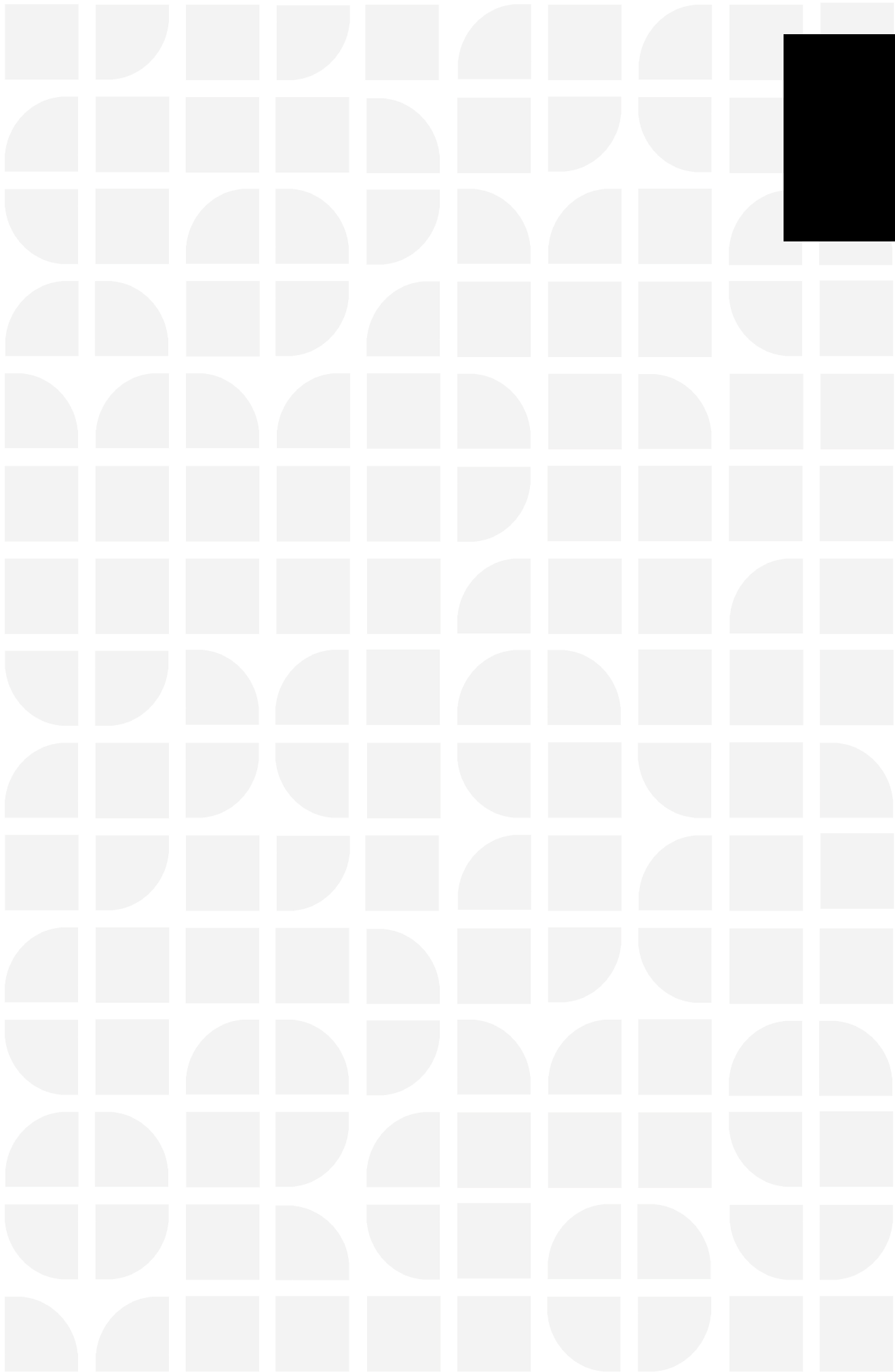




Entwining sound, space and narratives. Sound design approaches in exhibitions

Micol Riva

Keywords:

Sound-driven design, Exhibitions, Sound narratives, Approaches.

ABSTRACT:

This article explores the evolution of exhibition design, focusing on the integration of sound as a key narrative and experiential element. In recent decades, technological advances and discoveries in neuroscience have influenced the design of exhibition spaces, transforming them into multimodal experiences that go beyond mere visual engagement. Sound emerges as a central tool, capable of shaping the emotional, spatial, and narrative dimensions of exhibitions. Through case studies and interviews with exhibition and sound designers, I propose four sound design approaches – *transparent, relational, unexpected, and imaginary* – as strategies for amplifying narratives through non-verbal sounds and soundscapes. Balancing its informative and evocative roles, sound is a fundamental component in generating meaning and creating engaging, communicative, and memorable experiences.

Questo articolo esplora l'evoluzione dell'exhibition design, concentrandosi sull'integrazione del suono come elemento narrativo ed esperienziale. Negli ultimi decenni, i progressi tecnologici e le scoperte neuroscientifiche hanno influenzato il design degli spazi espositivi, trasformandoli in esperienze multimodali che superano il semplice coinvolgimento visivo. In questo contesto il suono emerge quale strumento centrale, capace di modellare le dimensioni emotive, spaziali e narrative delle mostre. Attraverso casi studio e interviste con progettisti e sound designer, propongo quattro approcci al design sonoro – *trasparente, relazionale, inaspettato e immaginario* – quali strategie per rafforzare le narrazioni attraverso suoni non verbali e paesaggi sonori. In equilibrio tra ruolo informativo ed evocativo, il suono diviene componente fondamentale per la generazione di senso e per la creazione di esperienze coinvolgenti, comunicative e memorabili.

Micol Riva

Research fellow at the Architecture and Urban Studies department of Politecnico di Milano on the project "FUTURSPACE. Future Spaces for Cinema and Entertainment". Between 2024 and 2025, she conducted research on "Sound Design and Cultural Heritage" at the Design department of Politecnico di Milano. She also works as a professional exhibition designer, pushing the boundaries of exhibition, narrative, and interaction through the design and development of installations and exhibitions.
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Multidimensional exhibition spaces

Exhibition design as a field of study¹ and as a practice² has undergone major changes in the past decades. On the one hand, technological innovations have radically changed how we perceive and interpret the world. The spread of digitally enhanced “sensitive and sensory, hybrid and phygital” spaces changed the way we transfer and share knowledge, build meaning, and live.³ As the digital and physical realities mingle, in the *postdigital*⁴ contemporary exhibition spaces, the *phygital* metaphor becomes “a narrative device” where *space, narrations and technologies* inform “space-based, multimodal storytelling mediated by blended experiences and devices”.⁵

On the other hand, scientific findings in cognitive and sensory studies have shown how human cognition is deeply rooted and embodied in our neural and sensory-motor system. The *embodiment* paradigm emphasises the mutually influencing relationship between *cognition, perception* and *action*.⁶

In the museum field, these discoveries fostered the adoption of multimodal and multisensory strategies to enhance the visitors’ experience, inducing the so-called “sensory turn”.⁷ Designers and professionals began to move beyond visual centrality, starting to “explore the aesthetic potential of the nonvisual senses”⁸ as a way to “make sense of the world, or translate sensory perceptions and concepts into a particular ‘worldview’”.⁹

Enhanced by these rather radical turns, museums have become increasingly “narrative”:¹⁰ cultural

spaces where *intangible cultural heritage, context, and communities*¹¹ are dramaturgically intertwined into a complex and dynamic relational system through a deliberate “act of direction”¹² orchestrated by designers.

Grounded in *percepts and concepts*,¹³ narrative acts as a foundational means for creating and interpreting human culture, fostering multiple layers of interpretation. Indeed, through storytelling, the exhibited artefact can enter into a “museological resonance”¹⁴ with the visitors, evoking “cultural forces”,¹⁵ raising attention, and generating new meanings. This resonance enables meaning-making and learning, preserving memories, and “encouraging personal reflection and public discussion”.¹⁶

These socio-technological and cultural shifts have inevitably impacted exhibition design practices, refocusing them from exhibiting technologies to crafting increasingly visitor-centred experiences¹⁷ and giving shape to hybrid, narrative, multimodal spaces. Exhibitions have thus become *performative-ly-driven* experiences¹⁸ in which “the visitor is simultaneously actor, director, spectator, and participant”.¹⁹

Developing within the three-dimensional physical space and progressing through a fluid time sequence,²⁰ open and nonlinear narratives transform exhibitions into real communicative acts. By leveraging the architectural space, artefacts, scenography and media as triggers of new behaviours, they enhance knowledge transfer and foster social awareness.

And sounds, with their elusive nature which crosses the boundaries between the physical and virtual, reality and imagination, cognition and emotion, have become key design tools that mold communicative spaces, fostering an “aural shift”²¹ in exhibitions.

Interlacing sources

To explore how sounds – especially non-verbal sounds and soundscapes – can be narratively used as design tools to enhance visitors’ engagement, I will cross-reference three main sources. These include scientific findings and insights from Sound Studies, Museum Studies, Exhibition and Narrative Design, and Cognitive and Sensory Studies; design approaches emerging from a series of semi-structured interviews I conducted over the past two years, and a qualitative analysis of practice-based case studies.²²

The semi-structured interviews drew on the “people, processes, and products” design research framework,²³ as applied in the *ASDP* project.²⁴ It included a structured section to gather information about professionals and a semi-structured section to collect insights into processes, communication challenges, languages, approaches, and tools designers use to incorporate sound as a design material in their practice.

With their consent, I interviewed sound designers from the fields of music, multimedia, cinema, VR, and sonic interaction, and exhibition designers who have worked on music-related exhibitions and multimedia interactive narratives, namely:

- Riccardo Castaldi, sound and exhibition designer;²⁵
- Andrea Cera, sound designer and researcher;²⁶
- Tommaso Leddi, musician and sound designer;²⁷
- Alberto Morelli, musician and sound designer;²⁸
- Max Viale, musician and sound designer;²⁹
- Uwe Brückner, exhibition designer;³⁰
- Ico Migliore, exhibition designer;³¹
- Franco Rolle, exhibition designer.³²

Based on grounded theory, Figures 1 and 2 illustrate the qualitative research process – from excerpts selection to *open coding* to *selective axial coding* –³³ that I used to analyse and classify the primary data obtained from the interviews.

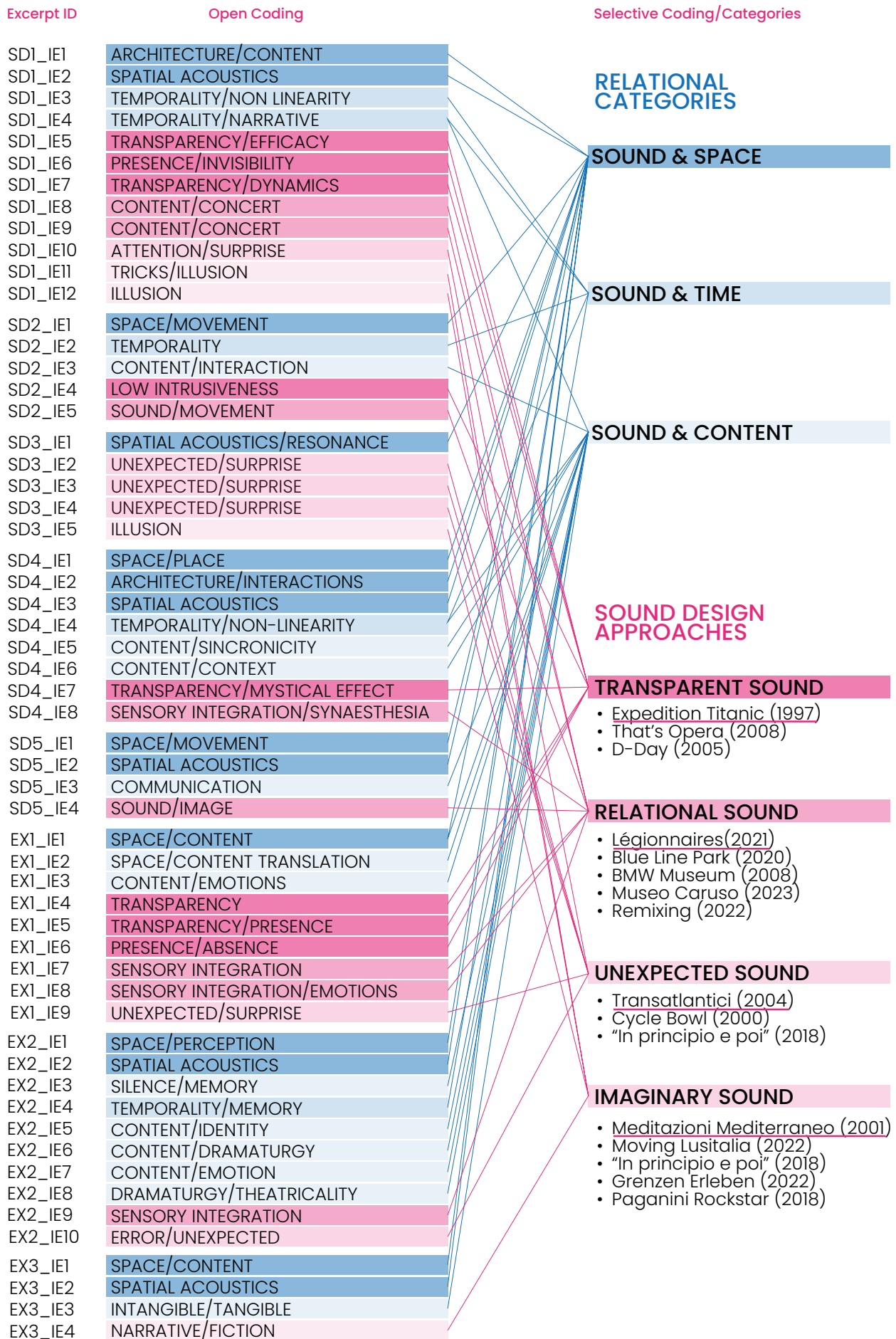
The case studies analysis covered multimodal narrative projects developed since the early 2000s, investigated through the lenses of curatorial and narrative strategies, listening experience, sound roles and functions, and design solutions. It included projects in which sound plays functional, communicative, narrative, and sensory roles, integrating seamlessly with the space, objects, displays, and media to achieve specific curatorial/cultural objectives.

Based on the data collected through the interviews, classified through the *selective axial coding process* outlined above, and the analysis of case studies, I have identified three main categories – *sound and space*, *sound and time*, *sound and content* – as well as four possible sound de-

ID	Interview Date	Interviewee name/role	Mentioned Case Studies	Approaches Excerpts Selection	Excerpt ID
SD1	7/8/2024	Riccardo Castaldi Role: sound & exhibition designer & co-founder Studio/Firm: The Bus		Un orecchio ai contenuti ed un occhio all'architettura	SD1_IE1
				in dialogo con il multimediale, la colonna sonora di una mostra è definita dall'architettura sia in termini di riverberazione che di separazione, isolamento dei contenuti sonori.	SD1_IE2
				La colonna sonora di una mostra è per sua natura non lineare, ma a partire da un medium totalmente lineare.	SD1_IE3
				Oltre ad essere utile a strutturare la visione, il sound design serve a far capire lo scorrere del tempo, a dare linearità a dei montaggi che sarebbero al contrario completamente pazzi, privi di senso, se fossero senza suoni.	SD1_IE4
				Il [sound] designer è senza un palco ma ha la possibilità di muoversi in un territorio nascosto, sottile, ma proprio per questo vantaggioso: il suo lavoro può arrivare ad essere del tutto trasparente ed estremamente efficace allo stesso tempo.	SD1_IE5
				La colonna sonora di una mostra deve essere a cavallo tra invisibilità e presenza, deve essere necessaria, altrimenti è meglio non ci sia, deve essere suggestione e indicazione al tempo stesso	SD1_IE6
				Una cosa positiva del sound è essere invisibile, ma essere invisibili non significa che tu non possa o debba essere dinamico, cioè non deve essere per forza tutto sotto il cappello di questa invisibilità.	SD1_IE7
				Molto spesso parliamo più di concerto dei contenuti. [...] c'è un aspetto importante di concerto: la concentrazione di contributi si può ottenere in molte maniere, non ultima quella di sincronizzare fra di loro i vari interventi, in modo tale che non si sovrappongano o, se si sovrappongono, ciò avvenga in maniera costruttiva per creare dei momenti carichi.	SD1_IE8
				Bisogna avere un approccio olistico per capire che quella sonorizzazione va a integrarsi in una situazione spaziale e contenutistica e visiva, e quindi deve fornire quello che manca e supportarla: nel complesso è inscindibile.	SD1_IE9
				[...] ogni tanto devi risvegliare l'attenzione del pubblico con un colpo di cannone e calcare la mano su determinate questioni che possono essere vissute in prima persona. [...] Sto pensando alla spazializzazione del suono, che può essere teatrale, cioè può farti voltare da una parte o dall'altra	SD1_IE10
				Per quanto riguarda il pubblico, quindi, è un lavoro che gode di questo suo essere nelle retrovie; bisogna sfruttarlo e godere di questa cappa di invisibilità che ti permette di fare dei trucchi.	SD1_IE11
				Come ci sono le illusioni ottiche, che sono all'ordine del giorno, ci sono le illusioni acustiche.	SD1_IE12
SD2	10/24/2024	Andrea Cera Role: sound designer & researcher Organisation: IRCAM-Paris	<i>D-DAY, le design aujourd'hui</i> , Centre Pompidou, Paris 2005	In ambito teatrale o nella danza, così come nelle mostre, l'aspetto spaziale è interessante: la rappresentazione tradizionale frontale tende ad appiattire lo spazio. [...] nelle mostre, per esempio, ciò che fai è proprio pensato per una funzione spaziale, cioè per colorare spazi diversi, per agevolare il passaggio da una stanza all'altra, per invitare una persona a spostarsi.	SD2_IE1
				La temporalità [nel design sonoro per le auto] è completamente fuori dal gioco e questa è una differenza enorme tra la musica e la composizione musicale dove il tempo è fisso e va da sinistra a destra, sostanzialmente. [...] il sound design è il grado estremo di lavoro puntuale su pochi secondi di suono, mentre la musica è molto più grezza da questo punto di vista [...]	SD2_IE2
				nel sound design il significato, l'immedesimazione, cioè quello che in musica succede tra pubblico e musicisti, avviene tra persone e oggetto, perché il suono di un'auto, o il suono che si sente in una mostra, o in una fiera, o nel salone dell'auto, crea un rapporto tra l'oggetto esposto e il soggetto, ed è un rapporto non tanto diverso da quello che c'è nella musica: una specie di rapporto emozionale e di scambio di senso.	SD2_IE3
				Ho sempre avuto un interesse anche per il concetto di bassa intrusività, [...]; un'idea di uso del suono non intrusivo che poi ha teorizzato. La mia pratica si chiama di 'low intrusiveness', non di 'no intrusiveness'; [...] quando la musica, il suono o il sound design vengono fruiti passivamente, secondo me c'è un obbligo etico di ridurre la loro intrusività al minimo necessario.	SD2_IE4
				Anche con Camurri abbiamo lavorato tantissimo sull'interazione tra suono e movimento. Abbiamo usato il suono per suggerire la lentezza, il controllo: una ricerca su come la fluidità è percepita e misurata dal sistema informatico con cui interagisci - una specie di exergame - e su come restituire un suono più o meno fluido a seconda di come ti muovi, per incitarci ad essere più fluido, più lento, più controllato. [...]	SD2_IE5
SD3	7/12/2024	Tommaso Leddi Role: musician & sound designer Studio/Firm: Studio Azzurro Produzioni	<i>Transatlantici. Scenari e sogni di mare</i> , Genova 2004 <i>Meditazioni Mediterraneo</i> , Genova, Palazzo Ducale 2001	Di fronte alle caratteristiche riverberanti di uno spazio, e dato un tema di progetto, di solito comincio ad avere delle visioni: [...] Se hai un posto che rimbomba e hai dei contenuti video potenzialmente rimbombanti, io fai rimbombare. Se tu invece volessi avere dei suoni utilissimi e senza eco, in uno spazio molto riverberante sei fregato. Bisogna andare a vedere i posti perché poi non nessuno può riportarti la verità sonora dei luoghi.	SD3_IE1
				Nella mostra sui transatlantici, per esempio, c'era tra le altre cose l'idea dell'onda anomala che mandava questi transatlantici sott'acqua, per cui c'era questo evento per cui, di colpo, si sentiva il fruscio di queste onde tremende che arrivavano dall'alto e da altre stanze. Questo in un museo è un tocco di classe perché produci anche qualcosa di inaspettato: accade qualcosa che unisce tutto improvvisamente, magari con un suono drammatico.	SD3_IE2
				tu non puoi dare quello che uno si aspetta e basta. [...] è una questione di misura che, nello stile della narrazione, va scelta di volta in volta fino a raggiungere il giusto livello.	SD3_IE3
				ci mancava qualcosa, [...] quell'astrazione, quel - come si può chiamare? - quella stranezza, quel contributo spiazzante. In quell'occasione ho registrato con la chitarra un sacco di loop, utilizzando non proprio la chitarra classica, ma usando magari le bacchette per suonare o mettendoci sopra degli oggetti e delle cose; una chitarra ritmica, macchinosa, insomma, e poi io con il computer componevo dei loop tutti asimmetrici.	SD3_IE4
				Ho avuto una grande lezione da Paolo Rosa, sempre nei transatlantici, con l'installazione dedicata alla coperta della nave. L'idea era che tu, come spettatore, ti sentissi come se fossi proprio lì, su una nave, con i suoni della nave, con i suoni del mare, con il vociere della gente, i richiami, perché lo scopo era trasportare le persone in quel tempo e in quello spazio con l'immaginazione.	SD3_IE5
SD4	7/22/2024	Alberto Morelli Role: musician & sound designer Studio/Firm: Studio Azzurro Produzioni	<i>"In principio e poi"</i> , Padiglione Vaticano, Biennale di Venezia 2018	Per i lavori installativi, [...] ci avviciniamo a quello che viene definito un lavoro site specific, cioè devi sempre fare i conti con quello che è il luogo [...] creare delle vere e proprie composizioni fatte di suoni, di "elementi musicali", di rumori e ambientazioni: tutti ingredienti, questi, che troviamo ovviamente anche nel cinema, ma che nell'ambito delle opere multimediali interagiscono con uno spazio che non è quello di una sala protocollata	SD4_IE1
				Nello spazio si incontrano poi altri problemi legati al suono, per cui è necessario fare ciò che in gergo viene comunemente definito fine tuning, cioè una sorta di accordatura che in realtà è un ulteriore aggiustamento in termini di mix sul campo [...] A monte si possono verificare le caratteristiche acustico-architettoniche dello spazio, ma il più delle volte, anche se esperisci il luogo prima, il luogo viene comunque modificato dall'allestimento.	SD4_IE2
				Per esempio, il fatto che io debba misurarmi con uno spazio che ha delle rifrazioni non significa necessariamente che sia un problema, al contrario può essere anche un'opportunità, e quindi io misuro le mie proposte a partire dallo spazio. [...] potenziare l'insorgenza di nuove modalità percettive che magari sollecitano più la propriocezione o il tatto rispetto alla vista, [...]	SD4_IE3
				l'installazione multimediale prima di tutto non è lineare [...] un'installazione è un ambiente in cui l'inizio e la fine corrispondono ai momenti in cui tu entri a tu esci, ma ciò non dipende da un inizio reale e definito: potresti ritornare il giorno dopo e riprendere quello che hai lasciato il giorno prima. Siamo cioè in un contesto che assomiglia molto a quello che è un paesaggio sonoro naturale. Faccio una passeggiata nel bosco: dove è l'inizio e dov'è la fine?	SD4_IE4
				devo organizzare la progettazione di queste composizioni in modo tale che i flussi non si soffochino uno con l'altro, come fossi un progettista di giardini che deve scegliere delle piante che possano vivere e dialogare fra di loro, senza soffocarsi l'una con l'altra, ma che possano essere anche percepite a colpo d'occhio insieme, nello stesso momento. Dal punto di vista sonoro è una situazione analoga: io devo contemplare la possibilità di poter ascoltare tutte queste cose da diversi punti di	SD4_IE5
				se devo fare un lavoro per un'esposizione, un progetto museale attinente al territorio, io devo necessariamente andare su quel territorio, studiare tutto quello che sono gli aspetti sonori musicali, le tradizioni del territorio stesso, a partire dalla lingua o dalle lingue - gli idiomi - fino alle musiche tradizionali e quindi anche tutto l'aspetto organologico, gli strumenti utilizzati all'interno di questo territorio, le storie di questo territorio, i paesaggi sonori del territorio, incluse anche le	SD4_IE6
				A proposito di Brian Eno: l'esperienza del viaggio diventa un'esperienza molto profonda, in cui non si dà nulla per scontato, e l'idea del viaggio in aereo diventa anche una sorta di esperienza di ascensione, sebbene temporanea, con tutto il portato "mistico" [...] un livello musicale aggiuntivo che aveva una caratteristica particolare dal punto di vista musicale, perché era estremamente sospeso, a volte quasi metafisico. [...] era un tappeto sonoro trasparente, discreto, che potevi ascoltare o	SD4_IE7
				lo penso che la multimedialità, inevitabilmente, soprattutto quando si interfaccia con lo spazio, comincia a sfiorare e a volte anche a toccare proprio la dimensione della sinestesia. [...] possiamo anche permetterci di adottare il termine sinestesia spostandolo in una dimensione che ha a che fare con la multisensorialità.	SD4_IE8

ID	Interview Date	Interviewee name/role	Mentioned Case Studies	Approaches Excerpts Selection	Excerpt ID
SD5	6/24/2024	Max Viale Role: musician & sound designer Studio/Firm: Tokonoma	<i>Légionnaires</i> , Luxembourg, 2021	in una installazione, il progetto del sound designer deve prevedere il movimento dello spettatore nello spazio e quindi deve prevedere un progetto della diffusione del suono in quello spazio specifico.	SD5_IE1
			<i>Remixing Industrial Pasts</i> , Luxembourg, 2022	[Il sound designer] è colui che progetta la diffusione del suono nello spazio, tenendo in considerazione il linguaggio che si utilizza per quella determinata forma di comunicazione e poi, appunto, a seconda si tratti di cinema, teatro o installazione, il silenzio non esiste in natura. Soprattutto, quando tu fai delle opere installative, dove quindi devi dialogare con lo spazio, devi tenere presente che quello spazio lì non è silenzioso, non lo sarà mai.	SD5_IE2
			<i>Moving Lusitania</i> , Luxembourg, 2022	Anche se tu decidi di isolarlo acusticamente, è comunque una scelta estremamente determinante per la narrazione, quindi devi tenerlo in considerazione.	SD5_IE3
				in un'installazione devi tener presente che comunque non è possibile utilizzare il suono esclusivamente in modo didascalico o metaforico, oppure esclusivamente musicale. No, devi mischiare per forza di cose e, a seconda del progetto, nell'installazione deve esserci un equilibrio tra questi elementi. Pensiamo sempre a due elementi separati: immagine e suono. Non esiste, non esiste immagine senza suono.	SD5_IE4
EX1	4/17/2025	Uwe Brückner Role: exhibition designer & founder Studio/Firm: Atelier Brückner / Studio Uwe Brückner	<i>Expedition Titanic</i> , Hamburg Speicherstadt, Germany 1997	to cover projects that were very much related to content or to storytelling you need people who are skilled in transforming texts or content into spatial design.	EX1_IE1
			<i>RICORDI – That's Opera. 200 Years of Italian Music</i> , Bruxelles, Belgium 2008	Whenever you have a content or a text and you want to interpret this in a spatial or compositional design, it is a kind of translation into another language.	EX1_IE2
			<i>BMW Museum</i> , Munich, Germany 2008	you will recognize how important the sound is not to only support but to evoke or even to provoke certain emotions of the spectators. [...] Richard Wagner sort of perfectionated this idea of the 'character's sounds'. He dedicated certain sounds and certain compositions to the characters acting in his Operas. [...] I think the sound is a very fluid connecting character. It can be the cement, it can be the silicon, it can be the degrees, it can be the oil among all the other senses or aspects of design	EX1_IE3
			<i>Cycle Bowl</i> , Expo Hannover, Germany 2000	sound design always played a major role in my designs and very often I use sound design as a 'hidden champion': the main focus might not be on sound design but in the background sound design plays a major role in completing an impression.	EX1_IE4
			<i>Grenzen Erleben. Experiencing Frontiers</i> , Expo Biel, Switzerland 2022	I deeply believe in sound design as a necessary, undoubtful element of modern scenography. I think there is no modern Scenography with an inappropriate sound design [...] even in the absence of sound, if it is done on demand, and if it is done as a compositional element, a space or an object will still sound even if there is none.	EX1_IE5
				sound design is always there, even if it is absent.	EX1_IE6
				according to my definition of scenography, there is always more than one sense occupied or triggered in any kind of spatial design. [...] It is always many senses that are involved at the same time, synchronously, and very often good designs are playing with this kind of orchestration — as I call it — of different senses being activated, provoked or triggered by a good scenography.	EX1_IE7
				Sound Design is connecting the senses. Sound Design is perfect for filling the gaps between touching, hearing, looking. And the perception is a summary of all these different experiences that you collect in milliseconds. And Sound Design is the emotional glue between these different experiences	EX1_IE8
				If you create a space that people cannot define, or an installation, or a feeling where you have no equivalent and no comparison, very often the people are or become so curious that they come back to the same space to figure out what was the reason	EX1_IE9
EX2	3/19/2025	Ico Migliore Role: exhibition designer & co-founder Studio/Firm: Migliore+Servetto	<i>Blue Line Park</i> , Busan, Corea 2020	Da sempre integriamo la dimensione sonora negli allestimenti. [...] Un altro incontro importante è stato con Paolo Soleri: siamo stati con lui ad Arcosanti (Arizona, USA), e lì, per esempio, l'acustica, la percezione dello spazio e del territorio dal punto di vista acustico, così come la percezione dello scambio tra le persone è stata fondamentale.	EX2_IE1
			<i>Alcantara Chromophone</i> Palazzo Reale, Milan 2015	Per tornare a John Cage, il rumore dello spazio è un valore: la musica "perfettamente pulita" trasmessa al tuo orecchio non esiste.	EX2_IE2
			<i>Neutra. Monochrome Affinity</i> , Milano Design Week, Palazzo Visconti,	il silenzio, le pause, sono uno strumento sonoro potente per poter capire e memorizzare.	EX2_IE3
				L'altra variabile che inseriamo sempre nei progetti è quella del tempo, che fa sempre parte della musica, del ritmo — nel senso della leggibilità e della memoria —, dell'attraversabilità e di cosa accade durante la giornata. [...] Il tempo è una variabile molto complessa, ma è un materiale di progetto fondamentale di cui noi progettisti dovremmo tenere conto.	EX2_IE4
				ci siamo orientati verso un ambito che ci interessava molto, quello dell'identità intesa come raccontare storie [...] il tema dell'identità coinvolge tanti aspetti del progetto quali, per esempio, il racconto dei materiali intangibili come il tempo, il vuoto, la luce, la percezione degli spazi, la percezione cognitiva dei luoghi, che dal mio punto di vista è un argomento interessante.	EX2_IE5
				Il lavoro del progettista è un po' come il lavoro del regista: in studio ci occupiamo della drammaturgia, cioè capiamo che cosa vogliamo intercettare, come vogliamo incrociare le parti - perché il progetto è sempre un incrocio di parti- e quindi si cercano di immaginare i motivi per cui il suono è importante. Fondamentale è avere una visione drammaturgica dei contenuti e dello spazio, e poi capire se in quella drammaturgia servono partecipazioni, consulenze, persone che si	EX2_IE6
				Nei nostri progetti abbiamo senz'altro un approccio narrativo, ma soprattutto emozionale: l'emozione è ciò che ci si ricorda di più. Un conto è qualcuno che ti racconta una storia, ma c'è anche un aspetto molto emozionale che è ciò che permette poi di vivere una condizione di "emozione risvegliata", come con un grande rumore, o un grande silenzio. [...] Credo che la narratività non sia tanto legata alla musicalità, quanto piuttosto all'emozione.	EX2_IE7
				Il nostro processo progettuale e comunicativo è di fatto questo: dividere i progetti in scenari mappe e schizzi, dove lo schizzo rappresenta la fisicità, la mappa e lo scenario rappresentano invece quell'insieme di cose che succedono, le relazioni tra le cose, le azioni che si generano. Si torna dunque sempre alla drammaturgia, al tema della teatralità dei luoghi.	EX2_IE8
				La narrazione non è mai relegata a un solo senso: la narrazione dovrebbe essere integrata tra più sensi, e il sonoro è una parte di questi	EX2_IE9
				L'errore, poi, è fondamentale. [...] È quindi fondamentale lasciare questo margine, questa possibilità di trovare cose inaspettate.	EX2_IE10
EX3	3/3/2025	Franco Rolle Role: exhibition designer & co-founder Studio/Firm: NEO Narrative Environments Operas	<i>Paganini Rockstar</i> , Palazzo Ducale, Genova 2018	Il problema è come mettere in scena una storia nello spazio. [...] perdendo il concetto di "frame", di device [attraverso la fruizione online], si può lavorare su dimensioni di contenuti che hanno senso solo se sono collegati allo spazio, e le esperienze non servono solo per raccontare un contenuto, ma anche per raccontare una messa in scena. In questo caso, la parte audio deve essere trattata in modo molto specifico.	EX3_IE1
			<i>Museo Caruso</i> , Palazzo Reale, Napoli 2023	Oggi la tecnologia aiuta tantissimo, ma le scelte che stanno alla base del progetto dell'esperienza sonora intorno a un museo sono molto complesse perché, al contrario delle immagini, l'audio crea un inquinamento, di conseguenza crea enormi problemi nella gestione e nel controllo all'interno degli spazi, soprattutto nel caso di spazi unici non suddivisi in sale e spazi separati.	EX3_IE2
			<i>Renato Zero. La mostra</i> , La Pelanda, Roma 2014/15	Lavoriamo sull'intangibile come, ad esempio, la messa in scena della musica che è un bene intangibile per eccellenza. Come studio, siamo stati tra i primi a pensare al museo come luogo per la messa in scena di beni intangibili, il che comporta una serie di processi progettuali complessi, per trasformare un contenuto da intangibile a tangibile. [...] se non parti dai contenuti e non sai cosa significhi progettare e mettere in scena dei contenuti, e parti invece dal mezzo, il mezzo	EX3_IE3
			<i>Design / Opera</i> , Triennale, Milano 2013	Quindi il valore, il senso dei contenuti, è fondamentale; la natura dei contenuti è fondamentale. [...] il linguaggio è funzionale al racconto. È dal racconto che tutto deve partire, anche il linguaggio. Se l'allestimento è al servizio del contenuto, l'estetica e l'approccio cambieranno sempre, pur mantenendo una certa cifra "stilistica". [...] il linguaggio è funzionale al racconto. È dal racconto che tutto deve partire, anche il linguaggio. Se l'allestimento è al servizio del contenuto, l'estetica e l'approccio	EX3_IE4

Fig. 1:
Selection and encoding of interview excerpts. Source: the author.



sign approaches: *transparent, relational, unexpected, and imaginary*. To illustrate these approaches, I will focus here on four projects from the professional experience of the interviewed designers.

By combining my observations with the designers' insights and the scientific literature, these practical experiences provide exemplary models for creating effective sound narratives that help achieve complex communicative objectives, such as those required by contemporary exhibitions.³⁴

Far from exhaustive, these approaches are rather an exploration of some of the possibilities offered by sound as a design medium.

Listening-driven exhibitions. Communicating through sounds

Sound is inherently *relational*: it is part of a “system of relationships”³⁵ that interprets it as a *mediator* between the community of listeners and the environment.³⁶ Through sounds, we can engage with the environment at multiple “sensory, cognitive, emotional, and intellectual”³⁷ levels, make sense of our world, build identities, improve our sense of belonging, and strengthen social relationships.

Beyond semantic meanings, as in oral narratives, sound carries automatic spatial information³⁸ and evokes aesthetic and affective responses.³⁹ These are linked to the ability of sounds to elicit unconscious emotions, to trigger empathy⁴⁰ and to help recall memories.⁴¹

In *sound-driven/listening-driven*⁴² exhibitions, sound helps weave to-

gether *space, time, and narrative*⁴³ in a dramaturgy capable of entangling the exhibited artefacts with the audience. Echoing the title of an academic article of 2022,⁴⁴ *designing sound* narratives for exhibitions, therefore, truly *means designing relationships* between sounds and other design elements, such as space, light, moving images, visuals, documents, artefacts, and scenography.

Sound and Space

*An ear to the content and
an eye to the architecture*

(R. Castaldi)

Space in exhibitions plays a crucial role. In listening-driven museums, space and sound are “compositional parameters acting conjointly as ‘producers of space’”.⁴⁵ Be it *narrative, performative* or *simulated*,⁴⁶ or a blend of these three typologies, the architecture of the space strongly influences designers' approaches regarding the arrangement of artefacts on display, scenography, and the design of sound “in relation to narrative, atmospherics, and other museum elements”.⁴⁷ Addressing the *phygital* and multimedia exhibition context,

The problem is how to stage a story within the space. [...] by losing the concept of the ‘frame’ [as in digital screens, ndr], you can work on content dimensions that make sense only when connected to space. Moreover, spatial experiences not only

Fig. 2:
From Open to
Selective Axial
Coding of primary
data collected
through expert
interviews.
Source: the author.

convey [cultural] content but also recount a mise-en-scène. In this case, the sound component must be treated in a very specific way.

(F. Rolle)

This is especially true when the designers' auditory intention is not only to transfer knowledge, but also to generate *affective spaces*⁴⁸ capable of triggering the audience's *sense of place*.⁴⁹

The design of a "soundtrack" for an exhibition is strongly influenced by the narrative path as well as by spatial architecture:

An exhibition soundtrack is shaped by the architecture in terms of both reverberation and separation, that is isolation of sound contents.

(R. Castaldi)

It is the space that primarily orients design choices in terms of sound systems, acoustic control strategies, aesthetic languages, and sound production.

The spatial architecture can be either an intriguing inspiration or a challenge:

Faced with the reverberant characteristics of a space, and given a narrative theme, I usually start to have visions [...]. If you have an echoing place and potentially echoing video content, you make it rum-

ble. If you want very clean sounds without echo in a very reverberant space, you are screwed. You must go and listen to the places. No one can report the sonic truth of the places to you.

(T. Leddi)

What is crucial, anyway, is considering the mutual interactions between sound, space, and content. Ideally, designers should make the best use of the existing architecture, considering that, although the acoustics of the space can be verified upstream,

more often than not, [...] the space and how it sounds will be altered by the set up.

(A. Morelli)

Likewise, it is fundamental to consider the audience's listening experience and its movement within the space, and design consequently:

In design, space is fundamental. In exhibitions, for example, what you do is precisely designed for a spatial function, such as "colouring" different spaces, facilitating the passage from one room to another, or inviting a person to move.

(A. Cera)

Sound and Time

*The soundtrack of an exhibition
is, by its nature, nonlinear,
but it originates from a totally
linear medium.*

(R. Castaldi)

As well as space, the temporal factor influences the development of *narration*. Through the interplay of narrative and experiential times, sound designers can manipulate the audience's perceptions and listening experiences, allowing stories to expand and contract while offering multiple levels of interpretation. Time, indeed, is

*a very complex variable,
but it is a fundamental design
material that we designers
should consider.*

(I. Migliore)

Since our human “narrative thinking” structures the events in temporally meaningful episodes that we can compose, collect, and preserve in our memory,⁵⁰ sound – which is inherently temporal – can serve

*to make clear the passage
of time, giving linearity
to [video] montages that
would otherwise look like
complete nonsense without.*

(R. Castaldi)

Likewise,

*silence and pauses are
powerful auditory tools
for understanding and
memorising.*

(I. Migliore)

However, although it seems the opposite, the audience's listening and spatial experience in exhibitions is intrinsically nonlinear, but the result of a continuous and unpredictable relationship that challenges the designers' practice:

An installation is an environment in which the beginning and the end correspond to the moments you enter or exit, but this does not depend on a real, defined beginning: you could return the next day and pick up where you left off the day before. That is, we are in a context that closely resembles a natural soundscape. [...] (T)his means you must consider that there may be several stations generating flows of images and sounds. Unlike a documentary, a film or an animation, there will be constant interactions between these sources in ways that are not necessarily predictable.

(A. Morelli)

Sound and Content

Whenever you have content or text, and you want to interpret this in a spatial or compositional design, it is a kind of translation into another language.

(U. Brückner)

In exhibitions the sonic matter can assume a double form. Not only do sounds appear as displayed artefacts – such is the case of museums and exhibitions devoted to musical instruments, music production, cinema, telecommunications, and sound art – but rather they are embraced as a design and communicative tool.⁵¹ As mentioned earlier, sounds can foster interpretation, enhance engagement and learning, preserve memories, and elicit empathy and emotions.⁵²

In sound design, meaning and identification – i.e., what happens in music between the audience and the musicians – happens between people and objects. [...] the sound heard in an exhibition [...] creates a relationship between the exhibited object and the subject, and this is not so different from what originates in music: a kind of emotional relationship and exchange of meaning.

(A. Cera)

Meaning making, indeed, is fundamental, and narrative is a primary means of achieving it. Narrative, in turn, shapes and guides aesthetic approaches and languages:

Everything must start with the narrative, including the language. If the scenography serves the content, the aesthetics and approach will always change.

(F. Rolle)

Narrative also plays a significant role in building identities. It shapes various aspects of the project, especially the representation of

intangible elements such as time, void, light.

(I. Migliore)

It is thereby fundamental to have a dramaturgical vision of both content and space, that is designing sound and silence interactions with spatial and design elements to shape experiences of “awakened emotion” (I. Migliore):

You will recognise how important the sound is not only to support, but to evoke or even provoke certain emotions of the spectators. [...] Richard Wagner sort of perfected this idea of the ‘character’s sound’. [...] I think the sound is a very fluid connecting character. It can be the cement, it can be the silicon, it can be the degrees, it can be the oil, among all the other senses or aspects of design connecting them.

(U. Brückner)

In the exhibition ecosystem, sound in its multiple expressions of *music* (e.g. soundtracks, music compositions, mood music), *narrative* (e.g. scripts, theatrical presentations, readings, interactive dialogues, oral histories, interviews), and *ambient sound* (e.g. soundscapes, sound effects, natural sounds, concrete sounds)⁵³ lies at the heart of a complex interpretive system. And as a dramatic character, it can fulfil many expressive roles at the same time:

In an installation, you must keep in mind that you cannot use sound exclusively in a didactic, metaphorical, or musical way. You must necessarily mix things up and, depending on the project, there must be a balance between these approaches.

(M. Viale)

Moving between the informative, evocative, and aesthetic functions, the design of sounds influences the unfolding of narratives in the exhibition space, requiring sound designers to act as “garden designers”:

Like a garden designer [...] [a sound designer] must consider the coexistence of different auditory content that can be experienced from different “points of listening”, simultaneously.

(A. Morelli)

Sounds in action.

The *multiversional narrative*⁵⁴ of sounds

As we have seen so far, the designer’s work is that of a *translator* serving the communicative purposes of an exhibition project. A sort of *director* capable of intertwining time, space, and tangible or intangible content into a coherent and expressive form, leveraging the sound spatiotemporal, evocative, and emotional qualities to affect the audience’s perceptivity, knowledge, and memory.

But let’s *designerly*⁵⁵ and narratively explore *in practice*⁵⁶ some of the approaches that exhibition and sound designers can adopt to intentionally⁵⁷ *design the sound*, and *with the sound* for specific cultural and communicative listening purposes.⁵⁸

While I focus on narrative exhibitions, where the informative function plays undoubtedly an important role, I will especially concentrate on how the evocative, emotional, and empathetic roles of soundscapes and non-verbal sound can build, enhance, sustain, and integrate narratives.

Although these approaches are grouped under “classification hats” for clarity’s sake, in practice they frequently intermingle and blend, shaped by the communicative goals of each exhibition project.

1. Transparent Sounds

Very often, I use sound design as a 'hidden champion': the main focus might not be on sound design, but in the background sound design plays a major role in completing an impression.

(U. Brückner)

Among the approaches a sound designer can use to craft emotional and atmospheric soundscapes that enhance exhibition narratives and audience's engagement, there is that of the *transparent sound*.⁵⁹

Going beyond *causal listening*, sounds are either intentionally used to induce *empathetic and affective responses*⁶⁰ through timbre features or to create a sort of "sonic bridges", that coherently connect different spaces through the creation of an almost inaudible, nonetheless perceivable, soundscape.

*Expedition Titanic, Hamburg Speicherstadt, Germany, 1997*⁶¹

Expedition Titanic was one of the first multimedia narrative exhibitions in Europe. Dedicated to the story of the Titanic transatlantic, it took place in 1997 at the Speicherstadt in Hamburg and was designed by Atelier Brückner in collaboration with the renowned lighting designer and drama musician Rolf Derrer.

There, the scenography design strategy involved deconstructing the Titanic myth by creating a dramatic, emotional, associative atmosphere, from the ship construction to its wreckage. Without using texts, descriptions, or labelling to induce a particular interpretive view, the

narratives and dramaturgy relied solely on *choreographed* displayed artefacts, spatial images, dynamic lights, that were entangled by sounds and excerpts from the passengers' audio messages and reports.

In the core room, there were only two groups of objects, featuring champagne bottles and a leather shoe from a crew member, which were dialectically juxtaposed. They were showcased inside a "light space": the backlit translucent membrane which enveloped the room reflected in the floor and in the ceiling, blurring the edges, thus modifying the spatial perception to an "a-dimensional, not decipherable space". However, what most aroused the audience's emotions and gave rise to multifaceted interpretations was an ungraspable soundscape:

The main thing, but the most hidden at the same time, was the sound. It was a sound cave: in the back, we had subwoofers playing very low tones. You can feel these kinds of waves in your body: [...] [we played] in a range of bass, low tones that you can't hear, but still your body can feel. [...] the combination of this light space and the hidden sound created an atmosphere that made people stay no longer than three minutes in this room.

(U. Brückner)

The subtle interplay of sounds and lights, along with the two interacting groups of objects, created a kind of “pressure room” that shaped visitors’ behavior. The sound design induced a strong sense of discomfort, prompting people to leave the room quickly:

Sound and light waves [...] synchronously worked on these mystic feelings.

(U. Brückner)

The hidden, mystic effect described above represents a meaningful approach to soundscape design wherein the sonic presence plays on the edge between not being heard and, eventually, becoming conscious. A perspective on sounds that reminds Brian Eno’s *Music for Airports*: although opposite in intentions, he created a sort of suspended, meta-physical, transparent soundscape that you could listen to or not listen to (A. Morelli). A “low-intrusive” sound (A. Cera) or, as in this specific case, an intentionally intrusive sound that is nonetheless invisibly present. A strategy to “communicate without being noticed” (R. Castaldi), leveraging *pre-attentive modes of listening*⁶² to arouse immediate unconscious effects in the audience.

2. Relational Sounds. Sounds in Concert

*Very often we speak of
a concert of content.*

(R. Castaldi)

Another approach that designers use to create meaningful sonic in-

teractions between the exhibition narrative, spatial architecture, and scenography can be described as “sounds in concert”, paraphrasing the quote above. By using diffuse sound systems, such as loudspeakers or directional speakers, this approach treats the flow of vocal, musical, and ambient sounds along the exhibition path as if they were distinct voices in a symphony orchestra or opera. Depending on the acoustics of the architectural space, these elements may overlap and merge or may not. When they do, however, they should form a coherent sonic narrative in which all parts interweave constructively.

This relational interpretation of sound design allows for creating “scenarios” in which seemingly disconnected events occur simultaneously and “theatrically” (I. Migliore) in the same space, encouraging visitors’ actions, movements, and emotional responses. This design approach echoes the *dramatic performative strategy* proposed to label popular music exhibitions in which sound is theatrically presented through rhythmic, narrative, spatial, and expressive contrasts to achieve an emotional impact on the audience.⁶³

*Légionnaires, Musée Dräi Eechelen, Luxembourg, 2021*⁶⁴

Designed by Tokonoma and 2F Architettura in 2021, the *Légionnaires* exhibition at the Musée Dräi Eechelen in Luxembourg explored the history of Luxembourgish soldiers within the French Foreign Legion. By drawing upon personal testimonies, the exhibition illustrated the intrinsic contradictions and ambi-

guities between the Legion master narrative and Légionnaires' self-representation, trying to challenge the myth.

The spatial design guided the visitors from a brightly lit geometric entrance into a complex, fragmented scenography. This interior landscape housed a curated collection of artefacts, archival footage, and graphic materials. While six enveloping audiovisual installations defined the historical context along the perimeter, more intimate personal oral narratives emerged from vintage gramophone horns. These horns functioned as directional loudspeakers, offering visitors a personal and private listening encounter with the re-enacted memories of the Légionnaires. Meanwhile, a continuous, overlapping flow of different soundscapes, originating from the six perimetral audiovisual installations, pervaded every thematic zone, interweaving with the Légionnaires' personal accounts, architecture, exhibits, and visuals in a seamless experience.

This dramatic approach, which mingles personal stories and overlapping sonic soundscapes in a spatial symphony, allows for creating a diffuse atmosphere that establishes a "basic rhythm" throughout the exhibition path. It works like a *cinematic* soundtrack in which each element interacts, shaping the perceptual space and evoking a sense of identification and participation in the visitors.

3. Unexpected Sounds

*You cannot just give what
someone expects.
[...] it is a question of balance
that, depending on the nar-
rative style, must be chosen
each time until the desired
effect is achieved.*

(T. Leddi)

A third approach we can encounter in sound design practice-based experiences is what I call the "unexpected sound". Leveraging the functional and evocative power of sounds to suddenly interrupt the continuous flow of narratives, this approach enables designers to generate surprise in the percipients, raising their listening attention to specific exhibition contents or narrative moments.

Surprise plays a major role in cognitive and emotional reward. Although not always positive, there is a subtle tendency to feel rewarded through movement, novelty, and intellectual stimulation.⁶⁵

In (sound) narratives, wonder and surprise can be achieved by breaking the "before" and the "after", creating a discontinuity between two moments of a story. That is, a designer can either dramatically play with sound spatialization, *enveloping* the visitor in unique and memorable experiences⁶⁶ or drive the visitors towards uncertain territories using intense, sudden noises, which disrupt a calm atmosphere or the narrative flow.

*Transatlantici. Scenari e sogni di mare, Genoa, 2004*⁶⁷

A surprising, disorienting approach is what we encounter in *Transatlantici. Scenari e sogni di mare* (*Ocean liners. Seascapes and dreams of the sea*), a narrative exhibition designed by Studio Azzurro. A journey on Genoa shipbuilding tradition, which was presented in 2004 at Galata-Museo del Mare. Beyond reflecting the society that designed and built it, travelled on it, and at times scrapped or destroyed it, the transatlantic served as a metaphor for narrating macro-changes in European society through the 19th and 20th centuries. Divided into chapters, which took the form of *a setting, a sequence*, and, at times, *a documentary, an interactive experience, or a video environment*, it shaped an imaginative dialogue through the designed interactions of sounds, voices, objects, gestures, and movements of the spectators.

However, throughout this apparently “linear” journey, all of a sudden, a voice off-screen announced the tragedy: “... but the sea is tired of festivity”. The surprise effect was achieved through an audiovisual “rogue wave” (T. Leddi), suddenly arriving from above and from other rooms, and interrupting any other running narrative. Light turned blue, stories and oral testimonies stopped abruptly. Tremendous sound and visual waves engulfed all the rooms. The spatial perception changed, enhanced by deafening, vibrating, low-frequency sounds. The coming wave was so unexpected and surprising that the audience could do nothing but imagine, if not actually feel, it was sinking into pieces like a ship plunging under-

water, before falling back again into the main narrative “reality”.

This strategy of “surprise effect” stimulates the audience’s attention and enhance the listening experience:

Error is fundamental. [...] It is essential to leave this margin, this possibility of finding unexpected things.

(I. Migliore)

Leaving room for the unexpected can help achieve that narrative *climax* needed to make the experience memorable.

4. Imaginary Sounds

Just as there are optical illusions, which are commonplace, there are acoustic illusions.

(R. Castaldi)

Finally, the case study analysis and discussions with designers reveal a fourth approach to sound design that we can define as “imaginary sound”.

The crafting of illusory sound consists of “performing tricks”, taking advantage of that “cloak of invisibility” (R. Castaldi) made possible by the intrinsically elusive nature of the sonic matter.

In multimedia exhibitions, this effect relies especially on the mutually influencing relationship between sound and moving images. Within the so-called “audiovisual contract” in films, visual and auditory perception mutually affect, “lending each other their respective properties by contamination and projection”.⁶⁸

When the “visual stimuli ‘capture’ the sound”, we can produce different audio illusions.⁶⁹ However, this mutual interaction also happens among all sensory experiences and perceptions. This perceptual and cognitive “cross-pollination” enables the design of *cross-sensory* and *synaesthetic* experiences.⁷⁰ By orchestrating and deceiving several senses, this approach elicits emotional responses and constructs “seemingly real” scenarios.⁷¹

*Meditazioni Mediterraneo, Napoli, Castel Sant’Elmo, 2002*⁷²

Meditazioni Mediterraneo (Mediterranean Encounters) was an *ambient sensible* designed by Studio Azzurro in 2002. It was first presented in Castel Sant’Elmo in Napoli and staged again in Genoa in 2010, and Madrid in 2014. On these latter occasions, two new *étapes* were added: Siria, first, and La Mancha (Spain), later.

The first exhibition was structured around five large “unstable landscapes” recounting the stages of a journey through the Mediterranean Sea. It evocatively and metaphorically explored the concept of a *Mare Nostrum*, which marked, and it still marks, a geographical and cultural area. A space that embraced a rich mixture of ancient cultures, religions, and commerce, giving birth to a layered and shared identity, made of gestures, processes, relationships, materials, smells, sounds, colours, and voices.

One of the *étapes du voyage*, so-called “Colours entwine with sounds”, was dedicated to the Medina of Fes. A mingling of mazed alleys, pulsating buildings, where intense smells, flavours and eardrum rhythms were mixed with “guttural sounds of the

endless bawling”, all intertwined by the kaleidoscopic colours and hues of the Suk spices.⁷³

Surrounded by the rhythmic gestures of Moroccan artisans, a projected interactive carpet filled the central floor, tying the knots of contrasting feelings.

Walking on it, the audience’s shadows “erased” the texture of the carpet. Through their movements, people unveiled different top views of the spicy, colourful, and lively scenarios hidden underneath. Once each story was over, the magic: the threads of the carpet re-knotted themselves, the image became unstable, giving the impression of lifting you off the ground, ready to fly away.

Beyond the moving images, sounds were the real actors of deception:

*There were lots of speakers
all around and on the top,
so the sound spun around
when everything started
spinning, creating a vortex
that “lifted you up”.*

(T. Leddi)

An *ad hoc*-designed sound program interpolated people’s movement on the carpet through a camera, quantising it, and transforming the “flying carpet” sounds based on the audience’s kinetic speed. To enhance this illusion, at the end of the corridor, the usually uninterrupted muazzin’s voice stopped exactly when the carpet was flying.

As underlined by some scholars, “playing with the relationship between different sensory channels gives the opportunity to exploit the

power of contradiction in multisensory interaction”, inducing closer attention through emotional and perceptual stimulation.⁷⁴ Nonetheless, “Pretending is not lying [...]. For us humans, illusion corresponds to come into play. The creative game is made up of fiction, rules, framework, and context”.⁷⁵ And this is precisely what happens when the interaction of sounds, images, objects, smells, and interactive technologies is effective: the boundaries between the real and the virtual blur, making you feel as if you were right there, in that precise time and space, through imagination alone.

Conclusions

In recent decades, exhibition design has shifted from object-centered, visually dominant approaches to visitor-centered, multimodal experiences where sound plays a central communicative and narrative role. Advances in technology have enabled the creation of *phygital* spaces that blend sensory modalities and encourage active engagement and meaning making. In this context, sound is not simply decorative or supportive, but foundational: it shapes the space, guides the narrative flow, evokes emotion, and fosters memory and social connection, transforming exhibitions into immersive and performative environments. Consequently, an effective *sound-driven design* requires a holistic approach that considers spatial architecture, narrative structures, and visitors’ movements, balancing the informative, evocative, emotional, and aesthetic functions of sounds.

The scientific literature, interviews with sound and exhibition de-

signers, and the analysis of practice-based experiences have revealed that successful exhibitions treat sound as a *dramaturgical* tool. Seamlessly interwoven with visuals, artefacts, exhibiting systems, and space, sound can structure or amplify open-ended and nonlinear narratives, supporting both individual and collective interpretation. Addressing especially (non-verbal) sounds and soundscapes, and exploring sound design approaches that expand or enhance the exhibition narratives, I have proposed four possible strategies, accompanied by four exemplary cases:

1. *Transparent sounds*: an approach to soundscape design that leverages *pre-attentive modes of listening* and induces unconscious *empathetic and affective responses* in the audience⁷⁶, whilst going almost unnoticed.
2. *Relational sounds*: a dramaturgical and relational approach to sound design that creates a coherent sonic narrative by intertwining all the elements to shape the perceptual space, evoking a sense of identification and participation in visitors.
3. *Unexpected sounds*: an *enveloping*⁷⁷ sound design approach that leverages sound functional and evocative power to generate surprise and wonder, deceiving visitors’ expectations, and eliciting their cognitive and emotional sense of reward.
4. *Imaginary sounds*: a *cross-sensory* and *synaesthetic* strategy⁷⁸ that orchestrates multiple senses to create “seemingly real” imagery, enhancing visitors’ imagination and engagement.

These are just a few of the possible approaches that (sound) designers can embrace to create layered, memorable experiences and stimulate visitors' senses, emotions, and imagination. Nonetheless, they illustrate well the multisensory, cross-modal, and evocative potential of sound in *sound-driven* exhibition contexts.

A final, side note

As you may have noticed, this article contains no images. While it may seem a bold choice, I believe that neither photography nor audiovisual documentation can truly capture the complexity of listening within an exhibition space. In fact, this experience is intrinsically embodied, temporal, and deeply personal: qualities that make it nearly impossible to reproduce.

This condition raises a fundamental question: does it make sense to attempt a visual or audiovisual representation of a spatial listening experience – or any multisensory (exhibition) experience – for the sake of knowledge transfer and archival memory? If so, how can this be achieved, and what are the inherent limits? These questions remain open.

Certainly, compelling technologies exist. Binaural recordings⁷⁹, spatial sound field recordings, auditory augmented reality, and immersive multichannel audio recordings,⁸⁰ alongside virtual, augmented, and mixed reality technologies, can offer a general impression of atmospheres, emotions, and narratives. However, faithfully recreating a “lived experience” performed in space remains out of reach without an extraordinary investment of

technical expertise, time, and capital.

Perhaps, despite its limitations, the written or spoken word still remains our most evocative tool. Rich in metaphorical depth and deeply embodied, language might still be the best medium for suggesting the nuances of soundscapes and the temporalities of these situated embodied narrative experiences.

I believe this is an issue worth addressing, although not now nor here.

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Endnotes:

- 1 For different perspectives on Exhibition Design as a field of study and its evolution over time, please confront: Hooper-Greenhill 1992; Dernie 2006; den Ouden 2016; Austin 2020; Achiam, Haldrup, Drotner 2021; Guy, Williams, Wintle 2024, just to mention a few scholars addressing this topic. For a thorough overview of the definitions of Exhibition Design over time, please refer to Borsotti 2020.
- 2 Drawing on Reckwitz and Barad's practice theory, in an article of 2012, Lucy Kimbell defines "design" – of which exhibition design is a branch –, as an *embodied, situated, contingent, and routinised set of practices* carried by professional designers who engage with *designs* (i.e., material outcomes). Under this lens, the building of knowledge through design is understood as a bodily and mental social accomplishment. See Kimbell 2012.
- 3 Bollini 2024, p. 617.
- 4 For a definition of "postdigital" in museums, both in design and organisational terms, see Parry 2013 and Parry, Dziekan, de Wild 2025. For a definition of "postdigital" in Information Architecture see Resmini 2015, p.111, where we read: "The post-digital world is a world of information that escapes the restrictions of two dimensions and takes its place in physical space, where it becomes a pervasive layer constantly reproduced, remixed and remodelled, whose architectures silently create new behaviours, new opportunities and new barriers" (my translation).
- 5 Bollini 2024, p. 613.
- 6 Following especially the discovery of *mirror neurons* in the early 1990s by Giacomo Rizzolatti's group at the University of Parma, numerous studies have been conducted on the neurophysiological basis of cognition and the mind, as well as on the strong interrelationship between perception, action, and cognition. See, for example, Gallese 2005; Gallese, Lakoff 2005; Iacoboni 2008; Gallese, Morelli 2024, p. 30; Seth 2023; Lakoff, Narayanan 2025, p. 59.
- 7 Levent, Pascual-Leone 2014, p. xvii.
- 8 Levent, Pascual-Leone 2014, pp. xvii-xviii.
- 9 Classen, Howes 2006, p. 200.
- 10 Drawing on its own research and artistic practice, Studio Azzurro – an Italian art collective dedicated since the early '80s to exploring the poetic and expressive possibilities of new technological languages – observes shifts in museum paradigms, from "museums as 'collections' to museums as 'narrative'". A change driven by the advent of virtual and digital culture and the inclusion of the "intangible" in the museum discourse. See Studio Azzurro 2011, p. 23.
- 11 Lupo 2013, pp. 92-104.
- 12 Borsotti 2017, p. 17, my translation.
- 13 Cristallo, Mariani 2023, pp. 25-38.
- 14 Kannenberg 2019, p. 292.
- 15 Greenblatt 1991, p. 42.
- 16 Bedford 2001, p. 28.
- 17 Mason, Vavoula 2021.
- 18 Cortez 2019, pp. 351-352.
- 19 Cortez 2019, p. 360.
- 20 Macleod, Hourston Hanks, Hale 2012, p. xxi.
- 21 Cortez 2019, p. 248.

22 These outcomes are part of the results of the interdisciplinary research project “Sound Design and Cultural Heritage”. Funded by Politecnico di Milano, the work was conducted between 2024 and 2025 and led by Prof. Raffaella Trocchianesi (P.I.). The aim was to explore and codify the role of sound and sound design in the cultural heritage field, particularly in relation to interactions and exhibitions.

23 Cross 2006, p. viii.

24 Between 2018 and 2021, Zattra and colleagues studied sound design both as a discipline in its own right and as a practice, through a project titled “Analysis of Sound Design Practices” [ASDP], which examined sound design through the lenses of Nigel Cross’ (2006) “People, Processes, and Products” using an ethnographic approach. See Zattra et al. 2022, pp. 297-323.

25 Riccardo Castaldi, sound and exhibition designer, is co-founder of the multimedia exhibition design studio The Buss (<https://www.thebuss.net/>). Interviewed on 8th July 2024, my translation.

26 Andrea Cera, sound designer and researcher, has a long-standing collaboration with IRCAM - Paris. Interviewed on 24th October 2024, my translation.

27 Tommaso Leddi, musician and sound designer, has been a long-time collaborator of the art collective Studio Azzurro (<https://www.studioazzurro.com/>). Interviewed on 12th July 2024, my translation.

28 Alberto Morelli, musician and sound designer, has been a long-time collaborator of the art collective Studio Azzurro. Interviewed on 22nd July 2024, my translation.

29 Max Viale, musician and sound designer, has extensive experience in the field of film music and has been a long-time collaborator of the multimedia design studio Tokonoma (<https://tokonoma.studio/>). Interviewed on 24th June 2024, my translation.

30 Uwe Brückner, exhibition designer, was co-founder of Atelier Brückner, and is founder of Studio Uwe Brückner (<https://studio-uwe-brueckner.com/>). Interviewed on 17th April 2025.

31 Ico Migliore, exhibition designer, is co-founder of the firm Migliore+Servetto (<https://architettimiglioreservetto.it/>). Interviewed on 19th March 2025, my translation.

32 Franco Rolle, exhibition designer, is co-founder of the exhibition design studio NEO [Narrative Environments Operas] (<https://www.neo.mi.it/>). Interviewed on 3rd March 2025, my translation.

33 Corbin, Strauss 2007.

34 From now on, to clarify the distinction between sources – citations from the scientific literature and citations from interviews as primary data – I will follow this rationale: the scientific literature and theoretical framework will be cited in end notes as before; quotations from the interviewees will be included in the body of the text, using, where possible, the long in-text citation format, with the authors’ names in parentheses. Finally, inspirational quotations derived from the interviews are instead presented in italics, right-aligned at the beginning of the chapter, with the authors’ attribution.

35 Truax 1984, p. xii.

36 Truax 1984, p. 11.

37 Wiens, de Visscher 2019, p. 278.

38 This is particularly true for people who are visually impaired or completely blind. Grond and Devos (2016) describe an interesting experiment that uses binaural audio recordings as a tool to enable sighted individuals to experience and understand how automatic auditory spatial processing works in blind people. See Grond, Devos 2016.

39 Among the various ways in which sounds evoke aesthetic and emotional responses in film and audiovisual media, see, for example, Chion 2009 and Pauletto 2012, 2017. For a more in-depth look at how sound influences aesthetic responses in Sonic Interaction

Design, see, for example, Rocchesso, Polotti, Delle Monache 2009.

40 Iacoboni 2008, pp. 96-130.

41 Arnott, Alain 2014, pp. 85-107.

42 *Sound-driven design* is a novel design framework understood as “a design practice informed by technology and listening in the multisensory dimension of interaction”. It is a design approach which interprets listening, and sound as its entangled “flip side”, “as catalyst of the design space”: “a way of knowing through sound, which implies active, bodily explorations with all the senses”. See Delle Monache, Misdariis, Özcan 2022. For an interpretation of exhibition design through this framework, see Riva, Trocchianesi 2025.

43 den Oudsten 2016.

44 The title of the article reads “Designing sounds means designing relationships”. See Luca, Misdariis, Calleo 2022.

45 Cortez 2023, p. 318.

46 Dernie 2006.

47 Everett 2019, p. 314.

48 Cortez 2019, p. 249, recalling Leonard 2014.

49 For a discussion on the use of soundscapes as design tools for *sonic place-making/listening behaviours* in the cultural heritage context see Udsen, Halskov 2022.

50 Breithaupt 2025, pp. 29-33, my translation.

51 Bubaris 2014, pp. 391–402.

52 For a more detailed discussion of the various roles sound can play as a means of communication, see Bedford 2001; Levent and Pascual-Leone 2014; Bailey, Broackes, de Visscher 2019.

53 Stocker 1995, p. 25.

54 Breithaupt 2025, pp. 207-223, my translation.

55 Nigel Cross, in his 2006 book *Designerly Ways of Knowing*, introduces the neologism “designerly” as an approach to knowledge that emphasises the importance of *Design* both as a culture and as a discipline in its own right, beyond the already established cultures/disciplines of the sciences and the arts/humanities. See Cross 2006.

56 Discussing about “designs-in-practice”, Lucy Kimbell (2012, p. 135) acknowledges “the emergent nature of design outcomes as they are enacted in practice [...] which can mean the outputs created during a process of designing, such as blueprints, models, specifications, and what is finally assembled in products and services”, adding that “the concept of designs-in-practice foregrounds the incomplete nature of the process and outcomes of designing”. See also note 2 of this article.

57 For a discussion on *auditory intention* within the framework of Sonic Interaction Design (SID) – suitable also for sound design in exhibitions – see Susini, Houix, Misdariis 2014.

58 Delle Monache, Misdariis, Özcan 2024.

59 Sounds, here, should be interpreted as “transparent” only in terms of perceptual effects, but not in semiotics terms, that is in terms of neutrality or objectivity of (sound) representation, since the designers’ communicative strategy in the following case study is clear, albeit implicit. Addressing the rhetoric of transparency of representation in visual semiotics, Valentina Manchia (2022) suggests that “text, no matter how objective it pretends to be, can always be traced back to the communicative strategies put in place to construct this effect of immediacy or transparency”. See Manchia 2022.

60 Tuuri, Eerola 2012, pp.139-142.

61 Unless otherwise specified, the descriptions of the exhibition and quotations are

taken from my interview with Uwe Brückner (see note 30). You can get an impression of what the exhibition looked like at the following links: <https://studio-uwe-brueckner.com/works/#titanic>; www.atelier-brueckner.com/de/projekte/expedition-titanic; www.youtube.com/watch?v=QiA_LqP5e14.

62 Tuuri, Eerola 2012, p. 141

63 Cortez 2019, pp. 353-356.

64 The descriptions of this exhibition are drawn from my interview with Max Viale (see note 29), discussions with my colleagues at Tokonoma studio, and my own visit to the exhibition. For further information, please consult Asili et al. 2021 in Camarda et al. 2021, pp. 230-239. Other textual, visual and audiovisual documentation can be retrieved here: <https://tokonoma.studio/works/legionnaires>; www.uni.lu/c2dh-en/articles/legionnaires/.

65 Breithaupt 2025, pp.126-127 and pp. 140-143, my translation.

66 Cortez 2019, p. 356.

67 The descriptions and quotes come from Studio Azzurro 2011, pp. 61-75. Quotations from my interview with Tommaso Leddi (see note 27) are marked in the body of the text. For additional visual and audiovisual material, see: www.studioazzurro.com/opere/transatlantici/.

68 Chion 1994, p. 9.

69 For a thorough examination of sound illusions that somehow echo Gestalt principles, such as *scale illusion*, *continuity illusion*, *stereo effect*, *pseudophone*, and *McGurk effect*, see Arnott, Alain 2014, pp. 92-96.

70 With synaesthetic experiences, here, I mean intentionally designed scenarios where one sense stimulates another, influencing the final perception of a scene, rather than a rare neurological condition in which stimulating one sense automatically and unconsciously triggers another. See also the following note.

71 This concerns our *embodied*, multimodal way of perceiving and interpreting the world. While synaesthesia is a specific neurophysiological condition (see previous note), in multimodal exhibitions it should be understood more broadly as a multisensory information-processing mechanism based on *cross-modal correspondences*, where “sensation and cognition are continuous and contiguous” (Marks 2011). Meaning extends through “corporeal reverberation” (Marks, Mulvenna, 2013) and, like metaphors and analogies, expands experience. At the heart of the creative process, metaphors and analogies not only generate new meanings but also shape our self-perception and structure our language (Lakoff, Johnson 1980).

72 The descriptions of the exhibition come from Studio Azzurro 2002, and from my direct involvement as a designer in 2010, on the occasion of the Genoa production. Quotates from Tommaso Leddi (see note 27) are marked in the body of the text. You can get an impression of what the exhibition looked like at the following link: www.studioazzurro.com/opere/meditazioni-mediterraneo/.

73 Studio Azzurro 2002, pp. 130-131.

74 Rocchesso, Polotti, Delle Monache 2009, p. 21.

75 Gallese, Morelli 2024, pp. 228-229, my translation.

76 Tuuri, Eerola 2012, pp.139-142.

77 Cortez 2019, p. 356.

78 Interesting approaches for applying synaesthesia and cross-modal correspondences to design can be found in Riccò 1999 and Haverkamp 2009 and 2010. Haverkamp, in particular, outlines the *synesthetic design approach* as a “vertical” integrating strategy of *cross-sensory coupling* based on a set of redundant and consistent *multisensory features*. Concerning *constitutional synaesthesia* or more common perceptual and conceptual associations that cross different sense modalities, see Marks 2011 and Marks, Mulvenna

2013. See also notes 70 and 71.

79 Such as the ones used by Grond, Devos 2016, see note 38.

80 See, for example, Brandenburg et al. 2023; Werner et al. 2021; Sloma et al. 2024.

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