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Acoustic habitability in inhabited spaces of Mazatlán: A preliminary review of a scale of experience and control of the sound environment

Habitabilidad acústica en espacios habitables de Mazatlán: revisión preliminar de una escala de experiencia y control del ambiente sonoro

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ABSTRACT

Sound is part of the experience of any inhabited space, and acoustic habitability depends both on sound levels and on how users experience and control the sound environment. This instrumental, cross-sectional and exploratory study reviewed the preliminary functioning of a five-item scale of experience and control of the sound environment, administered in the survey of project FZ-EX-0002 of the Factoriza UAS platform among users of inhabited spaces in Mazatlán, Mexico. A preliminary cut of 5 cases, out of a target of 100, was analyzed with descriptive statistics, Cronbach's alpha, item analysis and Pearson inter-item correlations; McDonald's omega and exploratory factor analysis were attempted with a fixed analysis program. Feeling safe because of the sound environment obtained the highest mean (M = 4.20). Three items on the contribution of design, materials and pleasant sounds to the experience of the space were strongly intercorrelated and had the highest corrected item-total correlations, and the scale reached α = .681. The safety item was unrelated to that core, and the reverse-worded item on control and appropriation had a negative item-total correlation, so omega could not be interpreted. Exploratory factor analysis could not be estimated with five cases. The results identify revisions needed before the final data cut: defining the space being evaluated, rewording the control item, reviewing items that ask for causal attributions, and adding an independent measure of stress.

Keywords: acoustic habitability; soundscape; perceived control; scale development

RESUMEN

El sonido forma parte de la experiencia de cualquier espacio que se habita, y la habitabilidad acústica depende tanto de los niveles sonoros como de la manera en que los usuarios experimentan y controlan el ambiente sonoro. Este estudio instrumental, transversal y exploratorio revisó el funcionamiento preliminar de una escala de cinco reactivos sobre la experiencia y el control del ambiente sonoro, aplicada en el levantamiento del proyecto FZ-EX-0002 de Factoriza UAS a usuarios de espacios habitables de Mazatlán. Se analizó un corte preliminar de 5 casos, de una meta de 100, con estadísticos descriptivos, alfa de Cronbach, análisis de reactivos y correlaciones de Pearson entre reactivos; el omega de McDonald y el análisis factorial exploratorio se intentaron con un programa de análisis fijo. La sensación de seguridad que produce el ambiente sonoro obtuvo la media más alta (M = 4.20). Tres reactivos sobre la contribución del diseño, de los materiales y de los sonidos agradables a la experiencia del espacio se relacionaron entre sí con correlaciones altas y tuvieron las correlaciones ítem-total más elevadas, y la escala alcanzó un α = .681. El reactivo de seguridad no se relacionó con ese núcleo, y el reactivo inverso sobre el control y la apropiación tuvo una correlación ítem-total negativa, por lo que el omega no fue interpretable. El análisis factorial exploratorio no pudo estimarse con cinco casos. Los resultados identifican las revisiones necesarias antes del corte final: definir el espacio evaluado, reformular el reactivo de control, revisar los reactivos que piden atribuciones de efecto e incorporar una medida independiente de estrés.

Palabras clave: habitabilidad acústica; paisaje sonoro; control percibido; desarrollo de escalas

INTRODUCTION

Sound is part of the experience of any inhabited space. People do not merely hear the noise of traffic, neighbors or shops; they interpret the sounds of a place as a whole, evaluate them as pleasant or annoying, safe or threatening, familiar or alien, and act either to protect themselves from them or to enjoy them.

The acoustic habitability of a space therefore depends both on sound levels and on how its users experience the sound environment and how much control they have over it.

Research on environmental noise has extensively documented its associations with health. An umbrella review of 23 systematic reviews and meta-analyses found that high exposure to environmental noise was associated with an increased risk of cardiovascular disease, high blood pressure, diabetes and adverse reproductive outcomes, and that the risk of anxiety and depression increased with exposure, although most of the evidence was of low or very low quality (Chen et al., 2023).

The updated World Health Organization systematic review on noise and sleep found moderate-quality evidence that the probability of being highly sleep-disturbed increases with the level of nighttime aircraft, road traffic and railway noise when the question names noise as the source (Smith et al., 2022). Another meta-analysis, including eleven studies and 15,525 adults aged 35 years or older, found an association between long-term exposure to environmental noise and the risk of depressive and anxiety symptoms (Hu, 2025).

However, the relationship between sound and well-being is not limited to noise exposure. A meta-analytic synthesis of 18 publications found that natural sounds were associated with lower stress and annoyance and with better health outcomes and positive affect (Buxton et al., 2021). In addition, a survey of 216 residents of high-density residential areas in China showed that a low sound pressure level did not necessarily lead to an experience of tranquility, that tranquility comprised perceived restorativeness and pleasantness, and that commercial loudspeakers, machinery and traffic reduced it (Zhao et al., 2025).

This shift in perspective, from noise as a pollutant to the sound environment as a resource, lies at the core of the soundscape approach, which examines how people perceive, experience and understand the acoustic environment in context.

Mazatlán offers a setting in which this perspective is relevant.

The city is undergoing a tourism-related transformation: the boom in high-rise construction aimed at tourism and second homes has generated social tensions and pressure on infrastructure along the coastal strip (Bojorquez Luque et al., 2023); recent studies describe processes of touristification and tourism gentrification with sociocultural impacts on the local population (Mendieta Vega and Roldán Clarà, 2024).

Nightlife in emblematic spaces such as Plazuela Machado has been studied from the perspective of women's experience in public space (Cruz Coria, 2024). In a city where housing, commerce, leisure, and tourism coexist, the soundscape of living spaces is a dimension of habitability that deserves to be measured through the experience of the people who use them.

Most of the instruments available for this purpose come from other contexts and tend to focus on annoyance caused by specific noise sources. Studies of European and Asian cities measure exposure using noise maps or acoustic measurements rather than users' experience (Chen et al., 2023; Smith et al., 2022). Among the recently developed soundscape scales is one designed to assess the restorative potential of acoustic environments from children's perspective (Qin et al., 2024).

There is no brief Spanish-language instrument that captures how users of the habitable spaces of a Mexican city evaluate the acoustic environment of those spaces, the contribution of design and materials to making it bearable, and the control they can exert over it.

To this end, project FZ-EX-0002 of the Factoriza UAS platform designed a brief five-item scale organized into a single dimension, Experience and control of the sound environment. The project's title in Factoriza refers to acoustic habitability and environmental stress. However, the questionnaire does not include an independent measure of stress: stress appears only in the content of one of the items.

Moreover, the available data cut comprises 5 cases. For these two reasons, this article does not examine the relationship between acoustic habitability and stress; rather, it offers a preliminary review of how the scale functions. Its title reflects that scope.

The general objective was to examine the preliminary functioning of the scale of experience and control of the sound environment among users of living spaces in Mazatlán. The specific objectives were: (a) to describe the distribution of responses to each item; (b) to estimate the

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internal consistency of the scale using Cronbach's alpha and, when interpretable, McDonald's omega, and to analyze the contribution of each item; (c) to describe the correlations among the items; and (d) to identify aspects of the instrument and procedure that should be revised before the final data cutoff. The project did not state any hypotheses, so the study is framed as exploratory.

DEVELOPMENT

FROM NOISE TO SOUNDSCAPE

Traditional noise research treats noise as a pollutant whose intensity is measured and compared against limit values. This perspective has produced the strongest evidence on the effects of transportation noise on sleep and on cardiovascular and mental health (Chen et al., 2023; Smith et al., 2022), but it leaves out part of the experience.

In an area near an open-pit mine in Central Europe, exposed residents reported high annoyance and a perceived quality of life more than twice as poor as in the control area, although noise levels remained within permitted limits (Stanovská et al., 2025).

In three residential areas adjacent to motorways, noise barriers reduced exposure by 4.4 to 11.7 dBA at nearby points, but annoyance decreased directly in only one of the three cases; the authors discussed contextual factors such as the history of complaints and coping, and distrust of the authorities (Barros et al., 2024).

The soundscape approach takes these discrepancies as its starting point. What matters for habitability is not only the sound level but also the meaning of the sounds, the activity being performed, and the person's relationship with the place. Real-time mobile measurement in Hong Kong showed that momentary annoyance was nonlinearly associated with sound level and with its sudden increases, and that this relationship varied according to the activity microenvironment, individual characteristics, and time of day (Cai et al., 2023).

In the home, an analysis of descriptions provided by London residents during lockdown examined how the acoustic environment related to activities such as work, rest and physical activity, and identified the characteristics of an ideal indoor soundscape (Torresin et al., 2022). In an online survey of 942 participants in India, a larger proportion of people perceived the interior of their home as noisier during the 2020 lockdown, whereas the outdoor environment was perceived as quieter (Mimani and Nama, 2022).

SOUNDS THAT ENHANCE THE EXPERIENCE OF SPACE

The sound environment can also be a resource. In addition to the synthesis on natural sounds (Buxton et al., 2021), recent research from China has examined the links between soundscape perception and well-being in leisure spaces.

In a cross-sectional study of twelve urban parks in Foshan, the cognitive image of the soundscape was positively associated with emotional pleasure and with several dimensions of perceived restoration; the authors caution that their results are associations rather than causal effects (Liao et al., 2026).

Among 446 older adults in a park in Zhengzhou, soundscape perception was positively correlated with well-being; place attachment and perceived restorativeness mediated this relationship (Li et al., 2025).

In communities beneath flight paths in Shenzhen with similar levels of aircraft noise, those with more birdsong and fountain sounds had a lower proportion of highly annoyed people and better soundscape ratings (Qu et al., 2023).

These results indicate that an acoustic habitability scale should not be limited to recording annoyance. A habitable space may contain sounds that improve its users' experience; this positive contribution is a facet distinct from the absence of noise. The project's scale incorporates this idea in the item asking whether some sounds in the space improve the experience of using it.

CONTROL, COPING, AND APPROPRIATION OF SPACE

Recent evidence places control over and coping with the acoustic environment at the center of the relationship between noise and health. In a sample of 1251 schoolchildren from the

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Tyrol region, greater noise-coping efforts during schoolwork were associated with more mental health and sleep problems, and the structural equation model placed these efforts between the built environment and the health problems (Lercher et al., 2024).

Noise sensitivity and attitudes toward the source also modify the relationship between exposure and annoyance. In addition, the way the questionnaire is presented can influence responses: in a study of residents living near wind farms, those who knew the purpose of the research reported more adverse health effects than those who completed a version with the purpose masked (Qu and Tsuchiya, 2021).

Control is also related to the appropriation of space. The review by Kamani Fard and Paydar (2024) on place attachment in urban settings noted that social interaction and local characteristics that express history and culture are associated with a stronger bond. In the Zhengzhou park, place attachment mediated the relationship between soundscape perception and well-being (Li et al., 2025).

The project scale expresses this relationship in a conditional item: when people cannot control the sounds of a space, they find it difficult to feel that it is their own. As discussed below, this type of statement measures something different from the appraisal of the sound environment, because agreement with it reflects the importance people attach to control, and not necessarily an unfavorable experience of the space.

DESIGN, MATERIALS, AND SAFETY

The shape and materials of a space influence its acoustic behavior, and users may perceive them as resources for making noise more bearable. In Tomakomai, Japan, a strip of trees between a main road and nearby homes was associated with a lower proportion of residents who were highly sleep-disturbed; the authors linked the larger difference in summer to bedroom windows being opened more often in that season (Morihara et al., 2026).

However, the perception that design or materials reduce annoyance is not equivalent to a measured reduction in noise, as experience with noise barriers shows (Barros et al., 2024). Two items on the project scale address precisely this attribution: whether the design of the space reduces stress from everyday noise and whether its materials help make noise less annoying.

The soundscape is also related to the sense of safety. Sounds convey information about the presence of other people, the activity of a place and potential threats. In Mazatlán, qualitative studies have shown that the experience of public space, including nightlife, differs between residents and tourists and between men and women (Cruz Coria, 2024; Cruz-Coria, 2024).

The first item of the scale asks whether the sound environment of the space makes the person feel safe, which introduces safety-related content into the dimension that does not necessarily coincide with the content of acoustic comfort.

MEASURING ACOUSTIC EXPERIENCE USING SCALES

The internal consistency of a scale is usually estimated with Cronbach's alpha (Cronbach, 1951), which assumes equivalent loadings across items, and with McDonald's omega (McDonald, 1999/2013), which does not; simulation studies have compared the performance of both coefficients under different data conditions (Malkewitz et al., 2023).

Internal structure is examined with exploratory factor analysis; current recommendations for this analysis call for verifying the adequacy of the data and ensuring a sufficient sample size before interpreting its results (Ferrando et al., 2022; Goretzko et al., 2021).

Scales with positively and negatively worded items may show wording-related biases, because some respondents respond inconsistently to the positive and negative items of the same dimension (Steinmann et al., 2022); identifying these responses can reduce such biases (García-Batista et al., 2021). Finally, in measurement theory, indicators that form a construct, rather than reflect it, are termed formative, and their implications for factor analysis and reliability theory differ from those of reflective indicators (Bollen and Diamantopoulos, 2017).

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METHODOLOGY

DESIGN

An instrumental study with a quantitative approach, a cross-sectional design and an exploratory scope was conducted to examine the preliminary performance of a scale. Because the design was cross-sectional, the relationships reported are associations and do not allow causal inferences.

POPULATION, SAMPLE, AND DATA CUTOFF

The data come from the survey "FZ-EX-0002 · Acoustic Habitability and Environmental Stress" (LEV-0048), part of project FZ-EX-0002 on the Factoriza UAS platform, and from the frozen dataset DST-0043, with a cutoff date of 14 October 2026. The population defined on the platform is any user of a habitable space in Mazatlán, Sinaloa.

Table 1 shows the composition of the sample. Eight people opened the questionnaire and 5 completed it; no cases were excluded by the platform's quality control, and 5 cases with 5 items were analyzed. This is a preliminary data cut: n = 5 out of a target of 100, with data collection still open. At this sample size, the results describe only the initial performance of the items among the five people who responded and do not allow stable estimates; the analysis will need to be repeated with the final data cut.

Table 1. Sample composition.

Indicator	Value
Individuals who opened the questionnaire	8
Completed questionnaires	5
Cases excluded due to quality control	0
Cases analyzed	5
Items	5

Note. Survey "FZ-EX-0002 · Acoustic habitability and environmental stress" (LEV-0048); population: any user of a habitable space in Mazatlán; territory: Mazatlán, Sinaloa. Dataset DST-0043, fingerprint 46c5856a737eb2f2. Source: Factoriza UAS. Preliminary cut-off: n = 5 out of a target of 100, with the survey still open.

INSTRUMENT

The sound environment experience and control scale consists of five items that form a single dimension and are rated on a 5-point response scale ranging from Strongly disagree to Strongly agree. The items ask whether the sound environment of the space makes the person feel safe (R1), whether the design of the space reduces the stress they experience from everyday noise (R2), whether the materials help make noise less bothersome (R3), whether they find it difficult to feel the space as their own when they cannot control its sounds (R4), and whether some sounds in the space improve their experience when using it (R5).

Item R4 is reverse-scored and has been recoded in the data matrix, so that a high value indicates a favorable rating across all items. Table 2 presents the wording of each item.

Table 2. Structure of the instrument.

Code	Item	Reverse
R1	The sound environment of this space makes me feel safe.	No
R2	The design of this space reduces the stress I experience from everyday noise.	No
R3	The materials in this space help make the noise less bothersome to me.	No
R4	When I cannot control the sounds in this space, I find it hard to feel it as my own.	Yes
R5	Some sounds in this space enhance my experience when using it.	No

Note. The five items make up the Experience and Control of the Sound Environment dimension; the dimension column, which is identical in all rows, is omitted. A 5-point response scale was used (Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree). The reverse-scored item has already been recoded in the delivered data matrix. Source: Factoriza UAS, project FZ-EX-0002, survey LEV-0048, dataset DST-0043.

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PROCEDURE

The questionnaire was administered through the Factoriza UAS platform, which records explicit online informed consent before the first question and does not collect data that could identify individuals. The platform performs a quality control check on completed questionnaires before incorporating them into the dataset; for this data cut, no cases were excluded.

DATA ANALYSIS

Factoriza UAS calculated the descriptive statistics for each item (mean, standard deviation, skewness, kurtosis, and percentages of responses at the minimum and maximum values), the internal consistency of the scale using Cronbach's alpha (Cronbach, 1951), the corrected item-total correlation and the alpha if item deleted, and the Pearson correlations between items, with 95% confidence intervals obtained through Fisher's z transformation.

In addition, the project's supplementary analysis program, analisis_psicometrico.py, version 1.0, was run in Python 3.13.16 (Python Software Foundation, 2026), with NumPy 2.5.3 (Harris et al., 2020), SciPy 1.18.1 (Virtanen et al., 2020), and pandas 3.0.5; this program estimates Cronbach's alpha and McDonald's omega total (McDonald, 1999/2013) from a one-factor minimum residual model without reverse-scoring items. The program does not report omega when any item correlates negatively with the rest of the dimension, because in that case the coefficient is not interpretable.

The same program performs an exploratory factor analysis, preceded by the Kaiser-Meyer-Olkin measure of sampling adequacy (Kaiser, 1974) and Bartlett's test of sphericity (Bartlett, 1950), with the number of factors determined by parallel analysis (Horn, 1965).

With 5 cases for 5 items, the correlation matrix is not of full rank: the program could not compute the measure of sampling adequacy or Bartlett's test, and the factor solution showed communalities greater than 1 (Heywood cases) for two items. For this reason, the factor analysis is neither interpreted nor reported in the article; its complete output is retained in the reproducibility appendix.

With a single theoretical factor, the software did not estimate correlations between dimensions. No confirmatory factor analysis was performed. The methodological literature holds that item factor analysis requires much larger samples (Ferrando et al., 2022; Goretzko et al., 2021).

ETHICAL CONSIDERATIONS

Participation was voluntary, with explicit informed consent recorded online by the platform, which does not collect names, addresses or other identifying data. The data were analysed in aggregate. Because there were only five cases, the presentation of the results should avoid any combination of data that could allow an individual to be recognised.

STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

During the preparation of this manuscript, the following tools were used: the Factoriza UAS platform, for data management and the descriptive and internal consistency analyses; a Python analysis program with fixed and validated procedures, for omega and the exploratory factor analysis, the latter of which could not be estimated with the data available at the cut-off; and the Claude Opus language model (Anthropic), for running that program, assisted literature search, drafting, and assembling the document from the results. The authors reviewed, corrected, and approved the entire text, verified each reference, and take full responsibility for the content of the article.

RESULTS

DESCRIPTION OF RESPONSES

Table 3 and Figure 1 present the descriptive statistics for the five items. The sense of safety provided by the space's soundscape had the highest mean (R1: M = 4.20, SD = 0.84), followed by sounds that improve the experience of the space (R5: M = 4.00, SD = 0.71) and materials that make

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noise less annoying (R3: *M* = 3.80, *SD* = 0.84).

The item on design that reduces stress from everyday noise had a mean at the midpoint of the scale and the greatest dispersion (R2: *M* = 3.00, *SD* = 1.58). The reverse-scored item had the lowest mean (R4: *M* = 1.80, *SD* = 0.84); once recoded, this value indicates that respondents tended to agree that they find it difficult to experience the space as their own when they cannot control its sounds.

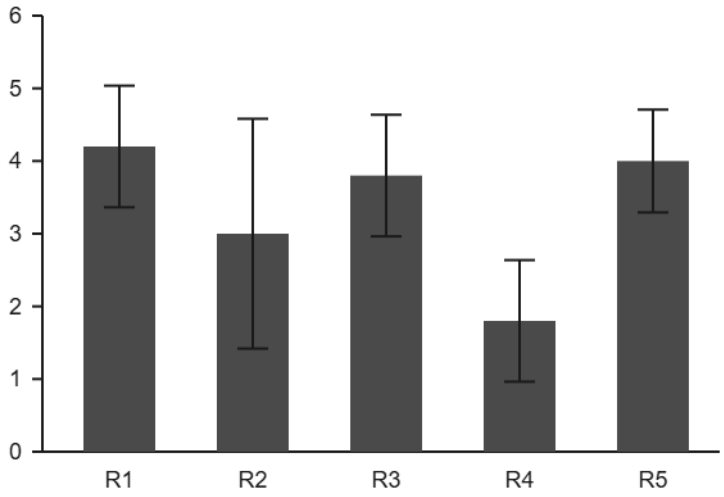
With five cases, the floor and ceiling percentages correspond to one or two individuals, and the skewness and kurtosis indices are not stable estimates of the shape of the distributions. As in other packages on the platform, the floor and ceiling percentages appear to be calculated from the observed values, as indicated in the table note.

Table 3. Descriptive statistics of the items.

Item	M	SD	Skewness	Kurtosis	Floor	Ceiling
R1	4.20	0.84	-0.51	-0.61	20%	40%
R2	3.00	1.58	0.00	-1.20	20%	20%
R3	3.80	0.84	0.51	-0.61	40%	20%
R4	1.80	0.84	0.51	-0.61	40%	20%
R5	4.00	0.71	0.00	2.00	20%	20%

Note.N = 5. Reverse-worded item R4 is shown recoded, so that a high value always indicates a favorable rating. Floor and ceiling indicate the percentage of responses at the minimum and maximum values. The item-total correlation column is omitted, as it is identical to that in Table 4. Run RUN-00243 of Factoriza UAS. Preliminary cut-off: n = 5 of a target of 100, with data collection still ongoing.

Figure 1. Mean scores per item with one-standard-deviation error bars.



INTERNAL CONSISTENCY

Table 4 presents the item analysis. Cronbach's alpha for the scale was .681. Three items had high corrected item-total correlations: design that reduces stress (R2: .972), materials that make noise less bothersome (R3: .938), and sounds that enhance the experience (R5: .764).

The sense of safety showed a virtually zero correlation (R1: .037), and the reverse-scored item on control and appropriation of space showed a negative correlation (R4: -.090). Deleting R4 would raise alpha to .800, and deleting R1 would raise it to .764; deleting any of the other three items would lower it.

Table 4. Item analysis.

Item	Corrected item-total r	α if item deleted
R1	.037	.764
R2	.972	.250

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Item	Corrected item-total r	α if item deleted
R3	.938	.431
R4	-.090	.800
R5	.764	.537

Note.N = 5. Scale from 1 to 5; reverse-scored item R4 is shown recoded. Run RUN-00243 of Factoriza UAS. Preliminary data cut: n = 5 out of a target of 100, with data collection still open.

Table 5 presents the output of the supplementary analysis program. The alpha matches the value obtained with Factoriza (.681). The program did not report omega because R4 correlates negatively with the rest of the dimension even after recoding, which renders the coefficient uninterpretable. It also warns that when an item behaves in this way, the definition of the instrument should be reviewed; in this case, the item is indeed flagged as reverse-scored, so the review concerns its content rather than its coding.

Table 5. Internal consistency by dimension.

Dimension	Items	n	α	ω	Observation
Experience and control	5	5	.681		Reverse-direction items: R4; ω not interpretable

Note.N = 5. The corrected item-total correlation excludes the item itself from the total. Cronbach's α for the full scale = .681 with 5 items. Factoriza UAS run RUN-00244. Preliminary data cut: n = 5 of a target of 100, with data collection ongoing.

CORRELATIONS BETWEEN ITEMS

Table 6 shows the correlations among the five items. The highest correlations were between the design that reduces stress and the materials that make noise less bothersome (R2 and R3: r = .945, 95% CI [.377, .996], p = .015) and between the design and the sounds that enhance the experience (R2 and R5: r = .894, 95% CI [.058, .993], p = .041); the correlation between the materials and these sounds was also high, but its interval included zero (R3 and R5: r = .845, 95% CI [-.146, .990], p = .071).

The sense of safety was weakly related to the materials (R1 and R3: r = .429) and to the design (R1 and R2: r = .189), was not related to the experience-enhancing sounds (R1 and R5: r = .000), and was negatively correlated with the reverse-scored item (R1 and R4: r = -.643, 95% CI [-.973, .553], p = .242). The reverse-scored item was not related to the experience-enhancing sounds (R4 and R5: r = .000) or to the materials (R3 and R4: r = -.071). With five cases, all intervals are very wide; only the first two coefficients mentioned excluded zero.

Table 6. Correlations between items.

Variable pair	r	IC 95%	p
R1 and R2	.189	[-.832, .918]	.761
R1 and R3	.429	[-.730, .951]	.472
R1 and R4	-.643	[-.973, .553]	.242
R1 and R5	.000	[-.882, .882]	1.000
R2 and R3	.945	[.377, .996]	.015
R2 and R4	.189	[-.832, .918]	.761
R2 and R5	.894	[.058, .993]	.041
R3 and R4	-.071	[-.897, .865]	.909
R3 and R5	.845	[-.146, .990]	.071
R4 and R5	.000	[-.882, .882]	1.000

Note.α = Cronbach's alpha; ω = McDonald's omega total from a one-factor minimum residual model, without reversing items. Complete cases per dimension. Experience and control = Experience and control of the sound environment. The program does not report α when any item correlates negatively with the rest of the dimension, as occurs with R4 after recoding. Source: prepared by the authors with analisis_psicometrico.py 1.0 (Python 3.13.16), dataset DST-0043_FZ_EX_0002. Preliminary cut-off: n = 5 out of a target of 100, with data collection ongoing.

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INTERNAL STRUCTURE

The exploratory factor analysis is not interpretable with this data cut. With 5 cases for 5 items, the correlation matrix is not of full rank, and the software could not compute the measure of sampling adequacy or Bartlett's test of sphericity.

The solution the program produced showed communalities greater than 1 for R1 and R2, an indication that the model cannot be estimated with these data. Therefore, its loadings and explained variance are not reported; they are retained in the reproducibility appendix. The structure of the scale will need to be examined with the final cutoff.

DISCUSSION OF RESULTS

This study examined the preliminary functioning of a brief scale of experience and control of the acoustic environment, based on a data cut of 5 cases. With a sample of this size, no figure in this article can be read as an estimate of the scale's properties in the population of users of habitable spaces in Mazatlán.

What the data do allow is to identify patterns in item behavior that guide the revision of the instrument before the final data collection wave; on that front, the results are clear.

The first pattern is the coherence of a three-item core: design that reduces noise-related stress, materials that make noise less bothersome, and sounds that improve the experience of the space were highly intercorrelated and showed the highest item-total correlations.

All three items refer to what the space contributes to its users' acoustic experience, both by attenuating noise and by offering pleasant sounds. This core is consistent with the soundscape approach, which views the acoustic environment as a resource as well as a source of annoyance (Buxton et al., 2021; Zhao et al., 2025), and with evidence that positive soundscape appraisal is associated with well-being and perceived restoration (Li et al., 2025; Liao et al., 2026).

Two of these items, however, ask respondents to make an attribution: that the design reduces their stress and that the materials make the noise less annoying. Experience with noise barriers shows that the perception of such attributions does not necessarily match the measured changes in the acoustic environment (Barros et al., 2024); moreover, wording the items with verbs that imply an effect may make it difficult for people without technical knowledge to answer them accurately.

The second pattern is the separation of the sense of safety. The item on the sense of safety produced by the sound environment had the highest mean but was not related to the rest of the scale. This result admits a content-based explanation: safety depends on the presence of people, lighting, the activity of the place, and its history, and the sound environment is only one of its cues.

Studies conducted in Mazatlán have shown that the experience of public space differs across user groups (Cruz Coria, 2024; Cruz-Coria, 2024), so acoustic safety might require several dedicated items or constitute a distinct facet of the sonic experience.

The third pattern concerns the reverse-scored item. A respondent who agrees that it is difficult to feel that a space is their own when they cannot control its sounds is not necessarily expressing a negative appraisal of the space being evaluated: the agreement may reflect the importance they attach to control over the sound environment, which the literature places at the core of the relationship between noise and well-being (Lercher et al., 2024).

The statement is also conditional and combines two components, control and appropriation, which makes it difficult to interpret. Recoding it as a reverse-scored item assumes that agreement with it is equivalent to an unfavorable experience; the data from this wave, with a negative item-total correlation and an alpha that would increase without it, do not support that assumption.

The result is consistent with a wording-related bias (García-Batista et al., 2021; Steinmann et al., 2022), but the content-based explanation appears more straightforward. It would be advisable to rephrase perceived control as a statement about the space being evaluated, for example, one about the possibility of regulating the sounds that reach it, and to cover appropriation in a separate item.

The fourth pattern is methodological and concerns the referent of the scale. The items refer to "this space," but the survey population is defined as any user of a habitable space in Mazatlán, and the data do not record which space is involved. A dwelling, a public square and a workplace differ in their sound sources, in the control they afford and in people's attachment to them; the literature shows that the relationship between sound and annoyance varies with the activity microenvironment (Cai et al., 2023).

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Without this information, responses from different people may refer to non-comparable spaces. Finally, the project title mentions environmental stress, but the questionnaire does not include an independent measure of stress; if the project aims to study this relationship, it will need to incorporate an established instrument, such as those used in the literature linking noise annoyance to mental health (Gong et al., 2022; Hu, 2025), and to consider the focusing bias that may arise from a questionnaire whose purpose is evident to respondents (Qu and Tsuchiya, 2021).

CONCLUSIONS

The study examined the preliminary performance of a five-item scale assessing the experience and control of the acoustic environment among users of habitable spaces in Mazatlán, based on a preliminary data cut of 5 cases out of a target of 100.

Three items, concerning the contribution of design, materials and pleasant sounds to the experience of the space, were highly intercorrelated and produced an alpha of .681 for the full scale. The sense of safety was not related to this core, and the reverse-scored item on control and appropriation had a negative item-total correlation, which precluded reporting omega. Exploratory factor analysis could not be estimated with this sample cut.

The limitations of the study are severe and must be taken into account when interpreting all of its results. The first is the size of the data cut: with 5 cases, the correlations have very wide confidence intervals, the alpha and the item-level indices are unstable, and the factor structure cannot be examined.

The second is the lack of a common referent: the scale asks about “this space” without recording which space is being referred to.

The third concerns the sample: the recruitment procedure, the type of sampling, and the characteristics of the respondents are unknown; the results cannot be generalized.

The fourth concerns measurement: the study does not include an independent measure of stress or measurements of the acoustic environment; the floor and ceiling percentages of Factoriza need to be verified; and no confirmatory factor analysis was performed.

The fifth is a design limitation: because the study is cross-sectional, it does not allow causal inferences to be drawn.

Directions for future work follow from these limitations. Before data collection continues, it would be advisable to specify in the instructions which space is being assessed, or to record it in a preliminary question; to rephrase the item on control and appropriation; to revise the items that ask respondents to attribute effects to the design and the materials; and to expand the scale with items that better represent the facets of annoyance, safety, and control.

With the final data collection wave, it will be advisable to repeat the item analysis, explore the structure of the scale if sampling adequacy permits, and then test it using confirmatory factor analysis in an independent sample. Incorporating an established stress instrument and sound level measurements in a subsample of spaces would make it possible to gather validity evidence based on relations to other variables and to answer the question posed in the project’s title.

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