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Validated translation into Portuguese of perceptual attributes for soundscape assessment

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Abstract
To support the dissemination of soundscape terminology and use in different languages, a collaboration of researchers from different regions of the world was established under the name of "Soundscape Attributes Translation Project" (SATP) to validate the translation of perceptual attributes for soundscape assessment published in the ISO/TS 12913-2:2018 standard (Acoustics - Soundscape - Part 2: Data Collection and reporting requirements). Translation into 15 different languages was already proposed, but the Portuguese language remained unrepresented. To fill this gap, the objective of this article is to present the translation of the referred attributes from the original terms in English into Portuguese (Brazil and Portugal), seeking their harmonization and validation. Lay people and experts were consulted through surveys to consider the meanings of the terms in English and to draft a preliminary translation. Then, the authors worked to refine the translations, until consensus was reached. The outcomes of the study and the proposed translations are presented.

Keywords: soundscape attributes, sound perception.

1 Introduction

In recent years, investments in soundscape tools became relevant to society and community stakeholders as an alternative to noise control policies [1] towards a proactive approach to promoting the health and well-being of the sonic environment [2]. Initially, "soundscape" terminology appeared with Southworth [3] in his urban studies and became popular with the Canadian music composer Murray Schafer [4]. Soundscape assessments go well beyond simple individual auditory judgment. It includes diversity in many dimensions like sound sources, contexts, and individuality of participants. Given these variances, efforts on standardizing are encouraged to develop a reference method for comparing different studies within an international community and interdisciplinary collaboration [5]. In 2008, the International Organization for Standardization (ISO) established the working group ISO/TC 43/SC 1/WG 54 "Perceptual assessment of soundscape quality" to support theoretical and methodological harmonization in soundscape studies and practice. It resulted in the publication of the three parts of the standard series ISO 12913. This standard defines the term as to how people perceive the acoustical environment within a context in time and space. It

has a human-centred approach that includes the auditory sensation, interpretation, and responses to the acoustic environment [6]. There are currently three different soundscape standards as follows: ISO 12913-1:2014 related to framework and definitions [6]; ISO/TS 12913-2:2018 associated with data collection methods [7]; and ISO/TS 12913-3:2019 regarding data analysis [8].

Method A of ISO/TS 12913-2:2018 [7] describes the methodology of data collection for assessing soundscape based on the rating of eight attributes. Each of these attributes, also called perceptual attribute (PA), were scaled by subjects according to the suitability to soundscape descriptions. The eight PAs listed in method A of ISO/TS 12913-2:2018 are derived from Axelsson and colleagues [9] work on a principal component analysis of 116 attributes from 50 soundscapes. These effective responses represent a two-dimensional model where the main dimension is related to how pleasant or unpleasant the environment was judged and therefore labelled as pleasantness. The second dimension relates to the amount of human and other activities and is also represented by how eventful or uneventful the acoustic environment is perceived to be and labelled as eventfulness [8]. If the pleasantness and eventfulness axes rotate 45° from the two main dimensions, two alternative dimensions appear. One dimension represents chaotic versus calm environments, and the second dimension denotes monotonous versus vibrant environments [8].

As a result of the application of this model, the eight PAs are: pleasant, annoying (based on the tradition in environmental noise research, the term ‘annoying’ is used instead of ‘unpleasant’), eventful, uneventful, calm, chaotic, vibrant, and monotonous. A pleasant soundscape consists of an acoustic environment that stimulates joy in people as a quiet park [9]. An annoying soundscape with a history from environmental noise assessments is considered unpleasant or harmful [8] and can be related to technological sounds [9]. Meanwhile, eventfulness and uneventfulness are related to how busy or not a place is regarding “human activity” [8]. Examples are a crowded city centre and a wilderness area without any human activity, respectively [8]. Additionally, a calm soundscape represents a quiet rural area, and a chaotic one can be a very noisy street corner [9]. Finally, a lively downtown shopping street characterizes a vibrant soundscape while a continuous noise from a ventilation system is related to a monotonous one [9].

Challenges in translating these attributes into other languages need caution in linguistic levels (conceptual and terminological) [10]. One of the main issues debated in the soundscape community is the applicability around the world of a set of attributes that is standardized only in the English language [11]. It is not clear whether the meanings of the technical perceptual attributes can be straightforwardly translated into other languages. Aletta *et al*. [11] point that sounds and their interaction with the environment are described differently in distinct languages. Also, they mention that research on the translation of soundscape attributes is limited [11]. Therefore, some studies have already identified critical aspects in adapting English versions for other languages [10].

After the publication of ISO/TS 12913-2: 2018 standard [7], an informal international collaboration network of research groups in the field of soundscape from different regions of the world was established under the name of “Soundscape Attributes Translation Project” (SATP). The aims of this project are Stage 1 - to provide translations, in languages other than English, of the protocol for collecting information about soundscape according to Method A from ISO/TS 12913-2: 2018; Stage 2 - to validate the translation of perceptual attributes for soundscape assessment as reported in the standard; and Stage 3 - to support the dissemination of soundscape terminology and its use in different languages [11]. As a result of this collaboration, translation into 15 different languages, obtained through focus groups and panels of experts in soundscape studies, have concluded [11]. There were selected languages from regions of the world where soundscape research is well established, and research groups are active.

After the first translations, the research groups carry out auditory experiments with native participants of different languages in different regions, using the same set of auditory stimuli to validate the translation of the questionnaire of the ISO. Portuguese is a language spoken by 3,7% of the world population (about 250 million people) [12] and remained unrepresented.

Given the importance of this language, the authors of the present work contacted the coordinator of the SATP. They expressed their desire to fill this gap and to include the Portuguese language in the project. This group consist of the present authors of this article and began meeting with the finality of developing the soundscape attributes translation into the Portuguese language. The group has a diverse background, with different areas of expertise, such as Environmental Sciences, Mechanical/Acoustic Engineering, Architecture and Urban Design, and Environmental Acoustics, as the order of appearance under the title. They have experience in soundscape for over ten years with related publications in the Portuguese language regarding data collection in Brazilian parks, urban areas, squares, and fairs [13-16], also as reflections on the application in urban planning [17], qualitative assessment of the sonic environment in urban areas and assessments of Portuguese historic zones [18, 19]. Additionally, there are publications in English regarding soundscapes in a public garden, urban sound planning tools, and traffic noise [20-22].

In the works of Aletta and colleagues [11], the first stage of the SATP was covered, and now there are many regions of the world applying the second stage (validation of translations by listening tests). Specifically, the first stage rests on the translation from English to the "best possible translation" in each regional language. Most groups used "expert panels" based on discussions and literature to an agreed consensus among specialists as methodology. We went further in this approach and applied an online survey to obtain the final translations for all attributes as described below.

2 Methodology

The present paper describes the development of Stage 1, with the first and provisional translation of soundscape attributes into Portuguese (from Brazil and Portugal), based on the reference attributes in English. The definition of the languages included in the SATP follows the classification proposed in ISO 639-3:2007 [23]. The standard defines three-letter codes for the representation of language names for comprehensive coverage of languages. While the ISO 639-3:2007 [23] code for the English version of the ISO/TS 12913-2:2018 [7] is ISO 639:eng, the code for the Portuguese translation of attributes is ISO 639:por.

Based on previous work done with the Portuguese language [13-19] where bibliographic research was made on the words used in other countries, and surveys applied to people (acousticians and non-experts) to ask them to use their own words for sound samples description. Our approach is of a qualitative methodology based on the researchers' previous experience and knowledge of soundscape studies to join the contributions from Portugal and Brazil.

The authors organized a qualitative data collection process in which the guiding principle was that considering the English words, it was desirable to keep the "meaning" rather than looking for a literal translation. Therefore, a set of three possible words to translate as closely as the same perceptual construction was established for each attribute. It is important to highlight that, before this preliminary translation, a free translation of the ISO 12913-2 standard was prepared.

The preliminary proposed terms translated into Portuguese for the perceptual attributes are presented in **Erro! A origem da referência não foi encontrada.**. In addition, the original terms in English [7], in French and Spanish [11] languages are presented given they share the same common ancestry as Portuguese, Romance languages.

After this preliminary translation (Table 1), natives from Brazil and Portugal answered a questionnaire relating the original terms in English with different sound environments and the translated words. The questionnaire was created in *Google Forms*, and it was divided into two parts. The first part was related to the soundscape perceptual attributes. Eight questions were formulated with words and pictures referring to different sound environment types and their eight soundscape attributes.

Table 1 – Preliminary proposed translations into Portuguese and English, French and Spanish.

Portuguese	*prazeroso/ confortável/ agradável*	*confuso/ desordenado/ caótico*	*desconfortável/ irritante/ desagradável*	*monótono/ entediante/ desinteressante*	*calmo/ tranquilo/ quieto*	*vibrante/ animado/ estimulante*	*sem acontecimentos/ uniforme/ estático*	*com atividades/ agitado/ movimentado*
English [7]	pleasant	chaotic	annoying	monotonous	calm	vibrant	uneventful	eventful
French [11]	*agréable/ plaisant*	*agité/ chaotique*	*désagréable /déplaisant*	*ennuyeux/ monotone*	*calme/ tranquille*	*stimulant/ dynamique*	*inerte/ amorphe*	*animé/ mouvementé*
Spanish [11]	agradable/ placentero	caótico/ confuso	desagradable/ molesto	monótono/ aburrido	calmado/ tranquilo	estimulante/ vibrante	sin actividad/ estático	con actividad/ dinámico

At first, each of the eight questions would contain an image related to different sound environments. However, after an analysis among the researchers, it was decided not to include images in each question, but to make an assembly/montage with the eight images and use it only at the beginning of the questionnaire to illustrate different acoustic situations and not to point each situation as specific for the sound environment described. Each question started with the description of a sound environment (related to different soundscapes), followed by a question of which words was more suitable to the description of the related attribute, considering that the respondent was immersed in the respective sound environment. The possible answers to each question were the respective set of three words and an incomplete field called “others”, allowing the respondents to freely write other words. Figure 1 shows an image of the first part of the questionnaire, and Table 2 presents its eight questions.

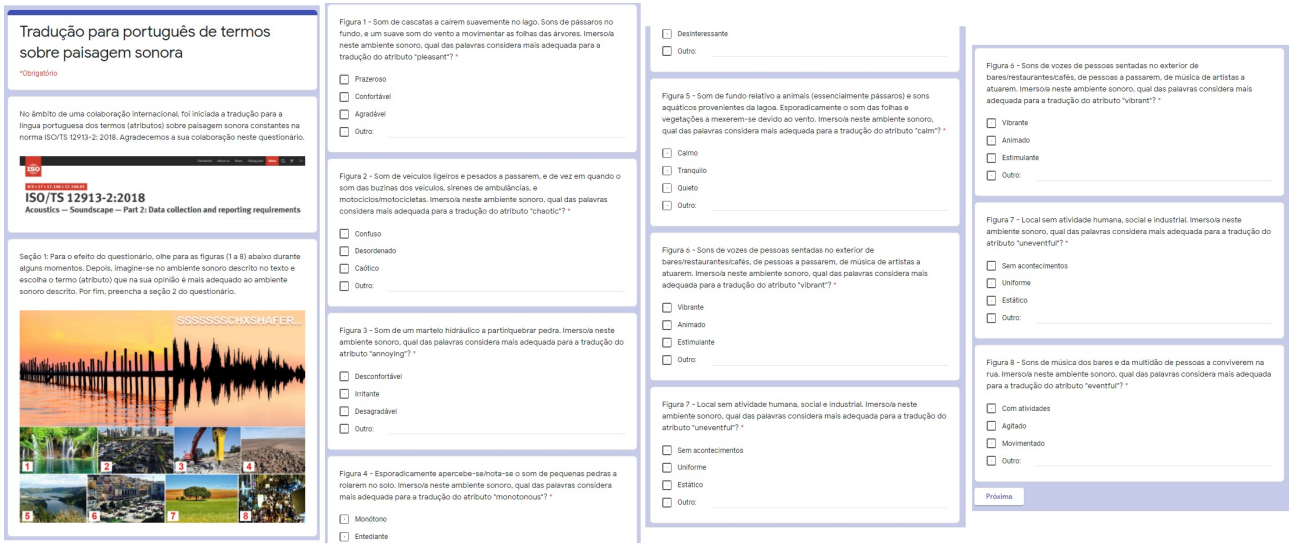

Figure 1 – First part of the questionnaire (created in *Google Forms*).

Table 2 – Questions of the first part of the translation survey.

Questions related to the soundscape attributes
1 - Sound of waterfalls gently falling into the lake. Sounds of birds in the background and a soft sound of the wind moving the leaves on the trees. Immersed in this sound environment, which of the words do you consider most suitable for the “pleasant” attribute translation?
2 - Sound of light and heavy vehicles passing by, and occasionally the sound of vehicle horns, ambulance sirens, and

motorcycles. Immersed in this sound environment, which of the words do you consider most suitable for the "chaotic" attribute translation?
3 - Sound of a hydraulic hammer breaking stone. Immersed in this sound environment, which of the words do you consider most suitable for the "annoying" attribute translation?
4 - Sporadically one notices the sound of small stones rolling on the ground. Immersed in this sound environment, which of the words do you consider the most suitable for the attribute "monotonous" translation?
5 - Background sound related to animals (mainly birds) and aquatic sounds from the lagoon. Occasionally the sound of leaves and vegetation moving due to the wind. Immersed in this sound environment, which of the words do you consider the most suitable for the "calm" attribute translation?
6 - Sounds of voices from people sitting outside bars/restaurants/coffee shops, people passing by, music by artists performing. Immersed in this sound environment, which of the words do you consider the most suitable for the "vibrant" attribute translation?
7 - Place without human, social and industrial activity. Immersed in this sound environment, which of the words do you consider most suitable for the "uneventful" attribute translation?
8 - Sounds of music from bars and of a crowd of people enjoying in the street. Immersed in this sound environment, which of the words do you consider the most suitable for the "eventful" attribute translation?

The second part of the questionnaire was related to the respondent's characterization, including gender, age group, native country, professional activity, and education level. Two other questions were included in this part: "*How do you rate your sensitivity to noise?*" and "*Would you like to send any comments regarding the completion of this questionnaire?*"

After elaborating the questionnaire, it was applied online and disseminated to both the Brazilian and Portuguese natives from June 2nd to June 28th, 2021. In Brazil, the research was supported by the Brazilian Acoustical Society (Sobrac – *Sociedade Brasileira de Acústica*) and in Portugal, by the Portuguese Acoustical Society (SPA – *Sociedade Portuguesa de Acústica*). A total of 245 people answered the questionnaire. Among them, 175 (71,4%) are Brazilians and 70 (28,6%) are Portuguese.

3 Results

The answers to the questionnaires were tabulated, statistically analyzed and compared to each other, to define the translations of the eight soundscape attributes into Portuguese. The results are present in this section.

3.1 Qualitative description of the respondents

Summing up the answers from the second part of the questionnaire, a qualitative description of respondents was done.

The majority of the participants' gender is female, 62,0% of the respondents. Regarding age group, most respondents are 18 to 29 years old (45,7%), followed by 21,2% for 40 to 49 years old. Regarding the professional activity, 38,4% of the respondents are students, 25,7% work in areas related to acoustics, sound or vibration, and 31,8% work in another area of activity. Regarding education level, most of them are undergraduate (40,4%) followed by graduated (39,6%). Concerning noise sensitivity, 45,7% of the respondents reported to be very sensitive to noise, 40,0% reported to be moderately sensitive, 14,3% reported to be slightly sensitive, and 11,8% reported to be extremely sensitive to noise.

The open question allowed the participants to comment on the questionnaire. Some of the respondents congratulated the initiative and found it very good, excellent, and interesting. One of the comments said: "*it is a wonderful initiative and work that will have great results for the acoustics in the national context*".

3.2 Results for the translated perceptual attributes

The main challenge was the possibility of translating each of the eight attributes of the ISO document into a single word. Therefore, the authors agreed that if a single word was not enough to translate the original meaning, a set of 2-3 words would be allowed to translate as closely as possible the same perceptual construction.

Table 3 presents a compilation of the results for the translated terms. In this table, the results for the Portuguese and Brazilians are presented individually. In the third column, the results are for all samples (Portuguese and Brazilians).

Table 3 – Compilation of the translation survey results.

Terms	Brazilian answers		Portuguese answers		Brazilian and Portuguese answers	
Pleasant	Agradável	58,46%	Agradável	62,16%	Agradável	59,33%
	Prazeroso	36,92%	Prazeroso	31,08%	Prazeroso	35,45%
	Confortável	4,62%	Confortável	4,05%	Confortável	4,48%
			Calma ou tranquilidade, Paradisíaco	1,35% each	Calma ou tranquilidade, Paradisíaco	0,37% each
Chaotic	Caótico	78,72%	Caótico	80,00%	Caótico	79,09%
	Desordenado	12,77%	Confuso	16,00%	Confuso	10,27%
	Confuso	7,98%	Desordenado	4,00%	Desordenado	10,27%
	Perturbador	0,53%			Perturbador	0,38%
Annoying	Irritante	67,32%	Irritante	60,49%	Irritante	65,38%
	Desagradável	22,44%	Desagradável	17,28%	Desagradável	20,98%
	Desconfortável	9,27%	Desconfortável	11,11%	Desconfortável	9,79%
	Estressante	0,98%	Incómodo	4,94%	Incómodo	1,40%
					Estressante	0,70%
			Violento, Molesto, Perturbador, Ensurdecedor, Agressivo	1,23% each	Violento, Molesto, Perturbador, Ensurdecedor, Agressivo	0,35% each
Monotonous	Monótono	68,28%	Monótono	68,42%	Monótono	68,32%
	Entediante	17,74%	Desinteressante	14,47%	Entediante	16,41%
	Desinteressante	13,44%	Entediante	13,16%	Desinteressante	13,74%
	Irregular	0,54%	Imprevisível, Letárgico, Irritante	1,32% each	Imprevisível, Letárgico, Irregular, Irritante	0,38% each
Calm	Tranquilo	56,10%	Tranquilo	70,13%	Tranquilo	59,93%
	Calmo	40,49%	Calmo	25,97%	Calmo	36,52%
	Quieto	2,44%			Quieto	2,13%
	Prazeroso, Aconchegante	0,49% each	Quieto, Idílico, Paz e Sereno	1,30% each	Prazeroso, Aconchegante, Paz e sereno, Idílico	0,35% each
Vibrant	Animado	38,58%	Animado	58,67%	Animado	45,22%
	Vibrante	37,06%	Vibrante	22,67%	Vibrante	33,09%
	Estimulante	23,35%	Estimulante	13,33%	Estimulante	20,59%
	Agitado, Excessivo	0,51% each	Animado	4,00%	Agitado, Excessivo, Incómodo	0,37% each
			Incómodo	1,33%		
Uneventful	Sem acontecimentos	45,36%	Sem acontecimentos	40,54%	Sem acontecimentos	43,66%
	Estático	37,11%	Estático	31,08%	Estático	35,07%
	Uniforme	11,86%	Uniforme	12,16%	Uniforme	12,31%
	Calmo, Parado	1,03% each			Parado	1,12%
					Calmo	0,75%
	Ocioso, Silencioso, Natural, Sem intercorrências, Esquecível, Quieto, Tranquilo	0,52% each	Agradável, Bucólico, Tranquilo, Estável e sereno, Parado, Pausado, Quieto, Rotineiro, Sem atividade, Sereno, Sossegado, Sem movimento	1,35% each	Sem atividade, Agradável, Ocioso, Silencioso, Natural, Sossegado, Sem intercorrências, Sem movimento, Bucólico, Estável, Pausado, Rotineiro, Esquecível	0,37% each
Eventful	Agitado	54,73%	Movimentado	45,57%	Agitado	50,36%
	Movimentado	35,32%	Agitado	39,24%	Movimentado	38,21%
	Com atividades	8,96%	Com atividades	12,66%	Com atividades	10,00%
	Calor humano, Notável	0,50% each	Incómodo, Movida	1,27% each	Calor humano, Incómodo, Notável, Movida	0,36% each

The results of Step 1 (the proposed translations into Portuguese) are presented in Table 4.

Table 4 – Proposed translations into Portuguese (and the reference English words).

English	pleasant	chaotic	annoying	monotonous	calm	vibrant	uneventful	eventful
Portuguese	*agradável/ prazeroso*	*caótico*	*irritante/ desagradável*	*monótono/ entediante*	*tranquilo/ calmo*	*animado/ vibrante*	*sem acontecimentos/ estático*	*agitado/ movimentado*

Considering the percentage values, two words were chosen for each attribute, except for "chaotic" that stood out relative to the second and third most voted expressions ("*desordenado*" and "*confuso*"). Additionally, these expressions were different for Brazilian and Portuguese natives. Therefore, only one word ("*caótico*") was considered in this case.

This work will continue for Stage 2 (validation), with listening experiments of auditory stimuli carried out with native speakers. Stage 2 aims to validate the preliminary translation. After the validation, the research group will reassess the need to change the translated words and whether it is possible to reduce the number of words needed for each attribute.

4 Conclusions

The standards and technical specifications for soundscape characterization are currently determined by the International Organization for Standardization (ISO) and aim to provide reliable parameters for researchers and professionals at an international level. However, they only exist in the English version. Thus, the present research aimed to clarify whether the meanings of the perceptual constructions described by the soundscape attributes, originally in English, can be directly translated into Portuguese.

This paper describes the work done up to the moment for Stage 1 of the SATP for the Portuguese language. The objective of this stage was to propose a translation for the eight soundscape attributes, originally in English, to the Portuguese language. Portuguese is the mother tongue of Portugal (Europe), Brazil (South America) besides São Tomé e Príncipe (Africa) and one of the main languages in several African countries (Angola, Mozambique, Guiné-Bissau, and Cape Verde) and Asian countries (Timor-Leste and Macau). The research group concerns the translation of these expressions would represent the diversity in the use of the language. In the present work, a representation was achieved for Europe and South America. Future research could include the same questionnaire application to natives from African or Asian countries where Portuguese prevails as the spoken language. As shown in Table 4, the research group decided to include two translated attributes for the original expressions. Although a comprehensive statical analysis will be described in future work, preliminary results indicate that two expressions would represent the majority of replies from both expressions (Europe and South America) and, thus, would unquestionably represent the translation of the original expressions to native speakers. This approach was verified for all seven attributes except for "*caótico*", which was chosen by 79,09% of the respondents, followed by 10,27% "*desordenado*" and 10,27% "*confuso*", and thus there was no statistical fundament to choose one expression or the other as a second Portuguese attribute, and "*caótico*" clearly represented the original attribute for most respondents.

The work will proceed for Stages 2 (validation of the translation of perceptual attributes for soundscape assessment as reported in the standard) and 3 (support the dissemination of soundscape terminology). Stage 2 consists of laboratory auditory stimuli experiments and is already under planning.

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