



## Soundscape assessment: towards a validated translation of perceptual attributes in different languages

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## ABSTRACT

The recently published ISO/TS 12913-2:2018 standard aims to provide researchers and practitioners around the world with a reliable questionnaire for soundscape characterization. The ISO Technical Specifications report protocols and attributes grounded in the soundscape literature, but only includes an English version. The applicability and reliability of these attributes in non-English speaking regions remains an open question, as research investigating translations of soundscape attributes is limited. To address this gap, an international collaboration was initiated with soundscape researchers from all over the world. Translation into 15 different languages, obtained through focus groups and panels of experts in soundscape studies, are proposed. The main challenges and outcomes of this preliminary exercise are discussed. The long-term objective is to validate the proposed translations using standardized listening experiments in different languages and geographical regions as a way to promote a widespread use of the soundscape attributes, both in academia and practice, across locations, populations and languages.

## 1. INTRODUCTION

Characterizing how sounds are perceived by people is one of the main goals of the soundscape approach. For this process, tools and scales that can consistently describe (perceived) qualities of (physical) acoustic environments are necessary [1]. Standardizing soundscape assessment is a challenging task, in which researchers have put increasing efforts in recent years [2–5]. 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. This led to the publication of: ISO 12913-1:2014 dealing with the general soundscape framework and definitions [6]; ISO/TS 12913-2:2018 dealing with soundscape data collection methods [7]; and ISO/TS 12913-3:2019 dealing with soundscape data analysis [8].

More specifically, Part 2 of the ISO 12913 series consists of technical specifications where actual protocols are proposed (as informative annexes) to standardize data collection methods for individual responses to acoustic environments experienced both in context (Methods A and B, through soundwalks) and off-site (Method C, through narrative interviews). The attributes proposed for the soundscape assessment during a soundwalk are derived from soundscape literature [9–13]. While the concept of “measuring perception” highlights some psychometric issues *per se* [14–16], one of the main issues currently being debated in the soundscape community is the applicability around the world of a set of attributes that is standardized only in the English language. It is not clear whether the meaning of the perceptual constructs described by the attributes of the technical specifications can be straightforwardly translated into other languages. Sounds, and the way they interact with the environment, are described differently in different languages [17,18]. Research on the translation of soundscape attributes is limited, and preliminary studies have already identified some critical aspects in adapting the English version for other regions [19–23], thus the applicability of the questionnaires proposed in the ISO/TS 12913-2:2018 in non-English speaking regions remains problematic, in spite of the standardized protocols. Similar issues were encountered when standardizing other socio-acoustic survey methods, like the assessment of noise annoyance [24], where the questions/wording of the protocol is proposed in nine languages (i.e., English, Dutch, French, German, Hungarian, Japanese, Norwegian, Spanish, Turkish). In order to address this gap, an informal international network with soundscape researchers from different regions of the world was established under the provisional name of “Soundscape Attributes Translation Project” (SATP). The activities of the network started in May 2019 with a first group of collaborators with relevant expertise and considerable geographical spread, covering 15 different languages. The overarching aim of the SATP collaboration is validating the first 15 translations of the soundscape attributes as reported in the ISO/TS 12913-2:2018, as well as validating a method

for the translation procedure and its analysis so that other languages can be added in the future. In this paper, we report the outcomes of the preliminary stage of the project (provisional translations) and describe the next steps towards validation. The main goal of the preliminary stage is providing the best possible translations to be used in the following listening experiments.

## **2. METHODOLOGY**

### **2.1. General structure of the project**

The project is being coordinated in UK by the Acoustics Group at the Institute for Environmental Design and Engineering of University College London. The soundscape attributes used as reference are those in English, proposed in the Method A of Part 2 of the ISO technical specifications; namely: *eventful, vibrant, pleasant, calm, uneventful, monotonous, annoying, chaotic*. The rationale for selecting the languages was about considering regions of the world where soundscape research is well-established and research groups are active in this discipline. For the definition/labelling of the languages, we referred to the classification proposed in the ISO 639-3:2007 [25]. Table 1 presents the 15 languages included in the present study with the corresponding ISO codes and the Universities/Research Institutions (research partners) that are coordinating the project in the different regions; after the English reference version, languages are reported in alphabetical order. When there is a mismatch between the local language and the country of the coordinating Institution(s), this is due to a native speaker researcher for that specific language who is based in a different country. When more Institutions from the same or different countries are involved, this is due to the need of covering a language being spoken in different regions (e.g., French for Canada and France, Dutch for Belgium and Netherlands, etc.).

The SATP initiative consists of two main stages: 1) provisional translation – the different Institutions organize a qualitative data collection process and propose a first translation in their local language, based on the English reference; 2) validation – a listening experiment is carried out separately by all Institutions in the local language (version translated from Stage 1) with native speakers, using a common set of auditory stimuli and standardized equipment and procedure for calibration, in order to validate the translations.

### **2.2. Data collection for the provisional translation (Stage 1)**

The objective of Stage 1 was providing a provisional set of attributes in each local language that should be the “best possible translation” of the English reference list of soundscape attributes, as per the ISO technical specifications. For this purpose, a qualitative approach was adopted aiming at an “educated guess” and based on previous experience and knowledge of soundscape studies of the researchers involved [22]. Research partners defined their own data collection strategy independently. Table 2 summarizes the range of methods used, the number of people involved, an estimation of the years of activity in soundscape research of the research partners groups, and whether the proposed translation was informed by previous work published in soundscape literature. The guiding principle was that, considering the reference data collection instrument (i.e., Pleasant, Annoying, Eventful, Uneventful, Monotonous, Exciting, Calm, Chaotic), it was desirable to retain the “meaning” rather than pursuing a literal translation; hence, it was also agreed that if a single word would not be sufficient to render the original meaning, a set of 2-3 words would be allowed to translate as closely as possible the same perceptual construct.

*Table 1: Languages included in the SATP with corresponding ISO 639 codes and research institutions coordinating the project locally; \*the English version is based on the ISO/TS 12913-2:2018 annex.*

<b>Language</b>	<b>ISO 639-3:2007 code</b>	<b>SATP Coordination</b>
<i>English</i>	<i>ISO 639:eng</i>	<i>University College London*</i>
Chinese (Mandarin)	ISO 639:cmn	Chongqing University, Shenyang Jianzhu University
Chinese (Yue)	ISO 639:yue	Hong Kong Polytechnic University, National University of Singapore
Croatian	ISO 639:hrv	University of Zagreb, University College London
Dutch	ISO 639:nld	Ghent University, University of Groningen
French	ISO 639:fra	Cergy Paris University, McGill University, University Gustave Eiffel
German	ISO 639:deu	Technical University of Berlin
Indonesian	ISO 639:ind	Bandung Institute of Technology
Italian	ISO 639:ita	Polytechnic Institute of Turin, University College London
Japanese	ISO 639:jpn	Fukushima University
Korean	ISO 639:kor	Hanyang University
Malay	ISO 639:zsm	Nanyang Technological University, Universiti Putra Malaysia
Spanish	ISO 639:spa	Austral University of Chile, University of Chile, University of Granada
Swedish	ISO 639:swe	Stockholm University
Turkish	ISO 639:tur	Çankaya University
Vietnamese	ISO 639:vie	Shimane University

*Table 2: Summary of methods used, number of people involved and available background for the translation in each language*

<b>Language</b>	<b>Method(s)</b>	<b>People involved</b>	<b>Years active in soundscape research</b>	<b>References for the translation</b>
<i>English</i>	n/a	4	>15	[7]
Chinese (Mandarin)	expert panel	3	>5	n/a
Chinese (Yue)	expert panel + linguistic advice	3	>5	n/a
Croatian	expert panel	3	>5	[26]
Dutch	expert panel	7	>10	[27]
French	expert panel	4	>15	[22,28–30]
German	expert panel + listening experiment	8	>15	[9]
Indonesian	focus group + soundwalk	9	>5	n/a
Italian	expert panel	2	>10	[21]
Japanese	expert panel + soundwalk + listening experiment	10	>15	[23,31]
Korean	expert panel	3	>10	[22]
Malay	expert panel + focus group + listening experiment	9	>5	n/a
Spanish	expert panel	3	>5	[32,33]
Swedish	expert panel	2	>15	[11]
Turkish	focus group	4	>10	[34]
Vietnamese	focus group	11	<5	n/a

### 3. RESULTS AND DISCUSSION

Most research partners relied on expert panels to draft the preliminary translation: these basically consisted of open unstructured discussion among the local soundscape experts, often starting with a

back translation of the ISO 12913 instrument and an iterative process of refining the set of attributes, until consensus was reached. Some groups developed a multi-stage process and piloting the proposed instrument with follow-up primary data collection (e.g., small-scale listening experiment or soundwalk); this happened more often for groups where previous references in literature were not available, making a scoping task more desirable.

The outcomes of Stage 1 are presented in Table 3, where the proposed translations for the 15 languages are reported. Almost every group opted to avoid a one-word translation of the English attributes and aimed for 2-3 terms that would together convey more clearly the meaning of the perceptual construct of interest.

To the best of the authors' knowledge, the SATP initiative is the first systematic attempt to harmonize the translations of soundscape assessment attributes in several languages at once. The main challenge the research partners faced was the possibility of translating each of the eight attributes of the ISO document with a single word in a different language. This proved particularly difficult when considering the transition from alphabetic to logographic systems; thus more terms were often necessary to retain the meaning. After the validation of the preliminary translation, the groups will reassess whether it is possible to reduce the number of terms needed for each dimension.

It is important to bear in mind that the soundscape circumplex model from which the eight attributes are derived was originally developed in Swedish and then translated into English [10,11]. Because the research community is now using the English translation rather than the original Swedish version to translate the model into other languages, some uncertainty and error are already propagated to any translation by default. For the sake of standardization, it should be noted that the ISO typically works with three reference languages: English and French, and Russian in some cases. Thus, the overarching aim of the SATP initiative is to confirm an English and a French norm, for references. These two versions should then be equivalent, so that other researchers can rely on them as a basis for future translations. For this purpose it is also necessary to standardize the translation methodology.

Preparation for the validation of the preliminary translations is currently in progress. Stage 2 will consist of a set of listening experiments to be conducted with a standardized procedure and equipment by each research partner locally with a sample of participants (approx. 30 people, age range 18-30, balanced in terms of gender) who are native speakers of the local language and will assess the soundscapes based on the data collection instrument translated in the local language. All research groups will be using the same set of auditory stimuli: this was provided by University College London and consists of 27 binaural recordings (30 s) recorded in London during summer and autumn 2019 [35]. The rationale for selecting the binaural recordings was having a set of audio excerpts that would be well-balanced in terms of sound sources types' composition and also have the potential of eliciting a broad range of responses on the attributes in use. For this purpose a pilot listening experiment was performed at University College London to extract the 27 desired audio stimuli from a pool of 50+ excerpts.

The 15 languages considered in the study so far would cover approximately 2.53 billion native speakers around the world (i.e., almost one third of global population) – examples of languages that would help increasing this quota include, among others, Standard Arabic, Hindi, Russian, Portuguese; thus the SATP network would welcome collaborators in corresponding regions. The outcomes of the SATP will hopefully support a widespread adoption of validated soundscape attributes, both in academia and practice.

Table 3: Preliminary translations of the ISO/TS 12913-2:2018 soundscape attributes from Stage 1

English	<i>eventful</i>	<i>vibrant</i>	<i>pleasant</i>	<i>calm</i>	<i>uneventful</i>	<i>monotonous</i>	<i>annoying</i>	<i>chaotic</i>
Chinese (Mandarin)	引人注意的 / 有故事性的 / 引人遐想的 / 身临其境的 (yǐn rén zhùyì de/ yǒu gùshì xìng de/ yǐn rén xiáxiǎng de/ shēn lín qí jǐng de)	热闹的 / 有活力的 (rènao de/ yǒu huó lì de)	愉快的 (yúkuài de)	平静的 (píngjìng de)	平淡无奇的 / 难以共鸣的 / 无体验感的 (píngdàn wú qí de/ nányǐ gòngmíng de/ wú tǐyàn gǎn de)	枯燥的 / 无趣的 / 单调乏味的 (kūzào de/ wúqù de/ dāndiào fáwèi de)	恼人的 / 烦人的 / 烦躁的 (nǎorén de/ fánrén de/ fánzào de)	喧闹的 / 混乱的 (xuānnào de/ hūnluan de)
Chinese (Yue)	精彩 / 多姿多彩 / 好玩 (jīngcǎi/ duō zī duōcǎi/ hǎowán)	鮮艷 / 有活力 / 生動 (xiānyàn/ yǒu huó lì/ shēngdòng)	優美 / 宜人 / 舒適 / 舒服 (yōuměi/ yírén/ shūshì/ shūfú)	冷靜 / 沉著 / 鎮靜 / 平靜 (lěngjìng/ chénzhuó/ zhènjìng/ píngjìng)	風平浪靜 / 平平無奇 / 唔太特別 (fēngpínglàngjìng/ píngpíng wú qí/ wú tài tèbié)	單調 / 枯燥 / 毫無變化 / 一潭死水 (dāndiào/ kūzào/ háo wú biànhuà/ yītánshǐshuǐ)	煩 / 煩擾 / 乞人憎 / 討人厭 (fán/ fánrǎo/ qǐ rén zēng/ tǎo rén yàn)	混亂 / 亂七八糟 / 污糟 (hūnluan/ luànqībāzāo/ wū zāo)
Croatian	sadržajan / pun događaja	uzbudljiv / živahan	ugodan	smirujuć	besadržajan / prazan	dosadan	neugodan	kaotičan / uznemirujuć
Dutch	druk / dynamisch	levendig / vrolijk	aangenaam / prettig	kalm / rustgevend	rustig / statisch	saai / eentonig	onaangenaam / onprettig	chaotisch / hectisch
French	animé / mouvementé	stimulant / dynamique	agréable / plaisant	calme / tranquille	inerte / amorphe	ennuyeux / monotone	désagréable / déplaisant	agité / chaotique
German	ereignisreich / dynamisch	lebendig / abwechslungsreich	angenehm	ruhig / erholsam	ereignisarm / statisch	monoton / eintönig	störend / lästig	chaotisch / hektisch
Indonesian	ramai / penuh / aktif / sibuk	bersemangat / menggairahkan / antusias / sukacita	menyenangkan / suka	tenang / tenang / damai	sepi / kosong / senggang / lowong	menjemukan / membosankan / menjenuhkan	mengganggu / menjengkelkan	ribut / kacau / berantakan
Italian	dinamico / vario	vivace/ stimolante	piacevole / confortevole	calmo / tranquillo	stabile / stazionario	monotono / noioso	spiacevole / irritante	caotico / confuso
Japanese	活気がある / 色々なことが起こる (kakki-ga-aruru / iroironakoto ga okoru)	楽しい (tanoshii)	快い (kokoro-yoi)	穏やかな (odayaka-na)	何も起こらない (nani-mo okoranai)	単調な (tanchō-na)	うるさい (urusai)	雑然とした (zatsuzen-to-sita)
Korean	활동적인 / 역동적인 (hwaldongjeog-in / yeogdongjeog-in)	활기찬 / 생동한 (hwalgichan / saengdonghan)	유쾌한 / 기분 좋은 (yukwaehan / gibun joh-eun)	조용한 / 차분한 (joyonghan / chabunhan)	비활동적인 / 정적인 (bihwaldongjeog-in / jeongjeog-in)	단조로운 / 지루한 (danjoloun / jiluhan)	불쾌한 / 성가신 (bulkwaeahan / seong-gasin)	혼란스러운 / 혼잡한 (honlanseuleoun / honjabhan)
Malay	meriah	rancak	menyenangkan	tenang	tidak meriah	membosankan	membangitkan	huru-hara
Spanish	con actividad / dinámico	estimulante / vibrante	agradable / placentero	calmado / tranquilo	sin actividad / estático	monótono / aburrido	desagradable / molesto	caótico / confuso
Swedish	händelserikt / livligt / aktivt	levande / spännande / uttrycksfullt	behagligt / trivsamt / tilltalande	lugnt / stilla / rogivande	händelselöst / inaktivt / passivt	enformigt / andefattigt / livlöst	störande / obehagligt / otrivsamt	kaotiskt / rörigt / bullrigt
Turkish	hareketli	heyecan verici	keyifli	dingin	durağan	sıradan	keyifsiz	kargaşalı
Vietnamese	sôi động / sinh động	sống động / náo nhiệt	đễ chịu / thoải mái	yên bình / tĩnh mịch	tẻ nhạt / nhàm chán	đơn điệu / buồn tẻ	khó chịu / phiền toái	hỗn loạn / hỗn độn

## 5. ACKNOWLEDGEMENTS

The authors are grateful to all participants of the Stage 1 of the Soundscape Attribute Translation Project (SATP) initiative. SATP is being coordinated at University College London: authors from this Institution acknowledge funding through the European Research Council (ERC) Advanced Grant (no. 740696) on “Soundscape Indices” (SSID).

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