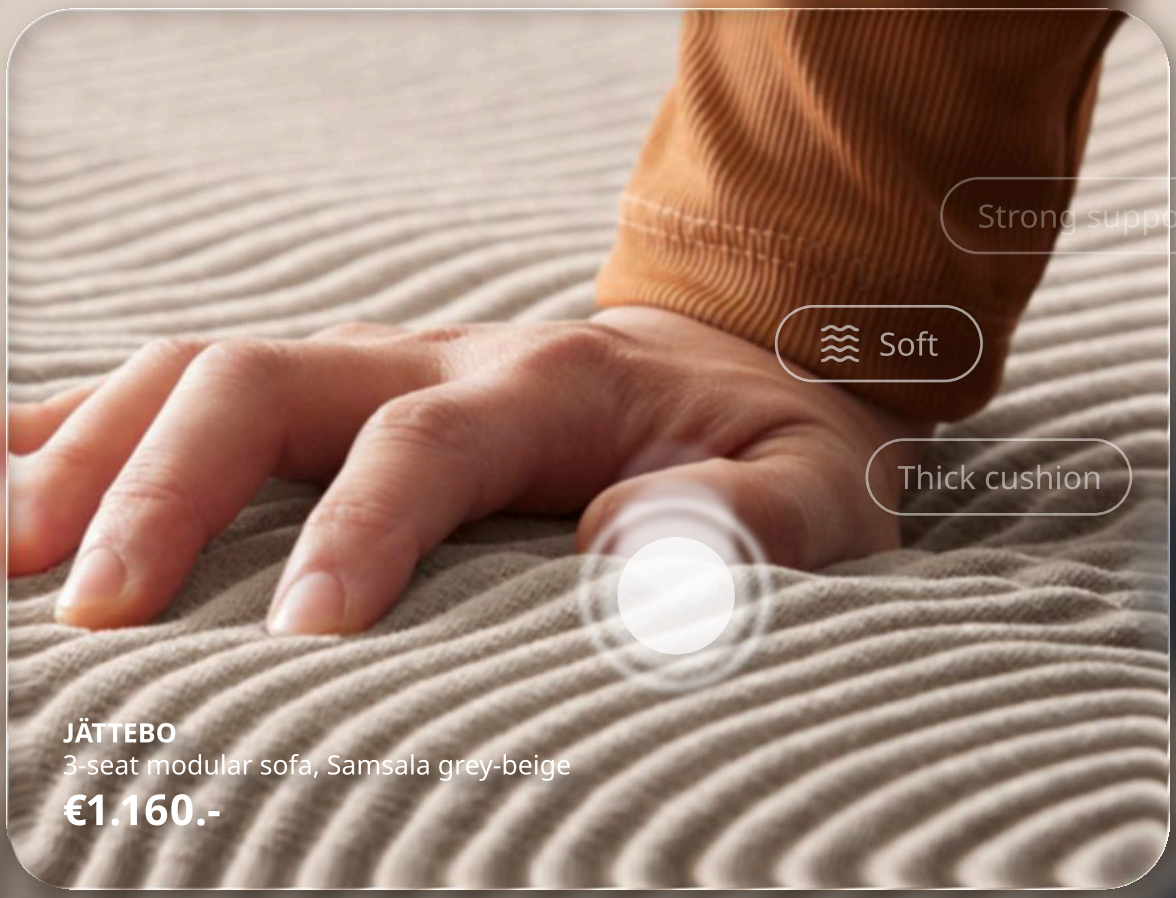
EXPLORING
IN-STORE DIGITAL HAPTIC EXPERIENCE
IN COMPACT RETAIL SPACES



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Abstract

This thesis investigates how digital haptic experiences can enhance or partially substitute physical product interaction in compact retail spaces. In IKEA's smaller store formats, limited display capacity restricts physical trial, creating a gap between customers' expectations to "see and feel" products and what can actually be experienced in-store. Focusing on sofas as a high-touch, high-involvement category, the research asks how digital tools can support product exploration, imagination, and purchase commitment when physical trial is constrained.

A multi-method approach was used. A survey across eight living-room categories conducted in three markets(US, Spain, India) mapped need-for-touch across products and information types, positioning sofas at the extreme end of the spectrum and identifying a broader cluster of high-touch, textile-involving categories.

In-depth interviews and in-store observations then traced sofa shopping journeys and revealed a recognisable sequence of haptic assessment (sitting, pressing, stretching, pinching) through which customers assess comfort and perceived quality.

These insights informed the design and iterative refinement of a digital haptic prototype—the Touch Explorer—based on interactive cinematics that visually simulate cushion deformation and fabric movement in response to user input. The prototype was evaluated with customers and co-workers to explore perceived diagnosticity, interpretation of cues, and the perceived role of the tool in the journey.

The findings show that sofas function as a high-risk "stress test" for digital trialability: key decision attributes are haptically loaded, errors are costly, and emotional involvement is high. Digital haptic cues are most promising when they approximate how products behave when actually touched, using familiar actions (pressing, pinching) to show deformation and movement. Within the DAST framework, the Touch Explorer extends trialability beyond limited physical samples and positions co-workers as "sensory translators".

Instead of a replacement for actual sit, customers see it as a supporting, bridging touchpoint—useful for narrowing the range, compensating for missing displays, and reactivating haptic impressions across channels.

This research is exploratory and context-bound to IKEA and sofas, but outlines a transferable research and design trajectory for digital haptics in other high-touch categories.

For practice, future work at IKEA could: 1) implement the Touch Explorer in real small stores and quantitatively assess its impact on dwell time, consideration of non-displayed variants, conversion, and returns, 2) extend the approach to other high-touch categories and markets, and 3) further integrate the tool into co-workers' roles and service flows.

For academia, future research could 1) quantitatively compare different digital representations (e.g., hand vs. no-hand, deformation parameters) in terms of haptic accuracy, 2) examine how individual differences such as Need for Touch and digital literacy shape adoption, and 3) explore multi-sensory and perceptual mechanisms to build more precise mappings between visual deformation and perceived tactile qualities.

01

> **Customers want to see, feel, and experience products to understand what they want and what they can buy.**

Introduction

In today’s omnichannel retail landscape, customers frequently switch between online and in-store channels, using each touchpoint for different purposes. While online platforms provide convenience and extensive product information, physical store visits remain essential for reducing uncertainty.



Source: Ingka Group internal material, used with permission (2026).

01 Introduction

As IKEA expands its small-store concept to more markets, the aim is to make the brand more accessible for the many people. In such stores, services must be easy and quick to launch, and every square meter has to work harder, both in showcasing the product range and in supporting purchase confidence.

In compact store formats, space limitations restrict the number of products that can be physically displayed (Figure 1). Customers may visit the store expecting hands-on experience, yet often encounter items that are not shown, available only in alternative materials or colors, or represented through minimal visual cues. This creates a widening gap between customer expectations and the physical realities of constrained retail environments.

Blue box store, Haarlem, NL



50
(approx.) sofas to try out

8
showrooms



10
(approx.) sofas to try out

2
showrooms

Small store, Norwich, UK

Figure 1.1 Display capacity comparison (Blue box store (left), Small store (right))
Source: Ingka Group internal material, used with permission (2026)



Figure 1.2 Practical challenge in small store display: Left- small store (UK)/ Right- small store (Indonesia) *Source: Ingka Group internal material, used with permission (2026).*
In some stores, sofas are displayed on elevated platforms to maximise the use of vertical space; while this supports range visibility, it can make spontaneous sit-down trial more difficult and may require co-workers' assistance.

This mismatch between expectations and what can be physically displayed raises a concrete challenge for IKEA: **How to provide enough reassurance to reduce uncertainty when customers cannot try all relevant products in person?**

Digital channels and in-store technologies open up possibilities to simulate or augment trial in new ways, but it is not yet clear how these tools should be designed to genuinely support sensory assessment rather than simply adding more screens.

To address this challenge, the next chapter reviews literature on the changing role of physical stores in an omnichannel context, on product assessment, and on sensory-enabling technologies that may act as digital proxies for sensorial experience.



02

Literature Review

2.1 Physical retail transformation
- 2.1.1 IKEA small store in DAST framework
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This chapter reviews three main streams of literature that frame the thesis. First, it discusses the changing role of physical stores in an omnichannel context and uses the DAST framework to position trialability as a key challenge for IKEA's compact store formats. Second, it zooms in on product assessment through touch, considering both product-level and individual-level perspectives by focusing on touch diagnosticity and Need for Touch across consumers. Third, it introduces visual- and sensory-enabling technologies as potential digital proxies for touch. Together, these perspectives lead to the research frame and guide the subsequent empirical and design work.

2.1 Physical retail transformation

With ongoing digital transformation, many retail activities have shifted to online platforms. Early discussions in the literature even suggested that physical stores might become challenging in the digital era (Nanda et al., 2021; Reinartz et al., 2019).

However, in the post-pandemic context, physical stores have re-emerged as important venues where customers seek sensory stimulation and pleasurable experiences (Szocs et al., 2023). Visiting a store creates value for customers in several ways, including discovery, convenience, customization, community, and shoppertainment (Breugelmans et al., 2023). Breugelmans et al. (2023) explicitly frame sensory experience as a key means to achieve "discovery" benefits, where customers use their senses to reduce product uncertainty, and as a central stage for brand communication.

At the same time, neither physical stores nor digital touchpoints can be considered in isolation. Jocevski (2020) proposes the idea of the physical retail space as an "aggregation hub" that connects multiple retailer–customer interaction points across physical and digital channels. In this view, an omni-channel experience emerges from orchestrating all controllable sensory cues across in-store and at-home touchpoints (e.g., websites, apps), rather than designing each channel separately.

2.1.1 IKEA small store in DAST framework

Roggeveen et al. (2020) introduce the DAST framework, which conceptualises retail atmospherics along four dimensions—***Design, Ambient, Social and Trialability***—and can be applied across both physical and digital environments.

> ***Design*** factors consist of both functional and aesthetic elements. Functional design elements include the layout, comfort, and signage; aesthetic design elements refer to the color, scale, texture/pattern, style, accessories, and merchandise presentation (Baker, 1986).

> ***Ambient*** factors in retail environments—such as lighting, sound and general atmosphere, tend to be processed at a more subconscious level (Szocs et al., 2023).
>
> The ***Social*** dimension refers to people in the environment, including staff and other shoppers (Baker, 1986; Baker et al., 1994). Social presence can intensify emotional responses to products (Pozharliev et al., 2015), but high crowding can also undermine comfort and reduce purchases (Zhang et al., 2014).
>
> ***Trialability*** is the new notion introduced by Roggeveen et al. (2020) within the DAST framework. It refers to the extent to which customers can experience a product before purchase, and is a key driver of progress in the customer journey.

To launch quicker, smaller stores while still providing sufficient service, technologies are utilized to reshape the *design* and *social* dimension. IKEA small store has introduced several digital services—such as QR codes on product tags, the Upptäcka mobile experience, Scan & Go, and other in-store touchpoints—to support product exploration and streamline checkout (Figure 2.1).



Figure 2.1 Product tags and QR codes in IKEA small store *Source: Ingka Group internal material, used with permission (2026).*

According to Huré et al. (2017), the increasing use of in-store digital services changes the role of co-workers: beyond providing product advice, they also explain, troubleshoot, and guide customers through digital tools. In IKEA small stores, this shift is part of a deliberate strategy to scale service through digital touchpoints; co-workers are expected to help customers navigate digital solutions as an integral part of the format.

Customers report that, compared with large IKEA stores, the merchandise layout in small stores feels "less magical", with fewer showrooms for inspiration. Several interviews mention that it lacks the feeling of "spending the whole day in IKEA", limited the depth and breadth of inspiration (IKEA, 2025).

For some customers who are familiar with IKEA's unique experience and strong expectations, this can lead to disappointment. For others who know IKEA only through small stores, there is a risk that they construct a reduced brand image and assume that IKEA only offers the basic styles they see in the small store. How to present the iconic IKEA ways of shopping while keeping the calmness and efficiency in the small store format therefore become a key focus of this research.

2.1.2 Enhancing trialability

The integration of these four dimensions should take into account product type and purchase context (Roggeveen et al., 2020). Through consistent sensory cues, appropriate levels of social interaction, and strategically designed product trial, the goal is to achieve a dynamic balance across the four dimensions without causing sensory overload. Among them, the "social" and "trialability" dimensions are considered moderating factors that can be used to balance the influence of design and environmental factors. When customers interact with staff (social) or try the product themselves (trialability), their understanding of and engagement with the product increase, which can amplify the effects of existing environmental cues.

Crucially, trialability is not limited to physical trial. Any function that allows customers to experience or simulate a product in advance, even without a full physical sample, contributes to trialability. In IKEA, there are tools like system planner, AR/ 3D tools (i.e., Kreativ, Figure 2.2) enable colour and material switching, and style or layout simulations. In an omnichannel context, this implies that digital touchpoints outside the store (e.g., App and website) also need to act as media for exploration and communication of product properties, not only as transactional interfaces.

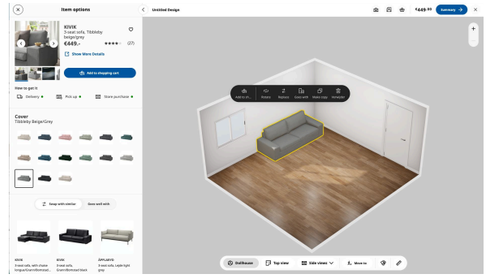


Figure 2.2 IKEA Kreativ, a 3D-model imagination tool allows customers to place the product in the room *Source: Screenshot from Ikea.com*

For high body-involvement products such as furniture, trialability is particularly important (Oh et al., 2008). As retailing becomes more digital, the role of the physical store shifts from a place to buy things to a place that helps customers make better and faster decisions (Hagberg et al., 2017). If customers cannot sense the product, it is difficult for them to feel confident about their choice. In IKEA's case, many customers explicitly cite the appeal of "seeing it and taking it home" as a core part of the brand experience (IKEA, 2022).

Customers can check the stock availability of specific products online before visiting, which provides a way to manage expectations in advance. However, when they do not use these tools, prior expectations may still misalign with what is physically available on the shop floor. In practice, this means that trialability in small formats is still effectively anchored in the relatively few products that are physically on display.

These findings from DAST framework point to a clear direction that the core question becomes not only how to broaden range exploration digitally in IKEA unique ways of shopping, but also how to ensure that these digital experiences carry sufficient sensory diagnosticity for customers to feel confident in their choices.

2.2 Product assessment

Two types of product's attributes, ***search attributes*** and ***experience attributes*** are distinguished by the ability of being evaluated by consumers prior to use (Nelson, 1970, 1974).

> ***Search attributes*** are aspects that can be evaluated through second-hand information (e.g., descriptions, specifications) and therefore place relatively low demands on sensory experience.
>
> ***Experience attributes*** require first-hand interaction and involve more subjective evaluation.

Everyday experience indicates that people assess products through multiple sensory channels: seeing the color and lighting effects, touching the texture by hand, hearing the sounds they produce, and smelling their subtle scents. Together, these perceptions shape people's past experiences and memories associated with specific sensory cues, which we then subconsciously rely on to recognize and evaluate product properties.

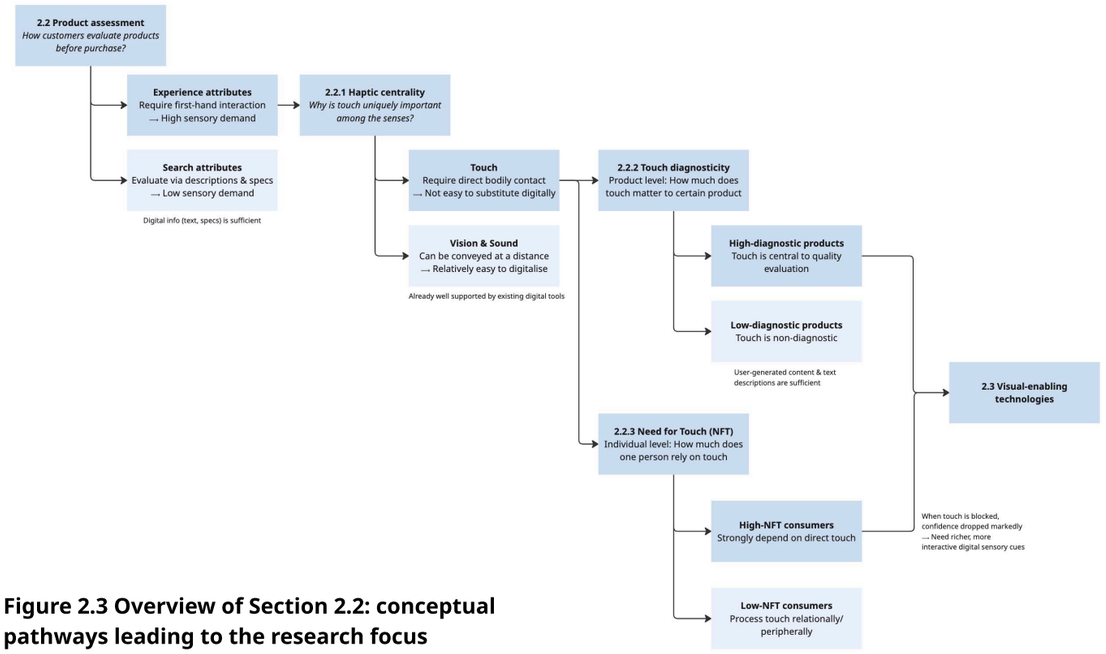


Figure 2.3 Overview of Section 2.2: conceptual pathways leading to the research focus

2.2.1 Haptic centrality

While sensory experience influences the shopping experience in a broad sense, this thesis narrows the focus to haptic. There are two main reasons for this choice. First, touch occupies a unique position among the senses in consumption contexts. Vision and sound can usually be conveyed at a distance and reproduced relatively easily through digital media, whereas touch requires direct bodily contact with the product. Tactile input is often critical for evaluating material qualities and for forming psychological ownership, particularly for durable, higher-involvement goods (Peck and Childers, 2003; Peck and Shu, 2009). In other words, for many products, customers may be willing to rely on visual and auditory information alone, but for products with strong tactile attributes, the decision does not feel safe without touch.

2.2.2 Level of Touch Diagnosticity for products

Depending on the nature of the product and the shopping context, products exhibit different levels of touch diagnosticity. By distinguishing between low vs. high importance of touch for consumers, Donato and Raimondo (2021) show that people follow different routes of information processing. For low-touch-diagnostic products, tactile information is not central to evaluation and is therefore non-diagnostic. In these cases, consumers tend to follow a peripheral route of processing, relying more on heuristics and simple cues, and are more willing to trust user-generated content that they perceive as reliable.

In contrast, for high-touch-diagnostic products, tactile experience attributes are key to assessing quality and are thus highly diagnostic. Here, consumers are more likely to follow a central route of processing, engaging in more analytical evaluation in detail. For such products, additional descriptions of experiential attributes cannot fully compensate for the absence of actual touch; instead, they may even heighten the frustration associated with "not being able to touch" the product. Consequently, for low-touch-diagnostic products, tactile descriptions conveyed through social and user-generated content can effectively increase purchase intention, whereas for high-touch-diagnostic products, it remains crucial to enhance the perceived diagnosticity of the (digital or physical) shopping experience itself.

2.2.3 Level of individual Need for Touch (NFT)

Beyond product-level differences in touch diagnosticity, individuals also vary in their preference for and reliance on tactile information, conceptualized as Need for Touch (NFT) (Peck & Childers, 2003). Low-NFT consumers tend to process tactile information in a more relational or peripheral manner, whereas high-NFT consumers strongly depend on direct touch and find it difficult to substitute physical contact with verbal or visual descriptions of experiential attributes. When direct touch is blocked (e.g., by a retail display case), high-NFT consumers exhibit a marked drop in confidence in their product judgments, whereas low-NFT consumers' confidence remains largely unaffected.

When touching products, consumers may be driven by two distinct motives: instrumental touch and autotelic touch (Peck & Childers, 2003a). Instrumental touch is goal-directed and used to diagnose product characteristics (e.g., firmness, thickness, construction), whereas autotelic touch is sought for its own sake, to increase enjoyment or sensory pleasure. For many products, especially those with rich material properties, both motives are activated simultaneously: consumers use discriminative touch to make instrumental quality judgments and affective touch to generate hedonic emotional responses (McGlone et al., 2014).

In summary, product assessment in retail contexts is shaped by an interplay between product-level and individual-level factors. Sofas are a prime example of a product category in which experience attributes such as comfort, support, and fabric feel are central to evaluation, and are therefore likely to exhibit high touch diagnosticity. This proposition will be empirically examined in the research scoping of this thesis.

While the literature suggests that, for high-NFT consumers, simple verbal descriptions or static images cannot fully compensate for the lack of direct touch, they require more interactive technologies that provide richer cues engaging both the instrumental and autotelic dimensions of touch (Donato & Raimondo, 2021).

2.3 Visual-enabling technologies

Building on the broader framework of sensory-enabling technologies (SETs), which comprise interfaces capable of delivering sensory inputs in online and mixed-reality environments (Petit et al., 2019), this thesis focuses specifically on visual-enabling technologies. In this context, visual-enabling technologies are understood broadly as digital interfaces and content formats (e.g., screens, touchscreens, VR/AR headsets) that support consumers in inferring tactile properties through sensory substitution, using visual, textual, auditory, or other mediated cues to provide actual or quasi-tactile feedback.

Across these technologies, three psychological mechanisms are particularly relevant for compensating the lack of direct touch:

> ***Mental imagery*** – consumers generate internal sensory simulations based on visual and verbal input; by mentally simulating product use, they improve prediction accuracy and significantly increases purchase intention (Schlosser, 2003)
>
> ***Perceptual re-enactments*** – reactivation of modality-specific sensory brain areas when consumers are exposed to product-related visual cues, such as pictures or videos, helping the brain to fill in missing tactile sensations (Simmons et al., 2005).
>
> ***Psychological ownership*** – interfaces that enable more direct or embodied interaction (e.g., touchscreens, virtual hands) can increase feelings of ownership of the product, thereby boosting valuation and willingness to pay (Luangrath et al., 2021).

The following subsections review three main categories of visual-enabling solutions that are relevant for this thesis: (1) basic visual and textual compensation (Pino et al., 2019; Luangrath et al., 2021), (2) image interactivity technologies (IIT) (H. Xie, 2016), and (3) VR/AR-based experiences (Javornik, 2016; Beck & Crié, 2016).

2.3.1 Basic visual & textual compensation

At the most common and cost-efficient level, digital communication of haptic attributes relies on basic visual and textual cues, together with consumers' mental imagery and perceptual re-enactments, to compensate for missing touch.

High-resolution photos and zoom functions allow close inspection of material details (e.g., weave, pile, seams), helping consumers infer tactile properties from visual texture and structure (Figure 2.4).



Figure 2.4 Static imagery and zoom-in views. *Source: IKEA Inter internal material, used with permission (2026).*

Descriptions of weight and feel (e.g., "smooth as silk", "light as air", "soft") trigger long-term memory of prior experiences with similar materials and support more functional evaluations of comfort and quality (Figure 2.5).

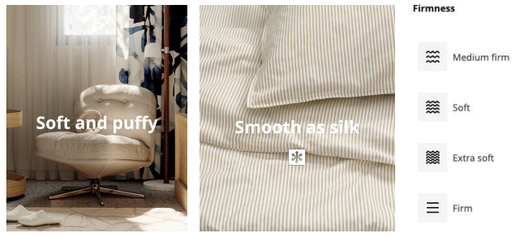


Figure 2.5 Textual haptic descriptions. *Source: IKEA Inter internal material, used with permission (2026). Recreated by author. Icons by Icons8*

Vicarious touch occurs when consumers watch a hand physically interacting with a product in a digital environment (Luangrath et al., 2021). Seeing another hand grasp, squeeze, or stroke a material can elicit a sense of body ownership over the observed hand, as if the virtual hand were "my" hand, which then spills over into psychological ownership of the product and increases its perceived value.

These effects are stronger when the hand movements are meaningful and diagnostic (e.g., compressing a cushion to show firmness, pulling fabric to reveal elasticity) (Figure 2.6).

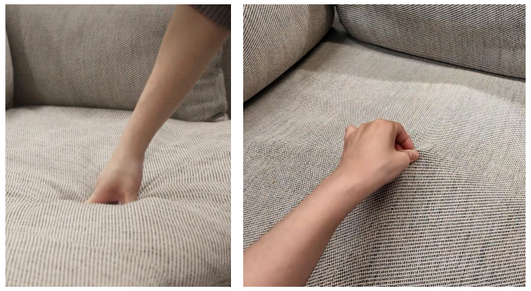


Figure 2.6 Hand cues and vicarious touch *Photo by author, used with permission from Ingka Group (2026).*

2.3.2 Image Interactivity Technology (IIT)

Image interactivity technologies (IIT) add active user control on top of basic visuals, allowing consumers to manipulate the representation and thereby simulate physical operations through changing visual feedback (Schlosser, 2003).

Users drag with a mouse or finger to rotate the product, mimicking the real-world action of moving an object (Figure 2.7).

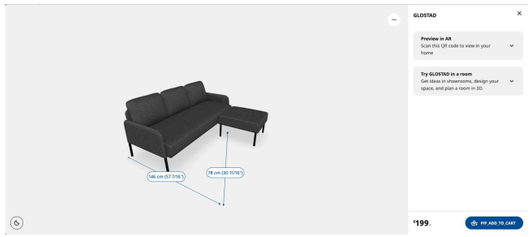


Figure 2.7 360-degree views and rotation. *Source: Screenshot from Ikea.com*

Xie (2016) proposed interactive cinematics as a middle ground between static images and actual physical touch (Figure 2.8 & 2.9). In this approach, the video responds in real time to user input (e.g., press, drag), visually simulating how the product would deform or move as if it were being touched.



Figure 2.8 Interactive cinematics (pressing cushion) Source: Xie (2016)



Figure 2.9 Interactive cinematics (pushing cloth) Source: Xie (2016)

Together, rotation-based IIT mainly enrich geometric information (shape, proportion, structure), whereas deformation-based interactive cinematics start to approximate haptic cues such as softness, elasticity or weight through vision. Through these interactions, IIT can strengthen mental imagery and perceived diagnosticity of the digital experience, without requiring specialised haptic hardware (Jiang & Benbasat, 2004; Choi & Taylor, 2014; Xie, 2016; Petit et al., 2019).

2.3.3 VR/AR Technology

VR and AR technologies have evolved from purely visual tools into systems that can be combined with tactile feedback (Fiorentino et al., 2022, see Figure 2.10). In furniture settings, customers can sit on a real sample sofa while viewing its configured version in VR, which helps to overcome the barrier of imagining how the product will fit into their home space.

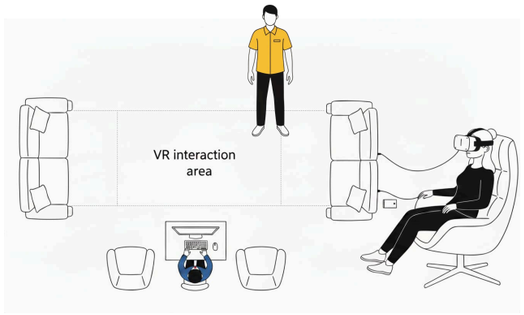


Figure 2.10 Layout requirement for Multi-Sensory In-Store Virtual Reality Customer Journey (MSISVRCJ) *(Source: adapted from Fiorentino et al., 2022. Recreated by author)*

IKEA's own AR services, integrated into its apps, allow customers to scan their room layout and place virtual furniture in situ (Figure 2.11). However, these tools primarily address spatial visualisation and still offer limited support for evaluating finer product properties, such as perceived sturdiness or softness.



Figure 2.11 IKEA Kreativ- scan your own room
Source: IKEA Inter internal material, used with permission (2026).

Given the space constraints, required hardware, and the need to maintain high customer throughput with limited staff, large-scale VR installations are not a realistic option for IKEA small-format store at this stage. Initial evaluations of interactive cinematics suggest that such IIT formats strongly boost novelty and engagement, but only marginally improve the accuracy of product attribute communication (Xie, 2016). Creusen et al. (2025) show that different visual formats vary in how accurately they convey material properties. They use property-perception discrepancy—the absolute difference between evaluations based on online stimuli and evaluations after touching the real product—as a key metric to quantify this gap.

Building on the above, this research aims to explore how interactive cinematics can be structured to convey haptically salient material properties more effectively and accurately.

Research question

This project therefore addresses a question:
How can interactive cinematics enhance or substitute physical product interaction in compact retail spaces to support exploration, imagination, and purchase commitment?

1. **Need for touch across product categories and information types:**
How do customers prefer information during their in-store journey, and how do various information formats (visual, tactile, interactive, verbal) influence their confidence and decision-making?
(Covers: need for touch, touch diagnosticity, impact of communication format.)

2. **Digital role in physical touchpoints:**
What digital touchpoints currently exist throughout the journey, what roles do they play in and where are the gaps between customers' needs and today's digital-physical experience?
(Covers: existing touchpoints, goals, pain points, omnichannel value/ friction.)

3. **Assessment interaction:**
How do customers use physical interaction to understand, imagine, and evaluate products, and in what ways can digital tools provide or enhance these cues when physical interaction is limited?
(Covers: existing multisensory interactions, relevant sensory cues, sensory substitution.)

The research activities in this thesis follow a three-phase process of **Research – Design – Evaluation** (Figure 2.12).
The *research phase* focus on understanding the IKEA context through a thorough context mapping. These insights are translated into *design phase.* Low-fidelity prototypes are quickly tested to probe perception accuracy and experience quality, before being organised into a more coherent interaction logic. In Evaluation phase, a refined prototype and user journey are brought back into the field for in-store testing and interviews to assess how the designed solution performs in context.

Conceptually, the first diamond can be seen as research for design, while the second and third diamonds operate as research through design, using the evolving artefact as a vehicle for generating and discussing new knowledge about digital haptic experiences in compact retail spaces.

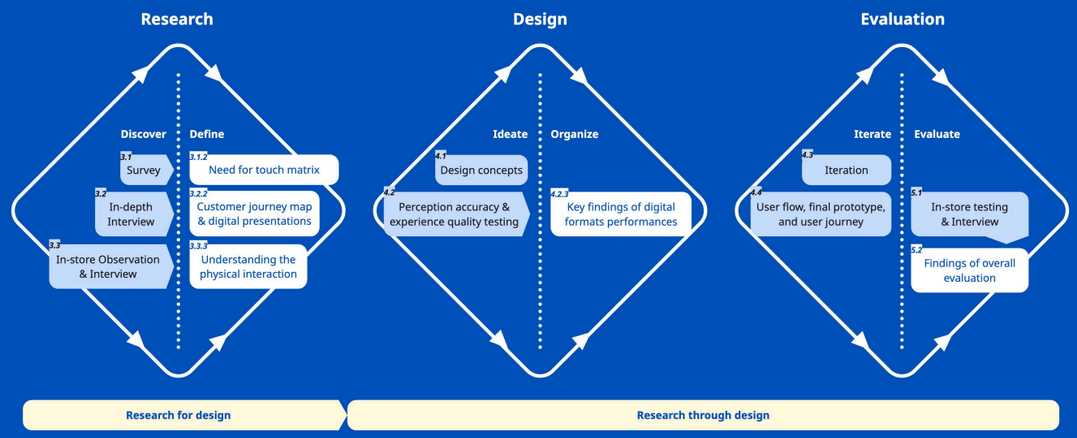


Figure 2.12 Three-phase research, design, and evaluation process *Created by author.*

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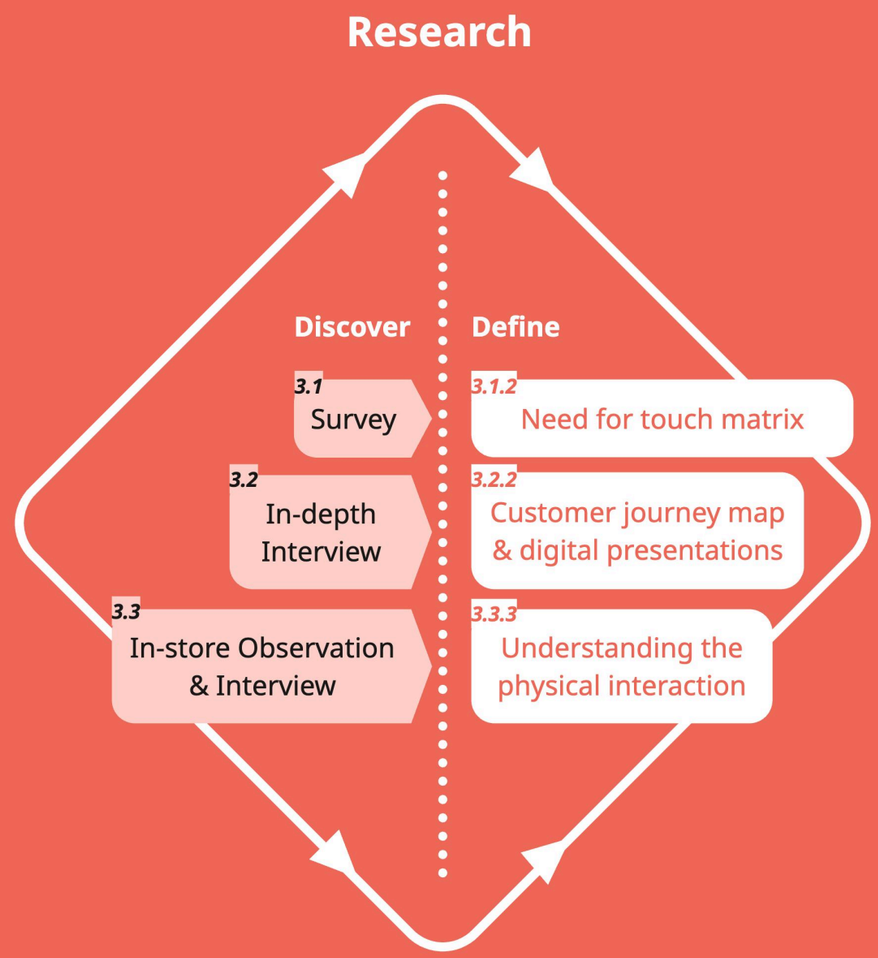
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- 3.3.1 Set-up
- 3.3.2 Findings- Understanding the physical interaction

3.4 Conclusion



Where, when and for what customers rely on physical interaction.

Research scoping aims to build a foundational understanding of 1) the role of haptic information in customers' product evaluation and 2) how customers currently assess products on digital and physical channels. Insights from this phase inform the selection of a focal product and the key interactions to be addressed in later concept development and evaluation.

03 Research Scope

3.1 Survey

3.1.1 Set up

This first survey aimed to understand how important haptic assessment is across different product categories and indicated where digital solutions could be most meaningful. As this thesis explores the potential of digital haptic experiences, we used the survey results to identify a product area where physical interaction is especially critical and where translating this interaction into a digital context would be most challenging and valuable.

The survey consisted of two parts, both using a 5-point rating scale to indicate the perceived importance of seeing and/or touching the physical product before purchase (1 = not at all important, 5 = very important). The survey was administered to 195 customers across three markets (US, Spain, India) with a broad spread in age and gender.

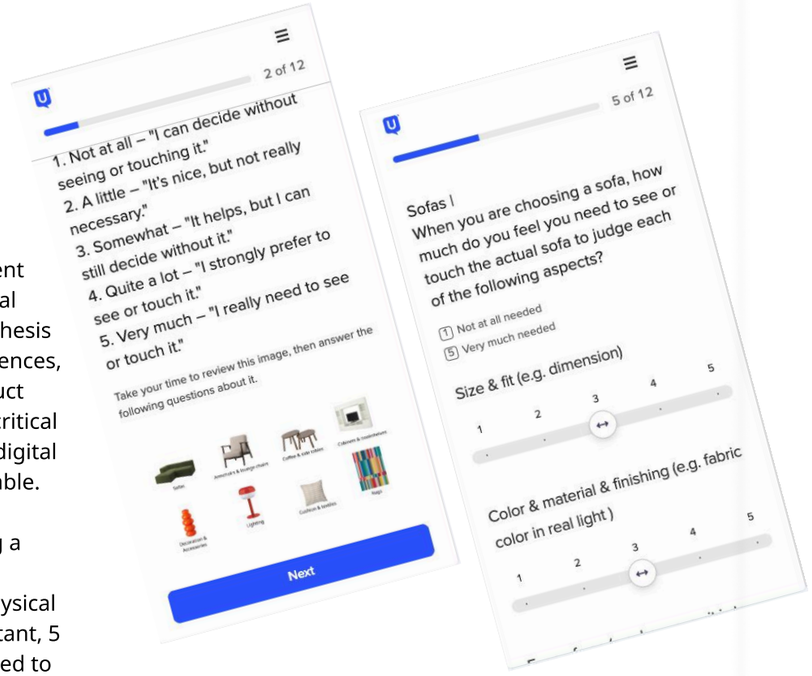


Figure 3.1 Excerpt from the need-for-touch survey *Created by author.*

Part 1 – Need for touch across product categories
Part 1 examined how strongly customers feel the need to see and/or physically touch products before purchase across eight living-room product categories (Figure 3.2). The result hence showed the level of diagnosticity of each product category.



Figure 3.2 Selected 8 living-room product categories *Source: IKEA Inter internal material, used with permission (2026).*

Part 2 – Need for touch across information types
In part 2, respondents rated how much they felt they needed to see or touch the physical product in order to judge different information types adequately. This allowed us to distinguish which decision-relevant attributes are most dependent on haptic interaction, independent of product category.

Across physical retail experience studies and IKEA internal customer report, six key information types are synthesized as experience attributes for living-room furniture:

Size & fit
how well the furniture fits the customer's home space.
Color, material & finishing
visual and tactile impressions of texture and appearance.
Ease of use
how easy it is to move, adjust or operate the product (e.g., mechanisms, functions).
Comfort
bodily comfort during sitting, lying or other use situations.
Quality & durability
perceived solidity, craftsmanship and expected lifespan.
Atmosphere & mood
the emotional tone the product creates in the room (e.g., cozy, calm, energetic) and how it contributes to the overall home atmosphere.

3.1.2 Need for touch matrix

For each category (Part 1), the mean score and the share of high-need responses (ratings 4–5) is calculated.

Overall, sofas, armchairs, cushions & textiles, and rugs clearly stand out as high haptic-need categories, while categories such as coffee & side tables, cabinets & bookshelves, lighting, and decoration & accessories show substantially lower dependence on physical touch (Figure 3.3).

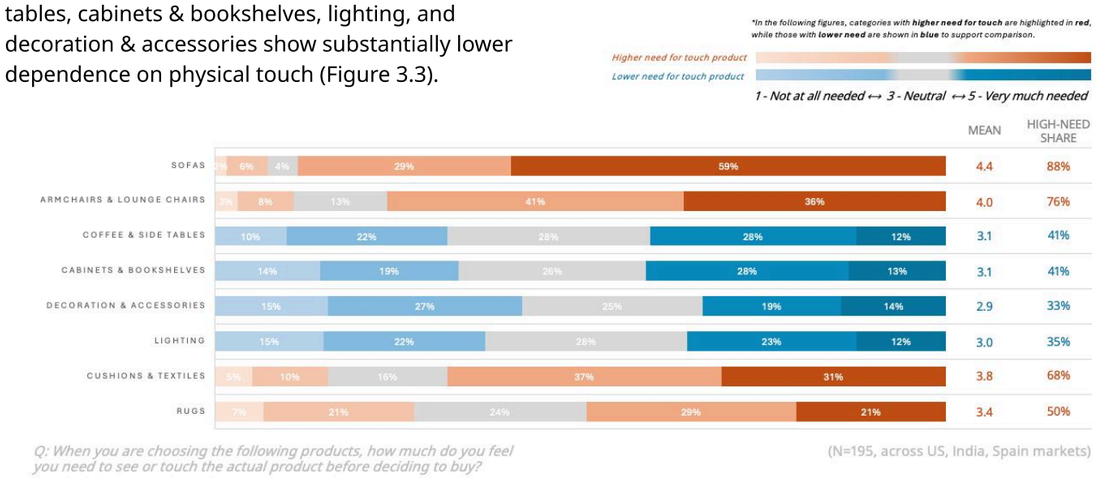
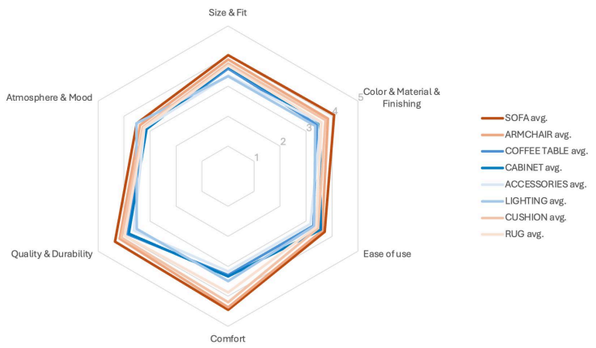


Figure 3.3 Need for touch across different product categories *Created by author.*

For each information types, the means score is calculated independent of categories. Figure 3.4 overlays the mean need-for-touch scores for the six experience attributes (information types) across eight categories.



Q: How much do you feel you need to see or touch the actual product to judge each of the following aspects? (1 - Not at all needed / 5 - Very much needed)
(N=195, across US, India, Spain markets)

Figure 3.4 Need for touch across different information types *Created by author.*

Across all products, comfort and quality & durability emerge as the most touch-critical information types, whereas ease of use and atmosphere & mood receive comparatively lower scores and appear more easily communicated through digital means.

This pattern is not only visible in the means: for sofas, armchairs and cushions & textiles, over 75% of respondents select high need for touch (4–5) when judging comfort and quality & durability, confirming that these attributes are strongly associated with physical interaction in these categories.

To synthesise Parts 1 and 2, product categories and information types were arranged along two axes according to their level of need for touch (from high to low). The mean need-for-touch scores for each product–attribute combination were then mapped onto this matrix, with the cut-off values 3.3 and 3.8 chosen because they naturally split the observed distribution into three roughly balanced regions (Figure 3.5).

***High need for touch* (≥ 3.8, orange)**
attributes that strongly rely on physical interaction.
***Medium / hybrid* (3.4–3.7, purple)**
attributes where both physical and digital information can play a role.
***Low need for touch* (≤ 3.3, blue)**
attributes with high potential to be communicated digitally.

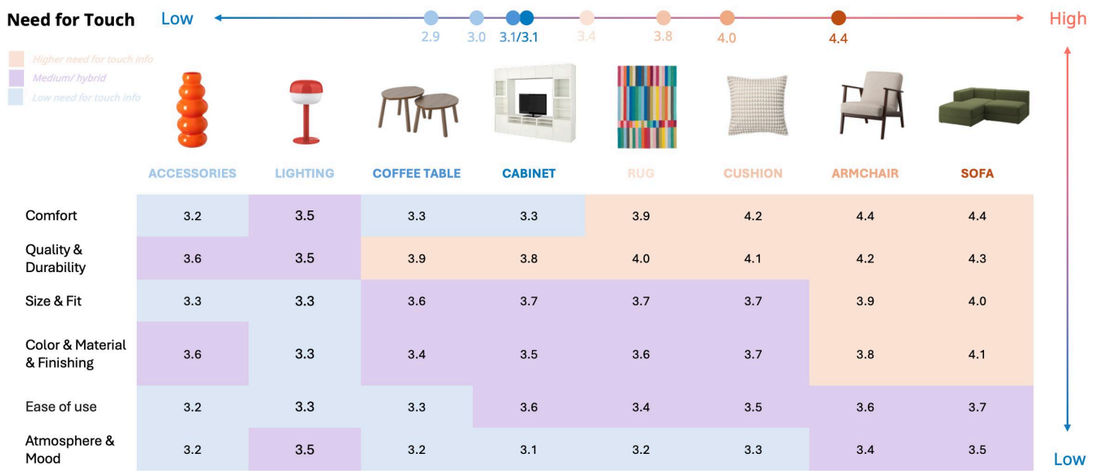


Figure 3.5 Need for touch across different product categories *Created by author.*

Interpreting the spectrum in design terms, the high-need-for-touch information should be prioritized for physical interaction in small stores and therefore represent the key challenge and opportunity for digital solutions to go beyond customers' expectations. The medium-need-for-touch information suggest hybrid physical–digital solutions, while the low-need-for-touch information points to attributes that can be largely shifted to digital presentations. This insight informs the discussion on how to allocate limited physical display space and where digital haptic or rich media solutions could be most impactful.

Because the aim of this thesis is to explore the boundaries of what digital haptic experiences can support, the subsequent design work deliberately focuses on this most demanding combination: **comfort assessment for sofas**. If a digital solution can meaningfully assist customers in this high-stakes, high-touch context, it is likely to be adaptable to less haptically intensive products and attributes as well.

Building on the finding in the need-for-touch spectrum that sofas have a particularly high need for physical interaction, the next step was to understand **how customers currently obtain these haptic information in their sofa purchase journeys**.

3.2 In-depth interview

3.2.1 Set up

In order to understand what customers expect, how they gather information across online and in-store channels, and where current IKEA gaps or pain points arise for both physical and digital touchpoints, an in-depth interview study was conducted.

The study consists of semi-structured online interviews with seven customers in the US who had purchased an IKEA sofa within the past three months. Participants varied in age and gender (3 males, 4 females; age range 25–50 years).



Figure 3.6 Excerpt from the In-depth interview *Created by author.*

Interviews follow a two-part structure, supported by a shared Miro board for co-creation:

Part 1 – Sofa purchase journey across channels

- Map the sequence of online and offline touchpoints activities.
- Identify what customers do at each stage, what kind of information they look for, and where haptic attribute information is sought but missing.

Here, the six information types from the previous study are carried forward and complemented with a brand- and service-related category (covering price, stock and delivery, and warranty), resulting in nine considerations in total (Figure 3.7). Participants were asked to indicate at which stages of the journey they paid attention to each type of information.

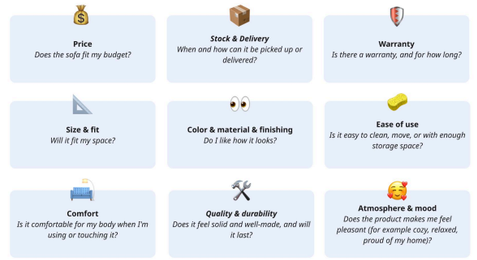


Figure 3.7 Nine considerations throughout the sofa purchase journey *Created by author.*

Part 2 – Performance of current online sofa presentation

- Discuss how customers interpret existing images, videos and 3D tools (Figure 3.8).
- Assess which sofa properties these formats communicate well, what remains unclear, and which words customers use to describe their needs and decision factors.

These interviews provide contextual insight into how customers navigate uncertainty across the journey and where digital haptic interventions could add most value.

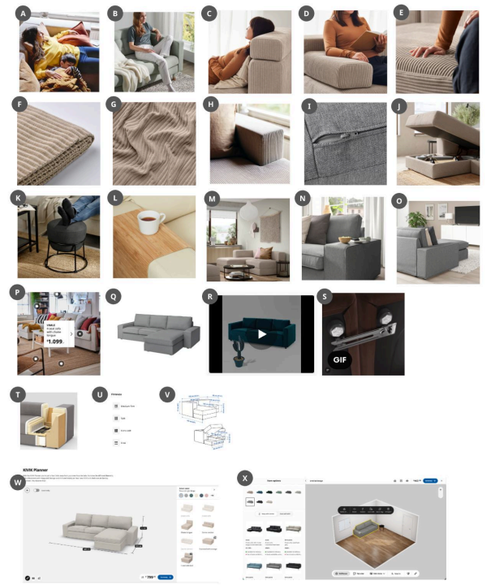


Figure 3.8 IKEA current digital presentation *Source: IKEA Inter internal material, used with permission (2026).*

3.2.2 Customer types & journey maps

Based on the seven interview participants, four preliminary customer types were identified by mapping their behaviour along two axes: the extent of online research and the timing of in-store assessment (early vs. late). These axes were chosen because they reflect, respectively, customers' openness to using digital services and their reliance on physical touch for reassurance.

This resulted in a quadrant with four groups (Figure 3.9): ***Frequent visitors***, ***Touch-driven shoppers***, ***Digital planners***, and ***Efficient hybrid shoppers***. Given the small sample, these types are best understood as emerging archetypes rather than statistically validated segments.

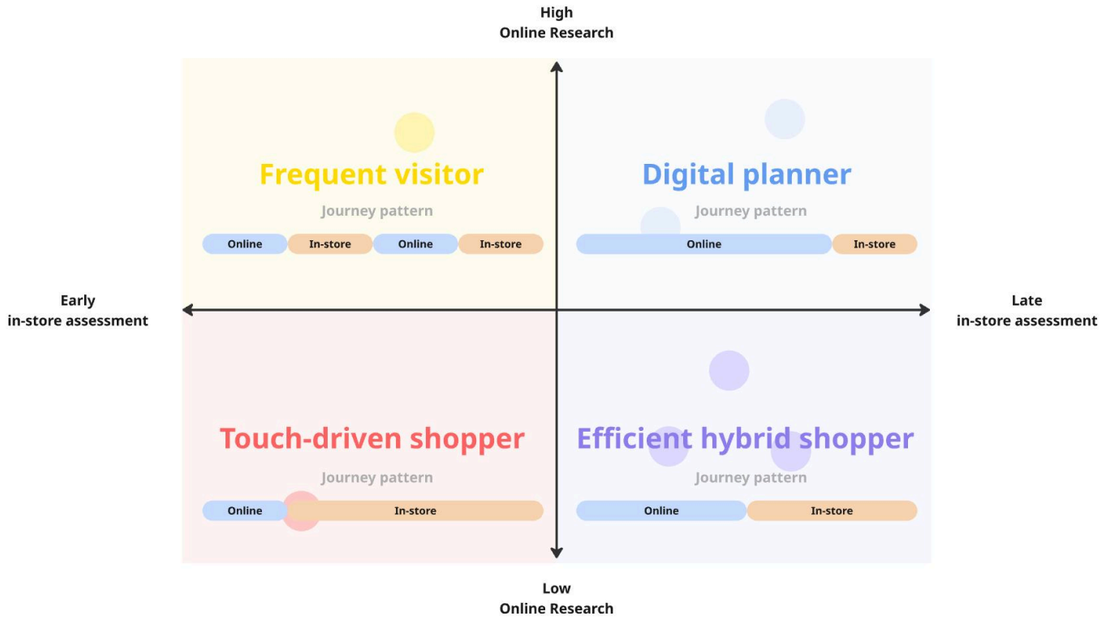


Figure 3.9 Emerging customer archetypes quadrant (dots represent the position of each participant) *Created by author.*

> ***Frequent visitors*** **(early in-store, high online research)**
> combine substantial online research with repeated store visits. They use digital channels to narrow down options, but still need several rounds of sitting, lying, and touching to build confidence. For them, digital content is useful but not yet trustworthy enough to fully rely on without double-checking in person.
> ***Touch-driven shoppers*** **(early in-store, low online research)**
> rely heavily on physical exploration in the store and do only minimal preparation online. Their decisions are driven by "gut feeling" and bodily comfort, and they often feel overwhelmed by the number of options in-store. Existing digital tools feel abstract and untrustworthy, so they rarely use them beyond basic functions such as store availability or price checks.
> ***Digital planners*** **(late in-store, high online research)**
> spend significant time browsing and comparing options online before visiting the store with a clear short list and a mission mindset. They read product details carefully and are relatively open to advanced digital tools (e.g. planners, AR, 3D views), using physical interaction mainly as a final validation step.
> ***Efficient hybrid shoppers*** **(late in-store, low online research)**
> use digital channels in a light, pragmatic way and visit the store with a narrow set of options. Their current experience is largely "good enough"; physical interaction is important, but the overall journey feels smooth and they do not actively seek more digital support.

For the subsequent design work, the focus was placed on the two ***early in-store archetypes***—***Frequent visitors*** and ***Touch-driven shoppers***. These groups show the largest gap between their strong need for haptic reassurance and the current performance of digital touchpoints. Either they experience the existing digital tools as too abstract and disconnected from real touch, or they are not fully aware of the digital support available.

Addressing their pain points offers the greatest potential to create digital experiences that genuinely enhance haptic assessment and reduce uncertainty. Once solutions work for these more demanding, touch-dependent customers, extending them to *Digital planners* and *Efficient hybrid shoppers* who are already more comfortable with digital channels is likely to be comparatively straightforward.

However, this also means that any new solution may initially appear risky, as these customers tend to be more demanding of the overall experience and are less open to trying digital tools. Designing for them therefore requires not only improving the functional value of digital touchpoints, but also carefully managing trust and adoption.

Building on the two emerging archetypes, and informed by the later in-store intercept interviews (3.3.2), two personas were created together with their journey maps (Figure3.10 & 3.11).

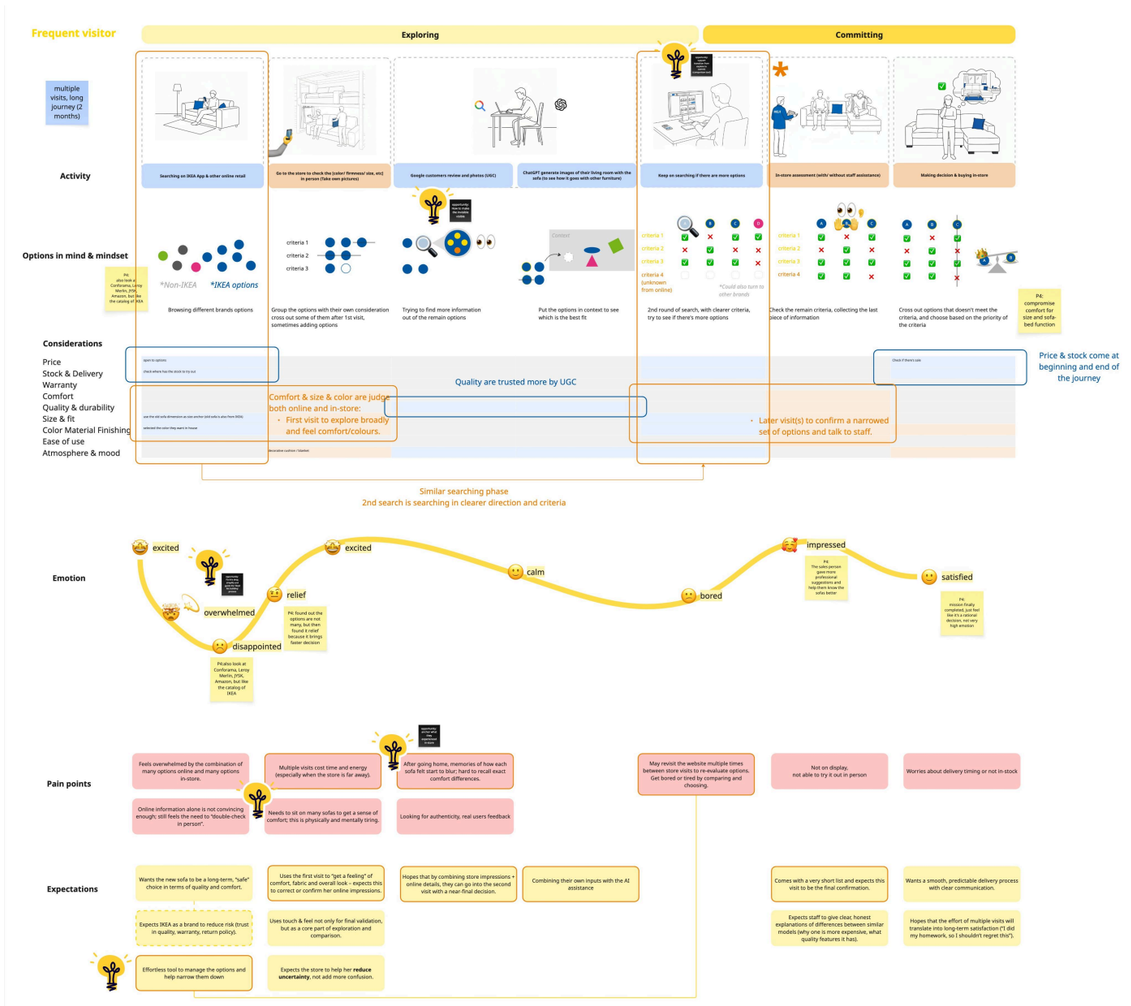


Figure 3.10 Frequent visitor's persona & journey map *Created by author.*

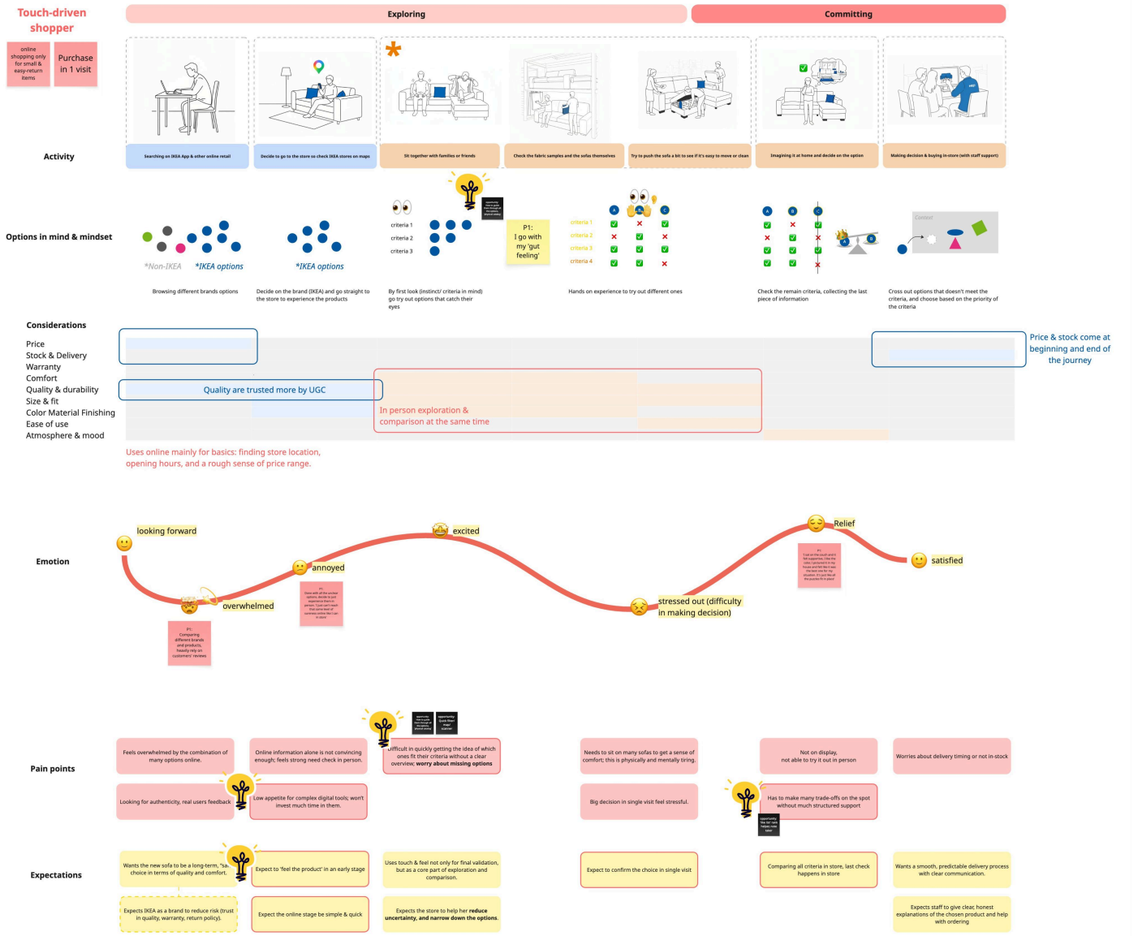


Figure 3.11 Touch-driven shopper's persona & journey map *Created by author.*

Putting the two journey maps side by side reveals a consistent pattern in how these customers approach sofa purchases. Online channels play only a supporting role, mainly for checking price and stock on the brand website and, to some extent, inferring quality from user-generated content.

Because they have a strong need to feel and explore the product in person, they enter the store with clear expectations that this basic trial will be possible. In small-format stores, however, this hygiene need for physical trial is not met, thus digital compensation becomes particularly important for these early in-store customers to partially restore the expected level of trialability.

Across both archetypes, several recurring pain points and expectations emerge. Because customers seek actual touch experience in an early stage, it also means they are not engaging with comprehensive understanding of the broad range of products IKEA offer:

- Customers often feel overwhelmed by the number of options in-store and find it difficult to keep track of which sofas they have already tried and how they compare. Afraid of overlooking options.
- Touch-driven shoppers experience high decision pressure when trying to choose in a single visit, while Frequent visitors invest substantial time and effort in repeated visits to gain enough confidence.

Taken together, these journeys highlight several opportunities for transitioning the digital haptic experience from online to in-store contexts (Figure 3.12):

Enrich the sensorial experience online, for example by enhancing visuals and interactions that communicate comfort, support, and fabric feel more concretely.
- For Frequent visitors, this can reduce the need for a first visit that is mainly about "getting a feel" for the sofas.
- For Touch-driven shoppers, richer haptic cues online can partly satisfy their need for touch while still leading them into the store earlier with a clearer overview.

Provide a physical anchor for the standard experience, allowing customers to compare sofas that are not displayed by mentally relating them to a reference sofa they have actually tried.
- This is particularly potential in small-store formats, where many sofas cannot be displayed physically.

Guide customers through a narrower, more structured decision path, helping them filter options based on what they have already tried and liked, rather than confronting them with a wide, undifferentiated range.

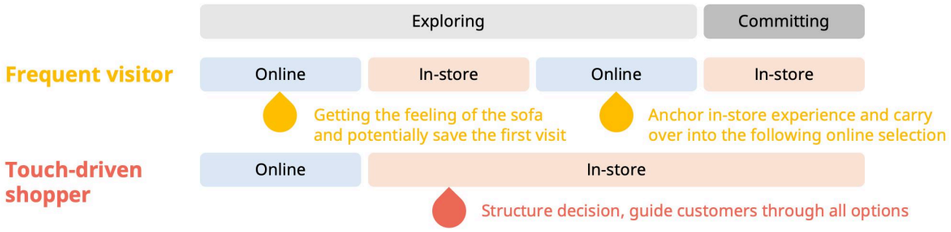


Figure 3.12 Opportunities in the two personas' journey *Created by author.*

3.3 In-store observation

3.3.1 Set up

Having identified which experience attributes matter most to customers and at which stages, the next step is to understand how these priorities are expressed in actual in-store behaviour.

An in-store study was conducted in the Haarlem blue-box store (Netherlands). The blue-box store was used to observe how customers ideally assess comfort and material qualities when a broader range of sofas is physically accessible. At this stage, the focus is on mapping the full repertoire of assessment behaviours.

The in-store research comprised:

- **Co-worker interviews with 2 sales co-workers**, focusing on frequently observed customer behaviours, typical questions, and perceived barriers to purchase when physical interaction is limited.
- **Customer intercept interviews with 5 customers**, conducted directly after their sofa exploration to capture fresh reflections on how they assessed different attributes.
- **Systematic observations of 20 customer groups**, documenting:
  - The sequence of interactions with sofas (e.g. sitting, lying down, pressing cushions, touching fabrics).
  - The duration and intensity of these interactions.
  - Routes taken through the department and locations where customers tended to pause, compare or discuss options.

Field notes included structured notation of interaction types and counts, as well as sketches of routes and meeting points in the store. These data reveal how customers practically use touch to reduce uncertainty and build confidence before committing to a sofa purchase. The findings from this visit were also compared with internal IKEA reports to understand how stores are currently tackling the same problems.

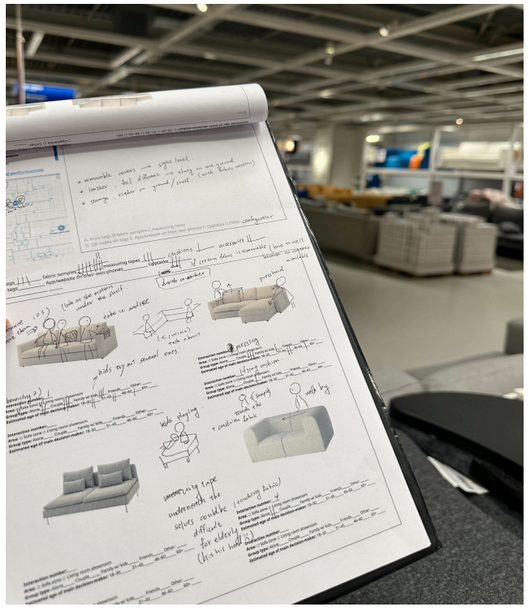


Figure 3.13 Excerpt from the field notes *Photo by author.*

3.3.2 Understanding the physical interactions

Building on the survey findings about the high need for haptic information in sofa decisions, the findings from this in-store visit were combined to synthesize a store audit of sofa assessment against customer expectations (Figure 3.14). This audit clarifies which key interactions customers expect to perform in the store, how well the current experience supports these interactions, and what is still missing in the overall journey.

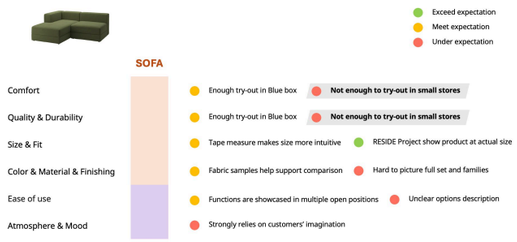


Figure 3.14 Store audit of in-store sofa assessment against customer expectations *Created by author.*

Customers come to the store for both exploration and validation, and they often spend considerable time trying and sitting on different sofas. Across 20 customer groups at different stages of their journey, several recurring behavioural patterns were observed (Figure 3.15).

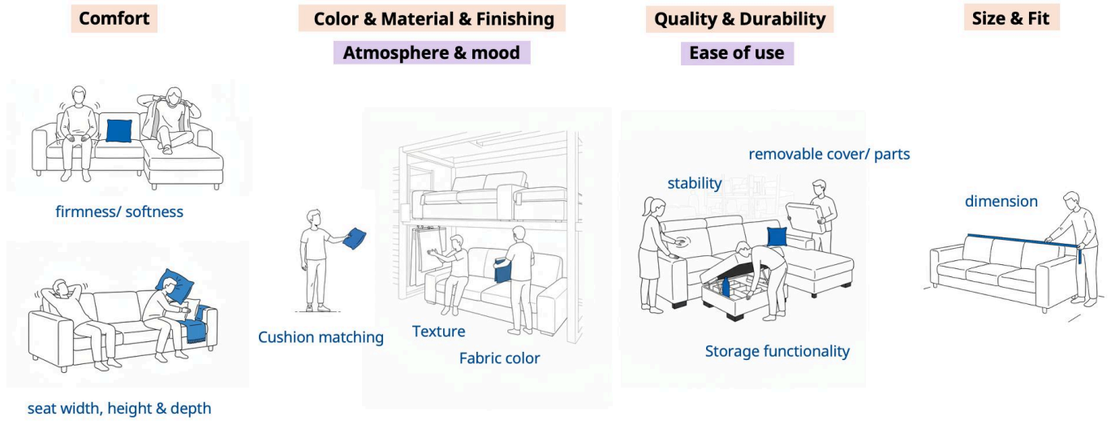


Figure 3.15 Behavioural patterns in-store *Created by author. Generated through Gemini.*

Comfort – whole-body trial as the core haptic experience

Comfort is the aspect that customers are least willing to compromise or substitute. It is assessed through whole-body interaction, where people sit, lean back, lie down, bounce slightly on the seat, and adjust their posture to feel support for the head, back, arms and legs. Within a few seconds they can decide whether a sofa feels “right” in terms of firmness or softness and whether the seat width, height and depth fit their body. Some customers even remove their coats to ensure that the sensation matches how they would use the sofa at home.

Color & Material & Finishing + Atmosphere & Mood – biggest time-spent factor in the store.

By contrast, colour and material are where customers spend most of their time in the store. They touch fabric samples, move cushions around to compare combinations, and repeatedly step back to judge how different covers and textures contribute to the overall atmosphere and mood of the living room they have in mind. This requires them to mentally integrate visual style, texture, and the feel of the fabric into a coherent “look and feel”.

Quality & Durability + Ease of use – judged through functional trials

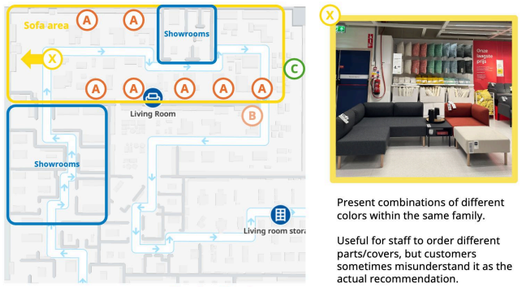
Quality and durability are typically assessed together with ease of use. When customers open and close storage compartments, test sofa-bed mechanisms or move modular elements, they are simultaneously judging stability, robustness and smoothness of operation. In blue-box stores, partially opened or “in-use” displays successfully invite this kind of hands-on testing, and customers feel free to manipulate products without asking for permission.

Size & Fit – straightforward but still verified physically

Size and fit seem at first glance to be the most straightforward aspect, as they are defined by measurable dimensions. Nevertheless, many customers still prefer to verify them physically—using tape measures and comparing sofas against their own body or against other furniture in the showroom. Tools such as the paper tape measure and the Upptäcka planner help to communicate dimensions, but customers often need co-worker guidance to start using digital tools, and these tools cannot fully replace the embodied sense of actual size.

From the four high need-for-touch attributes, the analysis in this thesis focuses on *comfort*, *quality & durability*, and *colour & material & finishing*. The remaining attribute, *size & fit*, is being addressed in a separate IKEA project (see Appendix A for full store audit) and is therefore outside the primary scope of this study.

The exploration of *colour & material & finishing* reveals a clearer opportunity for digital support. Fabric samples already give customers a direct sense of how the material feels in the hand and help them verify colour, but the overall experience is fragmented across swatches, partial displays and example pieces (Figure3.16). Customers are left to mentally assemble these fragments to imagine what a full sofa will look and feel like in a given fabric, and they receive little guidance on how different fabrics might also change perceived comfort because of their construction. At present, these questions are difficult to answer in the store.



Haarlem Blue box store

Present combinations of different colors within the same family.

Useful for staff to order different parts/covers, but customers sometimes misunderstand it as the actual recommendation.



Highly interacted tool



Observed impact is limited



Convenient for customers but high cost for the store



Other localized ways of presentation (Spain)

Figure 3.16 Ways of presenting colors & material options in store *Source: Ingka Group internal material, used with permission (2026)/ Photo by author*

When it comes to the overall comfort of a sofa, customers meant the feeling combining the the frame, the cushion, the feel of the fabric, and the overall size fit the body feels. Most customers still regard this as a high-stakes decision that requires actually sitting on the product. If possible, they want to try the real sofa and do not believe that digital tools alone can fully replace a full-body, in-person assessment. We therefore do not assume that digital solutions can or should substitute physical trial entirely.

However, by unpacking how customers assess comfort into specific actions and properties, there is an opportunity to translate parts of these bodily evaluations into digital representations. The following outlines five interaction patterns that customers most frequently perform on sofas, and the properties they focus on when engaging in each of these actions (Figure 3.17).

> ***Sitting/ Hand pressing cushion*** - firmness, supportiveness
> ***Touching the fabric surface*** - fabric roughness & ease of cleaning
> ***Crumpling fabric*** - fabric thickness
> ***Stretching fabric*** - fabric elasticity
> ***Lifting cushion*** - cushion weight

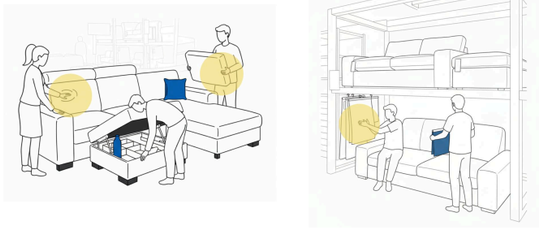


Figure 3.17 Actions customers made to assess sofa comfort *Created by author. Generated through Gemini.*

3.4 Conclusion

Across the three research activities in this chapter, a coherent picture emerges of where, when, and for what customers rely on physical interaction when choosing sofas.

The survey first established sofas as a high-stakes, high-need-for-touch category. Comfort, quality & durability, and colour & material & finishing clearly stand out as attributes that customers prefer to assess through direct bodily contact rather than solely through digital representations. Sofas were therefore selected as the focal product for subsequent qualitative work, with comfort assessment representing the most demanding test case for digital support.

The in-depth interviews then showed how different customer archetypes navigate their sofa purchase journeys across channels. Among the four types, the two early in-store archetypes—Frequent visitors and Touch-driven shoppers—exhibit the largest gap between their strong need for haptic reassurance and the current performance of digital touchpoints. They rely on the physical store as their main exploration space, use online channels only in a supporting role, and arrive early in the journey expecting that basic physical trial will be possible. In compact formats, however, limited displays and missing variants mean that this hygiene need for physical trial is not always met, leaving these customers particularly exposed to uncertainty and decision pressure.

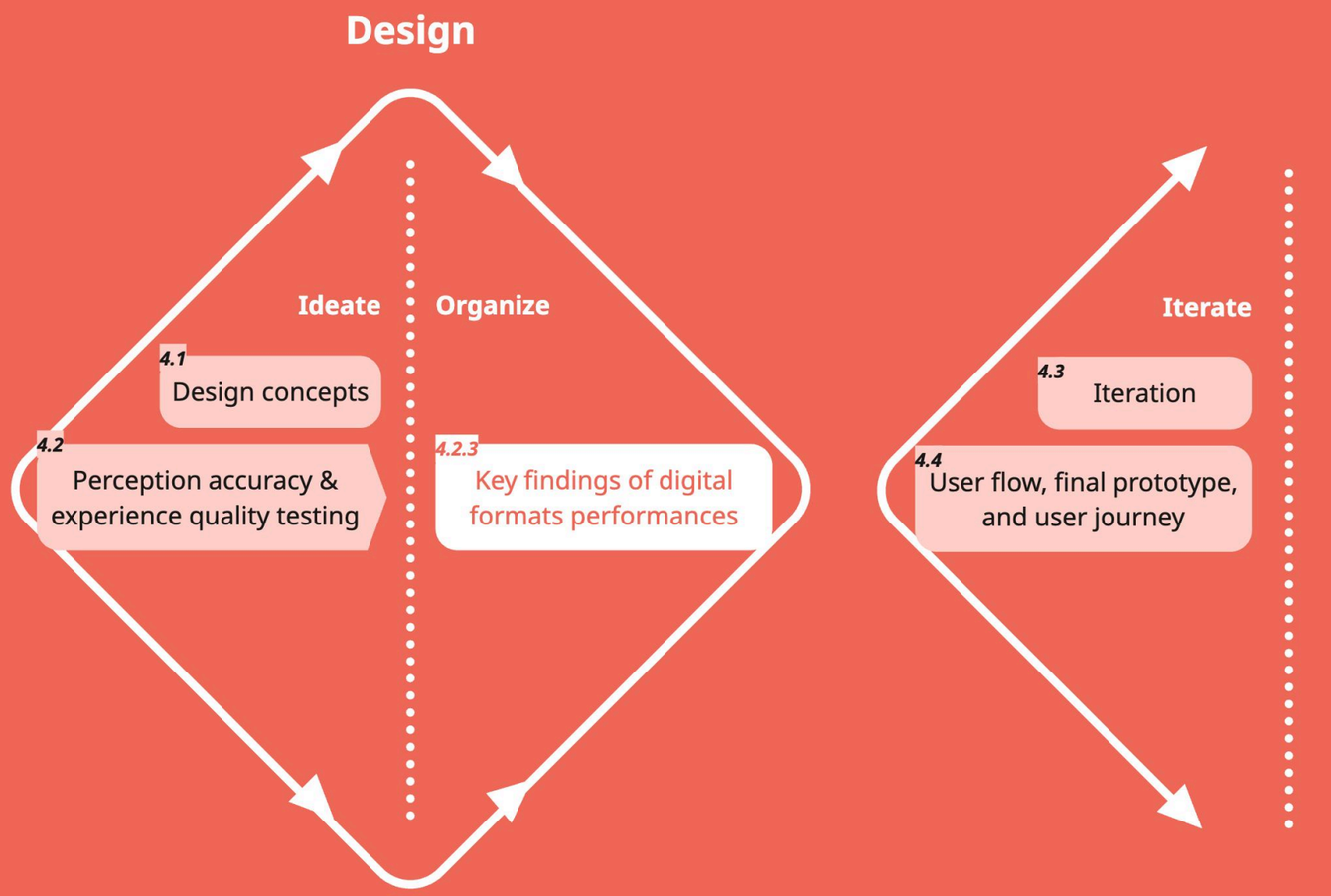
The in-store observations clarified how these expectations play out at the point of contact. Full-body sitting and lying remain irreplaceable for assessing overall comfort and are not perceived as fully substitutable by digital tools. At the same time, evaluations of colour, material and finishing are fragmented across partial displays, fabric samples and localised presentations, requiring customers to mentally assemble how a complete sofa will look and feel.

Taken together, these insights highlight several design opportunities for digital haptic support. Digital tools could consolidate fragmented comfort and material cues into a more holistic and comparable view, showing not only how a fabric appears on the complete sofa but also how it behaves under use. In addition, digital support can play a connective role before, during, and after the store visit, anchor the physical reference and link the touchpoints across channels.

The design concept developed in the next chapter translates these implications into a concrete in-store prototype. The prototype aims to make **sofa comfort information more accessible, comparable, and memorable** for **early in-store customers** within the constraints of **small-format retail environments.**

04 Prototyping

“What to offer, and how to deliver.”



4.1 Design concept
4.2 Quick test before prototyping
- 4.2.1 Research objectives
- 4.2.2 Research approach
- 4.2.3 Findings

4.3 Iteration
- 4.3.1 Reducing interaction for simplicity
- 4.3.2 Clarity of the material itself
- 4.3.3 Reveal more hint from indicator
- 4.3.4 Tutorial demonstration before start

4.4 Final Design
- 4.4.1 User flow
- 4.4.2 User journey throughout the omni-channel
- 4.4.3 Technical framework

This chapter translates the research findings into a concrete design direction and tests its feasibility through a series of rapid, exploratory prototypes. These prototypes should be read as design probes rather than statistically validated evidence.

Through quick iterations, interactive experiments, and small-scale qualitative feedback, they are used to assess whether the proposed ideas are understandable, usable, and promising enough to warrant further development. At the same time, they help surface critical assumptions and narrow down how a digital haptic experience for sofas could realistically be implemented in compact store formats.

04 Prototyping

4.1 Design concept

What – Interactive cinematics with sofa specific assessment interaction
Based on the research findings, the aim was to design a digital experience—***Touch Explorer***—that allows customers to explore sofas that are not triable, whether in-store trying alternative colors of the same model/ entirely different, or in online context before and after store visit.

The core interaction translates typical physical assessment actions into a digital environment, so that customers can interact with a screen as if they were pressing and testing the sofa itself. Inspired by Xie's (2016) work on interactive cinematics, the concept incorporates an interactive sofa simulation intended to trigger re-enactment of haptic sensations and a sense of ownership (Figure 4.1).

How – Comparison view and reference point
A second key element of the concept is comparison (Figure 4.2). Building on the idea of using a known reference, the design enables customers to relate the target sofa to products they have already experienced—either the physical display models in the store or even IKEA sofas they already own at home. The interaction is structured to make these comparisons explicit and easy to recall, helping customers understand what "softer" or "firmer" means in concrete terms and how much difference there is relative to another sofa.

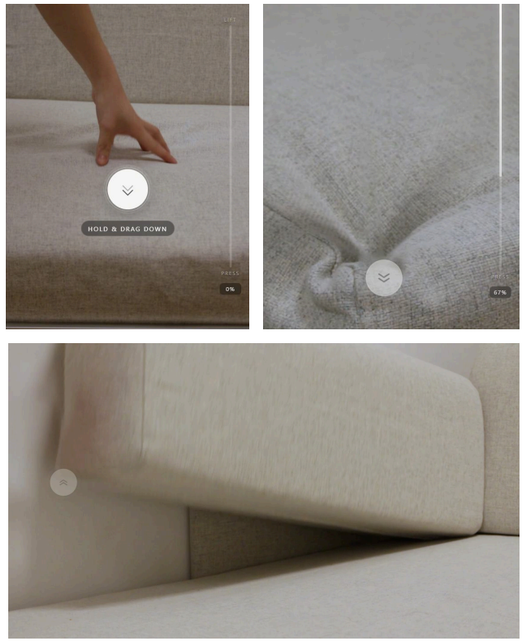


Figure 4.1 Interactive sofa simulation trials
Created by author.

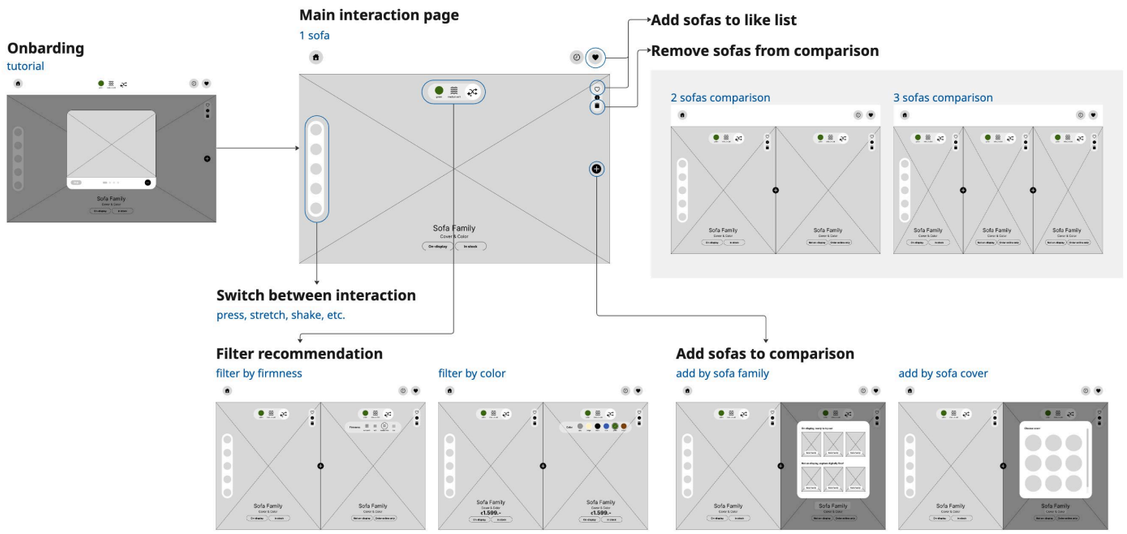


Figure 4.2 Wireframe of Touch explorer *Created by author.*

Overall, the concept is intended as an exploration tool that offers an intuitive visual impression of how different sofas feel, while giving customers autonomy to manipulate the interaction at their own pace. Rather than replacing in-store trials, it aims to extend them to a broader range of options that cannot all be physically displayed.

4.2 Quick test before prototyping

4.2.1 Research objectives

After deciding to use an interactive sofa simulation as the core interaction, a short pre-test was conducted to refine how haptic information should be represented digitally. Building on the in-store observations from the research scoping phase, six typical physical interactions were designed, together in consideration of the sofa properties that customers most frequently try to assess.

> ***Hand pressing cushion*** - firmness
> ***Spilling water on sofa*** - fabric roughness & tightness of the weave & ease of cleaning
> ***Crumpling fabric*** - fabric thickness
> ***Stretching fabric*** - fabric elasticity
> ***Shaking fabric*** - fabric weight & thickness
> ***Lifting cushion*** - cushion weight

Previous interviews on customers' perceptions of the current digital presentations showed that images or videos including hands are perceived as particularly helpful, because customers can infer how much force is being applied in the interaction. Based on this insight, the aim of this test was to compare two versions of interactive cinematics (with vs. without a hand visible) and explore which one provides a sensation that more closely matches the actual physical interaction. A non-interactive video was included as a comparison condition, allowing participants to relate back to their original assessment interaction and to reflect on which aspects of the experience were not well translated into the interactive formats.

This test was not designed to provide quantitative validation, but to probe which digital format best conveys the relevant haptic cues and which interaction elements are most important to retain in the prototype. It should therefore not be interpreted as statistical evidence in favour of either the "with hand" or "without hand" variant in terms of preference or accuracy.

4.2.2 Research approach

Six participants took part in the study, with ages ranging from 22 to 60 and a balanced mix of genders (3 males, 3 females).

At the beginning of the session, each participant completed the Need for Touch (NFT) scale to indicate whether they tended towards a high- or low-NFT profile. They were then exposed to 14 digital stimuli representing six interaction types (Figure 4.3). For each interaction, participants viewed both non-interactive and interactive videos; for the interactions that involved applying force, an additional version with a visible hand was included. The stimuli were presented in a varied order across participants to reduce potential order and fatigue effects.

Non-interactive videos:
used as a baseline that reflects how customer perceived and expected information

Interactive videos without a hand:
where the sofa surface reacts directly to the user's input.

Interactive videos with a visible hand:
interactions that involve force (i.e. pressing and stretching)

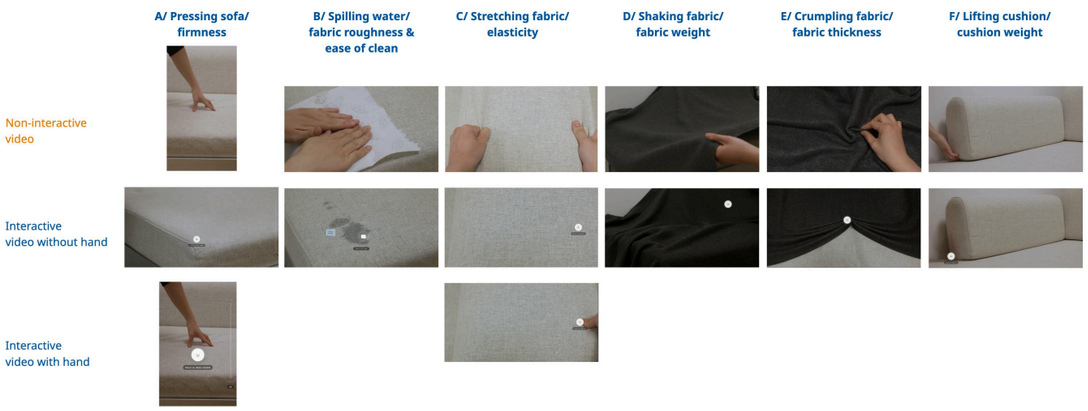


Figure 4.3 Stimuli overview *Created by author.*

For each digital interaction, participants rated the perceived sofa properties (firmness, fabric thickness, fabric roughness, fabric stretchiness, ease of cleaning, and weight) on a 7-point scale, and evaluated the experience on five dimensions: confidence to purchase, trustworthiness, playfulness, clarity, and usefulness. Whenever participants felt unable to judge a given property from the stimulus, this was recorded separately as "cannot determine".

Once all digital conditions had been completed, participants were taken to try the real sofa and asked to rate the same set of properties again (Figure 4.4). This allowed a comparison between ratings from digital format and ratings from actual physical experience, in order to identify which format produced the smallest discrepancy and which versions were experienced most positively overall.Throughout the sessions, the researcher stayed close to the participants to discourage rushed or inattentive responding and conducted short qualitative probes about moments of confusion or usability, providing additional input for the subsequent iteration of the concept.



Figure 4.4 Participants testing with both stimuli and the real sofa *Photo by author.*

4.2.3 Findings

Clear differences emerged between high- and low-NFT participants. High-NFT participants felt confident inferring fewer tactile attributes from the digital materials and showed lower accuracy to the actual sofa feeling than low-NFT participants (Figure 4.5). For some stimuli, the discrepancy between the interactive stimulus and the real interaction was even larger than for the non-interactive version (Figure 4.6), reflecting the literature finding that for high-NFT users, who rely heavily on touch in their decision-making, poorly performing digital experiences can actually increase uncertainty rather than reduce it.

Property	High NFT (NV)	High NFT (IV)	Low NFT (NV)	Low NFT (IV)	IV–NV
Firmness	10	12	6	6	2
Fabric thickness	3	3	0	0	0
Fabric roughness	0	0	0	0	0
Fabric stretchiness	2	3	0	0	1
Ease of cleaning	7	9	0	0	2
Weight	10	10	0	0	0
TOTAL	**32**	**37**	**6**	**6**	5

Figure 4.5 Property uncertainty and format performance by NFT profile *Created by author.*
Comparison of (a) the number of properties participants could not confidently judge and (b) the relative communication strength of non-interactive(NV) vs. interactive videos(IV).

At the same time, the test confirmed that interactive formats reliably boost perceived playfulness; they simply need to be carefully optimised to avoid reducing clarity, confidence, and perceived usefulness (Figure 4.7). Across the six interaction types, **pressing (A)**, **stretching (C), crumpling (E)**, and **shaking (D)** emerged as the most promising candidates for further development.

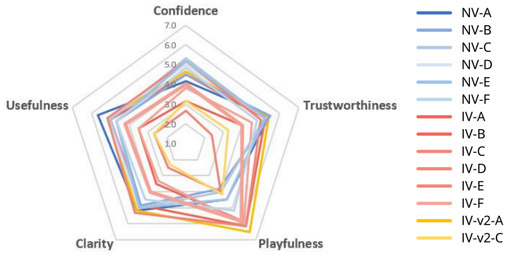


Figure 4.7 Perceived quality of non-interactive vs. interactive videos across all stimuli *Created by author.*



Figure 4.6 Accuracy discrepancy for key sofa properties across non-interactive and interactive videos, by NFT profile *Created by author.*
Accuracy discrepancy (digital rating minus real-sofa rating) for six representative interactions: A – hand pressing cushion (firmness); B – Spilling water on sofa (ease of cleaning); C – stretching fabric (elasticity); D – shaking fabric (fabric weight); E – crumpling (thickness); F – lifting cushion (cushion weight). Results are shown for non-interactive videos (NV) and two interactive variants (IV, IV-v2), separately for high-NFT and low-NFT participants. (See full result in Appendix B)

For the pressing interaction (A), the interactive versions increased playfulness but at times reduced clarity (Figure 4.8), especially when the point of contact was not clearly visible or when cues about cushion thickness and applied force were missing (Figure 4.9). Participants reported that, compared with a non-interactive video with a visible hand, the interactive experience required a higher cognitive load: they first had to figure out how the system worked and then mentally link their own input to the continuous speed and rebound of the cushion.

Among the interactive variants, the version with a visible hand provided useful clues about how much pressure was being applied, but still required additional hints to make the underlying mechanics easier to understand.

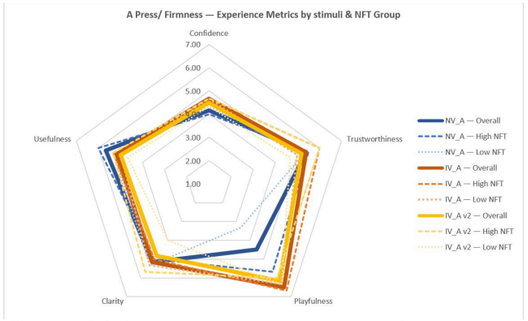


Figure 4.8 Accuracy discrepancy for A – pressing the sofa (firmness) across stimuli &NFT groups

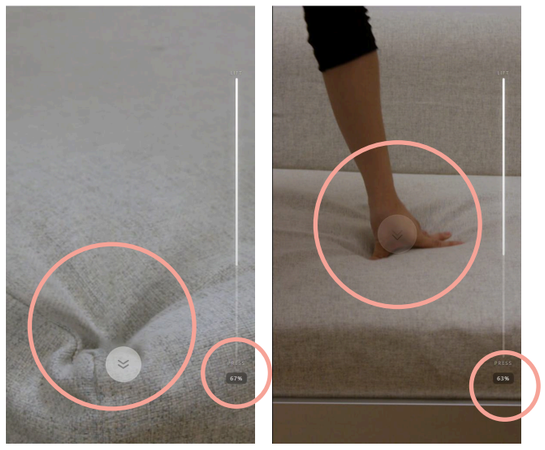


Figure 4.9 Pressing interaction prototypes (left: IV-A, right: IV-v2-A) The dragging handle partially blocks the focal contact point between hand and sofa, and the indicator does not clearly communicate the level of applied force.

For stretching the fabric, accuracy for stretchiness was low across all versions (Figure 4.10).

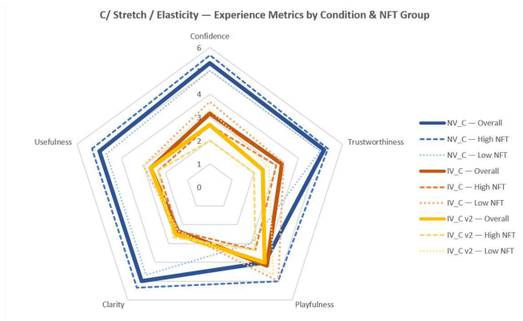


Figure 4.10 Accuracy discrepancy for C – stretching the fabric (elasticity) across stimuli &NFT groups The perceived quality ratings for the interactive videos are consistently low. Combined with participants' qualitative comments, this pattern indicates a strong need to improve the prototype design for conveying fabric elasticity.

The interactive version without a hand made it easier to focus on the fabric movement, but it also removed the hand as a useful scale reference for texture. Participants reported that it was difficult to judge stretchiness from the prototype, because they could not tell whether the fabric stopped moving because it had reached the edge of the screen or because it had reached the actual stretch limit of the material (Figure 4.11).

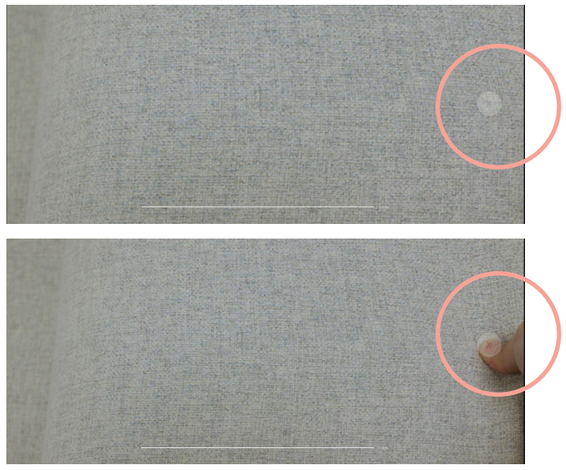


Figure 4.11 Stretching interaction prototypes (top: IV-C, bottom: IV-v2-C) The handle collides with the edge of the screen and draws attention towards the edge rather than the centre, where the fabric stretching actually occurs.

Based on the current small-scale test, however, no definitive conclusion can be drawn about which format is more accurate overall when comparing "with hand" and "without hand" variants. The results suggest a trade-off: when the judgement depends strongly on perceiving force (e.g. firmness), a visible hand appears helpful as a reference for pressure and depth; when the focus is also on reading fine material details (e.g. stretchiness), the hand can become an obstacle by partially blocking the view of the fabric.

They also noted that a single stretching gesture was not enough to form a complete impression of the fabric; they wanted additional interactions, such as rubbing or crumpling, to complement it and build a more complete understanding of the material (Figure 4.12).

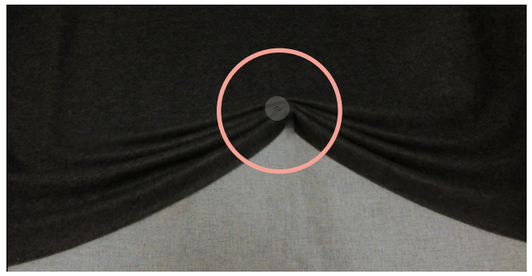


Figure 4.12 Crumpling interaction prototypes (IV-E) The interaction has potential to integrate different dragging directions while keeping a consistent view of the fabric.

The shaking interaction showed that the motion itself is an intuitive and effective cue, accuracy was comparable between non-interactive and interactive versions, while the interactive version clearly outperformed the baseline in playfulness and overall experience (Figure 4.13). Usability issues were similar to the stretching interaction, mainly related to handle placement near the screen edge, which made gestures feel constrained (Figure 4.14).

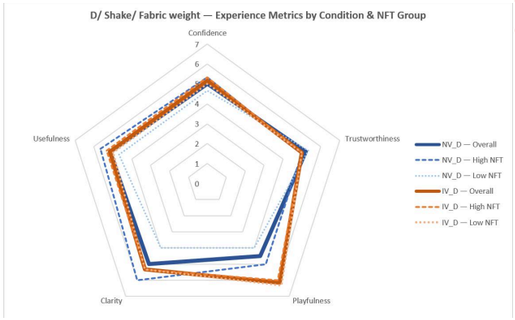


Figure 4.13 Accuracy discrepancy for D – shaking the fabric (fabric weight) across stimuli &NFT groups



Figure 4.14 Shaking interaction prototypes (IV-D) The interaction moves upward and easily runs out of the screen area.

This interaction was originally designed as a way to communicate perceived fabric thickness. The idea was that combining visual cues of fabric weight and movement would help customers infer how substantial or thin a cover feels. However, participants reported that fabric weight is not a primary concern when choosing a sofa, and shaking is not an action they naturally perform in this context. In other words, the interaction can convey the intended haptic quality quite accurately, but it is only weakly relevant to the actual sofa purchase situation.

To keep the interaction set simple and focused, it is therefore necessary to reconsider whether shaking truly provides the most useful information in the sofa context, or whether this interaction might be better suited as a representation for other product types—such as curtains or bed linens—where fabric weight and drape play a more central role in customers' decisions.

Interactions for ease of cleaning and cushion weight were perceived as interesting, yet their relevance for physical assessment was relatively low (Figure 4.15). The spill-and-absorption scenario for cleanability (Figure 4.16) was understood conceptually, but felt slow, cumbersome, and of limited added value compared with simply showing that the cover is removable and washable.

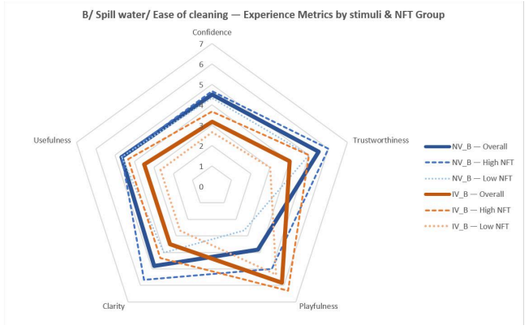


Figure 4.15 Accuracy discrepancy for B – spilling the water (ease of cleaning) across stimuli &NFT groups



Figure 4.16 Spilling water interaction prototypes (IV-B) The interaction feels too long, and the non-interactive videos already communicate this information sufficiently well.

The cushion-lifting interaction was seen more as entertainment than as a reliable source of information (Figure 4.17 & 4.18). Among the participants, three mentioned that this is something they might occasionally do in store, while the others regarded it as a fun interaction but were unsure whether they actually needed it.

These results suggest that such properties may be better conveyed through simpler, more static cues rather than dedicated interactive gestures.

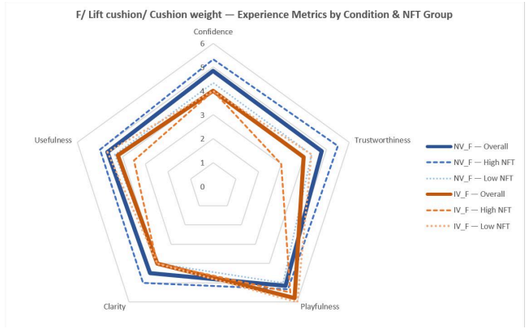


Figure 4.17 Accuracy discrepancy for F – lifting the cushion (cushion weight) across stimuli &NFT groups



Figure 4.18 Lifting cushion interaction prototypes (IV-F)

Taken together, the findings indicate that the next iteration should (i) reduce the number of interaction types and focus on a smaller set that combines informational value with high experience quality (pressing, and a merged stretching–crumpling gesture), (ii) improve the clarity of the material itself by keeping the fabric more visible and adjusting hand visibility depending on the property, and (iii) add subtle indicators that reveal more hints about thickness, applied force and stretch limits without overloading users with numbers. These implications directly informed the subsequent design iterations described in Section 4.3.

4.3 Iteration

The prototypes from the previous stage had revealed which gestures were worth keeping and how their visual representation should be adjusted. In the present step, these recommendations were incorporated into a higher-fidelity prototype that is closer to the intended final experience.

4.3.1 Reducing the amount of interaction to keep simplicity

The prototype test showed that not all interaction types contributed equally to haptic understanding. Participants also indicated that having many separate interaction modes made it harder to connect the responses into a single, coherent impression of the material.

In response, a smaller set of well-chosen interactions was already sufficient to answer most of the relevant properties.

> **Pressing**
> for perceiving firmness and rebound behavior.
>
> **Stretching / crumpling**
> merged into a single gesture to convey fabric thickness and elasticity.

Although the accuracy for pressing and stretching/ crumpling was not consistently higher than for other interactions, qualitative feedback showed that participants treated firmness and elasticity as more critical decision factors and evaluated these gestures more strictly, whereas for ease of cleaning and cushion weight they mainly relied on prior product experience and reported that the interactive and non-interactive formats felt largely similar. In other words, the additional playfulness of those interactions did not translate into a meaningful gain in diagnosticity.

This combination of quantitative and qualitative evidence suggests that pressing and stretching/ crumpling, despite their current limitations, are the most valuable candidates for further refinement in the prototype.

For the stretching/crumpling interaction in particular, the first prototype contained several design shortcomings, which made it difficult to draw a firm conclusion about whether a hand or no-hand version was preferable. To avoid basing decisions on an imperfect prototype, the next iteration will retain both variants and follow-up with a larger sample.

4.3.2 Clarity of the material itself

In the previous prototype, some of the UI elements (i.e. handles) that were meant to guide interaction ended up blocking the very details participants needed to see. The handles were brought close to the hand in the videos to strengthen the sense of ownership, it sometimes overlapped with critical cues. For example, in the stretching interaction, the handle and the hand often covered the area where force was applied, making it difficult to observe how the fabric actually deformed. Participants also tended to fix their attention on the control elements themselves, rather than on the fabric in the center of the screen, so the most important material cues were easily overlooked.

This iteration therefore focused on improving the visual clarity of the material through three main adjustments:

- **All key motion and contact points are placed near the center of the screen:**
  Helping users immediately focus on the video instead of controls at the edges.
- **Presenting the fabric at 1:1 scale:**
  The size of the fabric on screen is adjusted so that it makes the interaction feel more intuitive and supports a stronger illusion of “touching” real material.
- **Reducing visual noise from UI elements:**
  Interaction handles and icons are simplified and their visual prominence is reduced once users understand how the system works. The overall visual layer is cleaned up so that UI elements do not compete with the video for attention, with the goal of lowering cognitive load and keeping the focus on the product itself.

4.3.3 Reveal more hint from indicator

The study also highlighted that participants sometimes struggled to judge “how much” force or stretch was being applied. Without a clear reference, it was difficult for them to tell whether a cushion was very soft or only slightly softer than another, or whether the fabric had reached its stretch limit or was still capable of extending further.

To address this, the next iteration added subtle visual indicators that make these hidden parameters more legible and reveal more hint about how the different sofa performed.

- In the pressing interaction, the indicator was refined into a simple vertical bar that encodes both **cushion thickness** and the **range of possible compression** (Figure 4.19). The full length of the bar represents the total cushion thickness, while the dashed segment indicates how far the cushion can be pressed. This allows users to directly compare how much each sofa deforms under an equivalent amount of pressure.

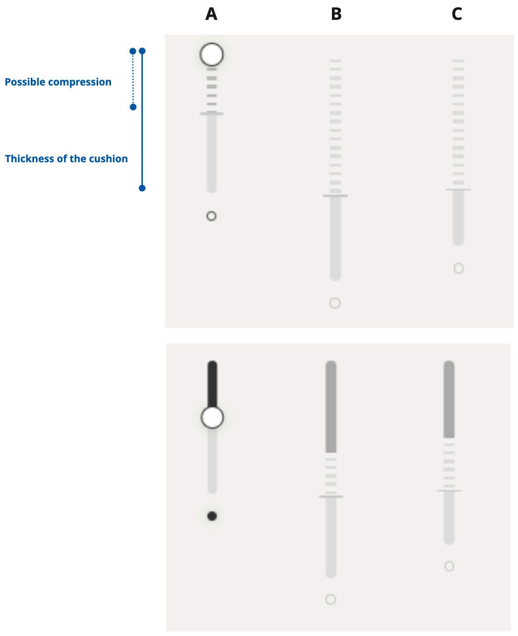


Figure 4.19 Pressing Indicator *Created by author.*

As the user drags the indicator downward, different sofas fill the bar to different degrees: softer cushions (A) reach a higher level of completion for the same input, whereas firmer ones (B, C) still have space left uncompressed.

- In the stretching/crumpling interaction, the indicator follows a similar logic. The dashed scale represents the maximum stretchable range for each fabric (Figure 4.20). Less elastic fabrics reach the end of the scale sooner, while more elastic ones can be stretched further along the dashed line.

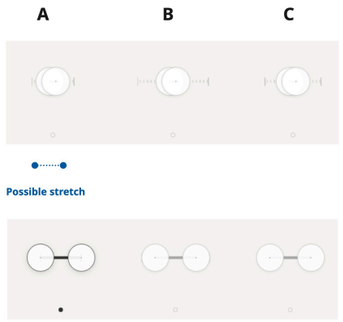


Figure 4.20 Pressing Indicator *Created by author.*

When users drag the handle to the limit for a stiffer fabric, they can still see remaining space on the scale for more elastic fabrics, making it easy to compare how much additional stretch each cover allows under the same input.

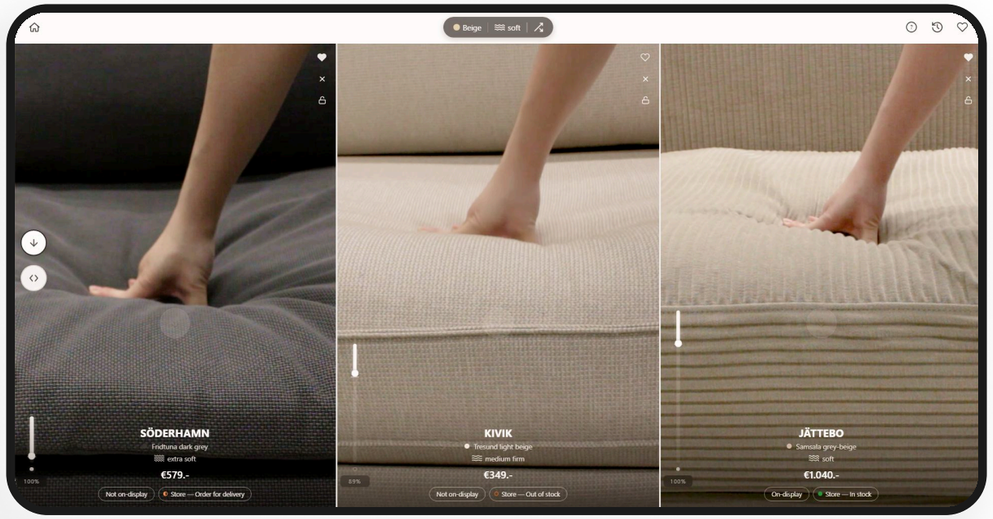
4.3.4 Tutorial demonstration before start

Finally, because this type of interaction is unfamiliar to most users, many participants initially hesitated and spent time on trial and error. Once they understood how it worked, however, they showed strong interest in exploring the tool further. To reduce this initial friction, a brief built-in demonstration was added to make the experience more self-explanatory.

- Introduces the two core gestures (press and stretch/crumple) through simple animations and minimal text.
- Explicitly demonstrates how to add sofas to the comparison view and how to read multiple panels side by side.
- Presents typical use cases and shows how the filter recommendations can be used when customers only have a few initial criteria in mind.

This onboarding step aims to lower the initial cognitive load, align the interaction with different sofa-choice scenarios (whether users already have a specific option in mind or are just exploring), and ensure that the core functions of the tool are understood and used to their full potential.

4.4 Final Design



High fidelity prototype available for check here.

4.4.1 User flow

The concept is implemented as a single-page interactive interface, designed for a large touchscreen placed in-store and adapted for online use. The main screen is dominated by a central interaction area where customers “touch” the sofa through different gestures. Around this core area, a set of lightweight controls allows them to switch interactions, filter options, and build comparisons and favourites.

Onboarding tutorial

Before entering the main interaction, a short onboarding screen introduces the basic functions (Figure 4.21). It explains how to perform the different gestures (i.e. drag and pinch, etc.) and how the interface responds.

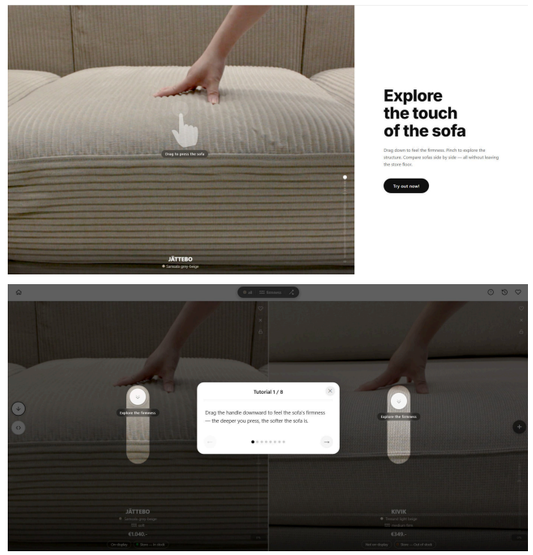


Figure 4.21. Idle page (top) and onboarding tutorial (bottom)

Main interaction page
Most of the screen is reserved for the gesture area, where the visual response changes according to how the user drags representing differences in firmness, elasticity and other properties (Figure 4.22).

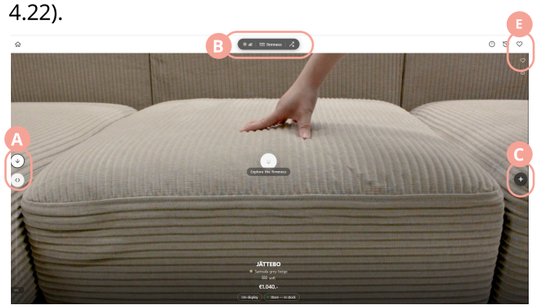


Figure 4.22. Main interaction page (pressing interaction)

The surrounding controls are organised as follows:

- **A/ Interaction switch (left vertical bar)**
  A vertical bar on the left side allows users to switch between different pressing and stretching modes (Figure 4.23).

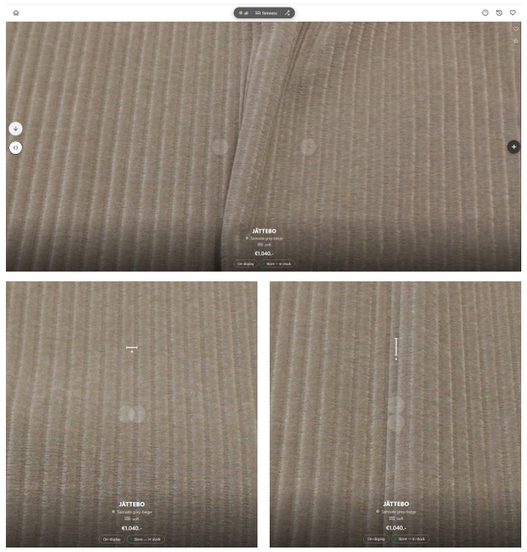


Figure 4.23. Main interaction page (top: crumpling; bottom left: horizontal stretch; bottom right: vertical stretch)
The stretching page allows three gestures: horizontal stretch (two fingers moving outward horizontally), vertical stretch (two fingers moving outward vertically), and crumple (two fingers moving inward horizontally).

For the stretching interaction, a with-hand version is added to show the exact hand movement and the force applied to the fabric (Figure 4.24).

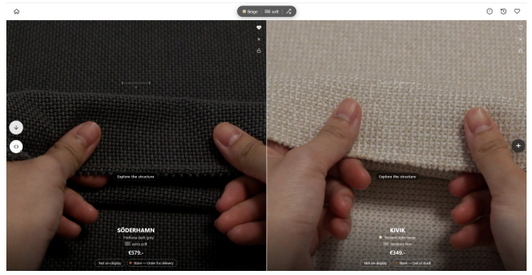


Figure 4.24 Stretching interaction (with-hand version) This version only allows the horizontal stretch.

- **B/ Filter and recommendation bar (top)**
  A horizontal bar at the top lets users filter sofas by firmness and color (Figure 4.25). Based on the selected criteria, the system recommends sofas that match the user's preferences and surfaces them one by one in the main interaction area (Figure 4.26).

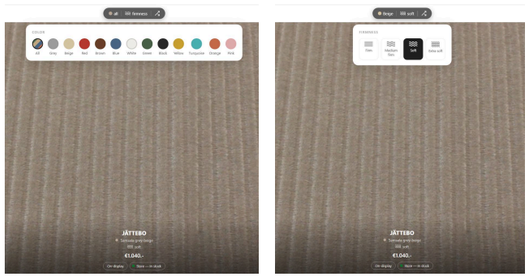


Figure 4.25. Filter and recommendation
This supports quick exploration of suitable options without browsing long product lists.

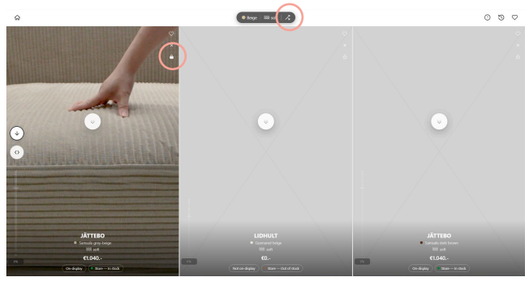


Figure 4.26. Lock and recommendation
By locking in their options and setting preferences, the system can then randomly recommend additional sofas that meet the chosen criteria, helping customers find similar products and compare them in more detail.

- **C/ Add to comparison (right side)**
  A "+" button on the right opens a panel where users can add sofas to a comparison view (Figure 4.27). Once added, up to three sofas can be shown side by side in comparison mode, illustrating how each one responds under the same interaction (Figure 4.28). This makes relative differences in softness, firmness, and fabric properties easier to grasp.

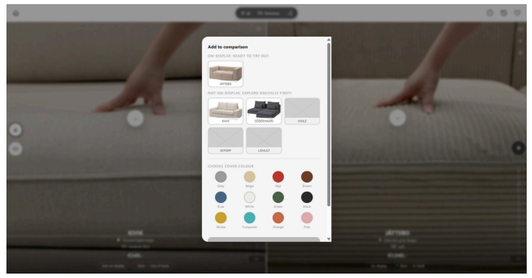


Figure 4.27. Add sofa into comparison panel
With a clear distinction between displayed and non-displayed products, customers know which sofas can be used as physical references.

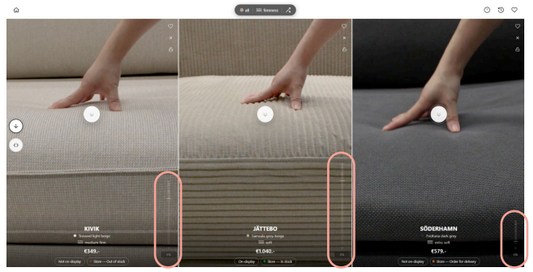


Figure 4.28. Comparison with up to three sofas at the same time
The indicator for cushion thickness and compression capability is placed at the bottom as an additional cue, making the differences even more explicit.

- **D/ Remove from comparison and manage panels**
  Each comparison panel includes its own remove button (Figure 4.29), allowing users to quickly adjust the set of sofas being compared without restarting the interaction.

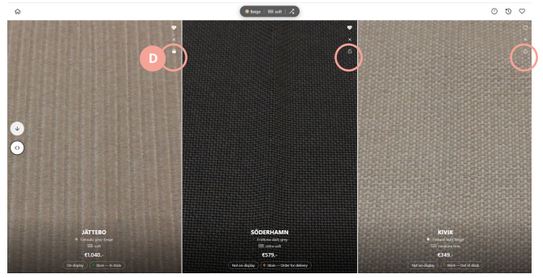


Figure 4.29. Remove sofa from comparison

- **E/ Add to like list and continue to purchase**
  A heart icon allows users to add the current sofa to a personal "like list" (Figure 4.30). From there, they can either buy the sofa directly in-store, place an order for delivery, or saving the list as a basis for further planning with a co-worker.

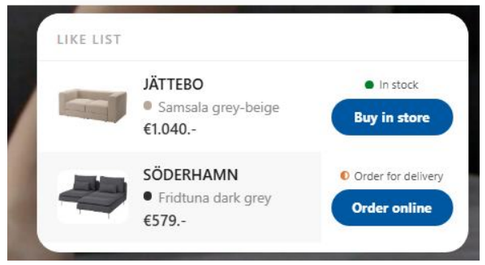


Figure 4.30. Like list with the next step

While these screens describe what Touch Explorer can do, it is equally important to understand where and when customers would encounter it in practice. The following section therefore examines how the tool is integrated into the sofa purchase journey.

4.4.2 User journey throughout the omni-channel

As outlined in Chapter 3, the concept is primarily designed for the Frequent visitor and Touch-driven shopper archetypes (Figure 4.31.).

For both groups, the journey begins online, scanning the market and form an initial set of options, including both IKEA and non-IKEA sofas. In an IKEA-specific scenario, customers first choose the brand based on trust in overall quality, price transparency and service. They then move to the product listing page (PLP), where they filter by basic criteria such as price range, color fit with their room, and size constraints.

When they want to understand visual style and atmosphere in more detail, Frequent visitors may also consult tools such as IKEA Kreativ or the Home Imagination Platform to place sofas in a virtual version of their home, whereas Touch-driven shoppers tend to skip these tools and go directly to the store once they have identified a few candidates.

Across both archetypes, however, comfort remains the missing piece in the online journey, which forces them to visit the store to make further assessments and to confirm whether the options truly meet their requirements. The *Touch Explorer* concept is therefore positioned as an additional step once customers have reached the product information page (PIP): it enriches the sensorial experience around comfort and material, turning abstract properties into more concrete, comparable cues before and during the store visit.

During the visit, *Touch Explorer* plays a key role at the point where some sofa options are not physically on display. It helps customers understand the breadth of the range and offers a brief substitute introduction to the haptic attributes of those non-displayed options.

- **For Frequent visitors**, *Touch Explorer* aims to reduce the need for a first "orientation" visit that is mainly about getting a feel for IKEA's range. Used online, it helps them compare and curate a personal list of sofas, making the set of options more manageable and focused before they enter the store. When they later interact with the physical sofas in-store, these experiences can be linked back to their digital shortlists, reinforcing memory and anchoring the digital impressions in real touch.

- **For Touch-driven shoppers**, the tool serves a slightly different role. Online, it can partly satisfy their strong need for touch and provide enough reassurance to justify a store visit, while also preventing the frustration of discovering that relevant options are not on display. In-store, the kiosk version supports those who rely heavily on physical interaction but struggle to gain an overview due to the constrained layout of small formats. By helping them discover sofas beyond what is shown on the shop floor and by recording the options they have explored, *Touch Explorer* supports them in narrowing down their choices without being overwhelmed by the number of alternatives.

In summary, the purpose of the tool is to build confidence in customers' understanding of the haptic properties of sofas and to support them in committing to a single option—whether that decision is followed by detailed planning with a co-worker, an in-store purchase, or an online order.

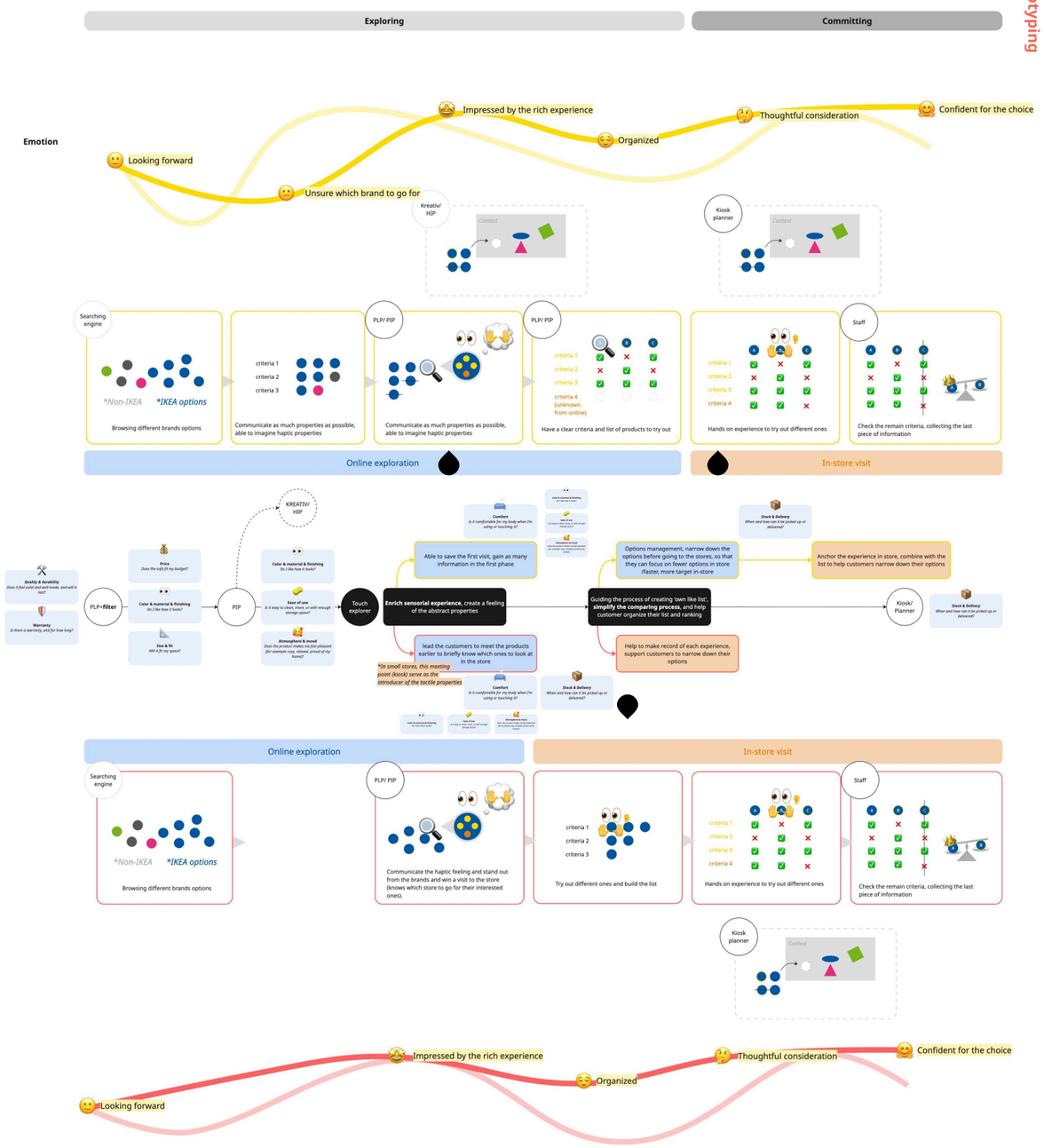


Figure 4.31. Omni-channel experience 'to-be' with design intervention (Touch explorer) for Frequent visitors & Touch-driven shoppers *Created by author.*

4.4.3 Technical framework

The interactive cinematic system relies on continuous sequences of JPG frames. All interactions follow a shared principle:

- a single full movement is recorded from start to finish, with fixed camera angle and distance, and the force and speed of the hand kept as consistent as possible across products.

- Each interactive sequence consists of a fixed number of frames, and during shooting the total frame count and playback speed (FPS) are kept constant across sofas to support comparability.

The recordings are then analysed with respect to the physical properties of each sofa, such as fabric texture scale, cushion thickness, and pressing or stretching depth. Key frames corresponding to critical points in the movement (e.g. maximum stretch, maximum compression, rebound speed) are identified. These timing and deformation characteristics are incorporated into the interactive sequences so that the visual deformation and indicator feedback align closely with the actual material response.

Interaction 1 – Explore firmness (cushion compression)

- **Frame structure**

The PRESS sequence is divided into three frame segments:

> **Frame 0:** Sofa in unpressed state.
> **Frame 0 to maxPressFrame:** User-controlled pressing phase; deeper dragging results in higher frame indices and visually deeper compression.
> **Frame maxPressFrame to endFrame:** Automatic rebound phase after the user releases their finger. In this phase, the system plays back the remaining frames at a fixed 30 fps to simulate the cushion returning to its original shape.

Each sofa has its own maximum press frame and end frame (Figure 4.32), determined by its actual compressibility, while the overall total frame count remains constant. For example:

	maxPressFrame	ReboundEndsFrame	TotalFrame
JÄTTEBO	25	37	38
KIVIK	28	37	38
SÖDERHAMN	21	31	38

Figure 4.32 Compression - frame structure

In addition, the indicator displays two physical references (Figure 4.33): the full indicator length corresponds to the actual cushion thickness, and a dashed mark shows the maximum compression distance, indicating how deep the cushion can be pressed in reality.

	cushionDepth (cm)	pressDepth (cm)
JÄTTEBO	23	5
KIVIK	18	5
SÖDERHAMN	7	6

Figure 4.33 Sofa physical properties

These measurements are scaled proportionally and translated into the indicator length, so that an approximate physical thickness is represented directly on the screen.

Interaction 2 – Explore structure (stretching and crumpling fabric)

The STRUCTURE interaction focuses on how users perceive fabric thickness and tension, using three sub-gestures to simulate different directions of force: **Crumple (pinch-in), Stretch-H (horizontal pinch-out), Stretch-V (vertical pinch-out)**

- **Frame structure**

> **Frame 0:** Fabric in default state.
> **Frame 0 to EndFrame:** User-controlled pinching/ stretching phase; the more movement results in higher frame indices and visually further crumple/ stretch.

Each sofa has its own maximum crumple/stretch end frame, and all sequences share the same playback speed. This means that when a stiffer fabric reaches its end, users can still see room for more elastic fabrics to continue stretching further.

The range of hand movement and the length of the on-screen indicator are both scaled proportionally to the total frame count, so that the interaction reflects these differences consistently (Figure 4.34).

		EndFrame	maxStretch-H (px)
JÄTTEBO	**Crumple**	50	-
	Stretch-H	27	30
	Stretch-V	32	48
KIVIK	**Crumple**	64	-
	Stretch-H	68	60
	Stretch-V	66	60
SÖDERHAMN	**Crumple**	51	-
	Stretch-H	59	50
	Stretch-V	48	50

Figure 4.34 Exploring fabric - frame structure & stretching physical property

An important detail is that each interaction is triggered independently on its own panel, which serves as the reference for the applied force.

When the user interacts with the firmest sofa and presses it all the way down, the other, softer sofas already appear fully compressed, because under the same force they would have reached their limit earlier. Conversely, when the user interacts with the softest sofa and presses it to its maximum, the firmer sofas still show remaining compression space, indicating that they could be pressed further in reality (Figure 4.35).

The same principle applies to stretching interactions. If the user stretches a less elastic fabric to its limit, the more elastic fabrics still show additional room to extend; if the user stretches a highly elastic fabric, the stiffer fabrics reach their limit much sooner on the scale (Figure 4.36). In this way, a single gesture on one panel reveals how different sofas respond under comparable conditions, making relative softness, firmness and elasticity visible across the set.

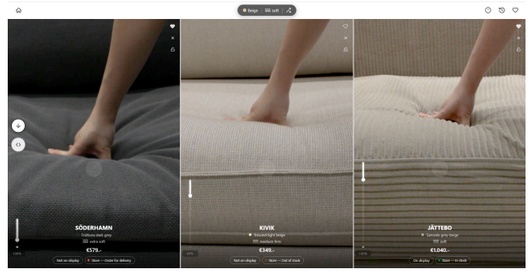


Figure 4.35 Firmness comparison (interacting on the JÄTTEBO panel) When dragging on JÄTTEBO, SÖDERHAMN has already reached 100% compression, while KIVIK has only completed 89%.

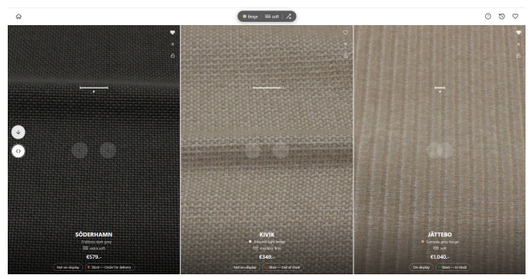


Figure 4.36 Elasticity comparison (interacting on the SÖDERHAMN panel) When pinching out on SÖDERHAMN, JÄTTEBO has already reached its stretch limit, while KIVIK still has some room left to extend.

05 Design Evaluation

5.1 Research approach

5.2 Findings

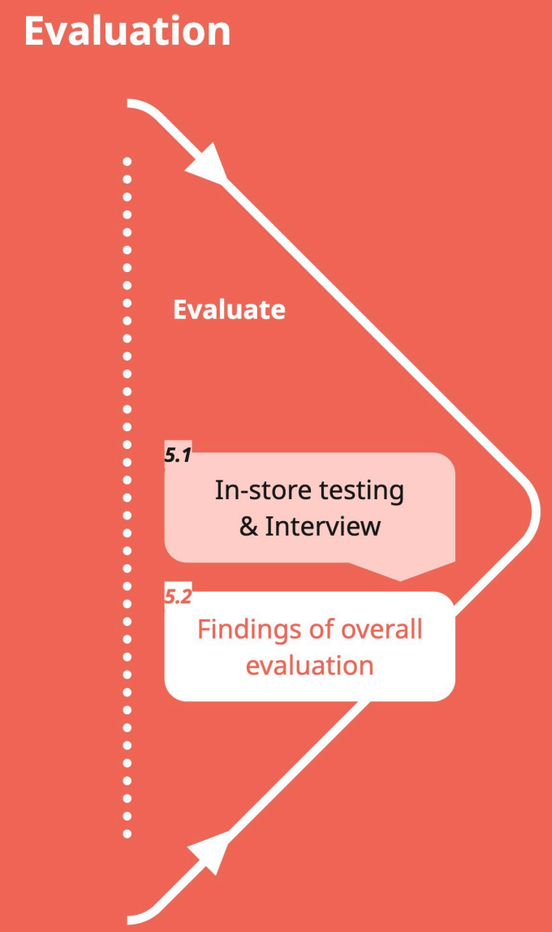
5.2.1 Firmness as a multi-component sensation

5.2.2 Stretchiness as perceived looseness

5.2.3 Texture as visual roughness and memory

5.2.4 Comparison-based relative judgement

5.2.5 Role of the tool in the journey



To evaluate the Touch Explorer concept under realistic conditions, the hi-fidelity prototype was tested with real customers and a store co-worker in the Haarlem IKEA store (Netherlands).

The aim of this in-store study was twofold. First, it examined how customers experience the core functions of the prototype—interactive haptic exploration and side-by-side comparison of sofas—in a natural shopping context. Second, it explored how the prototype fits into the existing store set-up and customer journey, and to what extent it helps customers understand sofas that are not physically on display.

05 Design Evaluation

5.1 Research approach

In total, 11 participants took part in the evaluation, including 10 customers and 1 sales co-worker from the sofa department. Among the customer participants, 7 identified as female and 3 as male, with ages ranging from 22 to 60 years. Customer recruitment followed an intercept approach in the store: the researcher observed shoppers who were actively exploring sofas and invited them to participate in a short test of approximately 20 minutes.



Figure 5.1 Testing set-up in Haarlem Blue box store (Netherlands) *Photo by author.*

The evaluation consisted of two parts:
Part 1 – Effectiveness of the interactive cinematic (single panel)
In the first part, customers interacted with the digital prototype installed in the sofa department and were encouraged to explore the JÄTTEBO sofa. The focus was on understanding whether the interactive cinematics concept was easy to understand and whether the digital experience could meaningfully convey haptic impressions of the sofas.

Based on insights from the previous test phase, four material properties were selected as particularly relevant and communicable through digital cues together with the interactions: **firmness**, **fabric roughness**, **fabric stretchiness**, and **fabric thickness**. Participants were asked to rate their perception of the four properties on a 5-point scale (1 = very low, 5 = very high).

After providing these ratings, participants were taken to experience the actual sofa and were asked to give ratings for the same four properties again. This procedure resulted in two sets of ratings per property and per sofa (digital vs. physical), which were later compared to quantify the property–perception discrepancy between the digital and the real experience.

Part 2 – Effectiveness of the comparison view and physical reference in improving accuracy
In the second part, participants were asked to add two additional sofas (KIVIK and SÖDERHAMN), which were framed as "not on display", and to rate the same four properties again based only on the digital experience. The only sofa they could physically touch was the JÄTTEBO, which served as the physical reference. After completing the digital ratings, participants were taken to the real sofas and asked to rate their actual impressions again, following the same procedure as in Part 1.

In addition to the quantitative ratings, short qualitative interviews were conducted after the test to capture participants' reflections on the interaction, their trust in the digital information, and how the prototype influenced their comfort and material assessments. These qualitative insights were used to complement and contextualise the numerical discrepancy scores when evaluating the overall performance of the digital haptic experience.

5.2 Findings

5.2.1 Interpreting firmness as a multi-component sensation

The findings indicate that participants did not experience "firmness" as a simple soft–firm continuum, but as a composite sensation emerging from several interacting factors. When explaining their sofa impressions, customers spontaneously referred to:

Cushion thickness – how deep the cushion appeared and how much "material" seemed available to sink into. Thin cushions, even when visually soft, were often described as "hard" because participants felt the underlying structure.

Cushion firmness – the perceived resistance of the foam or filling itself.

Supportness – a combined feeling of softness and being held; several participants described their ideal seat as "soft but still supportive".

Compression depth – how far they expected to sink into the seat under their body weight.

Seat width and depth – deeper seats were frequently associated with a softer overall impression ("you feel like you sink into it more"), even when the material itself was not necessarily softer.

Sofa cover – covers (e.g., leather, fabric) with the different elasticity and tightness can lead to different bodily sensations and impressions of firmness.

This pattern suggests that any digital representation of firmness must address multiple underlying components—cushion thickness, support, compression depth, cover fabric, and seat geometry—rather than conveying firmness as a single scalar value.

As shown in Figure 5.2, the digital prototype approximated firmness with varying accuracy across the three sofa models. For JÄTTEBO, digital and physical ratings were closely aligned (mean difference ≈ +0.2), suggesting a relatively faithful representation. For KIVIK, digital ratings tended to be higher (≈ +0.5), leading participants to expect a firmer seat than they actually experienced.

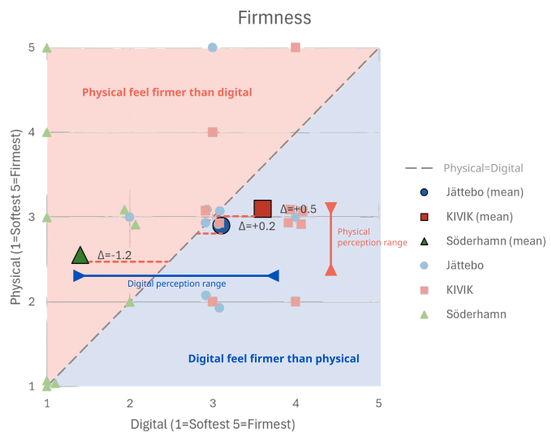


Figure 5.2 Digital vs. physical firmness perception gap (N=10)

The largest discrepancies appeared for SÖDERHAMN, where digital ratings underestimated firmness (≈ –1.2). On-screen, the pronounced cushion deformation and visually thin seat led participants to intuitively expect a very soft, "sink-in" experience. In reality, the combination of a soft yet thin cushion made the spring structure underneath more noticeable, and some participants described the seat as "not soft at all" or "the seat could not be described as simply soft or firm"; instead, they experienced both softness in the cushion and hardness from the underlying structure, which they perceived as qualitatively different from cushion firmness.

A second interpretation of Figure 5.2 is that the physical range of perceived firmness across the three sofas is relatively narrower than the digital perception, suggesting that, in bodily experience, the differences between the sofas are only weakly distinguishable. From a sensory-substitution perspective, this implies that digital tools are trying to communicate distinctions that are already difficult to detect in the physical domain.

The dragging indicator was intended to highlight those feeling components together with the visual deformation, specifically cushion thickness, compression, and support area, helping participants infer how far the seat could be compressed. However, this underlying logic was rarely understood immediately.

Before trying the physical sofas, most customers simply recognised that the interface was “about pressing” the cushion, yet without grasping how the visual deformation related to seat structure and support. Many didn’t really pay attention to the brief tutorial, so the prototype mainly functioned as an intuitive visual cue rather than a clearly learnable “firmness scale”.

Indicator placement also mattered: when positioned in the lower right corner, it was often covered by users’ hands (especially right-handed users) (Figure 5.3 A), while moving it further away from the seat area to the upper left corner weakened its perceived connection to cushion thickness (Figure 5.3 B). Lower left corner turns out to be relatively clear spot (Figure 5.4), but the lack of left handed participants also limited the reliabilty of this adjustment.



Figure 5.3 Indicator placement (A- lower right corner; B- upper left corner) *Photo by author.*

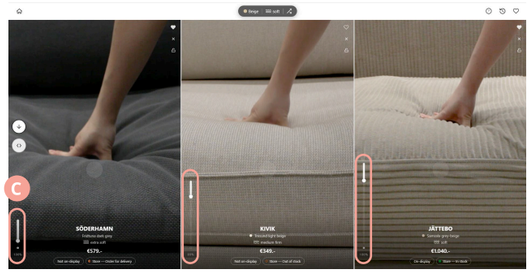


Figure 5.4 Indicator placement (C- lower left corner)

These findings suggest that such property-level explanations are necessary, but how to communicate them in a simpler, more immediately understandable and visually salient way remains an important direction for further exploration.

5.2.2 Stretchiness as perceived looseness rather than material elasticity

In this evaluation, the interviews revealed an unexpected divergence from the research scoping (chapter 3) findings. In the earlier in-store observations and interviews, several customers mentioned that they would touch the fabric samples and gently pull them to assess texture and material properties.

However, during the current rating task, a different pattern emerged. When asked to rate fabric stretchiness, participants could use the digital interaction as a basis for judgement, but when they moved to the physical sofas, it turns out that pulling the cover to check elasticity felt unnatural (Figure 5.5). Several participants explicitly stated that, in a real purchase situation, they would not normally perform this gesture on a sofa.





Figure 5.5 Unnatural pulling gesture (top) vs. participants’ preferred ways of assessing fabric (bottom) *Photo by author.* They emphasised that what mattered more was the tightness of the cover on the sofa—whether it would stay neat over time or start to look loose and baggy.

Because pulling the fabric in this way felt less intuitive and was practically harder to perform on a sofa, participants tended to assign lower stretchiness ratings in the physical condition (Figure 5.6).

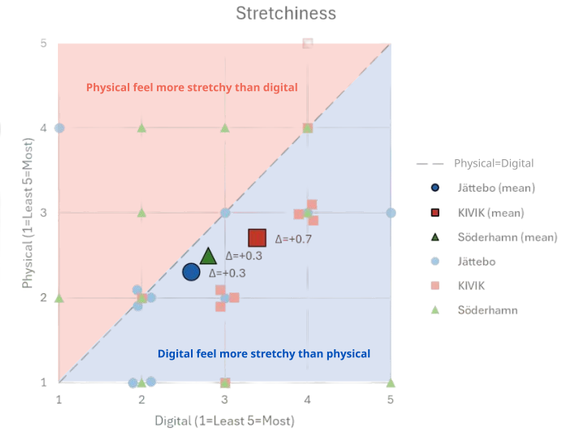


Figure 5.6 Digital vs. physical stretchiness perception gap (N=10)

Some participants also misinterpreted the digital scenes showing the fabric being crumpled without a hand (Figure 5.7) as representing layers of fabric bunching up on the seat surface. As a result, what they actually read from the stretchiness interaction was closer to a judgement of loose vs. tight fit than of material elasticity. Fabrics that appeared to move or wrinkle easily were described as “looser” or “baggy”, whereas fabrics that stayed in place were seen as more “fitted” and “tight”. A few participants openly questioned whether they would ever check elasticity in a sofa fabric, but they consistently cared about whether the cover would look neat and hold its shape over time.



Figure 5.7 Crumple interaction on the screen

By contrast, the hand-based stretching interaction can more clearly communicate the movement, and at the same time provides additional cues about fabric thickness (Figure 5.8). However, when the fabric is used as a sewn cover on the sofa, its thickness differs slightly from that of the fabric sample. As a result, the perceived thickness in the digital interaction may not fully match the felt thickness during physical interaction, which can lead to inaccurate judgments of fabric thickness (Figure 5.9).



Figure 5.8 Stretching the fabric itself with hand

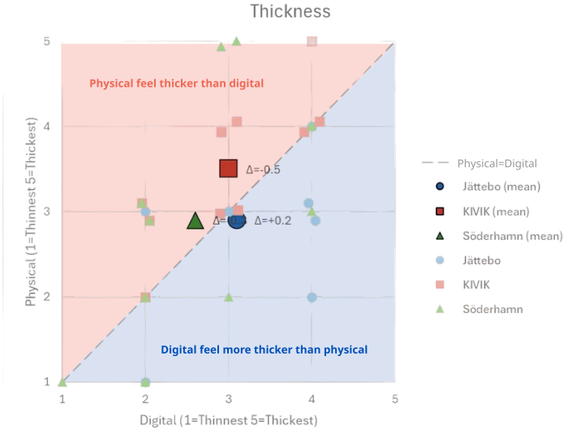


Figure 5.9 Digital vs. physical thickness perception gap (N=10)

This underscores the importance of clearly connecting the interaction to what people actually do on the sofa, or explicitly specifying that the interaction refers only to the fabric itself. Second, it indicates that the interaction itself is promising, but the current semantic framing—*“stretchiness”*—does not align with how customers naturally think about this aspect. Future iterations may therefore need to relabel it as *cover tightness* or *long-term neatness* or consider non-verbal measures, such as *general similarity judgements* between pairs of stimuli.

5.2.3 Texture thickness & roughness relies on visual texture and prior material memory

For texture thickness and roughness, participants relied strongly on visual texture and memories of similar materials. When assessing the prototype, many spontaneously compared the fabrics to familiar categories such as “linen” and “corduroy” and used these associations to infer roughness and smoothness (Figure 5.10).



Figure 5.10. JÄTTEBO & KIVIK fabric association *Photo by author.*

KIVIK’S pronounced weave pattern in the prototype led several participants to immediately classify it as “linen-like” and therefore relatively rough, even though the actual mixed-fibre fabric feels softer than expected when touched in the store.

Similarly, the dark SÖDERHAMN fabric was often interpreted as a woven textile because of the lighting and surface pattern on screen. In order to show the fabric at a 1:1 scale, the texture was not magnified, so the fine decorative pattern could easily be mistaken for a coarse weave (Figure 5.11). In reality, however, it has a decorative texture rather than a pronounced woven structure. These visual cues not only shaped expectations of roughness, but also influenced assumptions about how flexible or stiff the fabric would be.



Figure 5.11 SÖDERHAMN 1:1 scale (left) & close up (right) difference *Photo by author.*

Overall, roughness judgments in the digital experience appear to emerge from a combination of visual texture, lighting, colour, and prior material memory. Looking at the current performance (Figure 5.12), the gaps between digital and physical ratings are not notably large: the discrepancies are generally within ±1 point on the scale, and for SÖDERHAMN they are almost identical to the actual experience.

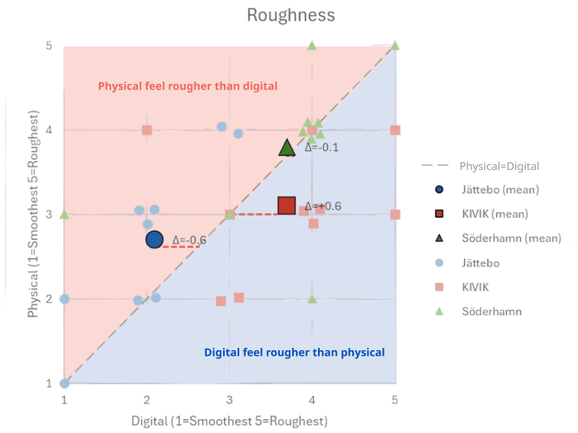


Figure 5.12 Digital vs. physical roughness perception gap (N=10)

To improve accuracy, future iterations may need to pay particular attention to how light and contrast emphasise or downplay texture, and whether additional cues (e.g. comparative close-ups with common associations, hand interactions) can help anchor these impressions more precisely.

5.2.4 Comparison mode helps relative judgements, but its interaction logic remains opaque

Across sessions, participants consistently described the comparison mode as one of the most helpful aspects of the prototype. Being able to view multiple sofas side by side and trigger the same interaction across panels made their sensory judgements feel “more precise” and “more standardised”.

Several participants reported that, once they entered comparison, they could more clearly see which options felt similar in firmness or fabric character and which ones deviated. In a few cases, participants even returned to adjust the first sofa they rate before comparison, and the final digital ratings then matched their physical impressions more closely.

However, the underlying interaction logic remained largely opaque. The touch handle on each panel, which was designed to indicate and trigger different levels of pressure as a reference force, was not actively noticed by participants while they were dragging. As a result, they did not clearly understand the relationship between the dragging motion and the intended levels of applied force.

While some participants noticed that “when you move one, they all move”, they did not understand that the active panel defined the baseline. Instead, they mostly focused on the visible amount of deformation in each panel and judged the sofas directly from the images, without meaningfully using the indicator bar as a reference.

In practice, comparison mode enabled relative judgements such as “this one is clearly softer than that one”, but these judgements were driven by the deformation they happened to trigger, rather than by a conscious understanding of the pressure logic behind the interaction.

To support more reliable and transferable decisions, future designs may need to foreground the logic of the shared interaction more explicitly, making it clearer how the input gesture relates to deformation.

5.2.5 Perceived role of the tool in the overall customer journey

Finally, the evaluation sheds light on how customers envision using this type of digital haptic tool within their sofa purchase journey. Most participants did not see it as a replacement for sitting on a sofa, but they clearly recognised its value for narrowing down options and for supporting decisions when physical access is limited.

Eight out of ten participants described the prototype as a useful way to pre-filter the range based on how well different options seemed to match their comfort preferences. Several explained that the tool would help them explore possibilities and gain a more accurate understanding of materials when they already had at least one physical reference for comparison.

At the same time, they emphasised that they would still want to visit the store and try the sofa in person before committing to a purchase; only two participants said they could imagine buying directly online based on the digital experience alone.

One participant also pointed out that the in-store sitting experience does not always match the feel of a brand-new sofa you receive, because showroom items have already been used by many visitors and may have lost some of their original bounce and support (Figure 5.13). From this perspective, a digital tool that could approximate the “new product” feel might even be perceived as more accurate than the worn floor sample.



Figure 5.13. SÖDERHAMN in the store, perceived as worn over time. *Photo by author.*

Five out of ten participants further suggested that the tool could help them recall and compare sensations after leaving the store, especially when impressions of different sofas start to blur together in memory. The “add to like list” function was particularly appreciated because it connected in-store exploration with later decision making. Participants liked the idea of saving the options they had explored on the screen and revisiting them at home, potentially together with other household members.

Co-worker shared a broadly similar view. Although they anticipated that the current interaction still looks somewhat complex and might require customers to spend time learning how to use it. They expected that some guidance from co-workers would be needed at first, but felt that the tool could effectively support customers in comparing options and filtering the range based on perceived comfort preferences. In particular, they believed it could help compensate for sofas that are not displayed in the compact format, while allowing them, as co-workers, to step in and explain differences between a few shortlisted options more concretely.

It should be noted that the co-worker interviewed for this study was not based in a compact store. As a result, further alignment and validation with co-workers in small-store formats will be needed to assess how the tool fits into their everyday routines and constraints.

In summary, participants positioned the prototype as a supporting, bridging touchpoint rather than a main destination: helpful for narrowing down the range, compensating for missing displays, and re-activating haptic impressions after the visit. These feedback are broadly aligned with the original design intention for the tool—support the decision-making process with a structured haptic exploration.

Theme/ statement	Participant type	Count
Comparison mode described as one of the most helpful aspects of the prototype	Customers	10/10
Adjusted initial digital ratings after entering comparison mode, leading to closer alignment with physical ratings	Customers	2/10
Prototype described as a useful way to pre-filter the range based on comfort preferences	Customers	5/10
Could imagine buying directly online based on the digital experience alone	Customers	2/10
Tool could help recall and compare sensations after leaving the store	Customers	5/10
Showroom sofas may feel different from brand-new sofas; a digital “new product” feel might be more accurate	Customers	1/10
“Add to like list” function connects in-store exploration with later decision-making	Customers	3/10
Prototype helpful for narrowing options and supporting decisions when physical access is limited	Customers	2/10
Felt that physically touching the sofa is still essential and that the tool would not help them much	Customers	2/10
Tool could compensate for non-displayed sofas and support comparison/filtering	Co-worker	1/1
Some initial guidance from co-workers would be needed due to perceived interaction complexity	Co-worker	1/1

Figure 5.14. Summary of evaluation themes for comparison mode and journey role (N = 10 customer participants, N = 1 co-worker)

Reflection on research process

Across Chapters 3 to 5, the project went through multiple rounds of studies in order to keep the design closely grounded in customers’ actual needs and reactions. Each iteration was intended to ensure that design decisions were based on ideas that had been tested and validated, rather than on assumptions alone. At the same time, due to time constraints, the conclusions drawn from these studies inevitably relied on the researcher’s judgement and on triangulation with rich internal data sources, rather than on large-scale quantitative confirmation. If future work could replicate and extend these studies with broader samples and additional data points, the robustness of the findings would be further strengthened.

Overall, the combined research activities helped to shape a clearer design target and a more concrete way of addressing it. They also contributed to pinning down the next steps for development. In the following chapter, the key findings from all studies are synthesised and brought back into dialogue with the initial literature review. On this basis, the thesis outlines directions for future research and further exploration of digital haptic experiences in compact retail spaces.

06

Discussion

6.1 Sofas as a high-touch benchmark for digital haptic experiences
6.2 Translating physical interaction patterns into digital touch cues
6.3 Rebalancing trialability and social interaction in the DAST framework
6.4 The role of the tactile explorer in the user journey and its omnichannel extension

This chapter synthesises the findings from the different studies and prototyping cycles, relates them back to the initial research questions and literature on digital haptics in retail, and discusses their implications for the design of compact store experiences.

06 Discussion

6.1 Sofas as a high-touch benchmark for digital haptic experiences

The research scoping results and the literature together position sofas at the extreme end of the need-for-touch spectrum. From a design and evaluation perspective, sofas therefore function as a "stress test" for digital trialability. They combine several properties that make digital substitution particularly challenging:

> **High touch diagnosticity:**
> key decision attributes (comfort, support, perceived sturdiness) are tightly coupled to bodily sensations rather than to purely visual features.
>
> **High consequence of error:**
> sofas are relatively expensive, highly visible in the home, and used daily over long periods, which raises the perceived risk of "getting it wrong".
>
> **High emotional involvement:**
> customers do not only check functional fit, but also look for a felt sense of relaxation and safety.

Starting from this extreme case makes it possible to work backwards towards other, structurally similar categories. Follow by sofas, armchairs, cushions & textiles, and rugs exhibit a comparable pattern. Two aspects in particular define this broader high-touch cluster:

> **Attribute structure**
> The more a category is dominated by experience attributes that are normally assessed through the body (e.g., softness, support, warmth, surface feel), the more it resembles the sofa benchmark and the more it is likely to benefit from digital haptic cues.
>
> **Role of textiles and compliant materials**
> Categories where fabrics, foams, or pile materials play a central role (sofas, armchairs, cushions, rugs, curtains) are structurally similar in that deformation, compression, and drape are meaningful carriers of information.

Across this cluster, a shared design guideline is that digital content should aim to approximate how the product behaves when it is actually touched, rather than simply adding more static visuals or descriptive text. Interactions such as pressing, squeezing, or pulling should trigger visible deformations and movements that mirror real-world assessment, so that customers can mentally connect what they see on the screen with how the product would feel in their hands or under their body.

In practical terms, this means not only showing the material, but also communicating the hand's action and the apparent force applied, and ensuring that the degree and speed of deformation correspond to the underlying physical properties that customers care about.

6.2 Translating physical interaction patterns into digital touch cues

The in-store observations demonstrate that customers' physical interactions with sofas consist of a recognisable set of haptic "assessment" that target specific experience attributes. Customers sit and lie down in different positions, shift their weight, bounce lightly on the seat, and adjust their posture to gauge support over time. With their hands, they press seat and back cushions, squeeze armrests, pull and rub fabrics, and compare these sensations across different sofas.

Each of these actions serves a diagnostic function: pressing reveals firmness and resilience, pulling highlights fabric elasticity and perceived robustness, and full-body sitting exposes how the sofa distributes weight and supports the back and legs. These findings support the notion that, for high touch-diagnostic products, customers construct their judgments through a sequence of micro-experiments that combine instrumental and affective touch.

The prototyping process shows that this sequence of physical tests can be used as a starting point for gradually identifying which interactions are suitable for digital translation. The goal is to select interactions that are close enough to customers' existing behaviour to feel intuitive, while still being technically feasible on a touchscreen and rich enough to support mental re-enactment and psychological ownership.

However the process of digitising physical perception is also inherently double-edged. Taking firmness as an example, the perceived digital firmness range is larger than the perceived physical one, meaning that the digital experience amplifies the real experience.

On the one hand, it helps customers articulate and compare their sensations more precisely than they normally would in the store: by seeing how far a cushion can be compressed, they gain a more explicit sense of relative differences that might otherwise remain vague. On the other hand, if the underlying physical differences are genuinely small, it is worth asking whether a highly granular digital scale is actually desirable, or whether it risks suggesting a level of distinction that customers do not meaningfully experience in their bodies. The challenge remains in understanding and finding a sweet spot for communicating the complex composition of comfort.

In this study, two variants of the interactive cinematics were explored: versions that included a visible hand in the scene and versions that showed only the product deforming. Although the sample size and study design do not allow for a robust comparison of which variant is more accurate, participants' feedback suggests that these alternatives afford different kinds of.

> **Cinematics with a visible hand** provided clearer cues about the direction and intensity of the applied force and made it easier to understand how the material moved in response to an action.
>
> **Cinematics without a hand** made the material itself more visible and were perceived as more helpful for inspecting finer details of the deformation.

Participants expressed individual preferences for one or the other, but no consistent pattern emerged in this small sample. This indicates a need for further research on how hand presence affects perceived diagnosticity. For the IKEA use case, however, it is plausible that a mature digital interaction sequence will need to combine both perspectives—using the hand to communicate action and force, and "no hand" variants to support closer inspection of the material behaviour.

This research case also illustrates that not every relevant attribute can, or should, be expressed through the interaction that would be ideal from a purely physical point of view. For example, fabric thickness is an aspect that customers associate with durability and resistance to wear. In principle, fabric thickness or weight could be communicated digitally by showing how a piece of fabric swings or drapes when it is shaken. However, "shaking a fabric swatch" is not an action that typically occurs in sofa assessment; most customers limit themselves to behaviours that fit normal use (sitting, lying, leaning, talking when sitting together). Even if participants in a test can accurately infer thickness from a swinging animation, such an interaction does not feel representative of how people actually evaluate sofas. By contrast, the same "shaking and draping" motion may be much more appropriate and intuitive for curtains, where the movement of hanging fabric is central to the product experience.

This example underlines that suitable digital haptic interactions emerge from the intersection of three elements: **the attributes that matter**, **the actions people naturally perform in that product context**, and the subset of those actions that can be meaningfully expressed through **finger-based interaction and visual deformation.**

Conversely, some parts of the assessment sequence are difficult to translate into a fingertip-on-screen format at all. Evaluations that depend on whole-body involvement, such as long-term sitting comfort, fatigue, or the fit between body size and seat depth, lose much of their meaning when controlled through a small hand gesture. An interactive cinematic where a user moves a slider or drags a finger to make a full person sit down may be technically "interactive", but it does not recreate the embodied feeling of one's own body sinking into the seat. In these cases, a simple video of someone sitting and standing may be equally or more informative than an interactive version, because the additional

control does not translate into a stronger sense of bodily simulation.

Similarly, fingertip sensations like nuances in surface texture or thermal feelings are, in principle, related to the hand, but are very hard to render visually that feels trustworthy. Addressing such subtleties may require other types of technology in the future, or may remain dependent on physical samples and swatches.

Because the aim of digital haptic exploration is not to replace the entire assessment sequence, but to complement it, it becomes crucial to understand how this sequence is distributed across touchpoints and media. Mapping out which questions customers ask, which attributes they try to assess, and which actions they use at each stage makes it possible to decide where different kinds of information are best provided.

> **Non-interactive presentation**
> dimensions, basic materials, and care instructions can be communicated effectively on the product information page through text, static photos, or simple videos.
>
> **Interactive presentation**
> aspects related to perceived softness, deformation under load, and small differences in movements are better served by interactive, touch-responsive visuals that invite customers to test the product with their finger.

Designing digital haptic tools therefore means both choosing the right interactions to simulate and positioning them within a broader information ecosystem, so that customers can follow a clear path to find answers to their questions without expecting a single tool to do everything.

6.3 Rebalancing trialability and social interaction in the DAST framework

The starting point of this research is to reframe trialability in compact retail spaces where physical trial is limited. In DAST terms, trialability becomes less tightly linked to the number of physical samples and more closely linked to the quality and diversity of experiences that support customers in trying the product before purchase. The Touch Explorer does not fully replace physical trial; instead, it adds an intermediate layer that can reduce uncertainty in a space-efficient way.

On the social dimension, the Touch Explorer can also reduce the expectation that co-workers should answer every detailed question and can enrich co-worker–customer interactions by providing a concrete visual reference, especially when explaining products that are not physically displayed. Rather than relying only on verbal descriptions, co-workers can stand alongside customers at the device, invite them to press and drag, and then help them make sense of the resulting animations in relation to their own bodily experiences and needs.

This positions co-workers as “sensory translators” who bridge digital cues and physical sensations, thereby enhancing both the perceived value of social interaction and the diagnosticity of trialability.

Furthermore, the Touch Explorer has the potential to reshape customer–customer interactions. When placed in a visible and easily accessible location, it can become a focal point for families or groups to jointly explore options, exchange impressions, and negotiate preferences. In such cases, trialability becomes a social activity in itself rather than a purely individual experience on a sofa. This can increase engagement and aligns with the “shoppertainment” and community elements highlighted in recent retail literature.

However, these opportunities also raise practical considerations about congestion, waiting times, and the need to keep the interaction quick and inclusive in a compact space. Rebalancing trialability and social interaction through digital haptics carries risks: if the device is perceived as difficult to use or as providing limited added value, it may be ignored or avoided, leaving the underlying constraints on trialability unchanged while adding another layer of complexity to the store.

Overall, to realize the potential of such tools, retailers need to integrate them thoughtfully into store layouts and service maps, train co-workers to use them as conversational and explanatory aids, and continuously observe how they affect real customer behaviour on the shop floor.

6.4 The role of the Touch Explorer in the user journey and its omnichannel extension

Based on the findings of this research, the Touch Explorer also has clear implications beyond the in-store journey, particularly for omnichannel experience design. The same interactive logic that underpins the in-store device can be extended to product information pages and mobile applications. For customers who start online, embedded interactive cinematics can act as a “haptic preview”, helping them form expectations about different firmness levels or fabrics before deciding whether a store visit is necessary and, if so, which store to visit.

For customers who have already tried sofas in the store, seeing the same interaction patterns on the product information pages or in the app can reactivate their bodily memory and provide reassurance when they revisit options at home, discuss them with family members, or complete their purchase online.

Maintaining consistency in the visual language of touch across channels is central to this strategy. If the way a cushion deforms or a fabric wrinkles is recognisably the same on the in-store device and on the customer’s phone, the digital experience can function as a bridge between contexts. Over time, customers may learn to associate certain visual patterns with certain haptic qualities (for example, “this degree of deformation corresponds to the softness I liked in the store”), making the digital cues increasingly meaningful.

At the same time, using the Touch Explorer at omnichannel-level comes with limitations and design challenges. The concept assumes a certain level of digital openness and curiosity; some touch-driven shoppers may prefer to rely solely on physical trial and may not feel the need to engage with screens at all. Furthermore, if the digital representations diverge too strongly from the eventual physical experience, there is a risk of disappointment or reduced trust in both the tool and the brand. Clear communication about what the digital interactions can and cannot convey, as well as ongoing calibration of the visuals against real customers’ perceptions of the products, is therefore essential.

07

Limitation & Future Work

While the multi-method approach in this thesis provides a rich and layered understanding of digital haptic experiences in compact retail spaces, several limitations need to be acknowledged when interpreting the findings.

07 Limitation and future research opportunities

Building on the conceptual and empirical foundations of this thesis, subsequent work could deepen, broaden, and quantify the understanding of how digital haptic tools function across products, contexts, and customer groups. The following sections outline how this work is positioned and identify key areas for future exploration.

1. **The empirical setting is specific to IKEA and to the sofa category.**
   The main fieldwork was conducted in the context of IKEA's blue-box stores, which are characterised by a strong brand identity, relatively standardised store concepts, and a deliberate orchestration of omni-meeting points throughout the brand experience. Other retailers, with different brand promises, product architectures, or levels of service, may show different patterns of customer behaviour and different expectations towards digital tools. Similarly, even within IKEA, lower-involvement or lower-touch categories may not require the same depth of haptic reassurance, and the role of digital haptic experiences may be different.

Future studies could extend the approach to other product categories and levels of touch diagnosticity.
In those cases, the research process developed in this thesis—combining a need-for-touch survey, journey-focused interviews, in-store observation, and prototype testing—could be applied as a transferable framework to other product categories and contexts.

2. **The sample sizes and compositions in the empirical studies are context-bound and serve primarily exploratory purposes.**
   The survey on need for touch across categories and information types included respondents from three markets (US, Spain, India), providing initial cross-market variation and ensuring that different cultural and regional perspectives were at least partially represented. However, this sample does not capture the full diversity of IKEA's global customer base. If the goal is to tailor digital haptic solutions more precisely to specific markets, the same research flow could be repeated in a more targeted way within individual countries or segments. The in-depth interviews and in-store observations involved small numbers of participants in specific locations, which limits the extent to which the identified archetypes and interaction patterns can be claimed to be universal. In addition, the prototype evaluations were intentionally conducted with small samples to inform design decisions rather than to derive stable theoretical principles. As a result, the proposed interaction patterns and design directions should be seen as context-sensitive and indicative, rather than as empirically proven "best" solutions.

Future research could also quantify the accuracy of different types of digital representations.
In this thesis, the evaluation of the interactive cinematics was primarily qualitative and did not statistically compare which variants are more effective. A next step would be to largely experimentally compare, for example, "hand-in-frame" versus "no-hand" versions of the same interaction and measure which variant leads to more accurate perceptions. Such studies would help move from context-sensitive design directions towards more robust evidence on how specific design choices influence perceived haptic accuracy.

3. **The semantic interpretation of attribute labels differ from individuals.**
   In this study, participants were asked to rate several properties related to comfort (e.g., firmness, stretchiness, roughness). However, individuals do not necessarily share the same understanding of these terms. Combined with the inherent complexity of how "comfort" is composed in the body, this means that a considerable amount of effort is needed to iteratively refine the wording and find descriptions that resonate across participants. The results of this project show that different participants sometimes mapped the same label onto different aspects of their experience (for example, interpreting "stretchiness" as cover looseness rather than material elasticity, or experiencing "firmness" as a composite of thickness, support, and seat depth). As a consequence, some of the numerical ratings used to validate the accuracy of the digital representations may be noisier or less directly comparable than anticipated, not because the tool itself is ineffective, but because the underlying semantic frame is unstable.

Future research should pay closer attention to this semantic layer.
Either by carefully pre-testing and refining the vocabulary used for attribute scales, or by complementing verbal ratings with more non-verbal measures, such as general similarity judgements between pairs of stimuli. Such approaches can help reduce interpretation bias and provide a more robust basis for evaluating digital haptic representations.

4. **The evaluation of the Touch Explorer focuses primarily on perceived diagnosticity and subjective experience, rather than on usability and in-store performance metrics.**
   The prototype studies assessed how participants interpreted the digital cues, how trustworthy and useful they found them, and how they imagined using such a tool in a real store. These are important early indicators that surface the potential of the concept, but they do not reveal actual usability under real shopping conditions, nor do they capture behavioural or commercial outcomes such as time spent in the department, conversion rates, or return rates. Any future implementation would therefore require more carefully designed deployments in real stores, including attention to interface refinement, placement and signalling in the space, and the time and support needed for customers to learn how to use the tool.

There is scope for more fine-grained investigation of the sensory and technical dimensions of digital haptics.
The interactive cinematics used in this thesis rely on visual deformation and movement as proxies for tactile qualities. Future studies could systematically vary motion parameters (e.g., speed, amplitude, damping) to map how changes in animation affect perceived softness, firmness, or quality. They could also explore multi-sensory extensions, for example by adding subtle sound cues or haptic feedback (e.g., vibrations), to examine whether these combinations improve property-perception accuracy or psychological ownership.

5. **The studies were conducted in a partly "staged" small-store context due to practical constraints.**
Although the starting point of the thesis is small-format stores, but the stores are not located where the researcher based, the time and access constraints meant that the prototype could not be fully tested in the exact small store setting. Instead, much of the validation took place in controlled or semi-controlled environments, complemented by hypothetical scenario discussions with customers and co-workers. This approach makes it possible to explore the perceived accuracy and potential usefulness of the concept, but it does not allow for direct observation of how the tool would perform, be adopted, or be maintained in the actual target environment over time.

Future research could conduct large scale field experiments to assess behavioural and business outcomes.
Once a refined version of the tactile explorer or comparable digital haptic tool is implemented in real stores, controlled A/B tests could compare departments or time periods with and without the tool. Outcome measures might include the number of sofas tried, dwell time in the department, the share of customers considering non displayed variants, purchase conversion rates, and return or complaint rates. Such studies would provide more robust evidence on whether digital haptic experiences merely enrich the subjective experience or also contribute to more confident and efficient decisions, and whether they justify investment from a business perspective.

Taken together, these limitations suggest that the conclusions of this thesis should be understood as **exploratory** and **indicative** rather than definitive. Step by step, the project has dissected abstract sensations that customers themselves rarely verbalise, and has experimented with translating these embodied interactions into a digital context. This process helped to clarify how different components of comfort and material impression are composed, where the boundaries of digital environments lie.

These together provide a grounded starting point for thinking about digital haptic experiences in high-touch categories and compact formats, but they call for further empirical work to test, refine, and extend the proposed concepts and design principles in more diverse, market-specific, and ecologically valid settings.

These avenues indicate that digital haptic experiences are a fertile area for interdisciplinary research, spanning consumer behaviour, sensory marketing, human–computer interaction, and retail operations. By combining larger-scale quantitative studies with in-depth qualitative and design-driven approaches, future work can move from exploratory concepts towards robust frameworks and practical guidelines for implementing digital haptics in omnichannel retail environments.

AI Statement

This thesis made use of AI-based tools to support specific stages of the research and writing process.

- Consensus was used to search for and identify relevant academic papers related to omni-channel retail, haptics, and multi-sensory experience. The result is manually double checked for the reliability.
- NotebookLM was used to help summarize and interpret existing literature and internal materials, and to surface potential conceptual links between them.
- IKEA AI Portal (project workspace) was used as a "librarian" for IKEA internal reports, assisting in locating relevant quantitative findings and insights to support the argumentation.
- ChatGPT was used to correct grammar, improve clarity, and fine-tune the scientific tone of the writing.
- Claude code was used to vibe code the prototype.

All research questions, study design decisions, interpretations of findings, and final conclusions were made by the author. AI tools were not used to generate original empirical data or to replace critical analysis and judgement.

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09

Appendices

A Store Audit: Customer Expectations vs. In-Store Delivery

B Full Results of Test 4.2: Quick Test Before Prototyping

09 Appendices

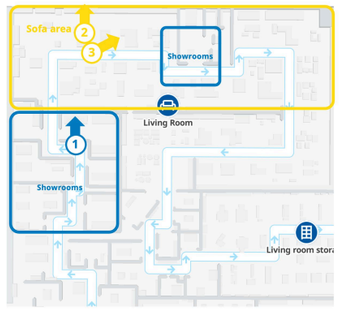
A Store Audit: Customer Expectations vs. In-Store Delivery *Photo by author and Ingka Group internal material, used with permission (2026)..*



Insights from
Store visits & interviews
*Include internal knowledge audit

Ways of presenting **families**

Blue box stores offer enough sofas to try, but **fail to clearly show each family and its combinations and color options.**



Haarlem Blue box store

~ 50 sofas available to try
~ 8 living room showrooms
~ 20 sofa families visually presented
~ 50 fabric samples available



Larger sofa sets shown in full living-room contexts.



Extra descriptions explain different configurations and options for each family.



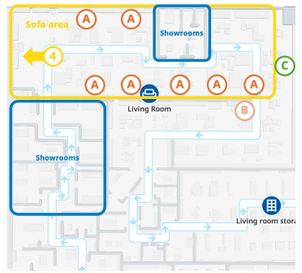
Each family has one on the ground for trial, mostly the best-sellers and special materials.



Ways of presenting **colors & materials**

Current presentation shows options, **but not all customers understand the logic behind**

A. Fabric samples B. Material structure C. Co-worker station



Haarlem Blue box store



Present combinations of different colors within the same family.

Useful for staff to order different parts/covers, but customers sometimes misunderstand it as the actual recommendation.



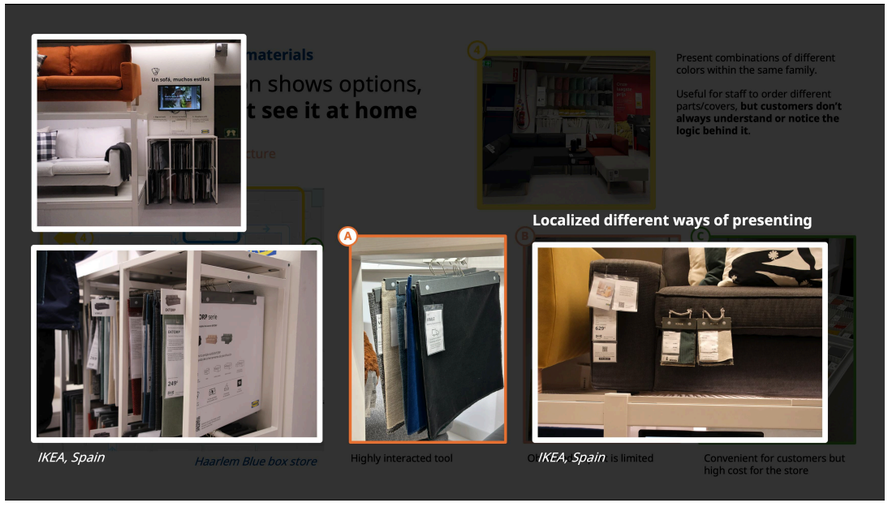
Highly interacted tool



Observed impact is limited



Convenient for customers but high cost for the store



Ways of presenting **ease of use**

Partially opened items invite customers to try functions themselves



Covers are displayed at eye/hand level so customers can easily touch, lift and see how simple they are to remove.





Sofas with hidden storage or functions are presented in the open position, often with a small icon to indicate the feature.

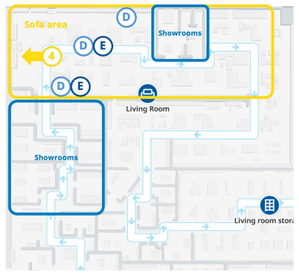


Some sofas are left partially open to show that customers are welcome to sit, lift, pull and test the mechanisms themselves.

Ways of presenting **Size & Fit**

Actual-size experience gives a more intuitive sense of size

D. Upptäcka E. Tape measure



Haarlem Blue box store



Almost every customers take the tape measure to check the dimension.

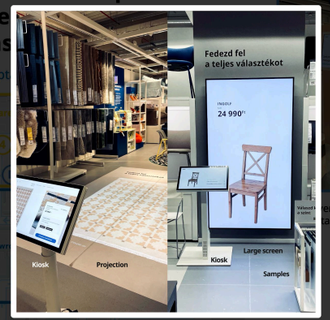




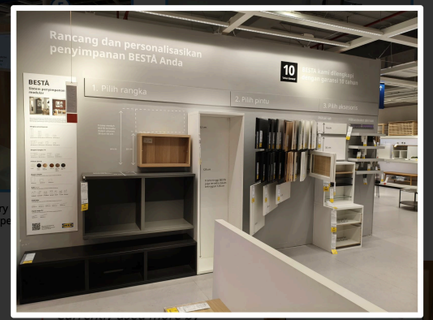
Upptäcka helps in planning their own sofas in 3D model settings.

Currently used more by co-workers than by customers; customers often need guidance to start and interpret the plan.

Different ways to communicate 'actual size' in other categories that work well



RESIDE , IKEA- projection or large screen showing actual size



BESTA Studio, IKEA- dimension on the wall showing actual size

Key Takeaways from In-store interactions



- Exceed expectation
- Meet expectation
- Under expectation

SOFA

Comfort	Enough try-out in Blue box	**Not enough to try-out in small stores**
Quality & Durability	Enough try-out in Blue box	**Not enough to try-out in small stores**
Size & Fit	Tape measure makes size more intuitive	RESIDE Project show product at actual size
Color & Material & Finishing	Fabric samples help support comparison	Hard to picture full set and families
Ease of use	Functions are showcased in multiple open positions	Unclear options description
Atmosphere & Mood	Strongly relies on customers' imagination	

B Full Results of Test 4.2: Quick Test Before Prototyping

	Firmness	Fabric thickness	Fabric roughness	Fabric stretchiness	Ease of cleaning	Weight
NV-A	-1.17	-0.17	-0.83	1.50	0.00	0.50
IV-A	-2.00	0.17	-0.67	1.33	0.20	0.60
IV-v2-A	-2.33	-0.33	-1.00	2.00	0.00	0.25
NV-B	-0.20	-0.60	-0.83	0.80	0.40	-0.33
IV-B	-1.00	-0.17	-1.00	0.83	-0.20	-0.67
NV-C	1.00	0.17	-0.50	-1.67	0.00	-0.33
IV-C	0.33	0.50	-0.50	-1.00	0.25	0.00
IV-v2-C	0.33	0.00	-0.33	-1.00	-0.50	-0.67
NV-D	N/A	0.17	0.17	0.33	0.20	-0.17
IV-D	N/A	0.17	-0.17	0.50	-0.20	-0.20
NV-E	N/A	0.33	0.50	0.83	0.00	0.50
IV-E	N/A	0.33	0.50	1.20	0.00	0.40
NV-F	-0.80	-0.25	-0.83	-0.40	0.80	-0.17
IV-F	-0.80	-0.25	-0.67	0.00	1.25	0.00

Accuracy discrepancies for 14 stimuli across six sofa properties

EXPLORING IN-STORE DIGITAL HAPTIC EXPERIENCE IN COMPACT RETAIL SPACES

IDE MSc Design for Interaction (DFI)
Graduation project by
YEN-HSIN LIN
Feb.-Jul. 2026

Coached by
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Project in collaboration with
INGKA GROUP (IKEA)
Mentor
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TU Delft | Industrial Design Engineering