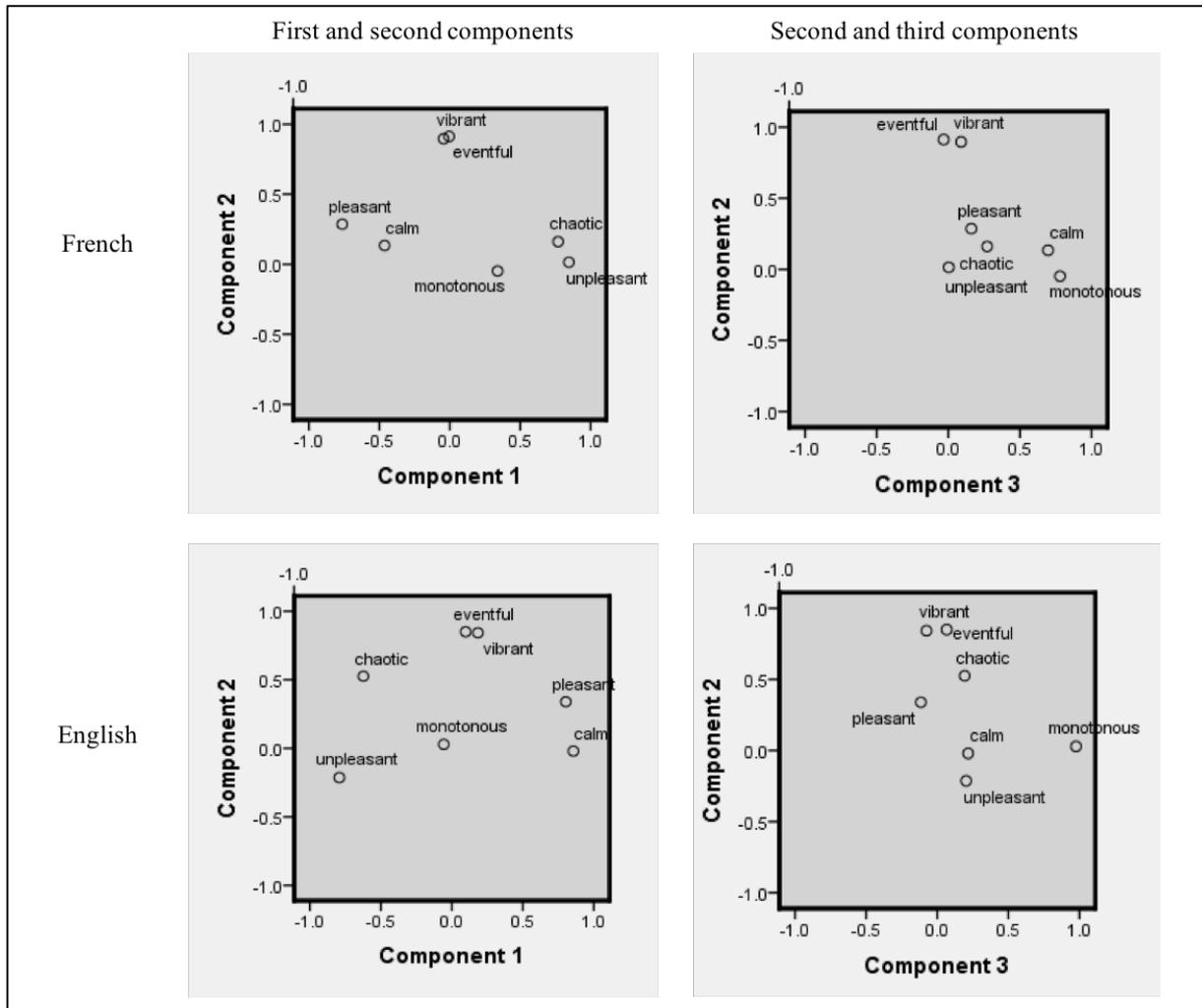
Figure 1 – Principal component analysis (PCA) on the seven Swedish Soundscape Quality Protocol

(SSQP) scales in French (above) and English (bottom)

As for the PCAs on the Noise Sensitivity Scales in English and French, with the three contexts combined, they both yielded only one component, and looked very similar, with only the "get used to noise" item going in the opposite direction of the four others items, as expected.

Separate PCAs on the NSS for the different contexts were 1-dimensional in both languages in the park, and in English in the restaurant, but 2-dimensional for French in the restaurant. For this last PCA, the first component is explained by the items "annoyed at neighbors" and "get mad", and the second one by "sensitive to noise" and "hard to relax", with "get used to noise" opposite on both dimensions.

4   DISCUSSION AND CONCLUSIONS

The French-speaking scientific community, especially in the behavioral sciences, needs reliable translations of established and new scales. This study shows that our translations of the perceptual descriptors from the Swedish Soundscape Quality Protocol (SSQP) and the shortened 5-item Noise Sensitivity Scale (NSS) are reliable, both indoors and outdoors. We chose not to offer side-by-side translations, to identify conceptualizations as conveyed in only one language.

The PCAs on the SSQP ratings reveal very similar results between French and English, and are in line with Axelsson's laboratory study (1), with a main components of pleasantness, and a secondary one of eventfulness. These findings suggest that these components are robust across languages, environments and testing conditions (e.g. laboratory settings vs. outdoor). The third component, monotony, is also similar between languages, except that "monotonous" loads the component more

strongly alone in English than in French, where the component is also loaded by "calm". Conversely, the "pleasant" and "chaotic" ratings in French solely load the pleasant-unpleasant component, while being associated with "eventful" in English.

Notably, the mean comparisons between languages reveal differences of ratings on the "chaotic" ("*chaotique*") and "eventful" ("*animé*") scales. "Chaotic" and "eventful" in English seem closer in meaning than their French translations, for which "*animé*" can be a bit more positive. This seems corroborated by the higher ratings of Sound Level Appropriateness for participants who filled out the French questionnaire. This more positive perception might be explained by a higher familiarity with the city; the French participants being older and having lived longer in Montreal, they reported coming more frequently to each of the locations. Furthermore, French speakers rated themselves as more extraverted, which could also have influenced their perception of the soundscape as more positive.

The results on the NSS ratings are also highly similar in English and French, with only the French translation in the restaurant condition on its own diverging from the one-dimensional pattern. This could be explained by a combination of language and setting conditions, the majority of the restaurant patrons being French and older as well as unbalanced sample sizes (216 in French vs. 31 in English). In French, we see a divide between the two items involving emotions (getting mad and annoyed), and the two about physiological reaction (being sensitive to noise and unable to relax), that can be explained by the meaning carried by the French translation of "getting mad" ("*se mettre en colère*") and "getting annoyed" ("*s'énerver*"). Compared to the English, they involve the idea of action; many French-speaking participants felt the need to explain they wouldn't necessarily act upon those feelings of annoyance, and even more in the setting of the restaurant, where such feelings would be out of place. Though it's beyond the scope of this paper, we also compared the PCAs of the SSQP between indoor and outdoor locations and did not find major differences, suggesting primarily that it was appropriate to collapse these results, but also that the use of the SSQP could be extended to include indoor environments.

Further work is required to further explore the relationships between soundscape evaluations, demographics, and noise sensitivity in the context of urban, shared, and public spaces, including indoor environments. This work will include a comparison with free response data that might help us interpret the nature of these relationships.

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