

BEYOND VISUAL TOOLS: AN INCLUSIVE EDUCATIONAL EXPERIENCE IN CO-DESIGNING YACHT INTERIORS WITH AND FOR USERS WITH VISUAL IMPAIRMENTS

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ABSTRACT

Interior design education relies predominantly on visual representation. Tools such as concept sketching, technical drawings, photorealistic renderings and digital animations continue to shape how students conceive, develop and communicate space. However, these tools presuppose a visually oriented user, an assumption that becomes critically limiting when the intended client or co-designer lives with a visual impairment.

This paper presents an industrial master's thesis project of an interior design student who, while initially investigating how to design yacht interiors for people with visual impairments, quickly encountered a more fundamental challenge. Beyond the spatial and sensory solutions required to make a yacht fully accessible to a blind or low-vision owner, the project revealed a significant methodological challenge: the necessity to imagine new ways and tools to communicate design intentions and to enable true co-design with non-visual users. As the perceptual system guiding the project shifted, the experience made visible what happens in both the design studio and the design process when visual dominance is suspended. In response, the project progressively adopted multisensory, tactile, and narrative-based representation strategies, including material exploration and verbal mediation.

The paper reflects on this educational experience and discusses its implications from two complementary perspectives: that of the student, navigating a profound reconfiguration of design habits, and that of the educator, observing how these changes affect teaching and assessment in design education. The outcome shows that moving beyond visual dominance fosters multisensory design literacy, with implications for inclusive design education beyond the nautical context.

Keywords: Interior design, design education, multisensory design, visually impairments, yacht design

1 INTRODUCTION

Interior design education is traditionally grounded in visually driven tools of representation. Sketching, 2D drawing, digital modelling, photorealistic rendering and, more recently, AI-generated imagery structure how spatial concepts are conceived, developed and assessed within the studio. Even as technological paradigms shift, visual output continues to function as the primary indicator of design competence and quality [1] [2]. In yacht interior design education – where architectural, engineering and aesthetic constraints converge – this reliance on image-based workflows is particularly pronounced, as students are trained to communicate complex spatial proposals primarily through drawings and visual simulations [3] and these artefacts often become the implicit measure of success.

This visual dominance is rarely questioned, largely because it is embedded in the epistemology of studio culture itself. Although design theory has long argued that space and objects are experienced multisensorially rather than exclusively visually [4] [5], pedagogical practices and assessment criteria continue to privilege what can be seen, displayed and critiqued. The tension between embodied spatial experience and visually mediated design tends to remain latent.

The issue becomes explicit when considering users with visual impairments. Visual impairment is not simply the absence of sight; it entails alternative modes of perceiving, orienting and constructing spatial understanding through touch, hearing, proprioception and smell. In such contexts, interior design must function as a multisensory system capable of communicating through tactile cues, acoustic differentiation, material contrast and spatial legibility. Research on educational environments for blind

and visually impaired users highlights the importance of textured flooring, acoustic modulation, clear circulation hierarchies and controlled lighting as fundamental elements for spatial comprehension [6]. Accessibility must be understood in relation to experiential navigation, cognitive mapping and the time required to reach and interpret information [7]. The analogy with design education is instructive: representational adequacy for sighted designers does not automatically translate into perceptual accessibility for blind participants. What appears resolved in visual terms may remain inaccessible in experiential ones.

The master's thesis discussed in this paper emerged from this disruption. Initially conceived as a project on designing yacht interiors for a visually impaired owner, it soon revealed a broader pedagogical challenge. Beyond addressing accessibility within a regulated maritime context, it exposed the limits of conventional visual tools in enabling communication and genuine co-design when vision is not the primary channel.

If design development relies on renderings and visual validation, how can a blind or partially sighted user participate as an active co-designer? Research in graphical design education shows that tactile aids and rapid prototyping can translate visual concepts into tangible artefacts [8], suggesting that representation need not be confined to sight. The issue therefore extends from inclusive yacht interiors to inclusive design processes. This paper frames the experience as an opportunity to observe what happens in design education when the perceptual system guiding both design thinking and design teaching fundamentally changes.

2 EDUCATIONAL CONTEXT AND METHODOLOGY

The project was developed within a master's programme in Interior and Spatial Design at the Politecnico di Milano and was structured as a research-through-design thesis embedded in an industrial internship. The thesis was developed over the course of one academic year, during which the student conducted the research while undertaking an internship at the shipyard Azimut | Benetti, addressing a topic of direct relevance to the firm. The project was therefore situated within a dual framework, combining academic supervision and industrial mentorship, with guidance provided by both a university professor and a company tutor. This dual context shaped the project's direction and constraints. The industrial setting required technical credibility in relation to yacht production, materials and regulations, while the academic environment encouraged critical reflection on design methods and co-design practices.

The research approach can be described as a research-through-design [9] educational case study [10]. The process involved the design student, the academic and industrial supervisors, a broader group of blind and visually impaired participants engaged through questionnaires, and one blind co-designer who was continuously involved in the in-person co-design phase. This involvement was structural rather than consultative.

Methodologically, the project combined qualitative research tools with iterative co-design. An initial phase included questionnaires distributed to around 30 blind and visually impaired participants working at an experiential exhibition in Milan where visually impaired guides accompany visitors through non-visual environments. Their contribution, although mediated through online questionnaires, provided essential insights into orientation, material perception, emotional comfort and everyday navigation practices. These findings informed early concept development and emphasised the importance of tactile and auditory cues. A subsequent phase consisted of in-person co-design with a blind participant who remained directly involved throughout the project. Through hands-on exploration of material samples, surface finishes and textural contrasts, the sessions investigated how materials could communicate information, evoke emotions and support spatial understanding through touch alone. In line with participatory approaches developed with blind users, where ideas must be communicated through accessible forms rather than visual artefacts alone [11], the process prioritised verbal explanation, shared interpretation and continuous feedback. As emphasised in recent research on co-design with visually impaired participants, materials themselves act as mediators in the process, sometimes facilitating and at other times constraining shared understanding [12]. Particular attention was given to how differences in texture, temperature, softness, rhythm and directionality could communicate spatial boundaries, circulation hierarchies or functional distinctions. These sessions often revealed mismatches between the designer's visual intentions and the co-designer's tactile interpretation of the same elements, prompting revisions in both material selection and spatial articulation. Feedback from questionnaires, co-design sessions and reflective observations was analysed through thematic clustering. Recurring themes such as welcoming atmospheres, directional clarity, tactile legibility and emotional comfort progressively

emerged from participants’ comments and reactions. These themes later informed the development of the project’s guiding strategies and became the conceptual basis of the final design proposal. While no full-scale prototype was produced, the iterative material testing informed the conceptual validation of the proposal.

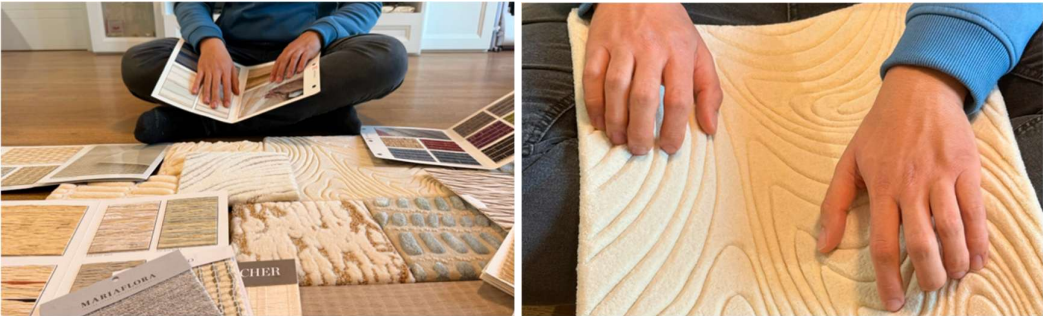


Figure 1. Material sample explorations during a co-design activity

Importantly, the methodology was not fully predefined at the outset. Instead, it evolved in response to concrete challenges encountered during the early project phases. The need to explain drawings that were not visually accessible, to test materials beyond aesthetic criteria, and to reframe design decisions in sensory rather than visual terms gradually reshaped the process. Adaptation, experimentation and critical reflection were therefore not supplementary activities but core components of the educational experience.

3 INTERIOR YACHT DESIGN EXPERIENCE

The design experience was developed within the professional context of Azimut | Benetti, one of the leading international groups in the luxury yacht sector. The company operates in a highly competitive market where innovation, craftsmanship and brand identity play a central role. Despite this advanced positioning, accessibility, particularly in relation to sensory disabilities, remains only marginally explored within the nautical industry. Within this framework, the thesis introduced a deliberately atypical design brief: the hypothetical arrival of a blind owner for whom no consolidated design protocol yet existed. The Magellano 30M model yacht was used as the reference platform for the development of the project, allowing the student to work within realistic spatial, structural and production constraints. The aim was not to redesign the vessel from scratch, but to reinterpret its interior architecture through a multisensory and inclusive lens.

3.1 Project strategies

The project was structured around two interpretative keys: *welcoming* and *direction*. These two dimensions frame the spatial experience of a blind owner on board, establishing the conditions through which the yacht can be perceived as both reassuring and navigable. *Welcoming* refers to the creation of environments that feel protective, legible and emotionally balanced. *Direction* concerns the capacity of space to guide movement, support orientation and enable the construction of a coherent mental map. To translate these principles into spatial action, the project operates through three dimensions: *forms*, *surfaces* and *perceptions*. Together with the two interpretative keys, these constitute the guiding strategies matrix: a tool to coordinate spatial, material and atmospheric interventions into a unified sensory language.

Table 1. Guiding strategies matrix

	Welcoming	Direction
Forms	Curved line	Guiding elements
Surfaces	Tactile decoration	Material discontinuities
Perceptions	Olfactory identity of spaces	Scent as guidance

Form refers to the three-dimensional structure of the interior and the way spatial volumes organise movement. Through solids and voids, continuity and curvature, form shapes both bodily experience and spatial character. Curved lines play a key role in creating welcoming conditions: they allow continuous

tactile exploration, avoid abrupt edges and convey protection and continuity. At the same time, form supports direction through guiding elements integrated into circulation paths. Handrails and volumetric alignments are conceived as spatial references that structure orientation, and in some cases curved forms themselves subtly guide movement, showing how welcoming and direction overlap.

Surface represents the immediate point of contact between body and space. For a blind user, tactile perception is central to understanding and memorising the environment. Decorative elements are therefore translated into tactile richness rather than visual display. Textures and material variation communicate comfort and quality through touch. Material discontinuities mark thresholds and functional changes, providing spatial information that supports navigation through embodied perception.

Perception includes the intangible atmospheric components that complete the experience of space. In particular, each area is defined by a distinct olfactory identity calibrated to its function. Scent contributes to welcoming by creating recognisable and emotionally differentiated atmospheres. Variations in fragrance intensity also support direction, allowing the user to sense proximity to or distance from specific areas, making smell an effective non-visual guidance tool.

3.2 Project outcome

The results of these strategies were consolidated in the redesign of specific areas on board, including the main deck saloon, the owner's cabin, the lobby and staircase, and the external dining area. The final proposal suggests how a universal design language could generate spaces accessible to both sighted and non-sighted individuals without diminishing aesthetic coherence. Rather than producing a specialised environment exclusively for a blind user, the project articulated a multisensory interior architecture capable of enriching the experience for all occupants.

A central element of the project is the handrail, conceived as a continuous spatial guide rather than a secondary safety feature. It accompanies circulation routes and connects functional areas, providing a stable tactile reference along both horizontal and vertical paths. In transitional zones, particularly around the staircase, it becomes a primary orienting device, ensuring perceptible and secure movement without reliance on visual cues. Here, material differentiation is used to delineate thresholds and signal functional changes. Furthermore, variations in flooring and surface textures mark transitions between circulation and living areas, allowing the user to construct a tactile mental map of the yacht.



Figure 2. Project Outcome: main saloon, a detail of handrail, upper deck

In the main saloon, curved lines in spatial elements and furnishings reinforce both *welcoming* and *directional* intentions. The absence of sharp geometries reduces perceptual tension and encourages fluid movement. Curvature softens the spatial experience while subtly guiding the body along natural trajectories. Olfactory identities complete the perceptual framework. Each primary area is associated with a calibrated scent corresponding to its function and atmosphere. Variations in fragrance intensity support spatial recognition and memorability, allowing smell to operate as an invisible orientation tool. In the upper deck, material contrasts distinguish circulation from seating zones, while the handrail continues to structure movement along the perimeter. The olfactory identity is lighter and more dynamic, reinforcing the social character of the space while maintaining recognisability. Finally, in the owner's cabin, tactile richness and softer materials emphasise comfort and stability. Texture differentiates key functional areas, supporting independent movement. A calm and subdued olfactory identity reinforces the cabin's private and restorative role.

4 REFLECTIONS

4.1 from student perspective

From the student's perspective, the project significantly transformed the understanding of design practice. As an interior designer in training, the student was accustomed to working primarily through visual tools: drawings, floor plans, renderings and spatial compositions. Working with a blind user disrupted this habitual framework and required a reconsideration of how space can be communicated, perceived and designed beyond the visual dimension.

The absence of visual access on the part of the co-designer exposed the extent to which conventional design processes rely on visual validation. The student recognised that spatial decisions are typically developed, evaluated and legitimised through drawings and images. In this project, however, such tools could not function as the primary medium of exchange. Space had to be translated into words, materials and sensory references. Unfortunately, due to time and budget constraints, there was no possibility to produce tactile mock-ups, relief plans and three-dimensional models to render volumes and hierarchies more accurately. In their absence, the process relied mainly on dialogue and material experimentation. Visual concepts were translated into multisensory narratives, and material samples – surfaces, textures, directionality and temperature – became tools for design communication. The core strategies emerged precisely through this tactile interaction and shared discussion.

Throughout the process, the student acted as a mediator between two dimensions: the multisensory perspective of the blind user and the visual, technical language required in dialogue with the academic supervisor and the company. Tactile impressions and experiential insights had to be reformulated into drawings and diagrams compatible with traditional design representation.

The student also recognises the limitations of the work. The strategies were developed through dialogue and theoretical reflection but were not tested through physical prototypes or real spatial simulations. Without implementation, their effectiveness cannot be fully verified. At the same time, this constraint revealed an important insight: meaningful design strategies can emerge from listening, dialogue and material perception. The project shifted the approach from designing for the user to designing with the user, broadening the conception of space as intrinsically multisensory and questioning the exclusive centrality of vision in the design process.

4.2 From educator perspective

From the educator's perspective, this project represented the first occasion in which visual impairment was addressed within a co-design framework in the context of interior yacht design education. While issues of accessibility are frequently discussed in the framework of mobility impairments, this was the first time that sensory disability became the central driver of the design process for a yacht co-design experience. In the initial phases of the research, several difficulties became evident. The student, as expected, relied heavily on visual representation tools: plans, sections, renderings and compositional studies. However, these instruments quickly revealed their limits when confronted with a non-visual co-designer. From an educational standpoint, it became clear that the challenge was not only technical but epistemological. The design studio traditionally operates through visual critique and visual validation. Assessments, discussions and feedback are largely mediated by drawings and images. When these tools lose their centrality, both student and educator must renegotiate the criteria through which design quality is recognised and evaluated. As an educator, this process demanded a reframing of supervision itself: feedback had to address multisensory consistency and experiential clarity.

Another observed difficulty concerned the absence of consolidated references or methodologies within both the nautical design sector and the interior design education for addressing visual impairment co-design experiences. Unlike more standardised accessibility contexts, such as public architecture, yacht interiors lack established protocols for sensory inclusion. This required both educator and student to navigate a largely unexplored design territory, balancing innovation with feasibility. In this context, educator felt the need to suspend the initial judgement on certain design decisions, as the project could not follow the conventional yacht design process. In many instances, the blind co-designer became the primary reference for assessing the validity of spatial and material choices, effectively redefining what constituted a "successful" design outcome.

Overall, the experience demonstrated that inclusive co-design does not simply produce alternative spatial solutions; it reshapes the educational process itself. It challenges representational hierarchies and invites a broader understanding of design literacy.

5 EMERGING INSIGHTS FOR INTERIOR DESIGN EDUCATION

The experience documented in this study reveals insights that extend beyond yacht interiors to broader questions in interior design education. Engaging with users outside the dominant sensory mode exposes how conventional processes rely on visual validation: spatial decisions are typically developed and assessed through images, while in this case space had to be conveyed through verbal descriptions, material samples and sensory references. This aligns with critiques in design education literature, which identify visual-centric bias as a barrier to inclusion and innovation, calling for greater engagement with multisensory knowledge in teaching and practice [13]. The pedagogical tension between conventional visual methods and inclusive co-design shows that inclusion is not only about accessibility outcomes, but about reshaping the criteria of the design process itself. Inclusive design education requires reflexivity in supervision, assessment and representation, encouraging educators and students to recognise and respond to bias in their methods, while challenging both academia and industry to rethink not only what is designed, but how it is conceived, communicated and critiqued.

Ultimately, this study does not only concern inclusive yacht interiors but raises a broader pedagogical question. From an educator's perspective, it prompts a necessary reflection: are we truly prepared to include visually impaired individuals within design studios? This project is a preliminary and situated exploration, yet it reveals structural tensions and suggests that inclusion requires more than technical adaptation. If vision is no longer the unquestioned centre of the studio, multisensory literacy, dialogic practice and methodological flexibility must become core pedagogical components. The main open questions remain: are we ready to move beyond treating difference and disability as project topics, allowing them instead to reshape the foundations of design pedagogy? Do we possess the tools, methods and assessment frameworks to teach design beyond visual primacy?

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