

Chapter

Inclusive Sensory Design in Phygital Retail: Regulatory Guidelines Bridging Accessibility and Brand Experience

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Abstract

Inclusive sensory design in phygital retail is increasingly relevant as retail environments combine physical and digital service interactions that rely on coordinated sensory conditions. Anchored in the European Accessibility Act (EAA), applicable from 28 June 2025, this chapter argues that compliance focused primarily on digital interfaces and self-service touchpoints is necessary but insufficient when environmental sensory conditions – such as lighting, sound, scent, visual density, and crowd dynamics – limit participation in retail services. The chapter integrates a critical literature review across multisensory retail environments, servicescape research, human-centered design, and accessibility and neurodiversity studies, together with documentary case studies of sensory-inclusive retail practices. Based on this synthesis, it proposes performance-based regulatory guidelines capable of preserving brand expression while ensuring choice, controllability, predictability, and phygital equivalence in access to services. The chapter introduces a sensory-accessibility taxonomy, a comparative case analysis template, a governance checklist for designers and retailers, and a Sensory Accessibility Statement template designed to support transparent compliance and inclusive innovation in multisensory retail environments.

Keywords: phygital retail, inclusive sensory design, European Accessibility Act, brand experience, sensory accessibility

1. Introduction

Contemporary retail environments increasingly operate as phygital service systems, in which physical and digital layers interact to shape how customers perceive, navigate, and participate in retail experiences. Within these environments, sensory conditions – such as lighting, soundscapes, scent, materiality, and dynamic media – are orchestrated alongside digital touchpoints, including mobile interactions, digital signage, and self-service terminals. Consequently, sensory design cannot be understood merely as an esthetic layer. Instead, it functions as operational

infrastructure that supports orientation, legibility, reassurance, and memorability within brand experiences.

The influence of physical surroundings on behavior and service outcomes has long been recognized in the servicescape tradition, which conceptualizes the service environment as shaping both customer and employee responses and, ultimately, service performance [1]. In retail contexts, environmental cues also function as informational signals through which customers infer service quality and store image [2]. Building on these perspectives, this chapter proposes a conceptual model describing how sensory conditions intersect with accessibility governance in phygital retail environments (**Figure 1**).

In phygital retail settings, this relationship becomes particularly significant because sensory conditions directly influence the usability of digital touchpoints embedded within physical environments. Excessive glare may undermine the readability of screens, ambient soundscapes may mask audio instructions, and visual clutter may increase cognitive load during service interactions. When such conditions occur, sensory design ceases to be a matter of atmosphere and becomes a determinant of effective access to retail services.

This issue becomes increasingly salient as accessibility regulation expands beyond public-sector contexts into private-sector services. The European Accessibility Act (Directive (EU) 2019/882) harmonizes accessibility requirements for specific products and services across the European Union and will apply from 28 June 2025 [3]. Its scope is directly relevant to phygital retail environments because it includes

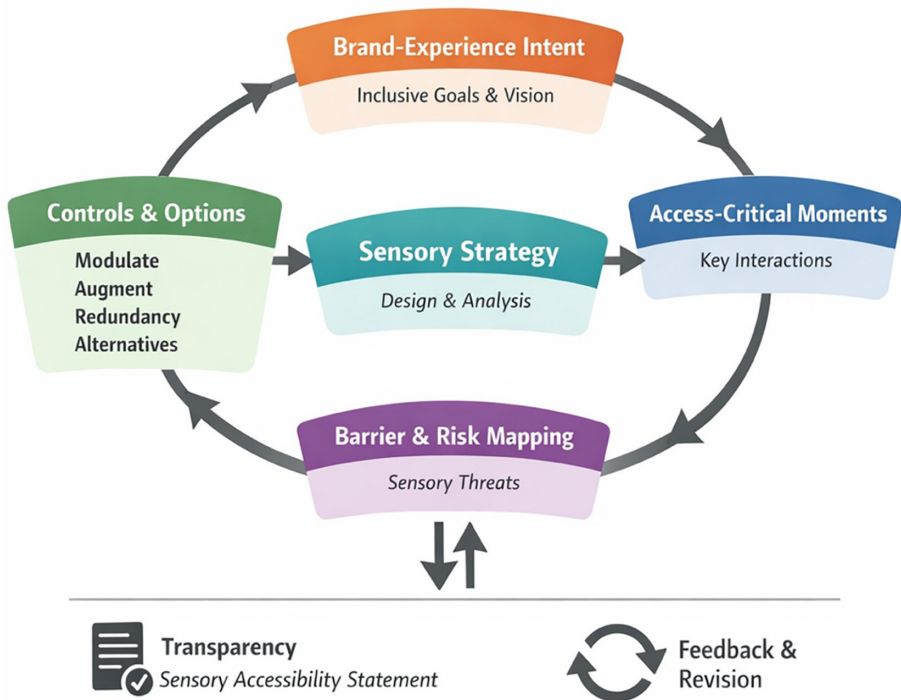


Figure 1. Sensory accessibility governance loop. Conceptual model linking brand experience intent, sensory strategy, accessibility risk assessment, and governance mechanisms.

e-commerce services as well as various forms of self-service terminals. However, compliance strategies frequently focus on digital interface accessibility alone. When environmental sensory conditions undermine usability at the point of interaction – for example, through glare, excessive noise, or overwhelming visual stimuli – interface-level compliance may fail to deliver effective accessibility in practice.

Against this backdrop, understanding sensory design as part of accessibility infrastructure becomes essential for both policy development and retail design practice. The model presented in this chapter conceptualizes inclusive sensory design as an iterative governance process in which brand-experience intent, environmental analysis, accessibility risks, and operational controls are continuously aligned.

In this chapter, the term “*phygital retail*” refers to retail environments in which physical spaces and digital systems are integrated into a single service ecosystem. Customers interact not only with material elements such as products, shelves, and spatial layouts but also with digital touchpoints, including self-service terminals, mobile applications, digital signage, and automated payment systems. This integration creates retail environments in which physical and digital interactions occur simultaneously and influence the overall accessibility of services.

1.1 Research problem and questions

Accessibility compliance in retail environments is frequently interpreted through an interface-centered perspective, while sensory conditions are often treated as matters of atmosphere or individual preference. In phygital retail environments, however, this distinction becomes increasingly untenable. Environmental sensory conditions can directly enable or disable access to digital touchpoints and core service interactions.

This chapter, therefore, addresses the following research questions:

- a. *How can sensory design in phygital retail be conceptualized simultaneously as a driver of brand experience and as accessibility infrastructure?*
- b. *Which provisions within the European Accessibility Act already imply multisensory access and alternatives to single-modality interaction, and where do gaps remain regarding environmental sensory conditions in retail contexts? [3, 4]*
- c. *What recurring patterns in documented retail cases demonstrate inclusion through sensory modulation and sensory augmentation without erasing brand expression? [5–9]*
- d. *What forms of performance-based regulatory guidance and governance instruments could support both policy development and design practice in multisensory phygital environments?*

1.2 Aim and contribution

This chapter develops a regulatory-oriented framework for inclusive sensory design in phygital retail, grounded in the European Accessibility Act and supported by a critical literature review, together with documentary case studies.

Rather than proposing prescriptive design rules, the chapter advances a performance-based perspective that allows brand environments to maintain

expressive freedom while ensuring that sensory conditions do not undermine accessibility.

To support both policy development and practical implementation, the chapter introduces five interrelated deliverables:

1. A *Sensory-Accessibility Taxonomy* linking brand-experience value functions with accessibility barriers and design levers;
2. A *Comparative Case Analysis Template* for examining inclusive sensory practices in retail environments;
3. A set of *Performance-Based Regulatory Principles* applicable to multisensory phygital environments;
4. A *Governance Checklist* designed to support implementation by designers and retail organizations;
5. A *Sensory Accessibility Statement template* intended to promote transparency and accountability in retail accessibility practices.

Together, these instruments aim to bridge the gap between accessibility regulations, multisensory retail design, and operational governance in phygital environments.

2. Methodology

2.1 Research design

This chapter adopts a qualitative, non-interventionist research design, combining two complementary approaches: (1) a critical narrative literature review aimed at conceptual consolidation and gap identification, and (2) documentary case studies based on publicly available sources.

This methodological structure aligns with the chapter's regulatory and governance-oriented objectives. Rather than generating new experimental measurements or behavioral effect sizes, the research seeks to translate existing empirical and conceptual knowledge into performance-based guidance capable of informing accessibility governance and design practice in multisensory retail environments.

The approach, therefore, emphasizes *interpretive synthesis and regulatory translation*, positioning design knowledge as a bridge between academic evidence and policy-oriented implementation.

2.2 Literature review approach and analytical lens

The literature review integrates five interrelated research streams that collectively frame sensory design as both a design practice and an accessibility concern.

The first stream concerns *service environments and servicescapes*, which establish how environmental conditions shape behavior, perceptions, and service outcomes [1]. The second stream addresses *retail atmospherics and multisensory store environments*, consolidating evidence that coordinated sensory variables influence customer evaluations and behavioral responses [10, 11].

A third stream derives from *environmental psychology*, particularly affective response models such as the Pleasure–Arousal–Dominance (PAD) framework, which explain how environmental stimuli shape approach–avoidance behaviors [12]. A fourth stream concerns *human-centered design and context-of-use frameworks*, which emphasize that usability and accessibility depend on the conditions under which interactions occur [13].

Finally, the review considers *accessibility regulations and standards*, including the European Accessibility Act and ICT accessibility requirements such as EN 301,549, together with research addressing sensory variability and neurodiversity [3, 14–16].

Taken together, these streams provide the conceptual foundation for interpreting sensory environments not only as experiential design elements but also as operational conditions that can enable or constrain participation in retail services.

2.3 Documentary case studies: Selection and sources

To complement the conceptual synthesis provided by the literature review, the chapter analyzes a set of documentary case studies illustrating inclusive sensory interventions within retail environments.

Cases were selected according to three criteria. First, each case needed to demonstrate an *explicit sensory intervention* within the retail environment. Second, the intervention had to involve a *clear accessibility or inclusion objective*, either explicitly stated or strongly implied by the implementation. Third, the intervention needed to relate to *phygital retail interactions*, particularly situations where environmental sensory conditions intersect with digital or service touchpoints.

Based on these criteria, four cases were selected:

- Tesco’s “*Quiet Hour*” initiative, representing scheduled sensory modulation in supermarket environments [5];
- Walmart’s “*Sensory-Friendly Hours*,” illustrating a time-based operational protocol implemented at scale [6, 7];
- IKEA’s *accessibility service*, which introduces tactile guidance and tactile maps as inclusive navigation tools [8];
- Mastercard’s *Touch Card*, developed in collaboration with accessibility organizations enables tactile differentiation of payment cards and increases payment independence [9, 17].

These cases collectively illustrate different strategies for addressing sensory accessibility, ranging from *stimulus modulation* to *sensory augmentation and multimodal interaction design*.

2.4 Limitations

This chapter does not present primary measurements – such as lux levels, decibel thresholds, or scent intensity measurements – nor does it report controlled experimental studies.

Instead, its contribution lies in the development of a *regulatory and governance framework grounded in existing literature and documentary evidence*. The proposed instruments are, therefore, intended to support auditable guidance development, organizational governance, and policy discussion, rather than to establish universal sensory thresholds for retail environments.

3. Empirical foundation: Literature review and documentary cases

The empirical foundation of this chapter emerges from the integration of two complementary sources: the literature review and the analysis of documentary retail cases. Together, these sources clarify how sensory conditions influence behavior and participation in retail environments and illustrate how organizations have begun to address sensory accessibility through operational interventions.

3.1 Phygital retail as a multisensory service system

Servicescape theory establishes that environmental dimensions – ambient conditions, spatial layout, and social context – shape cognition, affect, and behavior within service environments, ultimately influencing satisfaction and service outcomes [1]. Within retail contexts, environmental cues also function as informational signals through which customers infer service quality and store image [2].

Environmental psychology provides further explanation for why sensory intensity and unpredictability may influence behavior in these environments. The PAD framework, for instance, links environmental stimuli to emotional states that shape approach–avoidance responses [12]. In retail environments, such responses can translate into reduced time spent in-store, diminished willingness to engage with self-service technologies, and lower levels of perceived autonomy during service interactions.

Evidence from retail atmospherics research reinforces the multisensory nature of these dynamics. Reviews of experimental studies demonstrate that environmental variables influence shopping behavior through multiple mechanisms, including attentional processes, affective responses, and interpretive meaning-making [10]. From a multisensory perspective, store atmospherics therefore emerge not from isolated stimuli but from the *coordination of multiple sensory variables* operating simultaneously within the retail environment [11].

Taken together, these findings support an important interpretive shift. Sensory design should not be treated solely as a matter of atmosphere or esthetic enhancement; rather, it constitutes a functional layer of service performance and brand experience. When sensory conditions interfere with the completion of access-critical tasks – such as navigation, product information retrieval, or payment interactions – they become directly relevant to accessibility governance.

3.2 Human-centered design and accessibility as operational requirements

Human-centered design frameworks reinforce the importance of understanding the conditions under which interactions occur. ISO 9,241-210 emphasizes that effective design depends on analyzing users, tasks, and the *context of use* within real-world environments [13].

In phygital retail settings, the context of use necessarily includes sensory conditions such as glare, soundscape fluctuations, information density, and crowd

dynamics. These factors determine whether interactions with digital touchpoints – such as kiosks, payment terminals, or mobile interfaces – are practically achievable within the retail environment.

From a regulatory perspective, the European Accessibility Act provides the principal legal framework governing accessibility requirements for a range of products and services across the European Union, with implementation beginning on 28 June 2025 [3]. For ICT products and services, accessibility requirements are commonly operationalized through standards such as EN 301 549, which specifies accessibility criteria and evaluation approaches widely used in European compliance contexts [14].

However, a critical challenge emerges in phygital retail environments. Even when digital interfaces conform to accessibility standards, effective accessibility may still fail if environmental conditions undermine usability at the point of interaction. Excessive glare, high ambient noise, or visually saturated environments may render accessible interfaces difficult – or impossible – to use in practice.

3.3 Dissecting the European accessibility act through a sensory lens

Although the European Accessibility Act is frequently interpreted as a regulatory framework primarily concerned with digital accessibility, its provisions already embed a multisensory logic that is highly relevant to physical–digital service environments. In particular, *Annex I of the Directive*, which defines the functional accessibility requirements that products and services must fulfill, includes provisions stating that information necessary for operation, control, and orientation should be available through more than one sensory channel and that alternatives should exist when interactions depend on specific modalities such as vision, auditory perception, speech, or tactile interaction [3, 4]. The Directive also specifies that situations requiring timed responses should provide alerts through multiple sensory channels [3, 4].

To clarify how these regulatory provisions translate into operational implications for retail environments, **Table 1** summarizes selected requirements from Annex I and interprets their relevance for phygital retail contexts. The table highlights how the Directive implicitly requires multisensory redundancy and modality alternatives, both of which become particularly significant when digital interactions occur within complex sensory environments such as retail stores.

EAA requirement (<i>Annex I, paraphrased</i>)	Sensory implication	Phygital retail implication
Provide operation/control/orientation information via more than one sensory channel, including alternatives to vision, auditory, speech, and tactile elements [3, 4].	Multi-sensory redundancy is a baseline expectation.	In-store and phygital guidance should not rely on a single channel (only visual signage or only audio).
Provide alternatives when interaction relies on specific modalities (vision/auditory/speech/tactile) [3, 4].	Accessibility requires modality alternatives, not one universal format.	If a kiosk uses audio prompts, soundscape governance or alternative pathways become access-critical.
Where timed response is required, alert via more than one sensory channel [3, 4].	Critical cues require redundancy.	Environmental noise/light must not cancel feedback for payment, timed steps, or confirmations.

Table 1.
EAA requirements with explicit sensory implications (interpretive map).

These provisions demonstrate that accessibility regulation already recognizes the importance of multimodal interaction. In this sense, sensory accessibility should not be understood as an external or optional layer of accessibility regulation but rather as a principle embedded within its normative logic.

However, an important limitation emerges when these requirements are implemented in real retail environments. While the Directive establishes accessibility requirements for products and services, it does not explicitly address the environmental sensory conditions in which these interactions take place. In phygital retail environments, this omission becomes particularly significant because environmental factors – such as glare, background noise, or visual saturation – may effectively cancel out the intended accessibility modality.

Consequently, the operationalization of accessibility in phygital retail environments requires governance mechanisms that extend beyond interface compliance and consider the environmental sensory conditions shaping real-world usability.

3.4 Sensory variability, neurodiversity, and inclusion beyond “quiet”

Evidence addressing autism and retail environments indicates that sensory triggers frequently include bright lighting, loud or unpredictable noise, strong smells, and rapidly changing environmental conditions. These findings suggest that inclusive retail environments require more than the provision of occasional “quiet hours” alone [15]. Rather than assuming that stimulus reduction is universally sufficient, inclusive sensory design must address a broader range of sensory needs through mechanisms such as choice, predictability, controllability, and redundancy across sensory channels.

Design-oriented frameworks developed for autism-inclusive built environments further reinforce this perspective. For example, the ASPECTSS framework highlights the importance of acoustic control, sensory zoning, transition spaces, and opportunities for sensory relief within built environments [16]. These approaches indicate that inclusion depends not only on reducing environmental stimuli but also on structuring environments in ways that allow users to regulate their sensory exposure. As a result, inclusive sensory design in retail contexts requires governance mechanisms capable of addressing environmental conditions systematically, rather than relying on isolated adjustments.

Neurodivergent conditions, such as autism spectrum conditions or attention deficit hyperactivity disorder (ADHD), may involve heightened sensitivity to sensory stimuli, including lighting intensity, sound levels, visual complexity, or sudden environmental changes. In retail environments, these sensitivities can affect orientation, comfort, and the ability to complete service interactions. Recognizing these variations reinforces the importance of providing sensory choice, predictability, and controllability within multisensory retail environments [5].

3.5 Comparative case analysis template

To ensure traceability between empirical evidence and the regulatory guidance proposed in this chapter, the documentary cases analyzed in this study are examined through a comparative approach. This approach supports consistent identification of sensory strategies, accessibility mechanisms, governance arrangements, and potential regulatory implications across different retail contexts.

The analysis covers seven dimensions relevant to inclusive sensory design in phygital retail. First, it records case identification, including the organization, geographical context, retail format, and the phygital touchpoints involved. Second, it assesses sensory intent by describing the experiential goals and sensory variables mobilized within the retail environment. Third, it specifies the accessibility mechanisms addressed, identifying the barriers targeted and the participation outcomes enabled. Fourth, it documents design actions, including modulation, augmentation, redundancy across sensory channels, and alternative interaction pathways.

Fifth, it considers governance arrangements, including policies, staff training, accountability, and maintenance practices required to sustain the intervention over time. Sixth, it examines transparency mechanisms, focusing on how sensory conditions and available options are communicated to customers. Finally, it identifies transferable regulatory implications, outlining performance requirements and forms of evidence that may inform accessibility governance and policy development.

This comparative approach links descriptive retail practices to the performance-based regulatory guidance developed in the following sections.

3.6 Documentary case studies

The selected documentary cases illustrate different approaches through which organizations have addressed sensory accessibility in retail and service environments. To facilitate comparison across initiatives, **Table 2** summarizes the cases analyzed in this chapter, identifying the intervention type, the sensory variables involved, the transparency mechanisms adopted, and the regulatory principles illustrated in each example.

The cases reveal two main strategies for addressing sensory accessibility in retail environments: the modulation of sensory intensity and the augmentation of sensory channels.

Tesco's "Quiet Hour" initiative represents a strategy based on sensory modulation. The program establishes a predictable time window during which environmental stimuli are reduced, including dimmed lighting and lower checkout noise levels, thereby creating more manageable sensory conditions for customers with sensory sensitivities [6].

Case	Intervention type	Sensory variables	Transparency mechanism	Principle(s) evidenced
Tesco "Quiet Hour" [5]	Modulation (time-based mode)	Lighting; check-out noise	Public schedule + described changes	Choice/Controllability; Predictability/Transparency
Walmart "Sensory-Friendly Hours" [6, 7]	Modulation (time-based mode)	Soundscape; lighting; dynamic media	Corporate communication + consistent time window	Predictability; Choice; scalable governance
IKEA accessibility service [8]	Augmentation (added channel)	Tactile wayfinding; tactile maps	Published service description	Meaningful Stimulus; Phygital Equivalence
Mastercard Touch Card [9, 17]	Augmentation (tactile differentiation)	Tactile cues (notches)	Product documentation + partner narratives	Multi-sensory alternatives; independence at payment

Table 2.
Cross-case matrix mapped to regulatory principles.

A similar operational approach can be observed in *Walmart's "Sensory-Friendly Hours,"* which aim to reduce sensory load during designated periods. In some implementations, operational measures include reducing announcements and switching video walls to static displays, thereby minimizing dynamic visual and auditory stimuli [7, 8].

Other cases illustrate the complementary strategy of sensory augmentation. *IKEA's accessibility services,* for example, include tactile wayfinding supports, such as tactile guidance systems and tactile maps, enabling customers to navigate large retail spaces through additional sensory channels [9].

Similarly, the *Mastercard Touch Card* introduces tactile notches that allow users to identify different card types through touch, facilitating independent payment interactions for blind and partially sighted customers [4, 17].

Taken together, these examples demonstrate how inclusive sensory design can be implemented without eliminating experiential richness. Instead, organizations can either modulate sensory intensity or introduce additional sensory channels in order to support accessibility while maintaining coherent brand experiences.

Although the documentary cases analyzed in this chapter originate primarily from European and North American contexts, sensory expectations and tolerances may vary across cultural and regional environments. Factors such as local retail traditions, spatial density, social norms, and cultural perceptions of environmental stimuli can influence how sensory environments are experienced. Consequently, the strategies discussed in this chapter should be adapted with sensitivity to regional contexts when applied globally.

4. Results

Building upon the literature review and the documentary case analysis presented in the previous section, this chapter develops a regulatory-oriented framework for inclusive sensory design in phygital retail environments. The results of this work are presented as a set of interrelated governance instruments designed to support accessible participation in multisensory retail contexts. The following subsections introduce the main outputs of the framework, including a sensory-accessibility taxonomy, analytical tools for case comparison, performance-based regulatory principles, and operational governance mechanisms for retail organizations.

4.1 Deliverable 1: Sensory-accessibility taxonomy

The Sensory-Accessibility Taxonomy links brand-experience value functions, barrier mechanisms, inclusive design levers, and auditable evidence. It provides a practical tool for identifying how sensory environments influence both customer experience and participation.

Table 3 presents the taxonomy across several sensory dimensions commonly found in retail environments, including lighting, soundscape, scent, visual density, tactile feedback, and crowd dynamics. For each dimension, the table identifies typical brand-experience functions, potential accessibility barriers, inclusive design interventions, and forms of documentation that may serve as auditable evidence in governance or regulatory contexts.

Sensory dimension	Brand-experience value functions	Barrier mechanisms	Inclusive design levers (<i>pro-access</i>)	Auditable evidence (<i>artifacts</i>)
<i>Light and visual environment</i>	Legibility, mood, product highlighting, identity	Glare, flicker sensitivity, harsh transitions	Anti-glare placement; stable task lighting; moderated mode	Lighting specs; store plans; mode SOP
<i>Soundscape</i>	Tone, pace, reassurance, orientation cues	Masking of speech/audio guidance; peaks	Sound zoning; announcement governance; moderated mode	Sound policy; staff protocol; published schedule
<i>Scent</i>	Memorability, comfort cue, differentiation	Sensitivities; unpredictability	Disclosure; zoning; optional scent-free routes/times	Sensory profile disclosure; zoning plan
<i>Visual density and dynamic media</i>	Discovery, engagement, retail theatre	Cognitive overload; attentional fatigue	De-clutter near touchpoints; pause dynamic media in inclusive mode	Signage rules; “static media” protocol
<i>Tactility and haptics</i>	Reassurance, recognition, feedback	Lack of tactile alternatives; unclear affordances	Tactile guidance; haptic confirmations	Tactile map; hardware/product specs
<i>Crowd dynamics</i>	Social energy, urgency	Stress; reduced control; queue overload	Predictable calmer windows; alternatives; assisted pathway	Scheduling policy; queue SOP; staffing plan

Table 3.
Taxonomy linking value functions, barrier mechanisms, design levers, and auditable evidence.

In practice, the taxonomy can be adapted to different retail formats. For example, luxury retail environments may emphasize controlled lighting, minimal soundscapes, and carefully curated sensory cues to support calm and exclusive experiences. In contrast, high-volume mass retail environments may prioritize sensory zoning, predictable environmental conditions, and clear wayfinding cues to support efficient navigation while maintaining accessibility for diverse users.

4.2 Deliverable 2: Comparative case analysis template

The analytical template introduced in Sect. 3.5 is formalized as a practical instrument for translating retail practices into transferable governance requirements. By structuring case analysis across consistent dimensions – including sensory intent, accessibility mechanisms, governance models, and transparency mechanisms – the template enables organizations and policymakers to derive operational lessons from real-world implementations.

4.3 Deliverable 3: Performance-based regulatory principles

The overall structure of the regulatory-oriented framework proposed in this chapter is summarized in **Figure 2**.

The framework presented in this chapter translates insights from accessibility regulation, multisensory design research, and retail practice into governance instruments designed to support accessible participation while preserving the brand experience. In this model, the European Accessibility Act functions as the regulatory

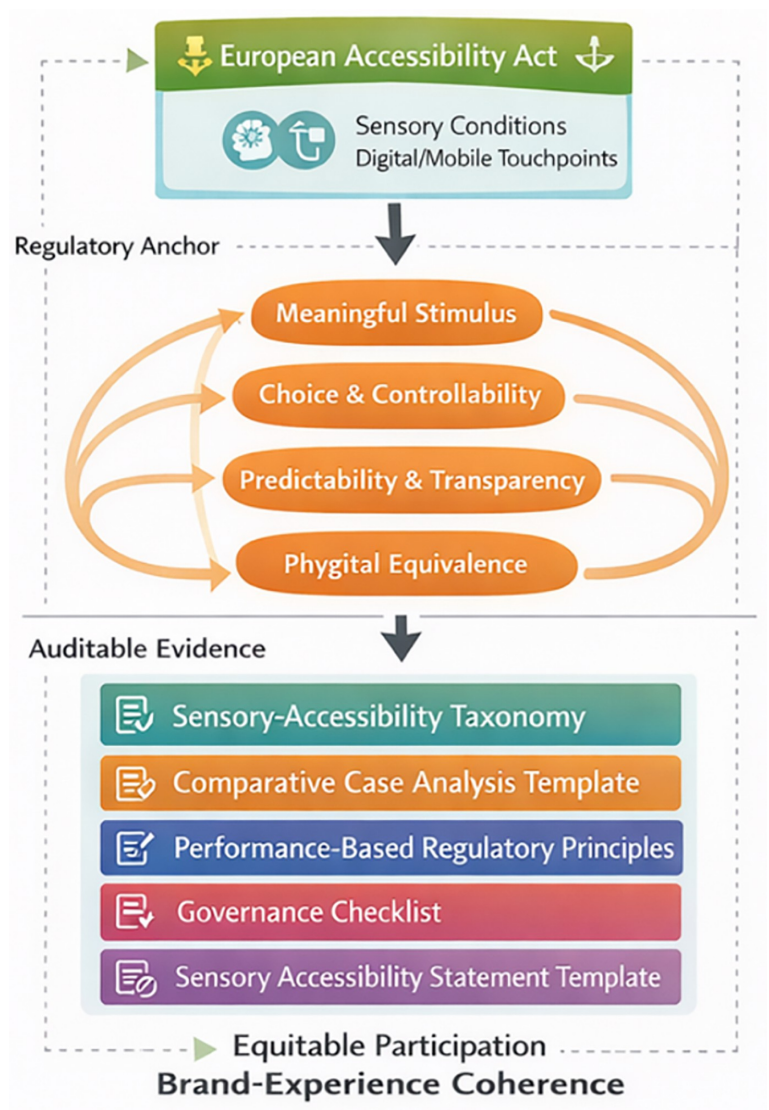


Figure 2. Regulatory blueprint for inclusive sensory design in phygital retail. Framework linking EAA requirements, context-of-use analysis, and governance instruments.

anchor, while context-of-use analysis identifies the sensory conditions that may affect accessibility in real retail environments. These elements inform a set of design principles and operational mechanisms that can be implemented through governance practices such as mapping sensory conditions, implementing inclusive controls, disclosing accessibility information, monitoring outcomes, and updating practices over time.

Based on the literature review, regulatory interpretation, and documentary case analysis, the chapter proposes four performance-based principles for inclusive sensory design in phygital retail environments. **Table 4** summarizes these principles and links them to performance requirements, potential compliance evidence, and

Principle	Performance requirement (regulatory-friendly wording)	Acceptable evidence for compliance	EAA alignment
Meaningful stimulus	Sensory stimuli must have stated purposes and must not compromise access-critical tasks.	Design brief; task zoning; barrier risk register.	Multi-sensory access and modality alternatives in Annex I [3, 4].
Choice and controllability	Equivalent pathways must exist for core tasks (self-service + assisted; standard + moderated mode).	Mode SOP; staffing protocol; signage; service options.	Alternatives to modality-dependent interaction [3, 4].
Predictability and transparency	Sensory profiles and options must be disclosed in advance, including temporary changes.	Published statement; schedule publication; update log.	Accessible info/instructions + multi-channel expectations [3, 4].
Phygital equivalence	Environmental conditions must not negate effective accessibility of regulated touchpoints in situ.	Placement standards (anti-glare/noise zoning); in-situ usability checks	EAA scope + Annex I multisensory intent supports outcome-based assessment [3, 4].

Table 4.
Regulatory guidelines with acceptable evidence and EAA alignment.

their alignment with the multisensory accessibility logic of the European Accessibility Act.

The first principle, meaningful stimulus, emphasizes that sensory stimuli should serve explicit experiential or functional purposes rather than generating unnecessary sensory intensity. In retail environments, sensory variables such as lighting, sound, or dynamic media often contribute to brand expression and spatial orientation; however, these stimuli should not interfere with access-critical tasks such as navigation, product information retrieval, or payment interactions.

The second principle, choice and controllability, requires that equivalent pathways exist for accessing core retail services. Customers should be able to complete essential interactions through different modes, including assisted service pathways, moderated sensory modes, or alternative interaction channels.

The third principle, predictability and transparency, highlights the importance of communicating sensory conditions and accessibility options in advance. Providing clear information about sensory environments – such as quieter time periods, sensory zoning, or alternative service options – allows customers to plan their visits and select environments that better suit their sensory preferences.

Finally, phygital equivalence requires that environmental sensory conditions do not undermine the effective accessibility of digital touchpoints embedded in physical retail environments. Even when digital interfaces comply with accessibility standards, environmental factors such as glare, excessive noise, or visual saturation may compromise usability in practice. Ensuring phygital equivalence therefore, requires evaluating accessibility under realistic environmental conditions rather than solely through interface-level compliance.

In operational terms, auditable evidence may include documentation such as lighting specifications, soundscape management policies, staff training materials, accessibility audits, internal service protocols, and records associated with Sensory Accessibility Statements. These forms of documentation allow organizations to demonstrate that accessibility considerations have been incorporated into both design decisions and everyday operational procedures.

4.4 Deliverable 4: Governance checklist

To support practical implementation, the chapter proposes a governance checklist for designers and retail organizations. The checklist identifies key operational steps required to ensure that sensory environments support accessible participation in phygital retail services.

These steps include identifying access-critical moments within the customer journey (such as entry, wayfinding, assistance, product information, payment, and returns); mapping sensory variables across retail zones and touchpoints using the taxonomy presented in **Table 3**; specifying inclusive sensory requirements, such as redundancy for critical information and alternative interaction pathways; and verifying phygital equivalence by ensuring that digital touchpoints remain usable under realistic environmental conditions, such as glare, noise, or crowding.

Additional governance measures include operationalizing sensory modes through staff training and service protocols, publishing transparency artifacts such as a Sensory Accessibility Statement, and establishing feedback and monitoring mechanisms to support continuous improvement.

In large retail organizations, the implementation of these governance instruments may involve a combination of centralized guidelines and local operational adaptation. Corporate accessibility policies can establish baseline principles for sensory accessibility, while individual stores adapt these guidelines to their specific spatial layouts, regional contexts, and customer profiles. Regular staff training, accessibility audits, and feedback channels can further support continuous improvement across multiple locations.

4.5 Deliverable 5: Sensory accessibility statement

To support transparent communication of sensory conditions and available accessibility options, this chapter proposes a structured *Sensory Accessibility Statement* that organizations can publish for customers and stakeholders (**Table 5**).

Section	What to include	Notes for auditability
<i>Coverage</i>	Store formats/locations; phygital services (kiosks, payment terminals, click-and-collect)	Link statement to store list and service scope
<i>Typical sensory profile</i>	Lighting, soundscape, scent, dynamic media, crowd peaks	Describe typical patterns; note variability
<i>Moderated options</i>	Times/zones + what changes	Publish schedules; specify exactly what changes
<i>Alternative pathways</i>	Assisted checkout; staff support; wayfinding support	Provide clear access routes and service points
<i>Contact and feedback</i>	Dedicated channel and response expectations	Log feedback and improvement actions
<i>Update cadence</i>	Review frequency; refit-triggered updates	Maintain versioning and change log

Table 5.
Sensory accessibility statement: Recommended structure and disclosure elements.

As illustrated in **Table 5**, the statement describes the typical sensory profile of retail environments, identifies moderated options such as quieter time periods or sensory zones, specifies alternative service pathways, and provides contact channels for feedback. Maintaining versioning and update logs ensures that this information remains reliable, transparent, and auditable over time.

5. Discussion

5.1 Sensory design as brand value and access infrastructure

Research on service environments demonstrates that physical settings influence customer behavior, perceptions, and service outcomes [1]. Within retail contexts, environmental cues also shape quality inference and store image, reinforcing the interpretation of sensory environments as functional components of brand experience [2].

Building on these foundations, this chapter argues that sensory design in phygital retail should also be understood as *access infrastructure*. When environmental conditions support orientation, comprehension, and interaction, they enable customers to complete service tasks independently. Conversely, when sensory environments interfere with perception or interaction, they may undermine the usability of digital touchpoints embedded in the retail environment.

5.2 What the EAA already implies, and what remains under-specified

The multisensory provisions embedded in *Annex I of the European Accessibility Act* require that information for operation, orientation, and control be available through multiple sensory channels, and that alternatives exist for modality-dependent interaction [3, 18]. These requirements demonstrate that accessibility regulation already recognizes the importance of multimodal communication.

However, the environmental contexts in which these interactions occur remain under-specified. In phygital retail environments, sensory conditions such as glare, background noise, or visual clutter may effectively negate the intended accessibility modality. Addressing this gap, therefore, requires governance approaches that extend accessibility considerations beyond interface design to include environmental sensory conditions.

5.3 Case patterns: Modulation and augmentation without erasing brand expression

The documentary cases analyzed in this chapter reveal two complementary strategies for inclusive sensory design. The first involves *sensory modulation*, implemented through predictable and scheduled adjustments to environmental stimuli, as illustrated by Tesco's Quiet Hour and Walmart's Sensory-Friendly Hours [6–8].

The second involves *sensory augmentation*, where additional sensory channels are introduced to support interaction and orientation, as demonstrated by IKEA's tactile

wayfinding supports and Mastercard's tactile card differentiation [4, 9, 17]. Together, these strategies demonstrate that inclusive sensory design does not require eliminating sensory richness or brand expression. Instead, it involves governing sensory conditions in ways that allow customers to access services through multiple sensory pathways.

5.4 Why performance-based regulation is appropriate

Retail environments vary widely in spatial configuration, brand identity, and experiential design strategies. Prescriptive regulatory approaches risk homogenizing retail environments and constraining creative expression.

Performance-based regulation provides a more flexible alternative by specifying accessibility outcomes rather than prescribing exact environmental conditions. As shown in **Table 4**, the principles proposed in this chapter link accessibility objectives to auditable evidence and governance mechanisms while allowing variability in sensory design.

5.5 Methodological reflections and limitations

Because this chapter relies on literature synthesis and documentary case evidence, it does not propose universal numerical thresholds for environmental variables such as lux levels, decibel limits, or scent intensity. Instead, the framework prioritizes governance instruments and performance outcomes that can be adapted across diverse retail contexts.

In this sense, the chapter should be understood primarily as an explanatory and interpretive contribution. Its purpose is not to prescribe fixed sensory standards but to clarify how sensory conditions interact with accessibility requirements in phygital retail environments. By articulating concepts from multisensory design, accessibility regulation, and retail practice, the framework highlights the role of sensory environments as operational conditions that can enable or constrain participation in retail services.

Consequently, the proposed framework emphasizes governance mechanisms, transparency instruments, and performance-based principles rather than fixed environmental thresholds. This approach allows accessibility considerations to be integrated into diverse retail environments while preserving variability in spatial configuration, brand expression, and experiential design.

6. Conclusion

Inclusive sensory design in phygital retail can simultaneously function as a competitive dimension of brand experience and as an accessibility enabler when sensory environments are treated as governable infrastructure rather than merely atmospheric features. Anchored in the European Accessibility Act, which becomes applicable from 28 June 2025, this chapter argues that interface-level accessibility compliance is necessary but insufficient when environmental sensory conditions undermine effective participation in retail services [3].

Through the integration of a critical literature review and documentary case studies, the chapter develops a regulatory-oriented framework for inclusive sensory design in multisensory retail environments. Five complementary outputs are presented: a Sensory-Accessibility Taxonomy (**Table 3**), a Comparative Case Analysis Template, four Performance-Based Regulatory Principles (**Table 4**), a Governance Checklist for designers and retailers, and a Sensory Accessibility Statement template (**Table 5**).

Beyond these instruments, the chapter offers an interpretive contribution by positioning sensory design as an emerging dimension of accessibility governance in phygital retail environments. Rather than prescribing uniform environmental standards, the framework highlights how sensory conditions can enable or constrain participation in retail services and, therefore, deserve greater attention within accessibility regulation, design practice, and retail management.

In this sense, the chapter can be understood as an invitation to integrate sensory design more explicitly into accessibility thinking. Recognizing sensory environments as part of the conditions of access allows both policymakers and designers to address inclusion not only through interface compliance but also through the governance of environmental experience.

Future research may extend this work by applying and testing the proposed framework in operational retail environments. Empirical studies could evaluate how sensory conditions influence the usability of digital touchpoints in situ, examine the effectiveness of sensory modulation and augmentation strategies, or assess how governance instruments, such as the Sensory Accessibility Statement, support transparency and participation in retail services. Such investigations would contribute to strengthening the evidence base for sensory accessibility in multisensory phygital environments.

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Conflict of Interest

The author declares no conflict of interest.

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