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PROGRESS IN THE TRANSLATION OF ISO/TS 12913-2:2018 SOUNDSCAPE MODEL INTO SPANISH: NEW INSIGHTS FROM THE SATP PROJECT IN CHILE

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ABSTRACT

Soundscape research focuses on individuals' perception of the acoustic environment in context, and the ISO 12913 standard defines a harmonized space for measuring and assessing urban soundscapes for future interventions. In this context, the ISO 12913 soundscape model, often referred to as the Perceived Affective Quality (PAQ) model, is the tool to capture people's subjective feedback. The model is based on 8 dimensions or attributes and originally formulated in English. In order to advance soundscape research, the Soundscape Attributes Translation Project (SATP) contributes to the translation of the PAQ model into as many languages as possible in order to achieve representativeness and general use of the research results. The translation of the PAQ model into Spanish was carried out by researchers from Spain and Chile, followed by listening experiments by native Spanish speakers in Spain and native English speakers in the UK in order to compare results in Spanish from the original English. New data from listening tests conducted by native Spanish speakers in Chile provide new results and validation of the Spanish translation of the PAQ soundscape assessment model.

Keywords: *urban soundscape, soundscape assessment, perceived sound quality, soundscape attributes translation, ISO12913 standard.*

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1. INTRODUCTION

Urban soundscape research focuses on how individuals perceive the acoustic climate of their environment in context. "Citizens" and "perception in context" are the basic guidelines for the study of urban noise from this new and innovative point of view in acoustics, which pays more attention to how sounds in the city are experienced by people than to how loud they actually are. The concept of "soundscape" isn't really that new, as it dates back to 1977 when Schaffer [1] formally introduced the term and started talking about our sonic environment under this new approach. What is relatively new is the impetus that this topic is gaining within the interactions between people and the built environment and the international standardization efforts, as it was only ten years ago, in 2014, that the new ISO 12913 standard began to shape this new discipline [2] and its associated working framework for soundscape studies [3, 4].

In this context, there is one core element that has received great attention in soundscape research: the eight-attribute soundscape circumplex model contained in ISO 12913-2 [3], often referred to as the *Perceived Affective Quality* (PAQ) model. The model is built around 8 dimensions or attributes, originally formulated in English in ISO 12913-2, from which the ISO coordinates '*Eventfulness*' (E) and '*Pleasantness*' (P) are derived. The importance of the PAQ model is that individual emotional feelings can be plotted as a single point on a graph [5], allowing emotional comparison of urban scenarios and/or the results of applying local policies to the built environment.

In terms of standardization and the adoption of common protocols for data collection and analysis, the improvement of the framework proposed by the ISO 12913 series is a permanent ongoing work in order to make the most of the exciting opportunities offered by soundscape research [6]. To this end, the determination of soundscape quality in urban areas appears to be, among others, a challenging issue [7-12] that requires a coordinated, collaborative and interdisciplinary effort. In this sense, the *Soundscape Attributes Translation Project* (SATP) contributes to the translation of the PAQ model into as many languages as possible, currently covering eighteen proposals, including Spanish, whose translation has been carried out by researchers from Spain and Chile.

In this context, first results of a comparison with the original English formulation of the PAQ model have already been presented [13], involving listening tests in the UK and Spain. As new data have become available from listening tests carried out in Chile using the same method and materials as those carried out in the UK and Spain, this work presents new results and checks to validate the Spanish translation of the PAQ model for soundscape evaluation following these research questions:

a) RQ1: Are there any differences between the listening test results obtained by native Spanish speakers in Spain and Chile?
b) RQ2: Are there any differences between the results of the listening tests in Spanish in Spain and Chile and in original English in the UK?

2. METHODS

2.1 Listening test stimuli description

The Soundscape Attributes Translation Project (SATP) started in 2019 as a network initiative led by the Acoustic Group at University College London (UCL) and a first group of collaborators among which was the University of Granada [13]. It later incorporated more national working groups reaching 18 languages in 2022 [14]. The SATP initiative considered the 8 PAQ model dimensions, also known as the 8 soundscape descriptors, proposed in Method A of ISO/TS 12913-2, and a working routine involving two initial stages: Stage-1 for translation from the original English and Stage-2 for listening experiments to test and validate the proposed translation. Each national working group carries out the work according to the same methodology, which for the listening experiment implies the use of 27 test sounds as described in Table 1. The 27 recordings were provided by the UCL researchers to the national groups participating in SATP without any information on their content, dominant sounds or recording location, and represent a diverse sample of typical urban environmental sounds: anthropic, non-anthropic, pleasant, unpleasant, eventful, non-eventful, etc. A set of sound stimuli attempting to capture the eight emotions as defined by ISO 12913-2 [3] Informal conversations revealed some of these characteristics, although the description given in Table 1 is based solely on the personal opinion of the authors.

Under this personal criterion, the 27 recordings include music of various kinds, from opera to percussion, even a version of Imagine in a Park (recordings nos. 1, 14, 17); human speech by children and/or adults, laughter or shouting (recordings nos. 1, 2, 7, 8, 9, 14, 16, 17, 18, 23, 26); voices heard in echo (recordings nos. 3, 27); petrol-powered saws, one at a much higher level (stimulus number 4) than the other (stimulus number 20); other machines (stimuli numbers 5, 22); traffic (stimuli numbers 10, 11, 12, 16, 24); train (stimulus number 12); water (stimuli numbers 5, 6, 9, 21); and small birds and/or seagulls (stimuli numbers 7, 15, 18, 19, 26), as summarized in Table 1.

Table 1: List of sound stimuli used in SATP Stage 2 listening tests

N	ID	Source *(*)*	N	ID	Source *(*)*	N	ID	Source *(*)*
1	CG01	H+S	10	E11b	T + M	19	VP01b	N
2	CG04	H	11	E12b	M	20	W01	M
3	CG07	H	12	HR01	T + M	21	W06	N + W
4	CT301	M	13	KT01	N	22	W09	M
5	E01b	T	14	LS06	H + S	23	W11a	H
6	E02	T + W	15	N1	T + N	24	W15	T
7	E05	H + N	16	OS01c	H + T	25	W16	T
8	E09	H + S	17	OS01d	H + S	26	W22	H
9	E10	H + W	18	RPJ01	H + N	27	W23a	H

(*) Authors' opinion on stimuli dominant source(s): H – Human, T –Traffic, N – Natural_birds, S – Sounds_music, M – Machine_work, W – Water

N	Content	N	Content	N	Content
1	Quiet music + laugh	10	Traffic + warning siren	19	Distant birds + gulls
2	Distant and quiet voices	11	Traffic + Hammer	20	Petrol engine power saw (-)
3	Quiet voices in eco sound	12	Traffic siren + railway	21	Distant water
4	Petrol engine power saw(+)	13	Very distant + quiet	22	Constant-frequency engine
5	Low frequency + water	14	Imagine song + voices	23	Distant and quiet voices
6	Traffic + water fall	15	Birds + distant traffic	24	Distant traffic + car door
7	Distant child + laugh + gull	16	Voices + traffic + "seller"	25	Very quiet & rhythmic sound
8	Quiet applause + voices	17	Percussion music + voices	26	Birds + distant voices + laugh
9	Water + distant children	18	Birds + distant voices	27	Distant voices in eco sound

(*) Authors' opinion on stimuli brief content

2.2 Translation of PAQ model into Spanish

For the listening tests in Chile, the translation into Spanish of the ISO/TS 12913-2:2018 PAQ model proposed after the first phase of the SATP project was used, as was done for the auditions in Spain. A description of the procedure and the proposed translation can be found in [13], from which Table 2 is extracted, with the preferred word and a synonymous alternative translation for each model dimension.

Table 2: SATP Spanish Stage 1 translation

PAQ dimension	PAQ dimension ID	Spanish - Word 1 *(preferred)*	Spanish - Word 2 *(synonymous)*
Pleasant	p	agradable	placentero
Chaotic	ch	caótico	confuse
Vibrant	v	estimulante	vibrante
Uneventful	u	sin actividad	estático
Calm	ca	calmado	tranquilo
Annoying	a	desagradable	molesto
Eventful	e	con actividad	dinámico
Monotonous	m	monótono	aburrido

2.3 Participants and data base description

Participants in the experiments were all volunteers. They listened to the 27 test stimuli and responded to their perceptions by rating the 8 dimensions of the PAQ model. Main characteristics in terms of age and gender, together with basic statistical information on their distribution, are shown in Tables 3 and 4. The experiment generated a large database in Spain, Chile and the United Kingdom, which are referred to in Table 4 as SPA1, SPA2 and ENG, respectively.

A total of 783 records in Spain and 864 records in Chile and the UK were obtained using the 27 listening test stimuli with 29 participants in Spain and 32 participants in Chile and the UK. As each record consists of responses to the 8 dimensions of the PAQ model, this gives a database of 6264 items in Spain and 6912 in Chile and the UK. These files are part of the global soundscape database repository, contributed by all SATP researchers and coordinated by the UCL team at Zenodo [15].

Table 3: SATP Stage 2 participants age distribution

	Mean	SEM	Median	Mode	SDEV	VAR	Kurt	Skew	Range	Min.	Max.	Addit	95%CI
Spain	**24.4**	2.15	20.00	**19**	11.58	134	3.81	2.26	39	19	58	708	4.404
Chile	**32.3**	2.17	26.50	**22**	12.30	151	-0.42	0.99	40	19	59	1032	4.435
UK	**39.7**	1.30	27.00	**23**	7.33	54	-0.06	1.00	26	21	47	950	2.642

Table 4: Listening test database facts and figures

Group	Data ID	Female	Male	Participants (N)	Test stimuli (S)	Nº data sets (NxS)	PAQ model dims (D)	Nº data elements (NxSxD)
Spain	**SPA1**	**10** (34.5%)	**19** (65.5%)	**29**	27	**783**	8	**6624**
Chile	**SPA2**	**12** (37.5%)	**20** (62.5%)	**32**	27	**864**	8	**6912**
UK	**ENG**	**13** (40.6%)	**19** (59.4%)	**32**	27	**864**	8	**6912**

2.4 Listening experiments methodology

A description of how the listening experiment within Stage 2 of SATP were carried out in Spain and UK can be found elsewhere [5, 13] The Spanish translation of the PAQ model was tested in May, June and July 2021 using results from native Spanish speakers, pending new data from non-European Spanish speakers after the completion of Stage 2 in Chile. This was finally achieved in June 2023, using the same methodology as in Spain and the UK.

2.5 Data analysis and test methods

The analysis of the data obtained from the listening tests was carried out using a combination of different mathematical techniques, following the method used in the previous Spanish-English comparison [13] and also those used in similar work within SATP. These methods include basic statistical description of data sets, classical analysis of variance and other tests of significance, including the Intraclass Correlation Coefficient (ICC) [16], the Structural Summary Method (SSM) analysis [17] and the distance of coordinates in the so-called ISO 12913 space as in [13].

3. RESULTS

3.1 Overall results from auditions

Scatter plot of ISO PAQ model circumplex coordinates (*Pleasantness, Eventfulness*) estimated from individual scores in auditions carried out in Spain (SPA1, N=783), Chile (SPA2, N=864) and the United Kingdom (ENG, N=864), is shown in Figure 1 together with Kernel Density Estimation (KDE) distribution and marginal histograms.

As can be seen, the coordinates are evenly distributed and cover the entire [P, E] space in Spain and Chile, a fact that was also confirmed when the responses of native English-speaking volunteers in the UK were compared with those of native Spanish-speaking participants in Spain [13].

3.2 Soundscape attributes comparison

The mean response values and other descriptive statistics (including *sem, median, sdev, kurtosis, skewness, range, minimum, maximum, addition* and *95% CI*) for the 8 dimensions of the PAQ model were calculated for each of the 27 test stimuli in the three countries. ISO12913 mean *Pleasantness* and *Eventfulness* (P, E) coordinates were also estimated.

With this information, matching correlations have been computed between mean PAQ model dimensions and ISO coordinates in different language groups: [SPA1 vs SPA2], [SPA1 vs ENG] and [SPA2 vs ENG] Results of the coefficient of determination R^2 in each case and dimension is shown in Table 5, where p-value < 0.000 in all cases.

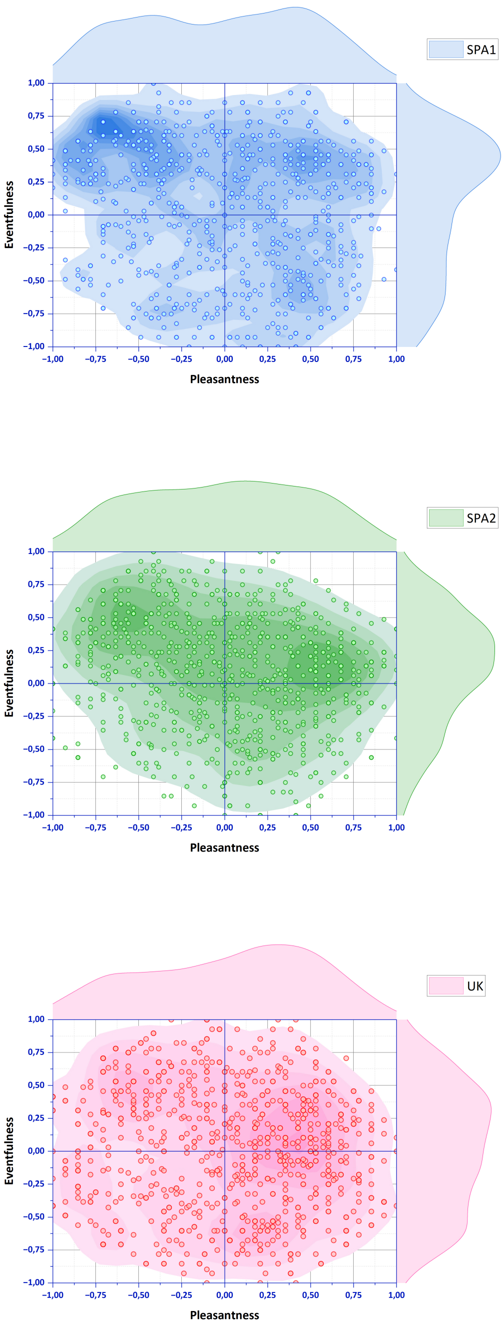

Figure 1: KDE distribution plot of ISO circumplex coordinates *(P, E)* from auditions in Spanish in Spain (SPA1, up) and Chile (SPA2, center) and in English in the UK (ENG, bottom)

Table 5: Coefficient of determination in matching correlations in Spain vs Chile (SPA1-SPA2), Spain vs UK (SPA1-ENG) and Chile vs UK (SPA2-ENG)

R^2	pleasant p	vibrant v	eventful e	chaotic ch	annoying a	monotonous m	uneventful u	calm ca	Pleasantness P	Eventfulness E
SPA1 - SPA2	0,801	0,649	0,852	0,949	0,939	0,808	0,791	0,888	0,884	0,928
SPA1 - ENG	0,913	0,803	0,792	0,860	0,948	0,730	0,795	0,874	0,932	0,876
SPA2 - ENG	0,915	0,521	0,868	0,908	0,976	0,894	0,886	0,956	0,950	0,906

p-value < 0.000 in all cases

Searching for differences >=0.5 in the model dimensions obtained from the audition scores with each of the 27 stimuli, as in [13], we find that most cases cluster around the '*eventful-uneventful*' and '*vibrant-monotonous*' axes, not only in the Spanish vs. English comparison in Spain, but also in the auditions in Chile.

Such differences are better observed in the combined circular representation of model dimensions scores for the 27 stimuli shown in Figure 2 (scores scale 1-*strongly disagree* to 5-*strongly agree*).

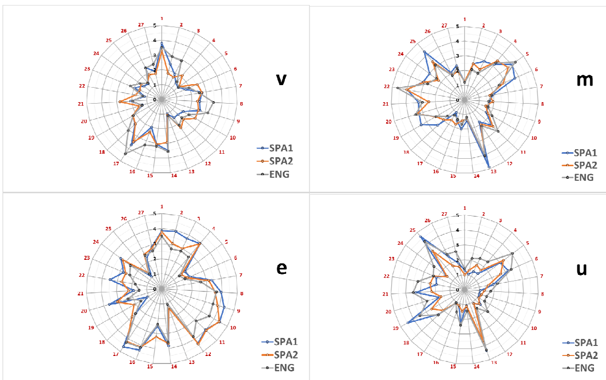

Figure 2: Combined circular representation of response scores for PAQ model "*vibrant-monotonous*" and "*eventful-uneventful*" dimensions in Spain (SPA1), Chile (SPA2) and UK (SPA3).

Looking at the absolute difference in each pairing (SPA1 vs. SPA2), (SPA1 vs. ENG) and (SPA2 vs. ENG) for these dimensions, listening test stimuli (1-4), (8-12) and (18-22) concentrate the differences. From Table 1 it can be seen that sounds 1 to 4 are mainly *human* sounds, sounds 8 to 12 are more related to *machines and traffic* and sounds 18 to 22 are more related to *nature*.

To determine how differences in model scores translate into ISO12913 space (ie, *[P, E]* coordinates), the geometric distance (Δg) between coordinates for the 27 sound stimuli was calculated from model dimension scores in three cases (pairings) as shown in Table 6.

Table 6: Absolute geometrical distance computed from *(P, E)* coordinates. Highlighted in red are distances over 0.4, orange color for distances over 0.3 and green color for distances over 0.2.

	stimulus ID	SPA1-SPA2	SPA1-ENG	SPA2-ENG
1	**CG01**	0,1317	0,0949	0,1106
2	**CG04**	0,2004	0,2428	0,2057
3	**CG07**	0,2006	0,3498	0,2249
4	**CT301**	0,0525	0,2489	0,2333
5	**E01b**	0,1514	0,3047	0,2275
6	**E02**	0,4620	0,4042	0,1343
7	**E05**	0,0437	0,1294	0,1442
8	**E09**	0,2047	0,0568	0,1525
9	**E10**	0,1449	0,1184	0,0570
10	**E11b**	0,0649	0,1350	0,1880
11	**E12b**	0,0535	0,2271	0,2611
12	**HR01**	0,0622	0,0933	0,1348
13	**KT01**	0,1916	0,1154	0,0769
14	**LS06**	0,2366	0,0565	0,1928
15	**N1**	0,1929	0,1102	0,1678
16	**OS01c**	0,0440	0,1380	0,1321
17	**OS01d**	0,1494	0,0511	0,1919
18	**RPJ01**	0,1220	0,1519	0,0343
19	**VP01b**	0,4241	0,2830	0,1450
20	**W01**	0,0727	0,2322	0,1963
21	**W06**	0,3602	0,1506	0,3270
22	**W09**	0,1332	0,3852	0,2894
23	**W11a**	0,1179	0,0849	0,0822
24	**W15**	0,1202	0,1390	0,1768
25	**W16**	0,2768	0,2320	0,0571
26	**W22**	0,1760	0,1188	0,0619
27	**W23a**	0,0801	0,0364	0,0857

As there is no guarantee that the data are normally distributed, a Mann-Whitney U test was also performed assuming that the data meet the requirements of this test, including a similar but skewed shape between groups, as can be inferred from the basic statistics and ANOVA results. If differences are statistically significant, the *U-test* value should be equal or less than the critical value (U-critic) and *p value* lay under 0.05, otherwise it can be concluded that there are no differences between groups or the differences are not significant.

The Mann-Whitney U test was first used to analyze the global differences for the mean scores of model dimensions and ISO12913 coordinates for the 27 sound stimuli in the paired groups [SPA1, SPA2], [SPA1, ENG] and [SPA2, ENG] (see Table 7)

Table 7: Mann-Whitney U Test statistics for mean scores for the 27 sound stimuli (U-critic=269.4)

U-test / *p value*	p	v	e	ch	a	m	u	ca	P	E
SPA1	**342.0**	**316.0**	**332.0**	**359.0**	**351.0**	**321.0**	**357.0**	**352.0**	**349.0**	**357.0**
SPA2	*0.349*	*0.201*	*0.287*	*0.462*	*0.408*	*0.226*	*0.448*	*0.414*	*0.394*	*0.448*
SPA1	**317.5**	**319.5**	**267.5**	**338.5**	**311.0**	**357.5**	**202.0**	**338.0**	**354.0**	**314.0**
ENG	*0.208*	*0.218*	*0.047*	*0.326*	*0.177*	*0.452*	*0.002*	*0.323*	*0.428*	*0.191*
SPA2	**343.5**	**289.0**	**254.0**	**346.5**	**336.0**	**315.0**	**241.0**	**330.5**	**337.0**	**325.0**
ENG	*0.358*	*0.096*	*0.028*	*0.378*	*0.311*	*0.196*	*0.016*	*0.278*	*0.317*	*0.247*

This test was also repeated for each one of the 27 test stimuli and the same three paired groups. This analysis included a total of 810 *U-test* correlations, 270 in each group. Summarizing these results, it is found that maximum differences between auditions in Spanish carried out in Spain and Chile (SPA1, SPA2) appear in *eventful* and *monotonous* in 9 audios, differences between auditions in Spanish carried out in Spain and in English in UK (SPA1, ENG) appear in *eventful* and *uneventful* in 14 audios and, finally, differences between auditions in Spanish carried out in Chile and in English in UK (SPA2, ENG) appears in *eventful*, *uneventful* and *vibrant* in 12, 19 and 13 audios respectively.

3.3 Structural Summary Method (SSM) analysis

Having in mind *U-test* results and in order to better determine which audios contribute the most to the observed differences in PAQ model scores, the Structural Summary Method (SSM) analysis has been repeated with the Chilean dataset just as it was applied to compare results in Spain and the UK in [13]. The sinusoidal pattern of the scores of the 8 model dimensions can be further analyzed by the results of the SSM fitting, which allows the analysis of the agreement between the interpretation of the perceived attributes in different languages (R^2 values > 0.8 would indicate a good fit of the data to the SSM cosine model). By doing so, previously published results of SSM approach applied to English-UK and Spanish-Spain comparison (see Table 4 in [13]) is now complemented by Spanish-Chile results presented together in Table 8.

3.4 Intraclass correlation coefficient (ICC) analysis: understanding of translated model dimensions

In addition to the analysis of the differences in the mean scores of the PAQ dimensions in the different language groups already presented, an intra-class consistency study was also carried out for each pair of model dimensions (soundscape attributes) for Spanish in Spain and Chile and for original English in the UK [16].

Table 8: SSM circumplex data cosine fitting results for the 27 audios in English (ENG), Spanish in Spain (SPA1) and Spanish in Chile (SPA2)

AUDIO name	AUDIO ID	ENG	English	UK		SPA1	Spanish	Spain		SPA2	Spanish	Chile	
		e	a	d	R^2	e	a	d	R^2	e	a	d	R^2
CG01	1	2.47	1.47	0.54	0.956	2.45	1.67	0.61	0.913	2.28	1.41	0.72	0.896
CG04	**2**	2.47	0.53	0.48	**0.959**	2.27	0.77	1.35	**0.477**	2.12	0.31	1.65	**0.196**
CG07	**3**	2.43	0.55	0.35	**0.910**	2.29	0.65	1.92	**0.375**	2.13	0.17	1.76	**0.092**
CT301	4	2.56	1.71	3.00	0.960	2.57	1.94	2.70	0.925	2.70	1.82	2.69	0.940
E01b	5	2.41	-1.47	1.14	0.847	2.38	-1.18	0.62	0.907	2.26	-0.99	0.91	0.833
E02	**6**	2.39	1.00	-1.00	**0.948**	2.44	-0.78	1.00	**0.762**	2.42	0.89	-0.68	**0.861**
E05	**7**	2.46	1.06	-0.14	**0.864**	2.47	1.09	0.15	**0.776**	2.37	1.20	0.15	**0.792**
E09	**8**	2.57	1.00	1.32	**0.981**	2.32	1.05	1.20	**0.759**	2.22	0.77	1.65	**0.799**
E10	9	2.55	1.01	1.54	0.987	2.38	1.28	1.62	0.879	2.27	1.03	1.41	0.854
E11b	10	2.47	1.71	2.47	0.960	2.44	1.93	2.34	0.880	2.54	1.94	2.26	0.943
E12b	11	2.58	1.71	2.85	0.965	2.57	1.99	2.59	0.936	2.61	1.95	2.53	0.960
HR01	12	2.48	1.69	2.43	0.953	2.40	1.90	2.38	0.873	2.56	1.92	2.30	0.937
KT01	13	2.35	-1.63	1.34	0.925	2.52	-1.87	1.26	0.907	2.40	-1.46	1.39	0.940
LS06	14	2.49	1.35	0.64	0.958	2.41	1.48	0.64	0.890	2.30	1.08	0.96	0.866
N1	15	2.53	1.47	-0.13	0.974	2.46	1.20	-0.10	0.946	2.45	1.53	0.14	0.828
OS01c	16	2.58	1.63	1.97	0.937	2.34	1.68	2.17	0.898	2.37	1.58	2.17	0.943
OS01d	17	2.60	1.82	1.29	0.968	2.41	1.78	1.35	0.941	2.39	1.48	1.48	0.934
RPJ01	18	2.50	1.14	-0.10	0.971	2.43	1.20	-0.41	0.851	2.37	1.18	-0.16	0.811
VP01b	19	2.57	1.72	-0.67	0.948	2.72	1.96	-1.02	0.973	2.52	1.60	-0.47	0.865
W01	**20**	2.41	-1.44	0.11	**0.936**	2.35	1.31	2.85	**0.759**	2.32	1.46	2.92	**0.849**
W06	21	2.47	1.31	-0.97	0.967	2.45	0.98	-1.10	0.908	2.49	1.27	-0.35	0.878
W09	22	2.56	-1.94	0.35	0.917	2.60	1.86	3.00	0.896	2.58	1.64	3.13	0.914
W11a	**23**	2.32	-0.14	1.38	**0.269**	2.34	-0.28	2.13	**0.175**	2.18	-0.33	1.17	**0.257**
W15	**24**	2.28	-0.29	0.23	**0.506**	2.25	0.55	2.83	**0.336**	2.05	0.47	2.27	**0.395**
W16	25	2.47	-1.49	1.85	0.953	2.66	-2.04	1.80	0.945	2.34	-1.41	1.93	0.919
W22	**26**	2.52	1.08	-0.32	0.864	2.42	1.35	-0.39	0.899	2.16	0.99	-0.21	**0.687**
W23a	**27**	2.49	0.46	-0.30	**0.775**	2.28	0.52	-0.16	**0.414**	2.11	0.39	0.17	**0.308**

Intraclass correlation coefficient (ICC) is commonly used to assess the reliability of raters, i.e. the errors in judgement made by humans involved in behavioral science research such as this. In this sense, the ICC correlation coefficient can be interpreted as a reliability index. The values obtained range between 0 (absence of agreement) and 1 (absolute agreement). The interpretation of these results is to a certain extent arbitrary, although there is some consensus in accepting Fleiss's proposal [18] where ICC < 0.4 means low correlation, ICC between 0.41 and 0.75 would indicate fair/good correlation and ICC > 0.75 a very good correlation.

In this research, as interpreted by [19], a value above 0.9 would indicate a very high level of consistency, which, in the case of the Spanish listeners, suggests that the translation successfully maintains the original semantic matching relationship of the eight soundscape dimensions (attributes). For the auditions in the original English, it would give an idea of the degree of agreement and variability between participants in understanding the soundscape attributes that define the PAQ model. This could be used as a reference for comparison with the Spanish translation.

This analysis was carried out for each pair of opposing PAQ model dimensions for each stimulus, both for the mean score (sample size N=27) and for each participant's understanding of the attribute being assessed (sample size N=29x27=783 in Spain and N=32x27=864 in Chile and the UK). Results are presented in Table 9, where ICC correlation coefficient is present together with the 95% confidence interval in each case.

Table 9: Intraclass correlation efficient (ICC) analysis for the eight attributes paired according to the four main PAQ model dimension axes.

SPA1	Mean of participants' evaluations (N=27)		Participants' evaluations (N=783)	
	ICC	*95% CI*	ICC	*95% CI*
(p – a)	**0.987**	*0.980 – 0.992*	**0.716**	*0.624 – 0.812*
(ca – ch)	**0.985**	*0.977 – 0.991*	**0.689**	*0.592 – 0.791*
(v – m)	**0.968**	*0.951 – 0.981*	**0.508**	*0.402 – 0.641*
(e – u)	**0.976**	*0.964 – 0.986*	**0.586**	*0.481 – 0.709*
SPA2	Mean of participants' evaluations (N=27)		Participants' evaluations (N=864)	
	ICC	*95% CI*	ICC	*95% CI*
(p – a)	**0.988**	*0.982 – 0.993*	**0.719**	*0.628 – 0.814*
(ca – ch)	**0.986**	*0.979 – 0.992*	**0.693**	*0.597 – 0.794*
(v – m)	**0.950**	*0.925 – 0.971*	**0.375**	*0.279 – 0.510*
(e – u)	**0.970**	*0.955 – 0.983*	**0.506**	*0.401 – 0.638*
ENG	Mean of participants' evaluations (N=27)		Participants' evaluations (N=864)	
	ICC	*95% CI*	ICC	*95% CI*
(p – a)	**0.988**	*0.982 – 0.993*	**0.726**	*0.635 – 0.819*
(ca – ch)	**0.987**	*0.981 – 0.992*	**0.706**	*0.612 – 0.804*
(v – m)	**0.979**	*0.968 – 0.987*	**0.589**	*0.484 – 0.711*
(e – u)	**0.972**	*0.957 – 0.983*	**0.518**	*0.412 – 0.648*

4. DISCUSSION

Previous results comparing scores in Spain and UK showed that "*eventful-uneventful*" and "*vibrant-monotonous*" dimension axes concentrated the most significative differences (see R^2 values for SPA1-ENG in Table 5). New results comparing scores in Spain and Chile and between Chile and UK shows that "*vibrant*" dimension seems to enter the scene presenting the greatest discrepancies, that is, lowest R^2 (see R^2 values for SPA1-SPA2 and SPA2-ENG in Table 5) Additionally, results in Table 5 also shows that differences between Spanish vs English are not so important in Chile (SPA2 vs ENG) as they were in Spain (SPA1 vs ENG) for the rest of dimensions.

Regarding the comparison of auditions scores by means of the Mann-Whitney U Test (see Table 7), main differences with English appear in the eventful/uneventful model dimensions axis where *U-test* value is lower than U-critic both in Spain (SPA1 vs ENG) and in Chile (SPA2 vs ENG). When comparing auditions scores in Spanish obtained in Spain and Chile, (SPA1 vs SPA2), results show that differences are not significant though "*vibrant*" and "*monotonous*" seems to stand out from the rest as these dimensions present the lowest *U-test* value and corresponding *p-value*. A similar result can also be inferred from comparison Chile-UK (SPA2 vs ENG), pointing out that the translation of these dimensions into Spanish is somehow interpreted in a different way by Chilean participants and that the deviation is coincident in Spain and UK. Specific test stimuli where deviations are concentrated, reinforce these results.

Regarding SSM fitting, results for audios ID 2, 3, 6, 7, 8 and 20 are highlighted in Table 8 as these were audios presenting a good SSM correlation in English but not in Spanish in Spain. Similar results are achieved in Chile, although with higher values of R^2, with audios ID 6 and 20 (marked in yellow) standing out (R^2 over 0.8) as in English. Also highlighted in Table 8 are test stimuli ID 23, 24 and 27 for which no SSM cosine correlation was found both in English and in Spanish in Spain and similar results are now obtained for Spanish in Chile, with the addition of audio ID 26, also marked in yellow, for which the good correlation in English and in Spanish in Spain now dissolves.

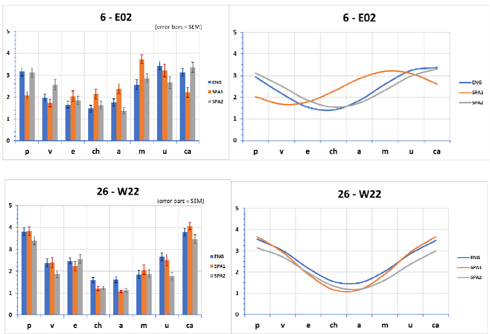

Figure 3: Mean PAQ scores (left) and SSM fitting curves (right) for audios ID 6 and 26 for English listening tests and Spanish auditions.

Summarizing the information that SSM cosine model fitting gives to this research, audios ID 6 and 20 show in Chile a closer response to English than to Spanish in Spain and audio ID 26 separates from previous results in a status that solely appears in Chile. Figure 6 illustrate these results.

Comparing the consistency results, Table 9 also shows that the (v-m) and (e-u) axes concentrate the largest deviations, with ICC not reaching 0.6 for the mean individual rating test. The ICC test carried out on each pair of attribute descriptors allows to investigate on the intra-class consistency of the translation into Spanish and compare against results in original English. This is better viewed when differences in each pair of dimensions are plotted for the 27 sound stimuli in the three cases as in Figure 4 for (v-m) and (e-u) correlations, revealing which audios concentrate the greatest understanding differences and coincidences and how does the understanding change from one case to another depending on the sound stimuli.

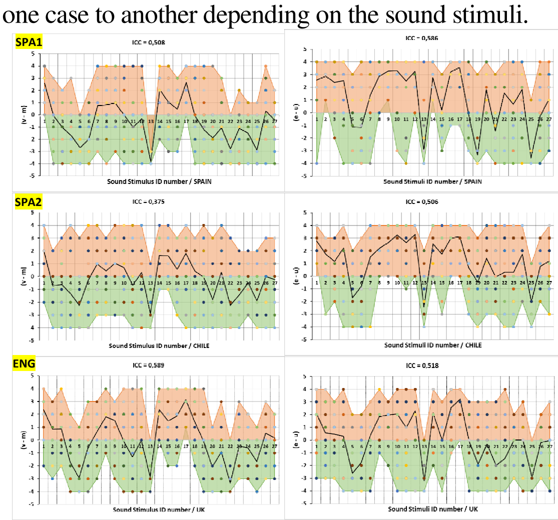

Figure 4: Dimension differences for each test stimuli from participants in Spain (SPA1), Chile (SPA2) and the UK (ENG). The mean difference is plotted as a solid black line between the maximum positive and negative difference distributions.

5. CONCLUSIONS

The new listening tests in Spanish carried out in Chile using the same SATP method as in Spain, show that Spanish native speakers in both countries produce similar overall scores. However, there are some exceptions on the "*vibrant-monotonous*" axis, which also affects the "*eventful*" dimension of the model (RQ1). Comparing the results of the auditions in Spanish in Chile with those in English in the UK, the main differences appear on the "*eventful-uneventful*" axis, as previously observed for the auditions in Spanish in Spain but, in addition, there are also differences in the “*vibrant*” dimension of the model (RQ2).

Taken together, these results seem to confirm the need for further refinement of the designation of the emotional perception linked to the presence or absence of activity in the environment. In this sense, the dimensions "*eventful/uneventful*" and "*vibrant*" and "*monotonous*" seem to concentrate the differences, a fact that may have more to do with behaviour/essence between people from different countries than with linguistic translation. These results add evidence to previous findings that have encouraged the establishment of a new starting point for soundscape research in relation to language translation: to find out whether the observed differences are due to a model that has been translated into Spanish and "*can be improved*" or to a model that was originally formulated in English and "*can be improved*". [13]. That is, questioning the English attributes resulting from a translation from the original Swedish after a first approximation by Axelsson et al [20] still makes sense and should be kept in mind.

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