THE FUTURE OF SOUNDSCAPE ASSESSMENT – WHAT CAN WE LEARN FROM QUALITATIVE DISCIPLINES?

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1 INTRODUCTION

The acoustics industry is making a move towards integrating soundscape design and conventional noise control. The Noise and Soundscape Plan for Wales 2023-2028[1] was published on 4th December 2023. Public consultation for the document highlighted that there are diverse opinions that exist in relation to soundscape in policy[2]. It is recognised that there are great opportunities for acousticians to add value to projects, collaborate with other disciplines, and facilitate a change in the industry with the "soundscape approach." However, one concern raised is the subjective nature of soundscape assessment and the potential for inconsistencies across projects. Conventional noise control is often quantitative aiming to achieve a particular sound level. It's often methodical, objective, and measurable. On the other hand, achieving "appropriate soundscapes" requires a qualitative approach. It is dependent on the context which is always subject to change.

Another environmental discipline that assesses the effects of change associated with development is landscape and visual impact assessment (LVIA). The word "soundscape" is the aural counterpart to the word "landscape", and both are based on perception by people.

This paper explores LVIA methodologies and draws parallels that could be used for soundscape assessment. This paper reviews the available metrics currently being used and developed for soundscape assessment and introduces the ideas of value, susceptibility, and sensitivity (taken from LVIA) into a soundscape assessment methodology.

2 SOUNDSCAPE GUIDANCE – SETTING THE FRAMEWORK

The work being done to apply the soundscape approach is evolving rapidly. Acoustic projects are becoming case studies with plenty of opportunities to learn for the future.

Two methods in particular have set the framework for defining soundscape and associated terminology. They also set out the procedure for soundwalks and give guidance for collecting/analysing data from surveys and questionnaires. These are summarised below.

2.1 ISO Standards

ISO 12913-1[3] (entitled "Acoustics – Soundscape – Part 1: Definition and conceptual framework") defines soundscape and associated perceptual elements of soundscape. It describes *"the process of perceiving or experiencing and/or understanding an acoustic environment, highlighting seven general concepts and their relationships: (1) context, (2) sound sources, (3) acoustic environment, (4) auditory sensation, (5) interpretation of auditory sensation, (6) responses, and (7) outcomes."* It is important to note that *"soundscape"* and *"acoustic environment"* are not interchangeable. The *"acoustic environment"* is the collection of sounds that have reached the listener, and the *"soundscape"* is perceived by the listener.

ISO/TS 12913-2[4] (entitled "Acoustics – Soundscape – Part 2: Data collection and reporting requirements") gives the requirements and supporting information for soundscape data collection and

reporting. It details how to obtain data through questionnaire (Method A), soundwalk (Method B), and interview (Method C).

ISO/TS 12913-3[5] (entitled “Acoustics – Soundscape – Part 3: Data analysis”) gives the requirements and supporting information on the analysis of questionnaire data. The responses to the “perceived affective quality” part of the questionnaire can be represented in a two-dimensional model where the main dimension is pleasantness and the second dimension is eventfulness. If these are on an x and y axis, two additional axes rotated 45° yield further human judgements, or “perceptual attributes” (PA) about how the acoustic environment is perceived to be. These eight PAs (pleasant, annoying, eventful, uneventful, vibrant, monotonous, chaotic and calm) can be seen in Figure 1 below.

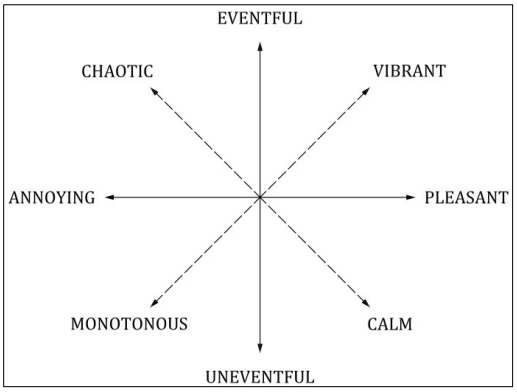

Figure 1 – From ISO/TS 12913-3 (Figure A.1), a graphical representation of the PAs

Overall, these ISO standards assert that soundscape studies shall always consider the key components: people, acoustic environment, and context.

2.2 SSID Protocol

The Soundscape Indices (SSID) Protocol[6] is another method for urban soundscape surveying. It consists of a recording stage (spatial audio-visual recordings) and a questionnaire stage. The questionnaires use a slightly different version of Method A from ISO12913-2 but with the same aim to collect perceptual responses from participants. The protocol has been implemented by several groups across multiple countries; the aim is to use the data collected to form a large, international soundscape database.

3 LEARNING FROM LANDSCAPE

Before acousticians can learn from landscape methodology, it is important to understand the terminology used. It is also important to note that despite landscape and visual impact being grouped together in an assessment they are distinctly different. Section 4 will discuss learning from visual impact assessment.

Landscape may be defined as an area, as perceived by people, the character of which is the result of the action and interaction of natural and/or human factors[7]. The word “character” in the definition is key as it is the overarching way to understand the landscape. The landscape character is a distinct and recognisable pattern of elements in the landscape that make one landscape different from another, rather than better or worse[8]. When something is uncharacteristic in the landscape it may have an adverse effect on the area.

Landscape value is the “inherent” component, which is independent of the development. On the other hand, susceptibility is development specific[9].

The first step in a landscape assessment (to eventually assess the significance of likely effects of a development), as to be expected, is establishing the baseline landscape within the area. The baseline informs the value of landscape character, the susceptibility that the landscape character has to change, and eventually the sensitivity. This is based on the Guidelines for Landscape and Visual Impact Assessment, third edition (GLVIA3)[10]. Note that the criteria and important factors in the tables in the following sections can change as they may be project specific (depending on the landscape and context).

Finally, although the next sections discuss key concepts of LVIA it is not the aim for acousticians to do the work of landscape architects. The aim is for reassurance that a qualitative assessment in the field of acoustics can be robust and there can be a partnership to learn from each other.

3.1 Value

Value is the level of importance of a landscape[10]. The value is attached to different landscapes by society, and it is recognised that a landscape may be valued by different people or groups for a variety of reasons. Value is presented as high, medium, or low based on defined criteria.

Value should be determined through a review of existing assessments, policies, strategies, guidelines, surveys, and should be based upon a structured assessment process including community-based evidence[9].

Example landscape value criteria is shown in Table 1 below,

Table 1: Landscape value, [10]

Value	Criteria for assessment value
High	Designated areas (including but not limited to World Heritage sites, Area of Outstanding Natural Beauty [AONB]). Landscape of high scenic quality with a distinctive combination of features, elements, and characteristics.
Medium	Local or regional recognition of importance. Some scenic quality. Some distinctive features, elements, and characteristics. Some cultural or historical elements.
Low	No formal designation, not valued for its scenic quality. Mainly common features and few or no cultural, historic, or ecological elements that contribute to the character.

3.2 Susceptibility

Susceptibility is the ability of a defined landscape to accommodate the specific proposed development without undue negative consequences for the baseline situation. Susceptibility will vary depending on the type of development and the scale of the change.

Example criteria for the evaluation of landscape susceptibility is shown in Table 2 below.

Table 2: Landscape susceptibility, [10]

Susceptibility	Description of susceptibility
High	Little or no ability to accommodate the proposed development without adverse consequences for the retention of the existing landscape baseline or the delivery of landscape planning policies and strategies
Medium	Some ability to accommodate the proposed development without adverse consequences for the retention of the existing landscape baseline or the delivery of landscape planning policies and strategies
Low	An ability to accommodate the proposed development without adverse consequence for the retention of the existing landscape baseline or the delivery of landscape planning policies and strategies

3.3 Sensitivity

Sensitivity combines the judgments made on value and susceptibility and is used in the assessment of significant effects. The sensitivity is based on a matrix as shown in Table 3.

Table 3: Sensitivity, [10]

		Value		
		High	**Medium**	**Low**
Susceptibility	**High**	High	High	Medium
	Medium	High	Medium	Low
	Low	Medium	Low	Low

4 LEARNING FROM VISUAL IMPACT

Visual impact is concerned with how people will be affected by changes in views and visual amenity.

The definitions of value, susceptibility, and sensitivity are largely the same but from the perspective of views and visual amenity.

Deciding upon the visual receptors for the assessment is similar to deciding upon the noise sensitive receptors for a large scheme. People living in the same area (for example, the same road with the same view) can be grouped together. This is based on the professional judgement of the landscape architect but should also be informed through discussions with the local authority. This is part of establishing the baseline. Similar to the above section “Learning from Landscape”, the visual baseline informs the value, susceptibility, and sensitivity. Note that the criteria and important factors in the tables in the following sections can change as they may be project specific.

4.1 Value

In terms of visual impact value, judgements are made about the value attached to views.

Example visual value criteria are shown in Table 4 below.

Table 4: Visual value, [10]

Value	Criteria for assessment value
High	Attractive features, focal points, or skylines. A view in a high-quality landscape such as an AONB, designated, or identified as of value in a guidebook or tourist literature. A view where the composition is a fundamental aspect of the design or function of a heritage asset.
Medium	Neither attractive or discordant elements. A view that is undesignated and undocumented.
Low	Discordant or unattractive features are dominant or prevalent. Views may contain some attractive features, but these are not strongly apparent in the view. A view that is undesignated and undocumented.

4.2 Susceptibility

Visual susceptibility differs from landscape susceptibility in that it is the evaluation of the visual receptor and the extent that their attention will be focused on the views. For example, pedestrians may have a high susceptibility compared to a commuter driving through the area (low susceptibility as not necessarily focused on the views).

Example criteria for the evaluation of visual receptor susceptibility is shown in Table 5 below.

Table 5: Visual susceptibility, [10]

Susceptibility	Description of susceptibility
High	Occupiers of residential properties, Public Right of Way (PRoW) users, visitors to heritage assets, people engaging in outdoor recreation whose attention is likely to be focussed on the landscape (for example, golf), travelling through a scenic route on road or rail and are aware of the views and visual amenity. Views with few detractors, is designated, is within a scenic area or is important to a heritage asset.
Medium	People working or travelling more generally through roads, rail, cycling, etc., staying in hotels or healthcare institution. Views where neither attractive or discordant elements are dominant and are undesignated and undocumented.
Low	People at work, at school, engaging in formal sport where visual setting may play a role but the attention is focused on the activity (for example, rugby), commuting in urban areas, and travelling at high speed on roads or railways. Views that are unattractive, undesignated, and undocumented.

4.3 Sensitivity

The sensitivity matrix for visual impact is the same as what is shown in Table 3 above for landscape.

5 WHAT CAN BE APPLIED TO SOUNDSCAPE ASSESSMENT?

Even at this basic level of understanding LVIA as a qualitative assessment, it is clear that there are both similarities and differences between LVIA and acoustics.

Landscapes and soundscapes are both experienced with multiple senses, most notably sight and hearing. However, there is less control over hearing when compared to sight. Sounds can be heard

even when they are not seen. Humans can close their eyes but cannot close their ears. Overall, sound can change frequently without moving from a given space whereas a landscape cannot change as quickly[11]. Despite that, both are always evolving and always subject to change. When urban development is already well established it is complex to change it completely, hence advocating for a proactive approach as opposed to reactive.

An important component of landscape value is community-based evidence to get a sense of what is perceived by the people. Sounds can also reflect the identity of the community by creating a sense of place, reinforcing cultural heritage, and adding to well-being. The soundscape approach is heavily reliant on questionnaires and mediated soundwalks to get up-to-date community-based evidence. However, LVIA does not tend to speak to people to get ideas of their perception.

There are mixed opinions within the acoustics industry on the ability to quantify, enforce, and regulate soundscape assessment. LVIA makes judgements that have to follow a robust methodology and potentially be subject to differing opinions. Further investigation on two areas – character and professional judgement – have the potential to improve the application of soundscape assessment.

5.1 More emphasis on character

In Planning Policy Wales, character is one of the five key objectives of good design[12]. Character can also be applied to aural identity.

Soundscape design is about what sounds are appropriate to or belong to a place at a particular time. The idea of character and "uncharacteristic" is important in soundscape design. Although the definition of soundscape emphasises the "acoustic environment", human perception involves multiple senses. In the book "Urban Soundscapes: A guide to listening for landscape architecture and urban design", the author states *"a frequent comment of my soundwalk participants is how, in many places, the aural does not correspond with the visual, and this often catches participants by surprise. Through listening and in time, some spaces become more interesting than initially thought just by looking at them. In other cases, places are less pleasant than initially thought, for example, if next to a motorway hidden from view."*[13]

Character assessments as part of the baseline can help to understand the soundscape and also assist in forming judgments and decisions about change. It provides more robust evidence for the assessment, and a more holistic approach to understanding the area instead of focusing on specific features[8].

5.2 Professional judgment

Part of the subjective and qualitative nature of soundscape assessment is risk of inconsistency. However, LVIA makes informed judgements that are potentially subject to differing opinions.

GLVIA3 states "*even with qualified and experienced professionals there can be differences in the judgments made. This may result from using different approaches or different criteria, or from variation in judgements based on the same approach and criteria. Ideally, and especially for complex projects, more than one person should be involved in the assessment to provide checks and balances."*[10] Judgments made must be reasonable and based on clear and transparent methods so it can be examined by others. Impartiality is very important for LVIA, and Landscape Institute Members operate under the Code of Conduct.

The soundscape approach is not the first time acoustic guidance is relying on professional judgement. For example, British Standard 4142:2014 requires subjective assessment of the potential tonality, impulsivity, and intermittency of a sound[14]. Wording in questionnaires can predispose judgements (for example, sound vs. noise).

Overall, the methodology must be specific and descriptive and must be followed in the assessment. It is both a challenge and an opportunity, but it is also a necessity to develop the soundscape approach further.

6 THE SOUNDSCAPE CRITERIA MATRIX

Sections 3 and 4 have summarised example criteria for value and susceptibility for both landscape and visual impact. Table 6 and Table 7 below use this information to propose candidate soundscape criteria for value and susceptibility to form the soundscape sensitivity matrix.

The value and susceptibility would be evaluated after data has been gathered from soundwalk and questionnaire. Each soundwalk assessment location would evaluate the value, susceptibility, and sensitivity.

Following the criteria tables is a discussion of the suitability of this as part of the soundscape approach in terms of benefits and limitations.

Table 6: Soundscape value (candidate example)

Value	Candidate criteria for assessment value
High	Natural sounds (even if man-made) that are characteristic or appropriate for the space. Tranquil spaces. Provides people with sense of safety, heritage and/or community. Notable soundmark. PA: Vibrant, pleasant, calm, eventful
Medium	Neither appealing or disconnected elements are dominant. PA: Eventful, uneventful, vibrant, calm, chaotic, monotonous (all depending on the context)
Low	Sound is uncharacteristic or out of place, unwanted, disturbing, commercial or industrial, out of control. Does not provide people with sense of safety. PA: Chaotic, annoying, monotonous, uneventful

Table 7: Soundscape susceptibility (candidate example)

Susceptibility	Candidate examples of susceptibility
High	Occupiers of residential properties, Public Right of Way (PRoW) users, visitors to heritage or cultural assets, tourists in a rural area, people engaging in sport where a quiet atmosphere is a key component (for example, golf).
Medium	Pedestrians, tourists in an urban area, people travelling or commuting by bicycle, staying in hotels or healthcare institutions, engaging in sport where a quiet atmosphere is not a key component but still need to communicate, at work or at school.
Low	People travelling or commuting by car, bus, tram, or train.

The sensitivity matrix is same as what is shown in Table 3 above.

6.1 Benefits & limitations

A number of key benefits of the soundscape criteria matrix have been identified.

The soundscape criteria matrix allows each soundwalk survey location to be given its own sensitivity assessment, recognising the individuality of spaces, and highlighting where soundscapes need improvement.

The matrix is also good for projects involving a new development on an existing space. There is a preconceived notion that soundscape is for projects involving acoustic design at the forefront. Not every project has the capacity to overhaul the acoustic environment to create an appropriate soundscape. However, there are opportunities to mitigate adverse impacts to existing soundscape and look at soundscape in the long-term.

Finally, by assessing susceptibility the soundscape criteria matrix gets acousticians thinking about the users of the space, whether that's current users and/or future users.

There are also a number of limitations to the utilisation of the soundscape criteria matrix.

Similarly to ISO12913-2 (the x-y axis of pleasantness and eventfulness), this matrix does not take into account the person's responses and outcomes (for example, feeling joy and therefore returning to the place again). ISO12913-2 does include the question *"how often would you like to visit this place again?"* with responses ranging from "*never*" to "*very often*". There is potential to incorporate responses to this question within the "value" criteria.

There is currently overlap in the PAs associated with high, medium, and low value. Currently it is a guide for the assessor after determining where a location is on the Pleasant-Eventful axes. It would be up to the assessor to use context from other survey responses to determine whether a location is high vs. medium or low vs. medium.

Finally, the use of susceptibility criteria may not be appropriate for all projects. It may be more appropriate to replace "soundscape susceptibility" criteria with "soundscape potential" criteria for large infrastructure projects involving acoustic design.

7 OPPORTUNITIES & NEXT STEPS

As soundscape continues to evolve within the acoustics industry there is still work to be done to formalise specific approaches to soundscape assessment. With acoustics at the forefront of decision making (instead of noise treated as something to simply mitigate) there are numerous opportunities to collaborate and integrate with other disciplines.

In terms of the soundscape approach learning from LVIA and evolving a robust assessment methodology, the following are proposed as "next steps."

7.1 Further investigation

As stated above, collaboration with other disciplines is key to evolving soundscape assessment. There are evident links between acoustics and landscape, but there are also links with other disciplines such as air quality, heritage, and ecology. To support the integration of methodologies of different disciplines it is proposed that a working group is established (that includes members from each discipline) to set the framework with a collaborative approach.

Also in terms of further investigation, the next step would be applying the soundscape criteria matrix within a case study to refine the criteria. The aim is to get different acousticians using the criteria on different projects to see if it helps mitigate the risk of inconsistency.

7.2 Digital EIA

With the exploration of more interaction and accessibility through Digital EIA, there are opportunities to present sound as an experience that is part of the project and in some cases part of the community.

Visual impact baseline study identifies and selects viewpoints to present in the assessment; these can be selected to represent specific views valued for their quality or cultural association. An acoustic equivalent that could be utilised more through Digital EIA is the presentation of soundmarks. Making use of the familiar term landmark, a soundmark is a unique sound that form part of a community's identity. This has potential to be explored more through the SSID Protocol (and using the data collected to form a large, international soundscape database).

7.3 Tranquillity

There are links between acoustics and tranquility and also landscape and tranquility. In the growing interest of health and wellbeing it is appropriate to develop the subject further.

GLVIA3 defines tranquility as *"a state of calm and quietude associated with peace, considered to be a significant asset of landscape."* [10] The Noise and Soundscape Plan for Wales 2023-2028 states "*tranquility means different things to different people, but it is generally understood to refer to an untroubled state, characterised by peace and calm and free from unwanted disturbances."* [1]

Both disciplines are working towards accounting for tranquility more, with initiatives and research opportunities becoming more abundant. It's improbable that one discipline takes ownership of tranquility guidance and assessment; therefore, it's another opportunity for collaboration.

8 CONCLUSION

This paper has explored LVIA and introduced the ideas of value, susceptibility, and sensitivity to inform a soundscape assessment criteria.

It is worth noting that this proposed approach is not meant to replace other methods for presenting soundscape data. The ideas of standardising value, susceptibility, and sensitivity are to aid in consistent soundscape assessments and decision making.

The short answer to the title question *"What can we learn from qualitative disciplines?"* is *"we can learn a lot, but not on our own."* Further investigation and collaboration is necessary in order to continue to develop soundscape assessment criteria. However, the move towards integrating soundscape and conventional noise control means opportunities for acousticians looking to facilitate the change.

9 REFERENCES

1. Welsh Government, ‘Noise and Soundscape Plan for Wales 2023-2028: Our national strategy on soundscapes’. (December 2023)
2. Welsh Government, ‘Consultation – summary: Noise and Soundscape Plan for Wales 2023-2028’. (December 2023)
3. ISO 12913-1:2014, ‘Acoustics – Soundscape – Part 1: Definitional and conceptual framework’. International Organization for Standardization. (2014)
4. ISO/TS 12913-2:2018, ‘Acoustics – Soundscape – Part 2: Data collection and reporting requirements’. International Organization for Standardization. (2018)
5. ISO/TS 12913-3:2019, ‘Acoustics – Soundscape – Part 3: Data Analysis’. International Organization for Standardization. (2019)
6. A. Mitchell et al., ‘The Soundscape Indices (SSID) Protocol: A Method for Urban Soundscape Surveys – Questionnaires with Acoustical and Contextual Information’. Appl. Sci. 10(7), 2397. (April 2020)
7. Council of Europe, ‘Glossary of the Information System of the Council of Europe Landscape Convention: Spatial planning and landscape, No. 106’. (January 2018)
8. C. Tudor, ‘An Approach to Landscape Character Assessment’. Natural England. (October 2014)
9. Landscape Institute, ‘Technical Guidance Note 02/21: Assessing landscape value outside national designations’. (May 2021)
10. Landscape Institute and the Institute of Environmental Management and Assessment, ‘Guidelines for Landscape and Visual Impact Assessment, Third edition’. (April 2013)
11. U. Ruiz Arana, ‘Thinking with my ears’. Landscape Journal 2021(2):29-32. (April 2021)
12. Welsh Government, ‘Planning Policy Wales, Edition 12’. (February 2024)
13. U. Ruiz Arana, ‘Urban Soundscapes: A guide to listening for landscape architecture and urban design’. (2024)
14. British Standard 4142:2014+A1:2019, ‘Methods for rating and assessing industrial and commercial sound’. British Standards Institution. (2014 amended 2019)