

ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

**IMPLICIT DIMENSIONS OF EMPATHY IN THE PERCEPTION AND
CREATION OF ARCHITECTURAL SPACE**



Ph.D. THESIS

Elif AKTAŞ YANAŞ

Department of Informatics

Architectural Design Computing Programme

JUNE 2025

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ

**MİMARİ MEKANIN ALGILANMASI VE YARATILMASINDA EMPATİNİN
ÖRTÜK BOYUTLARI**

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Date of Submission : 13 May 2025
Date of Defense : 19 June 2025





To my father,



FOREWORD

The subject of this thesis emerged from questions that had long been circling in my mind, gradually taking shape through a series of fortunate encounters and growing like a snowball. During my doctoral coursework, I came across neuroscientific studies in art that explored the connections between the body, mind, and aesthetic experience—studies that immediately captivated me. They suggested that artworks, whether abstract or figurative, evoke emotional responses through a kind of bodily empathy, and that the aesthetic pleasure we feel is closely tied to this empathic engagement.

The idea that empathy and aesthetic appreciation are grounded in the body–mind connection felt deeply familiar, even though I couldn’t yet articulate it. It resonated with my own experiences in architectural education and practice. The initial seeds of this thesis were planted during in-depth discussions in a design cognition course with Elif Sezen YAGMUR KILIMCI. The idea later grew when I crossed paths with Joanna GANCZAREK at a conference in Rome, and it finally took shape during the writing process under the guidance of Leman Figen GÜL.

First and foremost, thanks go to my advisor Leman Figen GÜL, who has supported me with care and insight from the very beginning. I am sincerely grateful to work with her in this demanding long journey. Her thoughtful feedback, calm presence, and steady belief in my work were invaluable throughout this long process. I also extend my heartfelt thanks to my steering committee members, Elif Sezen YAGMUR KİLİMCİ and Joanna GANCZAREK, for their meaningful contributions to this thesis. Elif Sezen YAGMUR KİLİMCİ’s thought-provoking courses and consistent guidance helped shape the foundation of this research. Her insights continually challenged me to think more deeply about the cognitive dimensions of empathy in design.

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My deepest gratitude goes to both the family I was born into and the one I chose. My mother, father, and siblings supported me—both emotionally and financially—through every academic decision I made, from primary school to university. The constant support and close care of my parents-in-law comforted me. My husband and life partner, Gökhan YANAŞ, stood by me through all my emotional ups and downs and physical exhaustion; he was always my safe harbor. I cannot imagine how dull and difficult this eight-year journey would have been without his companionship.

When I was pregnant with my son Bulut, I dreamed of having this thesis completed before his birth. Now he is nearly three years old, and in the most difficult moments of this journey, he gave me the strength and joy to carry on.

Many people have contributed to this thesis, but there is one person without whom I would never have had the courage to embark on such a demanding path. He was the first in his family to earn a university degree, having left home at the age of six to pursue an education—and never returned. He has always been my greatest motivation to keep working, and I know that I owe much of this achievement to him. He was the first in his family to graduate from university, and now, thanks to him, I am the first in ours to earn a PhD.

This thesis is dedicated to my father.

June 2025

Elif AKTAŞ YANAŞ
(İç Mimar)

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ABBREVIATIONS

APP	: Appendix
EEG	: Electroencephalogram
fMRI	: Functional Magnetic Resonance Imaging





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IMPLICIT DIMENSIONS OF EMPATHY IN THE PERCEPTION AND CREATION OF ARCHITECTURAL SPACE

SUMMARY

The complex relationship between empathy and architectural space remains largely unexplored in design discourse, despite its critical role in shaping meaningful environments. This thesis addresses this gap by proposing a novel theoretical framework—FEELING AS—that identifies and articulates the spontaneous and tacit forms of empathy inherent in both the perception and creation of architectural space

Building on August Schmarsow's foundational insight that spatial creation originates from subjectively experienced enclosure—where the creative and appreciative subjects are initially unified—this research reconceptualizes empathy not as detached understanding but as an embodied act rooted in designers' spatial experiences. This perspective offers a powerful alternative to conventional empathy frameworks that often overlook the spatial dimension.

Empathy in social cognition means sharing one's feelings, thoughts, and perceptions to understand the point of view of the other person (Matsumoto, 2019); in other words, putting oneself in another person's shoes. It encompasses understanding others' feelings and emotions, whether perceived directly, read in fiction, or imagined (Decety, 2004). Although its roots trace back to German aesthetic theory in early 20th century, its application in design literature is relatively recent and has gained prominence over the past five decades (Stephan, 2023).

Today, empathy transcends its role as a design tool to become a lens through which designers interpret the nuances of human behavior, including emotions, intentions, and unspoken needs. The introduction of various empathic design methods and strategies (Leonard & Rayport, 1997; Koskinen & Battarbee, 2003; Kouprie & Sleeswijk Visser, 2009) has laid the groundwork for contemporary research aimed at conceptualizing empathy specifically for design practice (Smeenck, Sturm, and Eggen, 2019; Chang-Arana et al., 2022; Surma-aho & Hölttä-Otto, 2022). Recent studies extend this foundation by examining how empathy enables designers to understand not only users' functional requirements but also their emotional, cognitive, and social interactions with products (Smeenck et al., 2016; Chang & Arana, 2020; Apfelbaum et al., 2021), spatial environments (Altay, 2017), and complex systems (Hess & Fila, 2016; Surma-aho et al., 2018).

Empathy fosters a heightened sensitivity to the complexities of human experience, enriching participatory and collaborative design processes (Sanders & Stappers, 2014; Postma et al., 2012; Smeenck et al., 2019). In recent years, design research has moved toward more precise definitions and measurable approaches to prevent empathy from remaining a vague umbrella term (Chang-Arana et al., 2022). These developments reflect a shift from the designer's ability to adopt the user's perspective to a deeper capacity for establishing qualitative, intersubjective relationships with co-design

participants (Devecchi & Guerrini, 2017), situating empathy as both a relational value and a foundation for dialogic design cultures (Manzini, 2016).

However, existing literature predominantly frames empathy as a connection between designer and user, often neglecting the critical role of the spatial environment in which this relationship unfolds. To empathize with others, one must perceive people and how their bodies, movements, and emotions interact with the surrounding space (Stephan, 2023). According to Hutchins (2008), “Imagining a trajectory across perceptible space is the basis for the more complex practice of superimposing an imagined trajectory on imagined space.” The first one suggests imagining a path or route in directly perceived space. In contrast, the latter suggests a more complex action, such as superimposing an imaginary path or route over a fully imagined or conceptualized space. Like Hutchins' second example, the design of an architectural space requires the superimposition of different layers, including (1) users, (2) space, and their movements (3). In other words, architects imagine users' experiences in an imaginary space while designing. Nevertheless, the spatial encounter user act upon remains a critical yet underexplored component in the discourse on empathic design.

The Feeling AS framework developed in this thesis combines insights from aesthetic theory (*Einfühlung*), phenomenology, and neuroscientific research—particularly studies on mirror neurons and embodied simulation—to define empathy in architectural design as a combination of perception, imagination, and bodily resonance. This framework is based on research on bodily empathy in art perception, frames a unique perspective for conceptualization and operation of empathy in architecture.

The empathy framework developed within the scope of this thesis relies on three critical concepts in the history of empathy: early 20th-century empathy theories, empathy in social cognition, and experimental neuroscience.

1. Empathy in social cognition: The designer places herself in the user's position, feeling as the user.
2. Empathy in early 20th-century German aesthetic theory: The designer feels as if in the space and experiences its tactile and atmospheric features, including material, texture, and light.
3. Empathy in experimental neuroscience: The designer simulates or feels the movement that shapes the space.

In addition to theoretical foundation, grounded in the analysis of empirical data collected from series experiments. This research employs a mixed-methods approach, with qualitative methods as the core methodology supported by quantitative measures. The study design draws from design cognition research traditions, particularly protocol studies pioneered by Eastman (1976) and Schön's (1987) concept of "reflective conversation". Think-aloud protocols are the primary data collection method, a widely used method for capturing cognitive processes in real-time (Tversky, 1997; Goldschmidt, 2012; 2014; Hay et al., 2020; Gero & Milovanovic, 2020). Think-aloud protocols effectively reveal designers' tacit thoughts, imaginative projections, and sensory responses while interacting with visual or spatial stimuli, thus providing access to otherwise unexpressed cognitive and emotional processes.

The research structure comprises two pilot studies and two primary studies organized into distinct phases:

Pilot Study I (N=7): Explored participants' engagement with figurative and abstract paintings in a museum, examining correlations between trait empathy and narrative, perceptual, emotional, and technical responses.

Pilot Study II (N=22): Replicated and extended the approach in a classroom environment with design students, addressing methodological limitations and validating analysis procedures.

Main Studies

Perception Phase (N=26): This phase investigated how individuals empathically engage with architectural space through visual perception with 26 participants. This stage focused on the mechanisms that shape participants' empathic interactions and emotional responses while viewing architectural space visuals.

Design Phase (N=16): This phase consisted of design protocols where 16 participants (the same as in the perception phase) actively generated design ideas while verbally expressing their thought processes. The design phase aimed to identify spontaneously emerging empathy in the early design process and explore its potential contributions to creative thinking and spatial conceptualization.

Through the empirical investigation of both the perception and design phases, this study demonstrates that designers' empathic engagement with space constitutes a form of embodied cognition that significantly influences the early stages of the design process. Empathy provides designers with new ways of seeing in these early stages, much like how sketching supports visual imagination. This research conceptualizes this contribution as seeing through empathy. It articulates the value of these empathic ways of seeing under three interrelated components: empathic framing, affordances, and embodiment.

Moreover, the study reveals that static trait empathy measures—such as the Empathy Quotient—have limited explanatory power in design contexts. Instead, the Feeling AS framework offers a dynamic and situational understanding of empathic engagement. It enables the identification of spontaneous, intuitive behaviors, such as gestures, embodied imagining, and user-oriented spatial adjustment, that emerge throughout the design process.

The findings challenge traditional conceptions of empathy as primarily user-centered, instead revealing its multidimensional nature as a mode of spatial thinking encompassing relationships between bodies, spaces, and movement. The Feeling AS framework moves beyond conventional definitions of empathy as merely "putting oneself in another's shoes," revealing its multidimensional nature within architectural contexts and establishing new pathways for design education and practice. It defines empathy as a form of somatic expertise directed toward the user and the spatial and kinetic qualities of architectural environments. By articulating these dimensions, empathic processes can be analyzed, communicated, taught, and re-applied providing both a tool for retrospective analysis and supporting the development of more responsive design practices



MİMARİ MEKANIN ALGILANMASI VE YARATILMASINDA EMPATİNİN ÖRTÜK BOYUTLARI

ÖZET

Mimari mekânlar, içinde yaşayan, hareket eden ve hisseden insan bedeninin deneyimleriyle anlam kazanır. Her ne kadar mimarlık temelde maddi bir uygulama olsa da, tasarım süreci büyük ölçüde soyut temsiller—eskizler, modeller ve diyagramlar—üzerinden ilerler. Bu araçlar ister çizim, ister fiziksel model ya da dijital simülasyon olsun, çoğunlukla statik kalır, mekânın yaşandığı andaki dinamik canlılığını tam olarak yansıtamazlar. Bu nedenle mimarlar, bir alanın kullanıcıya nasıl hissettireceğini hayal edebilmek için bu temsilleri zihinlerinde canlandırmak zorundadır.

Tasarım süreci boyunca, mekânın soyut temsilleri ile kullanıcıların yaşanmış gerçekliği arasında sürekli bir zihinsel geçiş yaşanır. Statik temsiller ile akışkan, çok duyulu ve duygusal mekânsal deneyimler arasındaki bu uyumsuzluk, soyut temsil ile somut deneyim arasında bir boşluk doğurur. Hutchins'in (2008) işaret ettiği gibi, bu boşluğu doldurmak, mekânsal ilişkileri zamansal ve deneyimsel bağlamlara dönüştürebilmeyi gerektiren gelişmiş bir bilişsel kapasiteye dayanır. Bu bağlamda mimarlar, pasif bir gözlemciye öteye geçerek binaları yaşayan ve etkileşen yapılar olarak hayal ederler. Bu zihinsel süreçler, tasarımcının mekânla kurduğu bedensel karşılaşmalarla derinden bağlantılıdır.

İşte bu noktada empati, tasarımcı ile kullanıcı arasındaki deneyimsel boşluğu kapatır. Mimarlar, insanların mekânla nasıl duygusal, fiziksel ve sosyal biçimlerde etkileşime gireceğini hayal ederken empatiye başvururlar. Bireylerin ihtiyaçlarına yanıt veren tasarımlar, çoğu zaman sezgisel ve örtük olarak işleyen empatik süreçlerin ürünüdür. Bu örtük empati biçimlerini anlamak, mimarlık pratiği ve eğitimi açısından büyük önem taşır. Ancak mevcut literatürde empati çoğunlukla kullanıcı merkezli bir bakışla ele alınmış; tasarımcının mekânsal atmosferler ve hareket dinamikleriyle kurduğu empatik ilişkiler ise henüz yeterince araştırılmamış ve sistematik biçimde belgelenmemiştir.

Empati, uzun zamandır insanların başkalarını anlamasını ve onlarla duygusal bağ kurmasını sağlayan temel bir yetenek olarak kabul edilmektedir. Tasarım bağlamında empati, özellikle insan merkezli ve katılımcı yaklaşımların odak noktası hâline gelmiştir. Ancak ürün ve etkileşim tasarımında yaygın bir kavram olmasına rağmen, mimarlık alanında empati yeterince teorize edilmemiş ve tanımı belirsiz kalmıştır.

Mimari ve tasarım literatüründe empati genellikle "kullanıcının yerine geçme" veya "kullanıcının gözünden görme" gibi basitleştirilmiş metaforlarla sınırlı tutulmaktadır. Bu dar tanımlar, tasarımcının kullanıcıyla kurduğu empatiyi vurgulamakla birlikte, mekânın kendisiyle, atmosferiyle ve içinde gerçekleşen hareketlerle kurulan bedensel ve duygusal ilişkileri göz ardı etmektedir. Oysa erken 20. yüzyıl estetik teorilerinden güncel nörobilim araştırmalarına kadar uzanan geniş bir literatür, insanların mekânla

ilişkisinin yalnızca bilişsel değil, aynı zamanda derin bir bedensel deneyim olduğunu ortaya koymaktadır.

Bu tez çalışması, erken 20. yüzyılın *Einfühlung* (içe yansıtma) teorisini, modern fenomenolojik yaklaşımları ve güncel nörobilimsel bulguları—özellikle ayna nöronlar ve bedensel simülasyon üzerine yapılan çalışmaları—bir araya getiren disiplinlerarası bir bakış açısıyla mimari mekânın algılanmasına ve tasarlanmasına yönelik özgün bir empati çerçevesi geliştirmeyi amaçlar. Bu bağlamda çalışma, empatiyi sadece bir kişilik özelliği veya bilinçli bir çaba olarak değil, mimarın tasarım sürecinde spontane olarak ortaya çıkan, bedensel ve örtük bir düşünme biçimi olarak yeniden tanımlamayı hedeflemektedir.

Empatinin sadece insanlar arasında değil, literatürün önerdiği gibi tasarımın mekansal ve bedensel boyutlarında nasıl işlediğine dair net bir anlayışın olmamasında yola çıkarak bu tez çalışması aşağıdaki 3 soruya cevap aramaktadır.

- 1.Mimarlar, mimari mekânın algılanması ve tasarlanması sırasında mekânsal çevrelerle nasıl empatik ilişki kurarlar?
- 2.Empatik etkileşimin erken tasarım sürecine katkısı nedir?
- 3.Kişilik özelliği olarak empati düzeyi (trait empathy), tasarımcıların mimari mekânla kurdukları empatik ilişkiyi etkiler mi?

Bu soruları cevaplamak için tez, tasarım bilişi araştırmalarından teorik perspektifleri ve deneysel yöntemleri birleştiren disiplinlerarası bir metodoloji benimsemiştir. Metodolojik olarak, bu araştırma nitel ve nicel yaklaşımları bir araya getiren üç ayaktan oluşur. Birinci olarak, katılımcıların düşüncelerini nasıl sözlü olarak ifade ettiklerini ve mekan ve kullanıcılarla nasıl empatik olarak etkileşime girdiklerini yakalamak için yüksek sesle düşünme protokollerini kullanılmıştır. İkinci olarak, katılımcıların beğenme, aşinalık ve kendi bildirdikleri empati düzeylerini ölçmek için öznel raporlar toplanmıştır. Son olarak, genel kişilik özelliklerinin bir rol oynayıp oynamadığını değerlendirmek için Empati Katsayısını (EQ) kullanılmıştır; bu, kişilerin sosyal empatisini ölçen doğrulanmış bir psikolojik ölçektir.

Öz bildirim temelli yöntemler, bireylerin öznel içgörülerini yakalamada değerli olsa da (Surma-Aho vd., 2018; Alzayed vd., 2021; Apfelbaum vd., 2021), tasarım sürecinin dinamik ve sezgisel doğasını yansıtmakta sınırlı kalmaktadır. Buna karşılık, protokol analizi tasarımcıların düşünsel süreçlerine doğrudan bir pencere açarak (Tversky, 1997; Goldschmidt, 1991, 2012, 2014; Hay vd., 2020; Gero & Milovanovic, 2020), empatik tasarım bilişini daha bütüncül bir biçimde inceleme **olanağı** sunar. Sesli düşünme protokolleri bilişsel süreçleri gerçek zamanlı olarak yakalamak için tasarım bilişinde yaygın olarak kullanılan bir araçtır (Tversky, 1997; Goldschmidt, 2012; 2014; Hay vd., 2020; Gero & Milovanovic, 2020). Katılımcıların bireysel empati düzeyleri ise Baron-Cohen ve Wheelwright (2004) tarafından geliştirilen ve Bora ile Baysan-Arabacı (2009) tarafından Türkçeye uyarlanan Empati Katsayısı (EQ) ölçeğiyle ölçülmüştür. EQ ölçeğinin seçilme nedeni iki yönlüdür: İlki, empati türleri arasında ayırım yapmaksızın kapsamlı bir ölçüm sağlaması; ikincisi ise geçerliliği onaylanmış bir Türkçe versiyonunun bulunmasıdır. Bu sayede katılımcılara ölçek anadillerinde sunulurken, dilsel ve kültürel bariyerler en aza indirilmiştir. Bu metodolojik araçların birlikte kullanımı, hem derinlik hem de yapısal çerçeve sağlayarak, mimari tasarımda empatiyi çok boyutlu ve somut bir fenomen olarak ele almak için yeni bir zemin oluşturur.

Araştırma iki pilot çalışma ve iki birincil deneysel aşamadan oluşmaktadır:

- **Pilot Çalışmalar:** Bu ilk çalışmalarda, protokol düzenlemeleri geliştirmek ve görsel etkileşim yoluyla empatik tepkilerin nasıl ortaya çıkarılabileceğini gözlemlemek ve ölçmek için görsel uyarıcı olarak figüratif ve soyut resimler kullanılmıştır.
- **Algı Aşaması:** Bu aşamada, 26 katılımcı üzerinden bireylerin görsel algı yoluyla mimari mekanla empatik olarak nasıl etkileşime girdiğini araştırır. Bu aşamada mimari mekan görsellerini izlerken katılımcıların bedensel empatik etkileşimlerini ve duygusal tepkilerini şekillendiren mekanizmalara odaklanır.
- **Tasarım Aşaması:** Bu aşama, 16 katılımcının (algı aşamasıyla aynı) düşünce süreçlerini sözlü olarak ifade ederken aktif olarak tasarım fikirleri geliştirdiği tasarım protokollerini kapsar. Tasarım aşamasının amacı erken tasarım sürecinde kendiliğinden ortaya çıkan empatinin tanımlanması ve bunun yaratıcı düşünceye ve mekânsal kavramsallaştırmaya potansiyel katkılarını keşfetmektir.

Algılama aşamasında 26 ve tasarım aşamasında 16 katılımcıdan elde edilen ampirik verilerin analizine dayanan “Gibi Hissetme” çerçevesi, mimari tasarım sürecinin özgün gerekliliklerine uyarlanmıştır. Bu çerçeve, tasarımcıların kullanıcıları duygusal olarak nasıl simüle ettiğine, mekânsal atmosferlerle nasıl etkileşime geçtiğine ve mimari ortamlarda hareketi nasıl hayal ettiğine dair yeni içgörüler sunar.

Geleneksel olarak empati, çoğunlukla "kendini başkasının yerine koymak" şeklinde tanımlanırken, "Gibi Hissetme" bu sınırlı yaklaşımın ötesine geçerek, empatik katılımın yalnızca kullanıcı odaklı değil, mekânla ve hareketle kurulan bedensel ve çok duyulu ilişkileri de kapsayabileceğini gösterir. Bu çerçeve, empatiyi yalnızca başkasının yerine kendini koymak olarak değil, mekânın geçici, duysal ve etkileşimli deneyimiyle kurulan bir bedenleşmiş ortaklık olarak tanımlar. Böylece, mimari deneyimin yerleşik ve bedensel doğasını hesaba katarak, empatinin kullanıcıya, mekâna ve harekete yönlendirilebilen çok boyutlu bir olgu olduğunu ortaya koyar.

Disiplinler arası bir yaklaşım ile geliştirilen “Gibi Hissetme” çerçevesi ile sosyal bilimlerde yaygın olarak kullanılan yerleşik ölçüm teknikleri arasındaki olası ilişkilerin araştırılmasına olanak tanır. Ayrıca tasarım sürecinde sıklıkla sezgisel ve görünmez kalan empatik yönelimleri belirlemek ve bunlar üzerine düşünmek için yapılandırılmış bir analiz sistemi sunar. Böylece, empatiyi bir tasarım becerisi olarak analiz edilebilir hale getirirken, atmosferik deneyimleri de ilk kez bu kadar somut ve metodolojik olarak ele alır. Bu sayede çalışma, yalnızca kuramsal değil, operasyonel düzeyde de bu kavramların tasarım sürecindeki rolünü açığa çıkarır.

Algılama ve tasarım aşamalarına dair ampirik veriler, tasarımcıların mekânla kurduğu empatik etkileşimin, tasarım sürecinin özellikle erken evrelerinde etkili olan bir tür “somut biliş” ürettiğini göstermektedir. Bu bağlamda empati, eskizlerin görsel imgeleme katkısıyla benzerlik gösteren bir şekilde, tasarımcıya yeni “görme” olanakları sunar. Bu araştırma, söz konusu katkıyı “empati yoluyla görme” olarak kavramsallaştırmakta ve bu görsel yaklaşımların tasarıma etkisini üç temel bileşen üzerinden açıklamaktadır: empatik çerçeveleme, mekânsal olanaklar ve bedensellik.

Ayrıca araştırma, Empati Katsayısı (EQ) gibi statik öz nitelik ölçümlerinin, tasarım bağlamlarında sınırlı açıklayıcılığa sahip olduğunu ortaya koymaktadır. Buna karşın “Gibi Hissetme” çerçevesi, empatik katılımı dinamik ve durumsal bir fenomen olarak ele alarak, tasarım süreci boyunca ortaya çıkan jestler, somut imgeleme biçimleri ve

kullanıcı odaklı mekânsal ayarlamalar gibi kendiliğinden gelişen sezgisel davranışları analiz etmeye imkân tanır.

Elde edilen bulgular, empatinin yalnızca kullanıcı merkezli bir anlayışla sınırlandırılmayacağını, aksine beden, mekân ve hareket arasındaki ilişkileri kapsayan çok boyutlu bir mekânsal düşünme biçimi olarak ele alınması gerektiğini göstermektedir. “Gibi Hissetme” çerçevesi, empatiyi yalnızca “kendini başkasının yerine koymak” olarak tanımlayan geleneksel yaklaşımların ötesine geçerek, mimarlık bağlamında çok boyutlu doğasını ortaya koyar ve tasarım eğitimi ile pratiği için yeni yollar açar. Bu genişletilmiş tanım, araştırmacılar, eğitimciler ve uygulayıcılar için, tasarımın erken aşamalarında ortaya çıkan ancak geleneksel empati tanımlarında genellikle fark edilmeyen, empatinin incelikli biçimlerini tanımlamak ve geliştirmek üzere yeni bir kavramsal dil ve yöntemsel araçlar sunar.

Gibi Hissetme” çerçevesi, mimari tasarım bağlamında empatinin kavramsal olarak köklü bir şekilde yeniden tanımlanmasını temsil eder. Bu çerçeve, empatiyi kullanıcıya, mekânın uzamsal ve kinetik niteliklerine yönelen bir tür somatik uzmanlık biçimi olarak tanımlar. Bu boyutların açıkça ifade edilmesi sayesinde empatik süreçler analiz edilebilir, aktarılabilir, öğretilir ve yeniden uygulanabilir hale gelir; böylece hem geriye dönük çözümleme aracı hem de daha duyarlı tasarım pratiklerinin geliştirilmesini destekleyen bir yapı sunar.

1. INTRODUCTION

The design process of architectural space requires optimizing a complex set of parameters involving geographical, biological, psychological, and sociological factors to create a space that serves one or several functions. While functionality remains an undisputed priority in design education and practice, architects also shape the physical space and the experiences that occur within it. This requires a deeper connection between the user, space and atmosphere. Emphasizing adherence to anthropometric standards, designers may inadvertently overlook the emotional impacts, social interactions, and meaningful experiences tied to our embodiment within space. As Holl (1994) states, architectural thinking necessitates immediate sensory engagement more profoundly than any other art form (Holl, 1994; Mallgrave, 2010, p. 184). Architectural spaces derive meaning through the human body's lived, moving, and feeling experiences. A thorough knowledge of architecture necessitates looking beyond a building's purely symbolic elements and considering its more profound, nuanced, and "affective, tactile, sensual effects" on inhabitants (Kraftl and Adey, 2008: 214).

On the other hand, while architecture is fundamentally a material practice, it heavily relies on abstract representations throughout the design process, such as sketches, models, and diagrams. Therefore, architects actively animate these representations in their minds to envision how a space might feel from the users' perspective. As a result, they continuously oscillate between abstract representations of space and the lived reality of its users. The inherent discrepancy between static design representations and the fluid, multisensory, and emotional nature of spatial experiences creates an experiential gap between abstract representation and embodied experiences. Whether through drawings, models, or digital simulations, these media remain static—they do not capture the dynamic vitality of space as it is experienced. As Hutchins (2008) explains, this demands a powerful cognitive capacity to translate spatial relationships into temporal and experiential ones. Architects move beyond passive observation,

imagining buildings as vibrant and interactive structures. These efforts are deeply tied to our embodied encounters with space.

Empathy bridges the experiential gap between the designer and the user, enabling architects to imagine how people might interact emotionally, physically, and socially with space. Architects meet individuals' physical, emotional, and social needs in their designs, and they often do so through empathy, an implicit and intuitive process. Understanding these implicit empathic processes is critical to architectural design practice and education. However, within architectural literature, empathy has been predominantly approached from a user-centered perspective. The empathic relationships designers establish with spatial atmospheres and movement dynamics have yet to be sufficiently explored and systematically documented.

This thesis proposes a new framework called “Feeling AS” that redefines empathy in architecture as a spontaneous, bodily, and intuitive mode of design thinking. Drawing on early 20th-century *Einfühlung* theory, phenomenology, and contemporary neuroscience—especially embodied simulation theories—the study frames empathy as a cognitive act and a deeply embodied and emotional experience. The proposed framework emphasizes how architects attune to the user, the space (atmosphere), and movement. The aim is to identify better, interpret, and systematize how empathy arises in architectural design processes—offering new insights into the tacit and often invisible ways designers relate to space, not only through cognition but through the body.

1.1 Problem Statement and Research Questions

Empathy has often been explored through human-centered or user-centered frameworks in architectural design. The concept of “empathic design,” introduced by Leonard and Rayport (1997), underscores observing users in real-world settings to better understand their needs, informing participatory and inclusive design strategies (Kouprie & Sleeswijk Visser, 2009; Postma et al., 2012). While these strategies have significantly enriched product and service design, they frequently limit empathy to cognitive perspective-taking or behavioral prediction, neglecting its emotional, embodied, and spatial dimensions that are particularly pertinent in architectural contexts.

Empathy is recognized as an essential human capacity, enabling individuals to understand and emotionally resonate with others. As Stephan (2023) argues that "empathy is essential to even the most basic problematization in design." Within design disciplines, empathy has become central to human-centered and participatory approaches (Sanders & Stappers, 2014; Postma et al., 2012; Manzini, 2016; Devecchi & Guerrini, 2017; Smeenk et al., 2019). However, despite its prominence in product and interaction design, empathy remains undertheorized in architectural discourse. It is often narrowly reduced to user-centered thinking without accounting for the spatial, bodily, and temporal dimensions that are fundamental to architectural experience.

Existing definitions of empathy in architecture often borrow from psychology, lacking the specificity and conceptual rigor required to address architectural processes comprehensively. Empathy is frequently considered an inherent trait that architects intuitively employ, simplified into metaphors such as "taking the place of the other" or "integrating with the user." While such metaphorical language can inspire empathy research and facilitate cross-field communication, it risks creating confusion by remaining open to interpretation rather than providing the precise definitions that rigorous scientific study requires (Chang-Arana et al., 2022).

Therefore, empathy in architecture needs rethinking, especially in a post-digital, screen-based design context, becomes evident when we consider how current approaches fall short of addressing the full complexity of spatial and bodily experience. Integrating computer-aided design (CAAD) tools has further facilitated how users navigate and interact with the spatial environment before it is built. CAAD tools enable advanced visualizations to enhance user experience simulations with potentials and limits (Milovanovic et al., 2017; Gul et al., 2017; Doma & Sener, 2022). While specific computer-aided simulation tools transcend demonstrating the final spatial experience from the users' perspective, as Pallasmaa (2017) warns, digital tools may risk disrupting the delicate balance between material and mental realms in design. Thus, there is a critical need to move beyond simplified metaphors such as "putting oneself in the user's shoes" toward a deeper conceptualization of empathy as immersive, felt, and bodily engagement with spatial environments.

In architectural design education, empathy has predominantly been addressed within contexts of inclusive and universal design solutions (Demirkan & Altay, 2014; Altay et al., 2016; Yeşiltepe & Demirkan, 2023), focusing on teaching future architects and

designers to create environments that are accessible and welcoming to diverse users, including people with disabilities, elderly populations, and other marginalized groups. Research in architecture and interior design education has examined pedagogical strategies for fostering empathy in design studios (Patel & Alfaro, 2022), employing techniques such as empathic perspective-taking and role-playing exercises (Bernardi & Kowaltowski, 2010; Gomez-Lanier, 2018; Kocaoğlu & Demirkan, 2019; Efiltili & Gelmez, 2024). Beyond inclusive design, empathy in design education has been explored within healthcare environments (Gilfilen & Portillo, 2015; Sandman et al., 2020; Sachs, 2024) and sustainable design practices (Sandman et al., 2018).

While these studies provide valuable contributions to the field, they predominantly focus on empathy's deliberate and instructional applications. Current discourse underexplores the passive, intuitive, and spatially embodied aspects of empathy that architects and users may experience during their engagement with built environments. Beyond conscious efforts to empathize with users, there exists an implicit mode of empathy that operates spontaneously and pre-reflectively—an embodied response that emerges through direct spatial encounter. As research demonstrates, bodily awareness and perceptually grounded experience serve as essential preconditions for learning and problem solving (Clement 1994 Stephen and Clement 2007, Barsalou 2008, Black 2010)—capacities that risk being diminished in our digital design context. The ability to imaginatively project oneself into a spatial situation depends not only on visual perception, but also on kinesthetic and atmospheric sensitivity that requires re-enrichment in contemporary design education. Nevertheless, designers' implicit empathic processes, particularly the internal dialogues they establish with spatial atmospheres and their intuitive responses to dynamic bodily movements within space, remain underexplored and insufficiently documented.

This conceptual gap prompts critical questions regarding how sensory and bodily dimensions of empathic design thinking are fostered and sustained. It challenges current conceptual boundaries within architectural discourse, highlighting the necessity to investigate empathy not merely concerning user needs but also in relation to the spatial and kinetic attributes of environments. This reconceptualization becomes particularly urgent in light of the diminishing bodily and sensory engagement in architectural education, a consequence of increasingly screen-based, digital design practices.

To better understand the emergence of empathy in the perception and design of architectural space, this thesis addresses the following research questions:

- How do architects engage empathically with spatial environments during the perception and design of architectural space?
- How does empathic engagement contribute to the early stages of the design process?
- Does the designer's level of trait empathy influence their empathic engagement with architectural space?

1.2 Aim and Scope

This thesis aims to explore the implicit and spontaneous dimensions of empathy in architectural design and to develop a comprehensive theoretical framework that systematically captures and analyzes these empathic processes. The specific objectives of this study are:

- To identify patterns of empathic engagement architects, demonstrate during both the perception and creation phases of architectural space.
- To develop a robust method for assessing embodied empathy within architectural perception and design processes.
- To uncover the implicit and spontaneous emergence of empathy and its contributions to the early stages of the architectural design process.
- To evaluate the relationship between architects' trait empathy levels and their spontaneous empathic behaviors in design contexts.

1.3 Empathy in Architecture: A Conceptual Background

This thesis develops a theoretical framework to explore empathy in architectural space by integrating insights from early 20th-century *Einfühlung* theory, phenomenological philosophy, and contemporary neuroscience. The concept of empathy originates from the German term *Einfühlung*, meaning “feeling into,” which was initially developed within aesthetic theory to describe the projection of one's feelings into art or space (Lanzoni, 2012; Ganczarek et al., 2018). Translated into English in the early 20th century by psychologists Titchener and Ward, empathy has since evolved into a central

term in psychology and social cognition, typically referring to the ability to share and understand the emotional states of others (Decety, 2004; Matsumoto, 2019).

Contrary to its contemporary psychological interpretation, *Einfühlung* was originally employed in German aesthetic theory at the end of the 19th century to describe the embodied connection individuals have with both animate and inanimate entities. Robert Vischer (1873) introduced *Einfühlung* into German aesthetic discourse suggesting that empathic engagement involves becoming unified with an object by projecting the self onto it, linking aesthetic appreciation directly to this bodily projection. His theory proposed an unconscious bodily projection enabling comprehension of both organic and inorganic forms.

Scholars such as Robert Vischer, Theodor Lipps, and Wilhelm Worringer argued that humans establish empathic relationships not only with other individuals but also with spatial forms and objects. Building on these insights, August Schmarsow further articulated the profound connection between empathy and spatial creation. Schmarsow emphasized that the creative and appreciative subjects were inherently unified, highlighting the intrinsic link between a designer's generative process and their embodied interactions with space. In 1893, Schmarsow expressed this interrelation as follows:

"Every spatial creation is first and foremost the enclosing of a subject, and thus architecture as a human art differs fundamentally from all endeavors in the applied arts. At the outset, the creative and appreciative subjects are the same; they, therefore, constitute the starting point for our genetic explanation." (Schmarsow, 1893, cited in Mallgrave & Ikonou, p. 288)

Drawing upon Schmarsow's insights, this research investigates how architects' empathic engagements—both reflective and intuitive—influence their perceptions and designs of architectural spaces. Understanding these shared perspectives and motivations is crucial to comprehending the origins and developments of architectural forms.

1.4 Methodology

This thesis adopts an interdisciplinary methodological approach grounded in design cognition, combining theoretical insights with experimental methods to explore

empathy in the perception and creation of architectural space. The central focus is on uncovering how empathy emerges in designers' intuitive and often spontaneous interactions with space—both when perceiving environments and when generating design ideas.

To examine this, the research utilizes think-aloud protocols protocol technique, a well-established method for capturing cognitive processes in real time (Tversky, 1997; Goldschmidt, 2012; 2014; Hay et al., 2020; Gero & Milovanovic, 2020). Think-aloud protocols effectively reveal designers' implicit thoughts, imaginative projections, and sensory responses when interacting with visual or spatial stimuli, thus allowing access to otherwise unexpressed cognitive and affective processes. The research comprises two pilot studies and two primary experimental phases:

- Pilot Studies: These initial studies used figurative and abstract paintings as visual stimuli to develop protocol arrangements and observe how empathic responses might be elicited through visual engagement.
- Perception Phase: In this phase, 26 participants described their embodied experiences while engaging with architectural images. This stage explores how bodily empathic interactions manifest in the perceptual experience of architectural spaces.
- Design Phase: This phase involved 16 participants actively generating design ideas while verbally articulating their thought processes. The primary goal was to investigate the spontaneous emergence of empathic engagement during the early design process, exploring its potential contributions to creative thinking and spatial conceptualization.

Additionally, participants' levels of trait empathy were measured using the Empathy Quotient (EQ) scale, developed by Baron-Cohen and Wheelwright (2004) and translated into Turkish with a validated Turkish translation (Bora & Baysan-Arabacı, 2009). The EQ was selected for two reasons: it provides a comprehensive measure without differentiating between types of empathy, and it has been translated into Turkish by Bora and Baysan-Arabacı (2009), ensuring cultural and linguistic relevance.

This approach addresses the limitations of pre-existing self-report techniques (Surma-Aho et al., 2018) while investigating potential associations between the "Feeling AS"

framework and established measures. While self-report methods from social sciences capture subjective insights (Surma-Aho et al., 2018; Alzayed et al., 2021; Apfelbaum et al., 2021), protocol analysis offers a direct window into designers' thought processes (Tversky, 1997; Goldschmidt 1991; 2012; 2014; Hay et al., 2020; Gero & Milovanovic, 2020). Together, these methodological tools provide both depth and structure, enabling a novel exploration of empathy as an embodied and multi-dimensional phenomenon in architectural design.

1.5 Original Contribution and Significance of the Thesis

This thesis departs from the premise that empathy is not solely a tool for understanding users, but also a means of engaging deeply with space, atmosphere, and movement. It investigates how architects experience and imagine architectural spaces through an embodied, empathic lens—particularly during the early stages of design. By doing so, the study addresses a critical gap within architectural theory and design cognition research, proposing the "Feeling AS" framework as a novel approach to capturing spontaneous, implicit, and embodied forms of empathic engagement within architectural thinking.

The original contribution of this thesis lies in developing and applying the Feeling AS framework, an innovative and comprehensive model designed to capture the implicit and spontaneous emergence of empathy inherent in designers' intuitive thought processes. This framework facilitates a deeper understanding of the relationships among designers' perceptual experiences, their empathic engagements during the early design phases. By providing a structured lens for interpreting otherwise hidden empathic expressions within architects' dialogues, this approach illuminates previously tacit dimensions of empathy.

The significance of the thesis is articulated across three key areas:

1. **Theoretical Contribution:** The thesis redefines empathy within architectural discourse, moving beyond traditional user-centered perspectives toward a more holistic conceptualization. It incorporates empathic relationships established not only with users but also with spatial atmospheres and bodily movement dynamics, offering a richer and more nuanced understanding of empathy in architecture.

2. Methodological Contribution: The research introduces an innovative methodological approach using think-aloud protocols, systematically uncovering and analyzing designers' implicit cognitive processes. This methodological innovation enables the identification and interpretation of the subtle and spontaneous empathic interactions designers have with spatial environments.

3. Educational Contribution: The findings of this thesis provide strategies to foster empathic thinking in architectural education, offering insights and practical methods to enhance students' spatial and bodily sensitivity. It contributes to design education by highlighting empathy's tacit dimensions and offering insights for fostering creativity and empathy in curricula.

1.6 Structure of the Thesis

This thesis is composed of seven chapters, each contributing to the development and application of the Feeling AS framework and providing insight into empathic engagement in architectural design. Starting from the basic principles of *Einfühlung* theory, space, body, and movement, this thesis study has constructed its theoretical frameworks through the contributions of phenomenology and modern neuroscience in exploring empathy in architecture.

Chapter 2 provides a comprehensive literature review of empathy, tracing its development from the historical concept of *Einfühlung* through neuroscientific studies and design research applications to architectural contexts. It begins with historical roots in *Einfühlung* ("feeling into") to contemporary neuroscientific studies on empathy in art and continue how empathy has been conceptualized within design research. Further the chapter examines insights from neuroscience relevant to architecture, concluding with a phenomenological perspective on empathy in architectural design. This extensive review establishes the theoretical foundation for understanding how architects engage empathically with spatial environments, expanding empathy research into architectural discourse.

Chapter 3, titled *Empathy in Action*, functions as a conceptual bridge between the theoretical discussions in Chapter 2 and the methodological framework outlined in Chapter 4. The chapter explores design cognition through two key lenses: first, it investigates design as a reflective practice (Section 3.1), examining how designers'

thinking processes—including Schön's reflective conversation and Goldschmidt's dialectics of sketching—intersect with empathic engagement in architecture. Second, it explores the embodied nature of design cognition (Section 3.2), arguing that design thinking is not purely mental but deeply rooted in physical experience.

Chapter 4 outlines the research methodology, presenting both theoretical frameworks and experimental approaches used to investigate empathy in architectural perception and design. The chapter details specific protocols, including think-aloud design methods and various data collection techniques, while also describing two pilot studies that refined the research design and provided preliminary evidence of empathetic engagement with visual and spatial stimuli.

Chapter 5, entitled 'Perception Phase,' focuses on how participants perceive and interpret architectural spaces through think-aloud protocols and questionnaires, building on previous pilot study findings. In this phase, 26 participants engaged with selected architectural settings while thinking aloud, and their immediate reactions were recorded and systematically coded to identify instances of empathy. It presents both qualitative and quantitative analysis of the collected data.

Chapter 6, the Design Phase, investigates empathic engagement during the active process of designing architectural spaces. The chapter examines how the same participants from the perception phase (16 of them) engage empathically while actively solving design problems through think-aloud protocols. The findings contribute to the 'Feeling As' framework—comprising Feeling As the User, Feeling As in the Space, and Feeling As the Movement—which is synthesized across both perception and design phases in the concluding section of Chapter 6..

Finally, Chapter 7 summarizes the findings, contributions, of Feeling As framework as the central conceptual contribution of the thesis. The chapter explores empathy's contribution to early design processes, distinguishes between trait empathy and dynamic empathic engagement, and redefines empathy within architectural design contexts. It concludes by discussing study limitations, methodological considerations, and suggesting directions for future research while reflecting on the implications for architectural theory, education, and practice.

1.7 Glossary of Key Terms

This glossary has been provided to clarify key terms and theoretical concepts used throughout the thesis. It is intended to assist the reader in navigating the interdisciplinary vocabulary employed in the study and to support a clearer understanding of the arguments and analyses presented in the subsequent chapters

Affordance (n.): In ecological psychology, affordance describes a relationship between an organism and its environment – what the environment offers or makes possible for that organism. Coined by J.J. Gibson, the term refers to how perception involves directly recognizing what a surface or object affords—such as sitting, climbing, or hiding—without conscious inference. For Gibson (1979), an affordance is neither purely objective nor subjective but arises from the dynamic correspondence between an organism's capabilities and environmental features.

Atmosphere (n.): The overarching perceptual, sensory, and emotive impression of a space that emerges from the interaction between a perceiving subject and their environment. Drawing on Gernot Böhme's aesthetic theory, atmosphere is neither wholly subjective nor purely objective but exists in the relational field between the two. In architecture, it shapes how spaces are experienced holistically through light, materiality, color, form, and spatial qualities to evoke specific moods and effect.

Architectural Empathy (n.): The capacity of architects to attune themselves to users, spaces, and movements in ways that are embodied, affective, and imaginative—beyond rational or solely user-centered approaches.

Embodiment (n.): Embodiment refers to the condition in which self-experience and cognition are grounded in bodily experience, particularly through motor activity and sensorimotor engagement with the world. It suggests that even the minimal, pre-reflective sense of self—the feeling of "mineness" or the first-person perspective—emerges from the body's interaction with the environment, prior to any conscious or explicit awareness. In this thesis, embodiment is identified in the designers' use of gestures and movement as a means to physically simulate the experience of others and to externalize their design intentions more effectively.

Embodied Simulation (n.): A functional mechanism of the brain-body system, triggered by mirror neurons, through which we understand actions, sensations, and emotions (Gallese, 2003, 2005, 2014, 2019). This process occurs not only during direct

observation but also during the imagination of perceiving or performing an action. In aesthetic contexts, embodied simulation enables observers to resonate bodily with artworks, as motor areas of the brain are activated in response to depicted or implied gestures, movements, and manipulable objects.

Empathy (n.): Empathy is a basic human capacity to understand and share the feelings and perspectives of others. Although there is no single agreed-upon definition in psychology—with over 40 variations identified in the literature (Cuff et al., 2016)—a widely accepted view describes empathy as an emotional response shaped by both stable personal traits and situational influences, involving both affective resonance and cognitive understanding of another person’s experience.

Empathic Framing (v): The act of ‘naming the situation’ by framing a design problem from a human-centered, empathic perspective that guides design concept, intentions and priorities.

Empathy Quotient (EQ): A standardized psychometric test developed by Baron-Cohen and Wheelwright (2004) to assess trait empathy, used in this study as a comparative metric.

Kinesthetic Sensitivity (n): The designer’s attunement to movement-related cues in space, including posture, motion, balance, and bodily orientation. Kinesthetic sensitivity encompasses the designer's intuitive understanding of how architectural elements such as scale, proportion, circulation paths, and spatial sequences affect the body's sense of balance, rhythm, and spatial navigation.

Mirror neurons (n.): A class of neurons first discovered in the premotor cortex of macaque monkeys (Rizzolatti et al., 1996), which fire both when an individual performs an action and when they observe the same action performed internally by another. These neurons form the neurophysiological foundation of embodied simulation, enabling direct access to the actions, emotions, and intentions of others.

Simulation (n.): Simulation refers to the mental process of recreating or reenacting actions, sensations, or emotions without direct external input. It involves the activation of neural systems that are typically used during real experience, enabling individuals to “simulate” the behavior, bodily states, or feelings of others. Neuroscientific studies have demonstrated that simulation processes activate brain regions similar to those

engaged during actual experience, revealing the brain's capacity to recreate actions or emotions internally.

Trait Empathy (n.): An individual's stable, enduring disposition to empathize across situations, encompassing inherent tendencies toward emotional sensitivity, perspective-taking, and concern for others. Unlike context-specific empathic responses, trait empathy represents a consistent personality characteristic typically measured through self-report instruments such as the Interpersonal Reactivity Index (IRI), Empathy Quotient (EQ), or Toronto Empathy Questionnaire (TEQ).





2. EMPATHY

2.1 The Foundations of Empathy: Revisiting Einfühlung Theory

In contemporary social cognition, empathy entails sharing feelings and perspectives to understand others (Matsumoto, 2019). However, 'Einfühlung,' employed in German aesthetics in the late 19th century, emphasized our connection with living and non-living entities (Mallgrave & Ikonomou, 1994; Nowak, 2011; Schützeichel, 2013; Ganczarek, 2018). Inspired by his father, Friedrich Theodor Vischer's (1887) views on the concept of symbolism (Mallgrave & Ikonomu, 1994; Nowak, 2011; Schützeichel, 2013; Ganczarek, 2018), Vischer introduced the concept of Einfühlung to German aesthetic theory in 1873. He states that he derived the concept of Einfühlung from the dream reference he took from Scherner's (1861) book. The objectification of the body to other spatial forms in dreams inspires his definition, which he explains as follows:

“Thus, it (subject) unconsciously projects its bodily form - and with this also the soul into the form of the object. From this, I derived the notion that I called “empathy” [Einfühlung]” (Vischer, 1873); translated by (Mallgrave & Ikonomou, 1994, p.92).

In essence, Vischer's (1873) theory of empathy suggests being at one with the object by projecting part of the subject onto it and linking the object's aesthetic pleasure to this bodily empathic process. Historically linked to panpsychism, the concept suggests a bodily perspective with animals, plants, and objects (Ganczarek et al., 2018). Following Vischer, many German aesthetic theorists link aesthetic pleasure with the concept of Einfühlung, although their interpretation of how this occurs differentiates. Whereas Heinrich Wölfflin does not use the term Einfühlung in his doctoral dissertation (*Prolegomena to a Psychology of Architecture*), published in 1886, he describes a bodily empathetic process in perceiving the physical world, like Vischer's. He sought the answer to his famous question, “How is it possible for architectural forms to express an emotion or a mood?”. He sought the answer through bodily analogies in his doctoral dissertation. According to Wölfflin, a human's aesthetic perception of forms depends on his own physicality. For Wölfflin, we appreciate a

column's serenity because we understand gravity. In *Prolegomena*, he (1886) states as below.

Physical forms only have characteristics because we ourselves have a physical form. If we were beings who only perceived things visually, an aesthetic judgment of the physical world would always be denied us. However, as human beings with bodies that teach us to know what gravity, contraction, strength and so on are, we acquire the experiences that first enable us to empathize with the conditions of external forms (Wölfflin 1886, translated English in Micheal, 2017)

Following Vischer, Theodor Lipps was one of the most influential representatives of *Einfühlung* theory in the early 20th century. Lipps played an essential role in introducing and popularizing the concept of empathy in social cognition (Zahavi, 2014). Nevertheless, before introducing the concept of *Einfühlung* into the social cognition literature, Lipps had already developed ideas on the empathic perception of space. He was possibly the only non-architect theorist to rival Wölfflin alone in influencing architectural theory in the late 1890s (Mallgrave & Ikonomou, 1994). Lipps's readings of space via bodily analogies are like Wölfflin's. He uses a similar approach to Wölfflin in his famous example of the Doric column (1897) while expressing his views on space. Although he does not use the word empathy yet, he explains the pleasure that the column form evokes in people as follows.

The powerful contraction and self-raising of the Doric column that I perceive gives me pleasure, just as the powerful contraction and self-raising of my own body that I remember, or as the powerful contraction and self-raising of someone else that I perceive give me pleasure (*Raumästhetik und geometrisch optische Täuschungen*, published in 1897) [Lipps 1897; Schützeichel 2013]

Lipps and Wölfflin, leaving the material aside in architecture, focused on the movement of the forces that shaped the architecture and the form and gave similar column examples (Schützeichel, 2013). They attempted to move Vischer's concept of *Einfühlung* away from the pantheistic view into a more scientific framework rather than the metaphysical and obscure concept of projection (Wölfflin, 1886; Mallgrave & Ikonomou, 1994; Mallgrave, 2010; Nowak, 2011; Bridge, 2010). Wölfflin drifted away from the projection model in early works overtime but insisted on two critical ideas of empathy theory (Bridge, 2010). He believed that art form is expressive, and the viewer's subjective response is essential in determining the meaning of the form

(Bridge, 2010, p.16). Both theorists link the human's aesthetic perception of forms to their physicality. However, the empathic interpretations of these two theorists on architecture remained limited to formal and bodily readings (Wölfflin, 1886; Mallgrave & Ikonomou, 1994; Mallgrave, 2010; Nowak, 2011; Bridge, 2010). Nevertheless, Lipps interpreted *Einfühlung* as a fundamental mechanism of perception in general (Allesch, 2017). He broadened the application of *Einfühlung* from aesthetics to encompass our capacity to comprehend nature, objects, and other individuals (Lanzoni, 2012), integrating the concept into social cognition.

August Schmarsow was the first to formulate a comprehensive theory of architecture as a process of spatial creation (Schwarzer, 1991). For Schmarsow, architecture is “unique of all the arts in its ability to provoke *Einfühlung*” (Koss, 2006, p.141). Schmarsow differs from other theorists by challenging Wölfflin's “psychology of form” and insisting that the essence of architectural creation is “spatial construct” rather than form (Mallgrave & Ikonomou, 1994, p.59). In this context, Schmarsow focuses on spatial creation (*Raumgestaltung*), more specifically, the sense of “enclosure of subject” in the interior space (Schmarsow, 1994; Schützeichel, 2013). In his book *The Essence of Architecture*, written in 1893, he defined architecture as the art of creating space as in the following.

“Our sense of space [*Raumgefühl*] and spatial imagination (*Raumphantasie*) press toward spatial creation [*Raumgestaltung*]; they seek their satisfaction in art. We call this art architecture; in plain words, it is the creatress of space [*Raumgestalterin*].”
(Schmarsow, 1893, translated in Mallgrave and Ikonomou, 1994, p.287).

For Schmarsow (1893), other aesthetic theorists focus on the structure and exterior of the building while ignoring internal aspects of space creation such as spatial development, perspective, and composition, causing them to lose sight of the inner elements of architectural creation (Schmarsow 1893, in Mallgrave and Ikonomou 1994, p.292). For him, liberating architecture from form, matter, and style by abstracting material, as well as constructive or stylistic motifs (Schützeichel, 2013), was significant. According to Schmarsow, at heart, architecture is a spatial construct that draws its reference system from the human body. Further, his reading of space is based on a kinesthetic perception, even observing static objects, as in the passage below.

The linguistic terms that we use for space, such as “extension”, “expanse” and “direction” suggest a continuous activity on our part as we transfer our own feeling of movement directly to the static spatial form. We cannot express its relation in a way other than by imagining that we are measuring the length, width and depth or by attributing to static lines, surfaces, and volumes that our eyes and our kinesthetic sensation suggest to us, even though we survey the dimension while we are standing still. (Schmarsow, 1893 in Mallgrave and Ikonomu, p.291).

Throughout the twentieth century, it was common to use the concept of empathy to describe mental processes in the phenomenological tradition (Allesch, 2017). Although Schmarsow's views were unorthodox for his time (Mitchel, 1991), he significantly contributed to the transition toward phenomenological psychology (Mallgrave & Ikonomu, 1994, p.66). There are many parallels between Schmarsow's and Edmund Husserl's ideas (Mallgrave & Ikonomu, 1994). For example, Schmarsow's thoughts on movement resemble Husserl's theory of kinesthesia. He describes the movement as a determining factor in creating the third dimension (p.65). A few decades later, Schmarsow's ideas of space have found their counterparts in phenomenology, especially in Merleau-Ponty's views on perception. In his philosophy, Merleau-Ponty emphasized spatiality, which is always related to the body (corps) (Soysal, 2012). In his analysis of Cézanne paintings, Merleau-Ponty establishes an affective relationship between seeing the body and the seen thing by saying that quality, light, color, and depth exist but only because they resonate in our body (Merleau-Ponty, 2012, p.36). Merleau-Ponty's analysis of Cézanne goes beyond a phenomenology limited to the body or the subject; it reaches for the affective power of the works that tend to stand between the artist and the audience (Paterson, 2007, p.90). Pallasmaa (2015) likens the painter's way of thinking to that of the architect, as Merleau-Ponty tells in the *Eye-Mind*. Similarly, Mallgrave (2010) draws attention to the similarity of the views of Schmarsow and Merleau-Ponty. According to Schmarsow, the perceptual formation of architecture emerges from "the residues of sensory experiences, shaped by muscular sensations, skin sensitivity, and our bodily structure" (Schmarsow, 1873; cited in Mallgrave, 2010, p.160). Mallgrave (2010) notes, however, that despite Merleau-Ponty's deep insights into perception, he does not articulate the perceptual formation of architecture as explicitly and concretely as Schmarsow does.

Danish architect and urban planner Rasmussen (1959) discussed the layers of spatial experience in much more detail in his book *Experiencing Architecture* in the same

period. Schmarsow, as previously stated, had extended Lipps, Vischer, and Wölfflin's reading of space through a static body to a more kinesthetic understanding of space. However, he was still limited by the intrinsic properties of architectural elements, such as mechanical forces, which exclude the space's surface, texture, and other extrinsic properties. On the other hand, Rasmussen takes perceptual space a step further by adding extrinsic elements that create the atmospheric qualities of spatial experiences, such as daylight, material, texture, and landscape. He states the experience of architecture as follows.

Understanding architecture, therefore, is not the same as being able to determine the style of a building by certain external features. It is not enough to see architecture; you must experience it. You must observe how it was designed for a special purpose and how it was attuned to the entire concept and rhythm of a specific era. You must dwell in the rooms, feel how they are close about you, observe how you are naturally led from one to the other. You must be aware of the textural effects, discover why just those colors were used, how the choice depended on the orientation of the rooms in relation to windows and the sun. (Rasmussen, 1959, p.19)

The original idea of *Einfühlung's* theory seems to have evolved rather than following a bifurcated path in discussions of empathy from symbolism to phenomenology. Although nineteenth-century theorists had divergent perspectives on how empathy occurs, they all agreed that architecture differentiates from the other branches of art. Thus, they considered the perception of architecture through a different lens. For Vischer (1874) himself, architecture was the best way to empathize with inorganic forms, thus providing us with a spatial experience, a feeling of space (*Raumgefühl*) (Vischer, 1874; Schützeichel, 2013, p.297). Similarly, Wölfflin states,

"No one can contest our right to liken the perception of human expression to the perception of architectural forms. Where is the point at which this experience of empathy ceases? It will occur wherever we find existential conditions similar to our own, that is, where bodies confront us" (Wölfflin 1886, in Michael, 2017, p.6).

Even Worringer (1908), who argues that *Einfühlung* is always inclined towards the organic, says that due to its nature, only architecture can effortlessly break the contrast between organic and abstract among all arts (Worringer 1908 in Tunalı, 1963). For Schmarsow (1893), while space can be represented in painting and relief, it can only be created and experienced in architecture. The results of the body's interactions with

the world are represented in tangible form by architecture (Schmarsow, 1893; Schwarzer, 1991). Wölfflin agrees that art appeals to all senses; however, he emphasizes that only architecture produces an artifact that we can truly experience with all of our senses (Wölfflin 1886 in Michael, 2017, p.6) and the person who created this product, the architect, needs to go through all these empathic processes.

The concept of *Einfühlung* lost interest in the middle of the 19th century (Nowak, 2011), yet it has inspired many contemporary neuroscience studies today. Titchener's definition of empathy, based on kinesthetic image—which couple image and movement in the mind—parallels recent neuroscientific studies attempting to understand the components underlying empathy (Lanzoni, 2017). Moreover, the discovery of mirror neurons seems to have confirmed the phenomenological analysis of intersubjectivity, the living body, and empathy on a neurophysiological basis (Manganaro, 2017). Lanzoni (2018, p.17) notes that despite the evolving and complex definition of empathy over time, a recurring theme is that empathic connection transcends the boundaries of traditional interpersonal relationships, extending to various entities, including non-human elements like landscapes or architectural features. Freedberg and Gallese (2007) have pioneered many experimental studies in this field by associating the neural responses of the audience with empathic processes in understanding and interpreting works of art. Their theoretical background, which explains the empathetic reactions of the audience through the embodied simulation theory established via mirror neurons, traces back to Vischer.

Einfühlung was more than just a theory of art; it laid the groundwork for the contemporary understanding of empathy in art and architecture. The theory of *Einfühlung* proposes that the observer takes an active role rather than being a passive viewer, transforming artistic vision into a haptic vision (Nowak, 2011). Thus, presenting a multimodal understanding of perception, which links motor activity with vision in the observers' brain activation of motor circuits during the experience of works of art, have shown in several experiments since.

This thesis study starting from the basic principles of *Einfühlung* theory, space, body, and movement, has constructed its theoretical frameworks through the contributions of phenomenology and modern neuroscience in exploring empathy in architectural space. The subsequent section will delve deeper into embodied simulation theory, elucidating the intrinsic link between the observer and the architectural space, and

further discuss the integration of cognitive neuroscience findings in enhancing empathetic design practices.

2.2 From Einfühlung to Neuroscientific Perspectives on Empathy

Originally conceived as a theory to explain the emotional engagement with art, *Einfühlung* provides a framework for examining how observers interact with art and architecture. The connection between the act of creation and the appreciation has been a subject of interest since the term *Einfühlung* is introduced to the German aesthetic theory. Understanding how art creates aesthetic pleasure and interacts with brain systems of perception has greatly benefited from neuroscientific approaches employing imaging techniques. The relatively recent field of neuroaesthetics, pioneered by Semir Zeki, has further advanced this understanding by examining the brain processes involved in artistic appreciation through imaging techniques like fMRI and EEG (Zeki, 1999; Mallgrave, 2010). Freedberg (2017), states that empathy may not be a necessary component of art appreciation, it plays a significant role in understanding and explaining our interactions with works of art

Recently, empathy has gained recognition in architectural theory and practice, integrating cognitive neuroscience and the experiential turn. Neuroscientific findings, particularly in mirror neuron systems, highlight the importance of understanding human cognition and empathy for effective design (Pallasmaa, 2017). This multimodal understanding of perception, which links motor activity with vision, has been demonstrated in several experiments where observers' brain activation of motor circuits occurs during the experience of works of art. Neuroscientific findings, particularly studies involving mirror neuron systems, emphasize empathy's foundational role in effective design, underscoring how profoundly human cognition is embodied (Pallasmaa, 2017). These studies indicate empathy is fundamentally not merely a cognitive abstraction but a deeply bodily mechanism central to perceptual experience. Moreover, such research elucidates the inseparable relationship between observer and observed, revealing how emotional states, perceptions, and bodily responses significantly shape interpretations and experiences of spatial and artistic environments (Freedberg & Gallese, 2007; Umiltà et al., 2012; Gallese & Gattara, 2015; Sbriscia-Fioretti et al., 2013).

Studies have demonstrated that the empathetic responses elicited by artworks are not merely passive but involve dynamic, embodied processes where viewers' motor circuits and emotional states become activated (Freedberg & Gallese, 2007; Gallese, 2014, 2017, 2018; Gallese & Gattara, 2015). Freedberg and Gallese (2007) have introduced the embodied simulation theory of empathy in the aesthetics apprehension of artworks. This theoretical background, explaining the empathetic reactions of the audience through the embodied simulation theory involving mirror neurons, traces its origins back to Vischer's *Einfühlung* theory.

Embodied simulation theory links aesthetic experience with motor activity and related embodied mechanisms in the brain (Freedberg & Gallese, 2007; Umiltà et al., 2012; Gallese & Gattara, 2015; Sbriscia-Fioretti et al., 2013). Briefly stated, embodied simulation is the functional mechanism of the brain-body system triggered by mirror neurons, which are activated when observing someone else. Thus, it allows direct access to other people's emotions, actions, and intentions (Gallese, 2014, 2017, 2018; Gallese & Gattara, 2015). Moreover, mirror neurons represent only the perceptual facet of the embodied simulation. Yet, embodied simulation also occurs when we imagine perceiving something or imagine doing something (Gallese, 2019, p.116). Di Dio et al. (2007) show participants both original artworks concerning golden ratio and modified versions of them. They measure the aesthetics appraisal of participants based on fMRI activation in related motor areas. They (2007) detect activation in the somatomotor and inferior parietal lobule during the aesthetic judgment of Renaissance sculpture in the absence of visual stimuli. The inferior parietal lobe is known to be active during the observation of actions done by others (Di Dio et al., 2007). This result indicates that observed movement in the sculpture evokes an active embodied simulation in observers' brains even without visual stimuli.

Visible traces of the creative person also play a role in triggering embodied simulation mechanisms. Umiltà et al. (2012) claim that viewers build an embodied simulation in their brain related to their aesthetic appraisal based on the visible traces of an artist's creative gestures. They experimented and measured participants' activation of cortical motor areas using EEG while watching a visual stimulus. They detected high activation in the motor cortex of participants who viewed high-resolution photographs of the original cuts by Lucio Fontana. However, they found no activation in other groups of participants who viewed two-dimensional representations of the original

cuts created in a drawing program. Participants also reported liking the original cuts more than the representational cuts based on their subjective reports (Umiltà et al., 2012). According to Umiltà et al. (2012), this difference arises from the embodied simulation triggered when viewing the original cuts, which visibly retain traces of the artist's creative gestures. In contrast, the representational lines, despite being based on the original artwork, do not evoke this simulation, as they lack visible indicators of the artist's embodied actions.

Battaglia et al. (2011) investigated corticomotor system activation during three conditions: (1) viewing an artistic representation (Michelangelo's *Expulsion from Paradise*), (2) imagining the painting, and (3) viewing a photograph of the same pose. They found high motor activity in the first two conditions—viewing and mentally rehearsing the painted action—but not in response to the photograph. This suggests that Michelangelo's artistic rendering conveys kinesthetic qualities that the real photograph does not. The study highlights that expressive features of the artwork—visible traces of the artist's creative gesture—play a role in triggering embodied simulation. It also suggests that imagining action may engage a multimodal mechanism shared with visual perception.

Other studies also link the embodied simulation with visual and motor experience. Cross et al. (2011) found that viewers' aesthetic judgments about dance performance are related to their ability to physically produce the movement they watch. While their brain activity was monitored via fMRI, they asked the naïve participants to evaluate the movements of professional ballet dancers according to their liking and their belief in physically reproducing the same movement. The results revealed that viewers aesthetically found more pleasing the movements that they think difficult to perform (Cross et al. 2011). Kirsch et al. (2013) observed that after a certain physical training, apprehension of a dance performance of the participants has increased because they can imagine themselves doing certain dance figures. They (2013) have also monitored that participants' motor neurons were activated not only performing the action but also watching or imagining that action.

In another study, Jola et al. (2012) showed that both visual experience and empathic abilities can enhance motor interaction in the mind when observing movements. Massaro et al. (2012) found that visual features such as color and dynamism affect the aesthetic appreciation of natural images, while in human content images, participants

focus on facial and bodily expressions regardless of color and dynamism. Zhang et al. (2018) observed that landscape and non-landscape architecture photographs evoke similar aesthetic feelings, but strong aesthetic preferences were found for landscape architecture based on reaction times. They suggest that elements in landscape architecture, such as water, trees, and plants, evoke strong evolutionary implications, which can be associated with an embodied approach to beauty. Table 1 shows the summary of the research mentioned above.

Table 1.1 : Neuroscientific research related to embodiment.

Study	Authors (Year)	Art Type	Subjective Measures	Embodiment Measures	Methods
Art Moves Eyes	Massaro et al. (2012)	Landscape & Human Paintings	Aesthetic & Movement Judgments	None	Eye-tracking
Visual-Tactual Contingencies	Ludden et al. (2009)	Industrial Products	Surprise, Familiarity, Certainty	Vocal/Facial Expression, Exploratory Behavior	Behavioral Observation
Dance Perception	Cross et al. (2011)	Dance	Liking, Physical Ability	Liking & Reproduction Confidence	fMRI
Haptic Exploration	Muth et al. (2018)	Haptic Story Books	Liking, Pleasingness, Complexity	Pleasant Feelings	Touch Scale, Imagery Survey
Abstract Art & Motor Activation	Umiltà et al. (2012)	Abstract Art	Aesthetic Appraisal, Familiarity	Movement Perception, Personal Connection	EEG
Art Observation - Imagination	Battaglia et al. (2011)	Paintings	Imagery Vividness	None	fMRI
Classical Sculptures	Di Dio et al. (2007)	Renaissance & Classical Sculptures	Aesthetic & Proportion Judgments	None	fMRI
Landscape Architecture	Zhang et al. (2018)	Architectural Photos	Beauty, Familiarity, Complexity	None	Reaction Time
Dance Spectators	Jola et al. (2012)	Ballet & Indian Dance	Visual Experience, Physical Training	Empathy, Perspective Taking, Fantasy	fMRI

The definition of empathy in architecture, as framed within the scope of this thesis, aligns closely with the empathy observed in art appreciation, a concept extensively

explored by experimental neuroscience. This thesis develops and refines this definition specifically for architecture, drawing inspiration from existing art appreciation and neuroscience research. As an embodied phenomenon, architecture engages various brain areas across spatial, material, emotional, and multiple sensory dimensions, extending far beyond the visual domain (Mallgrave, 2010, p.159). Research examining the neural and behavioral responses elicited by architectural spaces or forms reveals similarities between the perception of space and the perception of art (Vartanian et al., 2013, 2014; Vecchiato et al., 2015; Banaie et al., 2017). Like art, architecture profoundly impacts its users, enabling architects to create environments that resonate intuitively with people. As Macarthur (2008) notes::

"The movement of architecture is still, it has the appearance of movement in painting, a fluidity without action, but this semblance also has a psychological explanation. Empathy exists between the stasis of buildings with the human body in stasis" (Macarthur, 2008, p. 481).

Stephan (2023) further explains that empathy involves a triangulation between an individual's consciousness, the shared world, and others' embodiment. To truly empathize with others, it is crucial to perceive their bodies or facial expressions and understand how they interact with their environment, whether real or imagined (Stephan, 2023, p. 9). In contrast to empathic engagement with art objects, when designing architectural spaces, there are no direct, perceivable spaces or people to engage with; instead, the engagement involves imaginary elements. The history of empathy teaches us not only about actual individuals and their responses to actual views but also about the imagination of these scenes (Freedberg, 2017, p.142). In other words, our ability to relate to hypothetical situations is also a form of empathy.

Envisioning the user's experience in an imagined space requires a deeper connection between the object, space, and atmosphere. Hutchins (2008) underscores that imagining a trajectory across a perceptible space is fundamental to the more complex practice of superimposing an imagined trajectory onto an entirely conceptualized space. This process involves envisioning a path or route in a directly perceived space and overlaying an imaginary path or route on a fully imagined or conceptualized space. Stephan's definition of empathy can be paraphrased as a triangulation between the designer's consciousness, the designed world, and the users' embodiments. The empathetic engagement of designers facilitates the creation of environments that evoke

emotions, enhance experiences, and foster a profound sense of connection and belonging. The subsequent section will explore empathy in detail from the perspective of neuroscience.

2.3 Empathy in Architecture: Insights from Neuroscience

Architecture is an embodied phenomenon that engages various brain regions across spatial, material, emotional, and sensory dimensions, extending well beyond the visual (Mallgrave, 2010, p. 159). Research into the neural and behavioral responses elicited by architectural spaces has also revealed parallels between the perception of space and the perception of art (Vartanian et al., 2013, 2014; Vecchiato et al., 2015; Banach et al., 2017). For instance, Vartanian et al. (2013) found that the aesthetic evaluation of visual stimuli, such as paintings and sculptures, shares a common neural network with the evaluation of architectural beauty. Architecture affects users similarly to art, allowing architects to design spaces that resonate intuitively with individuals.

Especially inspired by the philosophical foundations of 19th-century empathy theories, this interdisciplinary discourse has led to increased academic interest in understanding the complexity of perception of space from an embodied, multisensory perspective (Gallese & Gattara, 2015; Paterson, 2014; Mallgrave, 2015; Papalle et al., 2016). This embodied approach to architecture can be explored through two key aspects: the user's experience within architectural spaces and the designer's experience during the creation process. Users engage with architecture through embodied actions, while designers express architectural concepts through their own embodied experiences. Vartanian et al. (2013) highlights the need for further research, noting the scarcity of studies on how the physical characteristics of architectural spaces influence psychological well-being, despite the considerable amount of time people spend indoors. This indicates a critical gap in understanding how various sensory experiences, beyond the visual, affect our psychological states and emphasizes the importance of integrating neuroscientific insights into architectural design practices.

Neuroscience's collaboration with architecture has significantly enhanced our understanding of how users react to various architectural settings and geometries. The studies investigating embodied simulation and the embodied experience in architectural space perception parallel research in art perception. For example, Vartanian et al. (2013) revealed that contours in architectural spaces significantly

affect beauty judgments but have a limited impact on approach-avoidance decisions. Their subsequent study (2014) highlighted that ceiling height enhances aesthetic appreciation, though it did not activate emotion-related brain regions, suggesting that spatial cognition might be a key factor in aesthetic preference. Vecchiato et al. (2015) further contributed by demonstrating that familiar and comfortable features in architectural settings activate cerebral circuits related to presence and sensorimotor integration, using EEG to explore how different room settings affect the brain's response to architectural spaces. Banaeia et al. (2017, 2019) extended this understanding by exploring how geometric forms and personality traits influence emotional responses to architecture, finding that neuroticism and other personality factors modulate preferences and emotional reactions to various architectural shapes. The research suggests that empathy in architecture extends beyond merely understanding users' immediate responses; it involves anticipating how different spatial features interact with individual personalities and emotional states.

Elbailuomy, Hegazy, and Sheta (2017) investigate the influence of architectural spaces' geometric forms and construction materials on brain waves that affect the user's state of consciousness. They presented participants with spaces created from basic geometric shapes, including squares, circles, rectangles, and their combinations, constructed from concrete, steel, wood, and glass. The results indicate that different geometric forms and materials emit distinct resonance waves that influence the user's level of consciousness. While this study made a significant contribution to understanding the effects of geometric forms and materials, it, like the earlier study by Banaeia et al. (2017), had to simplify the complex structure of interiors within a laboratory environment. As a result, it presented a very basic form of architectural geometry to the participants.

Coburn (2020) recently contributed additional insights by identifying coherence, fascination, and hominess as key factors in aesthetic judgments of architectural spaces. Coherence reflects the ease of organizing a scene, fascination relates to its richness and interest, and hominess indicates the personal connection to space. These factors align with the idea that spatial qualities can profoundly affect emotional and cognitive responses, further integrating into the concept of empathy in architectural design. These findings integrate with the broader discussion on empathy in architectural

design by emphasizing the complex interplay between spatial characteristics, emotional responses, and individual differences.

In more recent research, Gregorians et al. (2022) employed first-person-view videos simulating travel through built environments to investigate the relationship between affect and architectural experience. Their findings confirmed a significant association between valence and the dimension of fascination, one of the three key psychological components of architectural experience identified by Coburn et al. (2020)—namely, coherence, fascination, and hominess. Similarly, Khaleghimoghaddam (2021) found that architectural settings significantly influence users' emotional and cognitive responses, including their aesthetic judgments and decision-making processes. Using functional magnetic resonance imaging (fMRI), the study explored the neural underpinnings of emotional experiences in architectural settings. It sought to determine whether pleasant and unpleasant architectural environments could stimulate brain regions associated with emotions. By measuring blood oxygenation level-dependent (BOLD) responses, the research identified the cortical and subcortical areas engaged during the emotional perception of architecture. The findings revealed that the emotional-perceptual experience of architectural spaces activates brain regions related to sensory processing, meaning-making, judgment, and emotional valuation.

Consequently, neuroscientific approaches to architectural design introduce a user-centered paradigm, addressing the limitations of vision-dominant perspectives. The reviewed studies predominantly focus on the emotional effects of geometric forms on users, employing subjective surveys and brain imaging techniques such as fMRI and EEG to gather data. Other research also accounts for user characteristics by incorporating subjective feature tests, further enriching our understanding of embodied experiences. Table-1.2 presents the method, approach and techniques used in the given literature.

As highlighted in the literature review, recent years have witnessed an increased collaboration between neuroscience and architecture, resulting in numerous studies investigating the psychological and cognitive dimensions of how architectural spaces are perceived. However, a significant challenge within these neuroscientific approaches is the tendency to simplify complex architectural environments into a limited set of variables suitable for laboratory analysis (Vartanian et al., 2013).

Table 1.2 : Method, approach and techniques used in the given literature.

Study	Authors (Year)	Architectural Elements	Subjective Measures	Embodiment Measures	Method
Contour Effects	Vartanian et al. (2013)	Curvilinear vs. Rectilinear Forms	Pleasantness, Beauty	Approach-Avoidance Decisions	fMRI
Ceiling Height & Enclosure	Vartanian et al. (2014)	Ceiling Height, Perceived Enclosure	Beauty, Pleasantness	Approach-Avoidance Decisions	fMRI
Virtual Environments	Vecchiato et al. (2015)	Rectangular vs. Curvilinear Forms	Familiarity, Comfort, Pleasantness	Embodiment, Affordances	EEG
Curved vs. Angular	Silvia & Barona (2009)	Curved vs. Angular Lines	Liking, Balance Preference	None	Behavioral Tests
Geometric Spaces	Shemesh et al. (2017)	Square, Round, Sharp, Curvy	Beauty, Safety, Pleasantness	Liking, Efficiency Perception	EEG
Material & Form Impact	Elbaiuomy et al. (2018)	Geometric Forms & Materials	None	None	Brain Wave Analysis
3D Architectural Forms	Banaei et al. (2017)	Naturalistic 3D Forms	Pleasure, Arousal, Dominance	Self-Assessment (SAM)	MoBI, EEG
VR Interior Forms	Banaei et al. (2019)	Linear vs. Curved 3D Forms	Pleasure, Arousal, Dominance	Self-Assessment (SAM)	VR, Personality Model
Interior Aesthetics	Coburn et al. (2020)	Coherence, Fascination, Hominess	Beauty Judgments	Approach-Avoidance Decisions	fMRI
Architectural Experience	Gregorians et al. (2022)	Fascination, Coherence, Complexity	Beauty, Pleasure, Valence	Arousal	First-Person Videos
Emotional Architecture	Khaleghimoghaddam (2021)	Pleasant vs. Unpleasant Environments	Emotional Behavioral Experience	Emotional-Perceptual Experience	fMRI

Jelić (2016) emphasizes the need for a systematic and coherent framework to shift from a disembodied architectural model toward one that recognizes users as fully embodied experiencing subjects.

This thesis aims to address an important gap identified in literature: the integration of both perception and creation of architectural space as unified, interconnected processes. While the perception of space has been widely explored, the design or creation aspect has not been sufficiently emphasized. By simultaneously addressing both aspects, this thesis seeks to bridge the existing gap between user experience and architectural design practice. Next section explains the conceptual and operational gaps in empathy in design research in detail.

2.4 Empathy in Design Research: From Concept to Application

As an essential human attribute, empathy fosters connection and understanding of user, making it a critical focus in design research. Empathy is a complex construct, making reaching a consensus on a single definition difficult. Given the complexity of human empathy, understanding it requires contributions from multiple disciplines, including evolutionary psychology, comparative psychology, developmental science, social psychology, neuropsychology, and cognitive neuroscience (Decety & Jackson, 2004). With recent discoveries in neuroscience and social psychology, empathy has recently gained a unique place in design research.

Current definitions of empathy in design research are primarily drawn from concepts in social psychology and neuroscience. Empathy in design is defined as processes that encompass both affective experiences and cognitive processes (Hess & Fila, 2016; Kouprie & Sleeswijk Visser, 2009). Cognitive empathy involves creating a theory about another's mental state and taking their perspective intellectually, a process often associated with the theory of mind (Shamay-Tsoory, 2011). Therefore, it is mainly associated with perspective-taking in design (ChangArana et al., 2020; Hess & Fila, 2016). On the other hand, affective empathy refers to more subconscious and autonomous processes in the design process.

Conversely, affective empathy is the ability to feel emotions in response to other people's experiences or to sense a "fellow feeling" (Shamay-Tsoory, 2011, p.18). For Kouprie and Sleeswijk Visser (2009), empathy in design involves both an immediate emotional response to another's affective state (affective empathy) and the ability to intellectually understand and reflect on this state from the other's perspective (cognitive empathy). They (2009) propose a four-phase framework comprising discovery, immersion, connection, and detachment. This framework emphasizes the

designer's journey into and out of the user's life. The designer's willingness is crucial, with the discovery phase fostering curiosity and motivation, the immersion phase enabling empathic processes, the connection phase involving emotional resonance, and the detachment phase allowing the designer to generate ideas that better align with the user's world.

Similarly, Hess and Fila (2016) define empathy as a multifaceted process encompassing both affective experiences and cognitive processes, highlighting its potential to be primed automatically or within the subconscious. For them (2016), either in isolation or concurrently, empathy generally has a cyclical relationship. Although, in theory, a distinction is made between cognitive and affective empathy, these components are interrelated and cannot be separated in practice (Kouprie & Sleeswijk Visser, 2009). Recent evidence suggests that each empathetic response may still elicit both the emotional and cognitive systems for empathy, even though these systems are separate (Shamay-Tsoory, 2011). Emotional and cognitive empathy commonly coexists in empathetic experiences, illustrating how intricate and varied empathy is as a psychological phenomenon.

Recent studies that attempt to conceptualize design-specific empathy through comprehensive reviews of psychology and neuroscientific literature propose new concepts (Anti et al., 2022; Chang Arana et al., 2022). Anti Surma-aho and Holttä-Otto (2022) integrated insights from both physiological and neuroscientific literature for better operationalization of empathy in the design context. They define five core concepts: empathic understanding, empathic design research, empathic design action, empathic orientation, and empathic mental processes. For instance, Chang Arana et al. (2022) focused on key concepts derived from psychology to provide explicit definitions and rigorous methods to address its broad and loosely defined nature as an umbrella construct. They (2022) point out that the effectiveness of empathic design methods is not always apparent, questioning how much empathic design is due to top-down control—where designers consciously try to be empathic—and how much is influenced by factors such as the type of stimuli, or the designer's trait or state influences.

Empathy in design is not only significant in practice but also in education. Hess, Strobel, and Brightman (2017) explored the causes and nature of changes in perspective-taking among engineering students. They found that peer interactions,

particularly the sharing of diverse perspectives, are crucial in developing empathetic perspective-taking tendencies. This indicates that educational settings can significantly influence the development of empathy through structured interactions and discussions. Similarly, Surma-aho, Björklund, and Hölta-Otto (2018) investigated novice designers' empathy in the early phases of design projects. Their findings align with Gerace et al. (2013) and Hess and Fila (2016), demonstrating that perspective-taking is centered on understanding others. However, they also observed that novice designers explicitly connect user actions to their design decisions while focusing on understanding others. This highlights the practical application of empathy in design processes, where understanding user needs translates directly into design solutions.

Ultimately, while the components and creation of empathy may need to be more well-defined, all depictions of empathy in design agree on achieving a comprehensive understanding of the user (Chang-Arana et al., 2020). It plays a pivotal role in both design practice and education. Empathy allows architects to envisage how users might interact with the environment in architectural design. However, existing design literature predominantly focuses on the interaction between the user and the product, often neglecting the spatial encounter that designers act upon or create. This study examines how architects engage empathically with spatial environments, broadening the scope of empathy research to include the spatial dimension.

The following Chapter "Empathy in Action," explores the multifaceted nature of design cognition and its connection to empathic engagement in architecture. Building upon insights from neuroscience and architectural cognition, this study develops its own methodology tailored specifically to design cognition. The following section expands on the role of empathy within design research, exploring how research in empathy research can be effectively integrated into architectural design processes.

3. EMPATHY IN ACTION

This chapter serves as a conceptual bridge between the theoretical perspectives outlined in Chapter 2 and the methodological framework developed in Chapter 4. While Chapter 2 provided a broad literature review of empathy—tracing its evolution across psychology, phenomenology, and neuroscience—this chapter narrows the focus to empathy as it emerges through the cognitive and bodily actions of architectural designers. By framing design as both a reflective and embodied practice, the chapter establishes a theoretical foundation for the empirical strategies adopted in this research.

These theoretical perspectives directly inform the study's methodological choices, such as the use of think-aloud protocols, video-based movement analysis, and the segmentation of design protocols. In doing so, this chapter sets the groundwork for examining how empathy can be operationalized and studied in real-world design processes—not as a static trait, but as a dynamic and situated phenomenon.

The architectural design process is a complex interplay of cognitive, emotional, and physical engagement, shaped not only by abstract thinking but also by bodily interaction with representations such as sketches, gestures, and spatial imaginaries. Building upon the early twentieth-century aesthetics of empathy, social psychology, and experimental neuroscience introduced in the previous chapter, *Empathy in Action* explores how these traditions converge within contemporary design cognition.

Section 3.1, *Design as a Reflective Practice*, explores how designers engage in reflective dialogues with their work, drawing on Schön's (1987) theory of reflection-in-action and Goldschmidt's (1991) visual dialectics of sketching. This section illustrates how moments of empathy can arise through iterative design reasoning and interaction with evolving design representations.

Section 3.2, *Knowing Body in Action*, shifts the focus to the embodied aspects of design thinking. Drawing from research in cognitive science and embodied cognition,

it argues that design cognition is not solely a mental operation but is enacted through bodily experience and sensorimotor engagement with space and materials.

Together, these sections articulate the theoretical framework through which this thesis conceptualizes empathy—not as a detached, intellectual understanding of the user, but as a situated, embodied, and iterative process inherent in design thinking. This framing provides the foundation for the methodological approaches discussed in Chapter 4, which aim to trace empathy as it manifests in both the perception and creation of architectural space.

3.1 Design as a Reflective Practice

Design activity is a multifaceted process requiring multiple cognitive layers. Within the field of design cognition, the situated and exploratory view of design (Schön, 1987; Schön & Wiggins, 1992; Goldschmidt, 1991; Suwa & Tversky, 1997; Goldschmidt, 2014) and the co-evolutionary view of design (Maher, 1996; Dorst & Cross, 2001) gained significant traction from the 1990s to the 2000s (Hay et al., 2020). Design activity is a complex process that requires many cognitive layers. In design cognition, the situated and exploratory view of design (Schön, 1987; Schön & Wiggins, 1992; Goldschmidt, 1991; Suwa & Tversky, 1997; Goldschmidt, 2014) and the co-evolutionary view of design (Maher, 1996; Dorst & Cross, 2001) became widely accepted from the 1990s to 2000s (Hay et al., 2020). There are various models in the literature that attempt to explain the cognitive processes underlying design activities, differing primarily in how they conceptualize design. Different models in literature explain the thinking process behind the design activity. Essentially, these models vary depending on how they define the design.

Herbert Simon's (1973) definition of design as a problem-solving activity is one of the most potent models that is still valid today. According to Simon, the design problem needs to be defined, and the designer must search for the best solution among many possible solutions. For Simon (1973), ill-structured problems can be well-structured with certain transformations. The problem can be decomposed into smaller and more manageable sub-problems, or the solution space can be narrowed down by adding related data to the problem space. The best solution is sifting through various solution sets to move the given situation into the desired situation (Simon, 1996). Following Simon, Eastman (1969) examines participants' cognitive and behavioral processes

from a problem-solving perspective through a protocol study. Eastman, like Simon, believes that ill-defined problems can be well-structured with partial specifications and re-identification of the problem. His study reports on a sequential cognitive activity between the given problem set and the desired state. The protocol study reveals the subjects' problem identification and decomposition process in their problem-solving strategies. The problem-solving approach presents a rational reasoning process and search strategies that exclude design as a mysterious creative activity.

Another equally accepted model introduced to the design literature by Schön (1987) is "reflection in action." For Schön, design is a process of discovery that can only be solved during the action. Learning and doing are inseparable in his view of design. Design knowledge emerges during the action, and designers access their knowledge in doing (Schön, 1992). Sketching is regarded as a unique form of visual reasoning. For Schön (1983), the design idea develops back-and-forth talks between the designer and her sketches. He calls this process a "reflective conversation" in which the designer produces knowledge and reframes the problem to move further (Schön, 1983; Schön & Wiggins, 1992). Designers engage with their designs through reflective conversation, which enables them to forge a distinctive and dynamic path for solving problems and develop the design idea organically through the interplay of action, reflection, and creation. He describes this process as a cycle that goes see-move-see. In seeing, the designer ascribes meaning to what she sees, "detects," "discovers," and "appreciates" or makes a judgment (Schön, 1992, p133). A move for Schön is "a shift from one drawn configuration to another" or transformation in the drawing (Schön, 1992). According to this definition, the design idea constantly evolves through the see-move-see cycle.

"Goldschmidt, like Schön, considers design to be an experimental process that can be revealed by examining the activities of human designers. She (1991) introduces two reasoning modalities in sketching—seeing as and seeing that—to describe the systematic dialectic between designers' thoughts. This dialectic fundamentally refers to the oscillation of designers' thoughts between those two modes. "Seeing as" refers to pictorial discourse, while "seeing that" involves non-figural arguments about the designed item. In essence, the designer interprets what they see ("seeing that") in the sketches as something else ("seeing as") through interactive imagination. Goldschmidt examines this dialectic pattern using the smallest units of design reasoning: "design

moves" and "design arguments." A design move is a coherent operation within a design situation that transforms the design state into a relatively different state (Goldschmidt, 2014). A design move may encompass several design arguments, the most minor semantic units. Unlike Schön's definition, a design move, in Goldschmidt's terms, does not necessarily involve an actual action; seeing can also constitute a design move if captured in think-aloud protocols (Goldschmidt, 2014).

Lastly, the co-evolutionary view of design is another widely accepted view introduced to design literature. The co-evolutionary view of design, initially proposed by Mary Lou Maher, describes the interaction between a design problem and its potential solutions, likened to the evolutionary fitness of two closely linked species (Maher, 1994; Wiltchnig & Christensen, 2013). In the co-evolution model, design practitioners alter the design problem by exploring possible solution sets until the problem and solution set are joined by an emergent bridge (Drost & Cross, 2001). This approach suggests that the problem and solution evolve together rather than sequentially. Similarly, Simon compares the design process to natural evolution, characterized by alternating cycles of generation and evaluation (Schaathun, 2022). Schön (1987) further emphasizes this cyclical nature, describing design as a reflective conversation in which designers continually reframe the current situation, leading to new insights and solutions. This iterative process, driven by trial and reflection, ensures the ongoing evolution of the design idea. According to Dorst and Cross (2001), in contrast to the linear problem-solving approach, the problem is continually redefined in the co-evolutionary process, allowing new solutions and knowledge to emerge.

The recent models offered by Drost (2019) explore the co-evolutionary model both from problems solving and reflective practice perspectives. From the rational problem-solving perspective, the design process consists of five steps: briefing, analyzing, synthesizing, simulating, and evaluating. Correspondingly, design criteria are determined in the analysis based on the brief provided. Then, solution sets are created in the synthesis stage, and following that, whether the solution sets meet the design criteria are tested in the simulating stage. Finally, the best solution is chosen during the evaluation. If the solution is not good enough, the process iterates back to solution alternatives. When there is a need to introduce new criteria, it is sometimes necessary to go back to the analysis and redefine the problem (Kruger and Cross; Drost, 2019).

Dorst (2019) proposes a second model as an alternative to the rational problem-solving model, based on Schön's definition of design as reflective practice. In this model, there are multiple reflective loops where designers explore different dimensions of the problem leading to the solution. He (2019) models the process as naming, framing, moving, and reflecting (Figure 3.1) based on Schön's design view. In the problem-solving perspective, the problem is given, yet in reflective practice, the designer names the situation and ascribes a meaning or value to it (Dorst, 2019). Reframing is essential to reflective practice since the designer sees the problems differently each time. According to Dorst and Cross, “a creative event occurs as the movement of insight at which a problem solution pair is framed: as Schön called ‘problem reframing’ (Dorst & Cross, 2001, p. 435). The reflective practice model offers a more detailed framework than the problem-solving model in the early design process (Dorst, 2019).

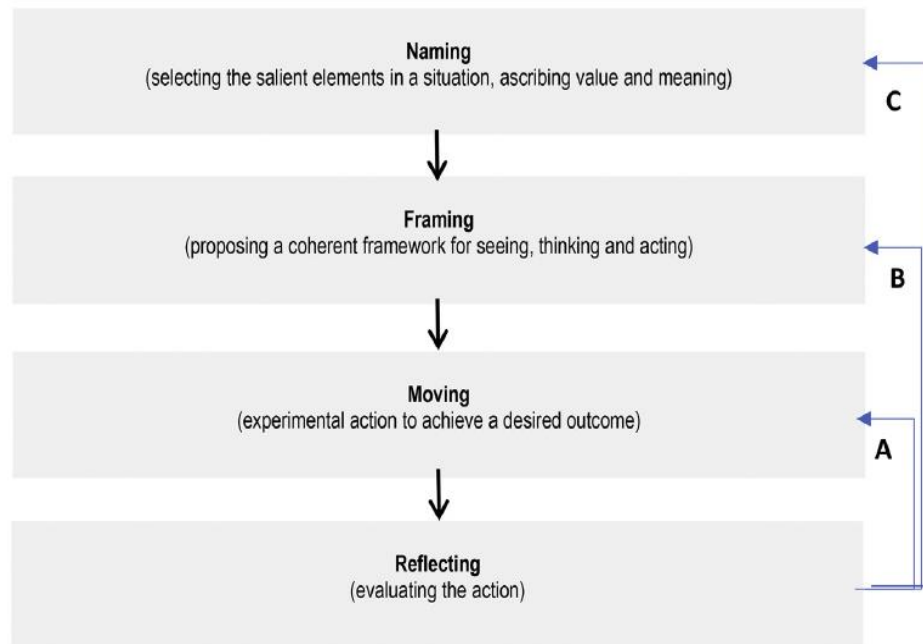


Figure 3.1 : Modeling design as reflective practice (reflection-on-action) (Dorst, 2019)

Consequently, empathic engagement occurs during the reflective conversation, as described by Schön, while envisioning the space and its experience. Pallasmaa (2017) articulates this dynamic as a constant interplay between external physical environments and internal mental and neural realms, akin to the seamless continuity of a Moebius strip's single surface (p.140). This fluid exchange between the abstract and the imaginative is what this thesis refers to as *empathic engagement* in the creation

of architectural space. Through the designers' dialogue, this thesis sought to define empathy specific to architecture, oscillating between the material and mental worlds.

3.2 Knowing Body in Action

Designers deal with several visual and spatial processes during the design process which requires often higher embodiment with objects, space or atmosphere. Recent studies have expanded the understanding of cognitive experience, incorporating insights from embodied cognition emphasizing the role of the body in shaping the mind. Theorization of the 4E of the cognition, which is embodied, enacted, embedded and extended is linked with several cognitive theories including ecological view of perception (Gibson and Gibson, 1982), grounded cognition (Barsalou, 2008) and embodied cognition (Nöe, 2004; Clark, 2008). James and Eleanor Gibson's ecological perspective of perception, which is assumed as an important cornerstone in the theorization of embodied cognition. Gibsons' ecological view differs from traditional cognition theories, which the sensory input is perceived by observer and processed by the brain. According to ecological view of cognition perception and action is structurally coupled, whereby “perception obtains information for action, and action has consequences that inform perception about both the organism itself and the events that it perpetuates” (Gibson, 1997: p. 25; Adolph and Kretch 2015). According to Gibson (1982), an affordance is an object's functional property relative to an agent, defining the sum of possible actions involving the object. Affordances simultaneously constrain and enable behavior.

Furthermore, research has shown that our previous physical experiences with material (Groth et al., 2015), bodily gestures (Alacam and Cagdas, 2016), and physical interactions with design artifacts influence cognitive processes during design (Lindemann et al., 2020). Groth et. al (2015) show that designers use embodied knowledge in processes, including direct interaction with the material and abstract processes. Alaçam and Çağdaş (2016) show that the body supports cognitive processes in design as a successful interface to represent visual gestures related to spatial properties. Gursoy and Ozkar (2015) investigate the making as an integral part of the thinking process in design, in contrast to the general distinction between thinking and making. Similarly, Schwartz (2016) suggests critical making as a reflective and generative design tool for architectural education. Groth et. al (2015) shows that

designers use embodied knowledge not only in processes including direct interaction with material but also in abstract processes. Groth and Makela (2016) DEE course suggest that the students' previous material experiences gathered through the body, guided them in material explorations even before the actual physical manipulation of the materials began. Moreover, results from their ethnographic study case study indicate that our mental images about objects include our previous physical experiences depending on the touch experience (Groth and Mäkelä, 2016). Lindemann et al. (2020) explored how bodily movements and physical interactions with design artifacts influence cognitive processes during design. Their findings suggest that design cognition is not merely a mental activity but is deeply rooted in physical experiences and interactions. Ultimately, those findings suggest that design cognition is not merely a mental activity but is deeply rooted in physical experiences and interactions.

3.3 Conclusion: Searching Empathy in Reflective Practice

Design cognition has established itself as a distinct research field by developing methodologies tailored to design practice, aimed at understanding the intellectual, embodied, and intuitive processes of designers. Over the years, this field has broadened to investigate not only individual designers but also design teams, design processes, evolving design artifacts, and ultimately, the users who engage with them (Hay et al., 2020). It encompasses a wide range of topics including design reasoning, patterns of thought, divergent and convergent thinking, design fixation, creativity, visual reasoning, co-evolution of the problem and solution space, and collaborative design—often supported by specialized methodological tools (Gero & Milovanovic, 2020).

According to Hay et al.'s (2020) structured review of major design journals over the past 15 years, the emerging research themes in the field include conceptual and creative design, design processes, methods and tools, artifact attributes, cognitive models, design dynamics, collaborative design cognition, and socio-cultural contexts. Despite this rich and expanding body of work, empathy remains an underexplored domain—especially in relation to the early stages of design and the lived, bodily experience of architectural space.

This thesis aims to address this conceptual and methodological gap by focusing on empathy within early-stage design cognition. It investigates how empathy emerges as architects perceive and create space, analyzing design protocols to trace moments of empathic engagement. In particular, it explores how empathy manifests during reflective dialogues with representations—such as sketches, gestures, or mental images—suggesting that empathy can be embodied and enacted during the design process itself.

By grounding its methodological choices in the theoretical perspectives of reflective and embodied design cognition presented in this chapter, the thesis establishes a coherent framework for empirical investigation. The next chapter outlines the research methodology in detail, describing how think-aloud protocols, movement-based coding, and multi-stage experimental settings are employed to examine the perception and creation of architectural space. These methodological approaches are not only informed by but also operationalize the conceptual assumptions introduced in this chapter. Together, they lay the groundwork for analyzing the dynamic interplay between empathy, design cognition, and architectural experience—both from the perspective of the observer and the creator.

4. METHODOLOGY

This chapter outlines the methodologies employed in this dissertation to explore the implicit dimension of empathy in the perception and design process of architectural space. It provides a detailed account of the research design, data collection, and data analysis methods, demonstrating their relevance to the study's aims and objectives. Additionally, this chapter introduces two pilot studies designed to refine the research methodology and overall design. Insights obtained from these preliminary studies informed adjustments to the experimental procedure and yielded initial evidence on how individuals empathically engage with visual and spatial stimuli. Consequently, these pilot studies laid the foundation for the experimental settings employed in the perception and design phases.

4.1 Research Design and Approach

This research adopts a mixed-method approach that combines qualitative protocol analysis with trait-based empathy assessment to explore how empathy manifests in the perception and design of architectural space. The methodology is grounded in a theoretical framework that integrates insights from *Einfühlung* theory, embodied simulation (Freedberg & Gallese, 2007), and social cognition, and culminates in the development of the Feeling AS Framework. The study proceeds through a sequence of pilot and main studies, each contributing iteratively to the framework's refinement and empirical validation.

Design research has primarily adopted methods from social psychology and neuroscience, such as self-reports (Surma-aho et al., 2018; Apfelbaum et al., 2021) and performance-based measures like empathic accuracy (Chang-Arana et al., 2020; Li et al., 2021). Empathy in design is challenging due to the need for coherent conceptualization, making it difficult to specify how it functions within the design process (Surma-aho & Holttä-Otto, 2022; Hess & Fila, 2017). Despite these complexities, some research has developed or adapted measures for design contexts. For instance, Hess et al. (2017) created the Empathy and Care Questionnaire (ECQ)

for engineers, and Li et al. (2021) developed a shortened version of Ickes' (2001) empathy accuracy test for design purposes. Surma-Aho et al. (2018) highlighted challenges with the general language of scales in specific contexts and potential biases in self-report methodologies. Gero and Milovanovic (2020) proposed three approaches to measure design cognitive processes: design cognition (focusing on designers' minds), design physiology (examining designers' bodies), and design neurocognition (analyzing designers' brains). These approaches enhance our comprehension of design thinking by employing empirical methods to investigate cognitive activity during the design process.

A review of existing design literature reveals that many studies have primarily adopted methods from the social sciences, particularly self-report tools (Surma-Aho et al., 2018; Alzayed et al., 2021; Apfelbaum et al., 2021) and qualitative analyses (Smeenk et al., 2016; Hess & Fila, 2017; Altay, 2017), focusing on designers' thought processes, which largely align with the 'design cognition' approach. In some cases, studies have combined self-report measures with qualitative analyses to achieve a more comprehensive understanding of empathy in design, such as using the IRI with content analysis to assess behavioral empathy in student design teams (Apfelbaum et al., 2021) and tracking changes in empathy across design stages (Alzayed et al., 2021).

In addition to these different approaches, a method specific to this thesis study has been developed by utilizing existing methods in the design of cognition and experimental neuroscience. The research includes two pilot studies and two main studies, structured into two phases: Perception and Design.

- Pilot Study I (N=7) focused on participants' engagement with figurative and abstract paintings in a museum setting, aiming to explore how trait empathy correlates with narrative, perceptual, emotional, and technical/artistic responses.
- Pilot Study II (N=22) replicated and extended this approach in a classroom environment with a larger group of design students, addressing methodological limitations of the first pilot and validating the analysis procedure.

The two main studies expanded the focus to architectural contexts:

- Perception Phase (N=26) examined how participants perceive atmospheric qualities in architectural images.

- Design Phase (N=16 same individuals from perception phase) investigated how empathy manifests during the act of designing, using think-aloud protocols to analyze the cognitive-emotional flow in the design process.

Main experiments in perception and design phase is aimed to address the primary research question of this thesis: "How do architects engage empathically with spatial environments during the perception and design of architectural space?"

Participants provided verbal data through think-aloud protocols, followed by subjective reports collected via survey questions developed on a Likert scale. Finally, the Turkish-translated version of the Empathy Quotient Test was employed to assess participants' social empathy. The only exception to this procedure was that a survey was not conducted in the design phase.

This thesis develops an empathy framework called “Feeling AS” to search for empathy in the perception and creation of architectural spaces, which is informed by literature and a series of experiments. By integrating design cognition methodologies with empathy studies, this thesis aims to provide novel insights into the interplay between cognitive processes and empathetic understanding in design. This approach enriches our understanding of the cognitive dimensions of design and bridges the gap between design cognition and empathy research.

4.2 Language as Architectural Representation

This thesis employs an approach that aligns with studies viewing verbal communication as a critical aspect of design activity (Dong, 2004; Dong, 2007; Dong, 2006; Luck, 2009; Murphy, 2012). The focus on verbal communication in design research and the research methods using verbal expressions is the recognition that language is part of 'doing' (designing) and 'thing done' (the designed work) (Dong, 2007, p.6). Language is a vital indicator of emotions. As Dong (2006b) suggested, the concept of design is imprinted on language both explicitly and implicitly, so language begins to structure the mode of its realization (p.11). Other design elements are also visible in conversations. According to Luck, depicting aesthetic experiences through drawing is challenging. The aesthetic experience of space is most visible in real-time conversations, rather than drawings, through speech and gestures (2014). Consequently, employing language as a method of expression is often more accessible

than physiological or bio-physiological explorations of various aspects of the design process (Dong, 2004; Dong, 2007; Dong, 2006; Luck, 2009; Murphy et al., 2012).

Using language in design research traces back to the pioneering protocol studies initiated by Eastman (1976), which gained prominence with Schön's (1987) concept of "reflective conversation." Eastman (1969) introduced the first protocol study to understand the human problem-solving process by observing a group of designers. In design cognition research, protocol studies are conducted to collect and analyze the designers' observable behaviors, activities, sketches, and verbal reports via audio-visual camera recordings. Two kinds of protocols are classified according to the reporting method: think-aloud protocols and retrospective protocols. Think-aloud protocols, where participants verbalize their thoughts during the design process, provide real-time data, although they face criticism for potentially obscuring cognitive processes (Tversky, 1997). Retrospective protocols, capturing verbal data after task completion, may lead to selective recall; however, showing participants their protocols can mitigate this issue (Tversky, 1997). Real-time reports are often deemed more accurate representations, as they offer immediate access to cognitive processes, avoiding delays associated with other documentation methods (Goldschmidt, 2012). Consequently, this thesis utilizes think-aloud protocol analysis, which is key for investigating designers' thinking processes while designing (Gero & Milovanovic, 2020), to search for empathic engagement of designers with architectural space.

The use of think-aloud protocols has facilitated a deeper understanding of empathy's implicit and spontaneous emergence during the early architectural design process. Sketching is integral to the reflective conversation where the designers think in action. Participants benefited from sketching while reasoning in talk-aloud protocols, allowing them to reflect on their thoughts visually and verbally. In other words, they express their thoughts while they are in action. The situated nature of the design (Schön, 1987; Goldschmidt, 1991) is enhanced during sketching, potentially enriching empathy. This approach suggests that tacit and automatic forms of empathy occur during architects' active sketching. Nonetheless, the analysis in this study utilized only verbal data for several reasons:

1-Language is an important indicator of feelings and thoughts, allowing architects to capture their thoughts, intentions, and emotions while drawing.

2- Verbal expression is a quick and easy way to access cognitive processes without the potential delays that come with other types of documentation.

3- Verbal communication is a universal and innate representational ability, thus allowing for a more equal understanding of participants' thought processes, regardless of their drawing abilities.

4- Language has more potential in depicting space. Certain architectural elements, such as atmosphere, materials, or light are difficult to depict in drawings.

In summary, the use of language in design research, mainly through think-aloud protocols, offers valuable insights into designers' cognitive processes and empathic engagement. Examining verbal expression and reflective conversation helps better understand the dynamic interplay between designers and their designs.

4.3 Data Collection Methods

The primary data collection methods for this study are protocol analysis, surveys, and empathy tests. Think-aloud protocols were employed to capture the real-time cognitive processes of designers during the design tasks. Two pilot studies were conducted to refine the research instruments and procedures. Following these, two main experiments were carried out, divided into perception and design phases. The perception phase involved 26 participants, while the design phase involved 16 participants, all of whom also participated in the perception phase.

4.4 Data Analysis

The primary objective of analyzing the data gathered during the design and perception phases is to understand the empathic relationships that participants establish with the space and its users through their verbal expressions. The verbal data gathered from the talk-aloud protocols is analyzed using the verbal analysis technique offered by Chi (1997). Verbal analysis is a methodology for qualitative coding that “tabulates, counts and draws” links between the occurrences of different types of expressions to reduce the subjectivity of verbal contents. (Chi, 1997, p2).

The selection of the verbal analysis technique for this study is driven by the need to comprehend the mindsets of the participants, rather than merely their problem-solving strategies. Chi (1997) outlines the following steps to be followed in verbal analysis:

1. Reducing or sampling the protocols.
2. Segmenting the reduced or sampled protocols (optional).
3. Developing or selecting a coding scheme or formalism.
4. Operationalizing evidence in the coded protocols by mapping it to a chosen formalism.
5. Depicting the mapped formalism (optional).
6. Identifying patterns in the mapped formalism.
7. Interpreting the patterns.
8. Repeating the process, possibly coding at a different granularity (optional) (Chi, 1997, p. 8).

In accordance with the verbal analysis techniques described in the literature, the verbal data were first transcribed into written reports. The duration of each participant's verbal recordings was approximately 45 to 65 minutes for the perception phase and 25 to 30 minutes for the design phase. The transcription of the verbal data from the protocols for a single participant required approximately 4 to 6 hours per phase.

Subsequently, the written reports were segmented semantically. Each segment was then coded according to the "Feeling As" framework, which was conceptualized for this study. While the structure of empathy may vary between the design and perception phases, "Feeling As" serves as a common code that encapsulates empathy in both contexts. In verbal analysis, coding is employed to quantify the qualitative content of verbal utterances, facilitating the analysis of the collected data. As noted by Chi (1997, p. 12), the development of the coding scheme is the most challenging aspect of verbal analysis, as the codes and formalisms used are entirely dependent on the researcher's theoretical orientation, the hypotheses or research questions, the task at hand, and the content area.

In summary, the data analysis in this study utilizes the verbal analysis technique to systematically explore the empathic interactions of participants during the architectural design and perception stages. The "Feeling As" framework, which emerged from the integration of literature findings with insights from a series of pilot studies and two main experiments, serves as the foundation for this analysis. Chapter 5 will present the pilot studies conducted as part of this research, while Chapter 6 will

detail the main experiments, focusing on the Perception and Design Phases. The procedures and analyses for each experiment are provided in their respective sections. The methodology adopted in this thesis study not only seeks to quantify verbal expressions but also aims to investigate the cognitive and emotional dimensions of empathy within architectural experience.

4.5 The Feeling As Framework: Empathy in Architectural Perception and Design

This section presents the *Feeling As* a framework, which is developed to capture the implicit and spontaneous emergence of empathy inherent in the perception and design of architectural space. The Feeling AS framework offers a comprehensive approach to understanding empathy in architectural perception and design, capturing the implicit and spontaneous emergence of empathy inherent in spatial experiences. Unlike approaches that view empathy as merely a cognitive disposition or that rely solely on predetermined user profiles, this framework conceptualizes empathy as an enacted, embodied, and often spontaneous mode of engagement that unfolds through the perception and creation of architectural environments.

The framework provides a comprehensive understanding of empathy that goes beyond predetermined user profiles or trait-based metrics, drawing insight early 20th-century empathy theories, phenomenological views on architecture, and recent insights from neuroscience (Figure 4.1).

1. Empathy in social cognition: The designer places herself in the user's position, *feeling as* the user.
2. Empathy in early 20th-century German aesthetic theory: The designer *feels as* if in the space and experiences its tactile and atmospheric features, including material, texture, and light.
3. Empathy in experimental neuroscience: The designer simulates or *feels* the movement that shapes space.

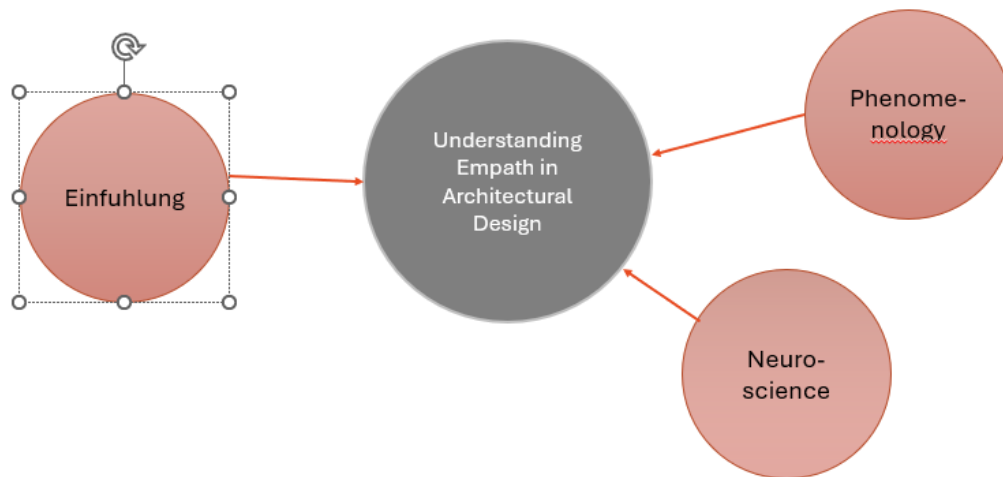


Figure 4.1 : Empathy framework integrates early 20th-century empathy theories, the phenomenological perspective on architecture, and insights from experimental neuroscience.

Although empathy in design is often described through metaphors such as “*taking the place of the other*” or “*integrating with the user*,” these metaphors capture certain aspects of the design process while overlooking others (Chang-Arana et al., 2022). The *Feeling As* framework, which is developed through a series of experiments and literature-based inquiry, is tailored to the unique demands of architectural design. Freedberg and Gallese’s (2007) theory of embodied simulation outlines four forms of empathic engagement in response to visual stimuli: (i) bodily resonance with gestures, movements, and intentions; (ii) recognition of observed emotions; (iii) simulation of bodily sensations; and (iv) empathy with the creator’s gestural traces served as the basis for the theoretical framework. These categories are adapted to the context of architectural design through the analysis of expressions collected during think-aloud protocols. This process led to the emergence of three central subcategories in the Feeling AS framework: Feeling As the User, Feeling As in the Space, and Feeling As the Movement.

As illustrated in Figure 4.2, the methodology is grounded in an interdisciplinary theoretical foundation, which informed both the development of the Feeling AS framework and the design of empirical studies. Accordingly, Feeling AS framework encapsulates designers' cognitive and embodied processes through three distinct but interconnected lenses of empathic engagement.

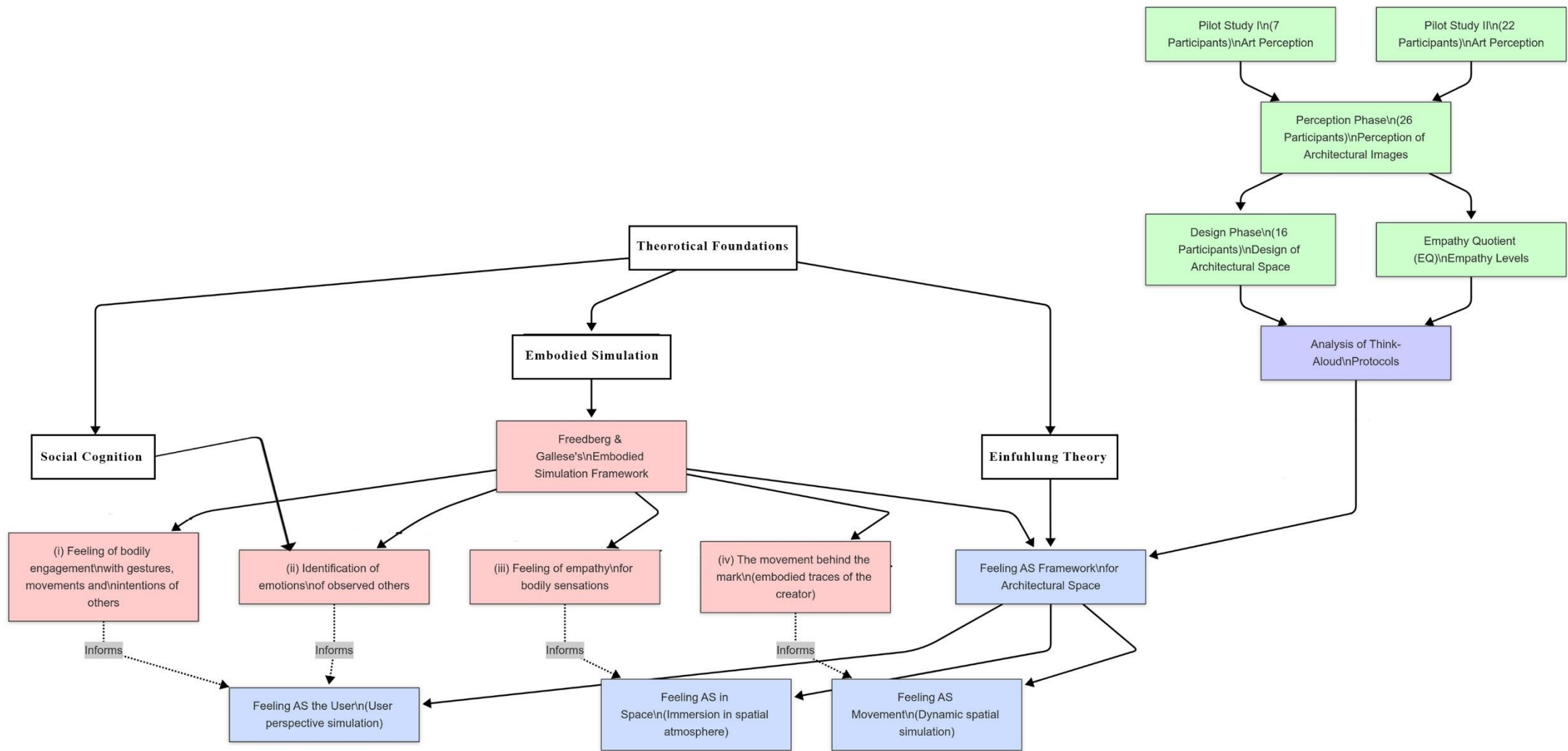


Figure 4.2: Development of the Feeling AS Framework: From Theory to Application Empathy FRAMEWORK

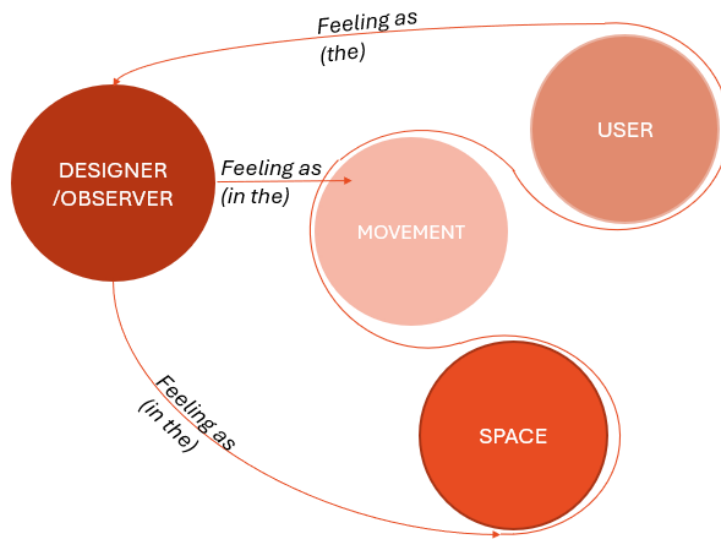


Figure 4.3 : Empathy Framework : Feeling AS in perception and creation of space

It encapsulates designers' cognitive and embodied process through the lenses of empathic engagement as they inhabit the user's perspective (Feeling As the User), immersing in the spatial atmosphere (Feeling As in the Space), and engaging in dynamic bodily simulation (Feeling As the Movement). These categories illuminate how designers translate embodied knowledge into spatial decisions. Figure 4.3 shows the empathy framework feeling as in perception and creation of space.

4.5.1 Feeling As (the) user: user perspective simulation

The Feeling AS framework's user dimension captures the designer's empathic ability to mentally simulate and adopt the user's sensory, emotional, and bodily movements. It requires simulating the user's bodily presence, anticipating their needs, and imagining how they might feel, move, and behave in a designed or perceived environment. Rather than relying on abstract user profiles or observational data alone, this form of empathy emerges as an enacted, embodied mode of perspective-taking, wherein the designer 'feels as' the user.

The user category resonates with Freedberg and Gallese's (2007) first and second modes of embodied simulation categories.

(i) The feeling of bodily engagement with the gestures, movements, and intentions of others, and

(ii) The identification of the emotions observed by others.

In "Feeling As the User," the designer does not merely reason about the user experience from a distance; instead, they simulate it viscerally and emotionally. Empathy thus operates as a cognitive process, a form of embodied imagination. As designers visualize users' bodies within space, they generate solutions responsible for users' physical, emotional, and social needs.

4.5.2 Feeling As (in the) space: immersion in spatial atmosphere

The second dimension of the Feeling As framework focuses on the designer's capacity to capture the concrete perception of atmospheric qualities such as style, materiality, spatial texture, and sensory ambiance. Unlike Feeling As the User, which involves adopting another person's perspective, this empathy mode requires a deep immersion in the space—refers to a space's overall sensory and emotive impression, including its mood and ambiance.

Feeling as Space closely aligns with the early 20th-century aesthetic theories of *Einfühlung*, particularly the idea of "projecting oneself into the space". It is not about seeing space through someone else's eyes—it's about being in the space yourself. In this sense, empathy is not directed toward another person but toward the emotive potential of the environment itself. Philosopher Gernot Böhme (2001) defines atmosphere as the relational field between subject and object. In other words, atmosphere does not arise from the perceiver or the object but from their interaction. Therefore, empathy with space requires sense and shape this relational field, which is called atmosphere.

The space dimension of Feeling As frameworks also resonates with the third component of embodied simulation described by Freedberg and Gallese (2007): the experience of emotions and sensations as if directly felt by the observer. They refer to Antonio Damasio's as-if body loop, wherein bodily states seen or implied in a visual stimulus are re-enacted through emotional and interoceptive brain circuits when perceiving a painting. Similarly, during the perception and design of space, the observer may simulate bodily presence and sensory experience as though physically situated within the imagined or observed environment. In architectural contexts, this manifests as immersion in spatial atmosphere, where designers engage with the

emotive potential of the environment itself, sensing and shaping the relational field between subject and object that philosopher Gernot Böhme calls "atmosphere."

4.5.3 Feeling As (in the) movement

The third dimension of the Feeling As framework emphasizes designers' ability to simulate and internalize dynamic qualities within static architectural space. While Feeling As the User refers to imagining how a specific user behaves, feels, or reacts in the space—emphasizing individual bodily experiences, emotions, or limitations—Feeling As the Movement refers to the designer's projection of choreographed, dynamic flow within the space. In other words, User Action is an empathic simulation of how the user moves. At the same time, Movement refers to how the designer shapes, directs or anticipates collective or programmatic flows through spatial forms.

As illustrated in the diagram, this dimension aligns with Freedberg and Gallese's fourth category: (iv) the movement behind the mark (embodied traces of the creator). Although architectural space appears static, it can generate kinesthetic responses through implied motion in form, enabling designers to engage in dynamic spatial simulation that anticipates how movement will unfold within the designed environment.

4.6 Coding Schema

A hybrid analytical approach was employed to construct the coding framework, integrating both priori codes derived from literature and emergent codes identified through the analysis of verbal data (Mamabolo & Myres, 2019). The resulting framework, named Feeling AS, was developed to examine designers' empathic engagement during both the perception and creation of architectural space.

The term "Feeling AS" reflects an empathic shift in perspective—experiencing the space as if one were another, or as if inside the space oneself. Each category corresponds to a specific aspect of designers' reflective engagement and imagination. Tables 4.1 present the detailed coding schema developed for the perception phase.

Table 4.1 : Coding Schema for Empathy in Perception Phase

Empathy Framework	Category	Definition	Example
Feeling AS	USER	Imagining oneself or others as the user of space, including actions, emotional responses, or practical needs. This may involve adopting either a first-person or third-person perspective.	Example 1: Honestly, I'm sure it's beautiful for a person. It's a bit of a cramped working environment for me. Example 2: "It seems easy to walk from place to place.
	SPACE	Feeling the atmosphere or overall emotional impression of the space, shaped by light, material, texture, layout, and design intention.	Example 1: It gives me such a warm feeling here, but I actually thought that the material used, concrete, would give me the opposite, cold feeling Example 2: You know, the house is not competing with nature there. It felt like they were trying to integrate them more.
	MOVEMENT	Sensing dynamic qualities or implied motion in static elements—such as light, shadow, air flow, or form transformation.	Example 1: Here is such an origami. Ceilings, walls, and stairs from the space as if they are folding. Example 2: In fact, it is like calling you to go and experience the place.

The Feeling As (the User) category captures participants' efforts to simulate users' needs, behaviors, and emotional states. This may involve adopting either a first-person or third-person perspective. In the design phase, the Feeling As (the User) category becomes even more layered—it includes not only imagining how someone might feel in a space, but also how the designer begins to shape spatial elements in response to those imagined experiences.

The Feeling As (in Space) category focuses on the imagined atmospheric and affective qualities of environments. Atmosphere is often the first quality one perceives in a space. People's initial encounter with a space or scene is typically holistic and mood-based, rather than analytical. As architect Juhani Pallasmaa observes, "we grasp the atmosphere of a place before we identify its details or understand it intellectually" (Pallasmaa, 2014, p. 232). In the design phase, this appears in the designer's engagement with the atmospheric and emotional potential of space.

Lastly, the Feeling As (the Movement) category identifies designers' ability to project or simulate bodily motion and spatial dynamics. Whether it is the artist's gestures in action painting—such as throwing or scribbling—or the folded surfaces of architectural space, the viewer begins to simulate these movements within their own body. The image does not remain static on the surface; it triggers a sense of motion—both mentally and physically—allowing the viewer to feel the gesture or move within the space. A similar mechanism appears in the design phase, where the designer mentally simulates how space might unfold through movement, projecting a dynamic spatial choreography into the imagined environment. Table 4.2 presents the detailed coding scheme developed for the design phase.

Table 4.2 : Coding Schema for Empathy in Design Protocols

Empathy CODE	Categories	Description	Example
Feeling AS	(the) USER	(1) Imagining the possible behavior, emotions, or needs of the user in the space (2) Relate other people's experiences to their own.	(1) some children are afraid to enter such narrow places without their family (2) I loved the stories they told me in primary school, being in touch with nature... That's why I wanted to add this to our current park.'
	(in the) SPACE	Imagine/consider the atmosphere or emotion of the space	In general, when I look at it, it seems like the current park area is dry. I mean there is no interaction or experience.
	(the) MOVEMENT	Imagine the possible movement pertains to physical changes or dynamic sensations within the described space	'So, the first thing that comes to my mind is to create something like a small baby track in this place that will allow the children to rotate and eventually come back to the same point.'

4.7 Ethical Considerations

Ethical approval for this study was obtained from the Özyeğin University Ethics Committee (File No. 2019/13). Participants provided informed consent and were

assured of their right to withdraw from the study at any time. Data were anonymized to protect participant confidentiality, and all procedures adhered to ethical guidelines for research involving human subjects. Written informed consent was obtained from all participants before the study.

4.8 Pilot Study I: Investigating the Embodied Simulation Experience in The Perception of Art

The primary aim of this pilot study is to investigate how individuals with backgrounds in design (architecture, interior architecture, and industrial design) engage empathically with visual artworks. Specifically, the study seeks to understand the affective, cognitive, and bodily empathy designers develop toward artwork through verbal expressions elicited by observing abstract and figurative paintings, as well as the relationship between their responses and their trait empathy.

The pilot study explores the empathic engagement of seven experienced designers with one abstract and one figurative painting. Participants were instructed to verbalize their thoughts, emotions, and sensations—expressing anything that came to mind—while observing the paintings. Following the think-aloud session, they completed a questionnaire assessing their engagement with the artworks. Using think-aloud protocols and subjective self-assessment, this pilot study examines how participants verbalize their engagement with artworks. Additionally, the Empathy Quotient (EQ) test (Baron-Cohen & Wheelwright, 2004) was administered to all participants to assess baseline empathy levels. Using think-aloud protocols and subjective self-assessment, this pilot study explores how participants verbalize their engagement with artworks.

4.8.1 Procedure

The study was conducted in a real museum environment, where seven experienced designers observed two paintings from the permanent collection of Istanbul Modern Museum—one abstract and one figurative. Each participant was equipped with a microphone attached to a headset and asked to verbalize their thoughts freely while observing each painting, without time restrictions. Participants could view the artworks in their original size, allowing them to perceive the brushstrokes, light, and colors as intended by the artist. Additionally, they were encouraged to observe the paintings from different angles to enhance their engagement with the artwork. While

participants were required to speak for at least 2–3 minutes per painting, they were not limited by time constraints. Figure 4.4 shows the participants in real museum environment.



Figure 4.4 : Participants in real museum environment

After completing the think-aloud protocol for each painting, participants responded to a five-question questionnaire adapted from Umiltà et al. (2012), which included the following questions:

1. How much did you like the painting? (Liking)
2. How much movement did you perceive in the painting? (Embodiment)
3. How familiar are you with this image? (Familiarity)
4. How much did you imagine the artist's actions and emotions when interpreting the art? (Empathy)
5. How much did you imagine yourself as the artist when interpreting the art? (Embodiment)

Additionally, all participants completed the Turkish version of the Empathy Quotient (EQ) test (Baron-Cohen & Wheelwright, 2006), translated by Bora & Baysan-Arabacı (2009). The EQ test provided a standardized measure of participants' empathy levels, with scores ranging from 30 (P04) to 63 (P01), indicating individual differences in self-reported empathy.

4.8.2 Materials

Two paintings, one figurative and one abstract—were selected from the permanent collection of the Istanbul Modern Museum. The selected figurative artwork, *Garden of My Childhood* (1942) by Alaaddin Aksoy, is an expressive composition featuring figures that convey emotions such as sadness, fear, anxiety, and distress (Figure 4.5). The painting is exhibited as part of the museum's permanent collection. None of the

participants were familiar with the painting, and they were not allowed to read the accompanying description until all experiments had concluded.



Figure 4.5 : Garden of My Childhood (1942) by Alaaddin Aksoy

The selected abstract artwork, *A Rustling in the Leaves Drives Him Away* (1981) by Angel Otero, is created using a unique process where the artist paints on glass and Plexiglas, then scrapes off the nearly dried paint, peeling it away like a skin (Figure 4.6). These painted layers are then recomposed on a separate canvas. The painting, which measures 244×367 cm, is exhibited as part of a long-term private collection at the Istanbul Modern Museum. As with the figurative painting, none of the participants were familiar with this artwork, and they were not permitted to read the accompanying description until all experiments were completed.



Figure 4.6 : A Rustling in the Leaves Drives Him Away (1981) by Angel Otero

4.8.3 Analysis

The verbal data were first transcribed into text, and then a verbal analysis technique was applied following Chi's (1997) framework. This analysis provided important insights into how designers engage with abstract and figurative paintings and the relationship between their engagement and trait empathy. In this analysis, specific steps from Chi's (1997) framework were utilized. First, the verbal data were transcribed and segmented, followed by the development of a coding scheme based on recurring themes in participants' responses. The coded data were then analyzed to identify patterns of engagement, which were interpreted in relation to participants' trait empathy levels. As a result, six primary engagement categories emerged: Perceptual Engagement, Emotional Engagement, Engagement with the Artist's Process, Narrative Engagement, Openness to Ambiguity, and Temporal Engagement. These categories reflect the different ways in which participants interacted with the artwork, revealing variations in their cognitive, affective, and embodied responses.

1. Perceptual Engagement

Participants exhibited perceptual engagement by focusing on the visual, haptic, and kinetic qualities of the paintings.

Visual Engagement: Participants described dominant colors and specific shapes, often commenting on contrasts and compositional elements. For example, phrases such as "Something yellow is very dominant" indicates participant's heightened sensitivity to the visual structure of the artwork.

Haptic and Somatic Engagement: Some participants imagined the tactile and physical qualities of the depicted forms. For example, p01 described that: "There is something that touches the floor, trying to hit the ground.". P01's attention to elements that seem to "step" or contact the ground points to a grounded, tactile engagement with the artwork, where the viewer imagines these abstract forms as having physical properties and interacting with the environment. This suggests an embodied reaction, where the participant physically situated themselves within the painting, reinforcing a deeper sensory connection.

2. Emotional Engagement

Participants expressed emotions evoked by the paintings, either through direct affective responses or reflections on the artwork's atmosphere:

Direct Emotional Responses: Participants reported feelings such as calmness, intrigue, and unease while observing the paintings. Especially when interpreting figurative paintings participants used lots of expressions such as anger, fear, and sadness related to emotion of the figures. “The expression in the dog's eyes impressed me. The discouragement and anxiety in the eyes of those closest to the dog” (p07). This example demonstrates how the participant resonated with the emotions of the figures and demonstrated a strong emotional attachment. The distress and discomfort conveyed to the viewer through the expression on the dog's face demonstrates the viewer's empathic relationship with the figure.

Reflections on the Painting's Atmosphere: The participant describes emotions evoked by the certain shape, color or overall atmosphere of the painting. For example, “When I look at it, it could actually evoke the aftermath of a disaster because of its colors, but since it is a painting where the leaves, trees, dogs and figures live more like this, I can say that it covers up that feeling of chaos”. This statement suggests that P06 initially perceives a sense of destruction or disorder in the painting, which they associate with its color choices of overall atmosphere.

3. Engagement with the Artist's Process

Participants engaged with the creative process behind the paintings, attempting to reconstruct the artist's techniques, gestures, and intentions:

Imagination of the artist's method and physical actions: Many verbalized observations about brushstrokes, layering techniques, and scraping movements used by the artist. For example, p04 speculated: “It's more likely that he painted the canvas black first and then drew the figures on it.” The participants' sensitivity to the physical process of painting, combined with their own experiences, allows them to step into the artist's perspective, imagining the choices made during creation.

Similarly, P02 reflected on the physical act of peeling and scraping paint: “Sometimes the forms are very sharp, sometimes very soft, you see organic forms that are bodily. Would you call it chaos? Or is the reason we say aggressive because of the peeling paints that were taken off with a spatula? I wonder if those torn pieces are there?” In this example, the participant suggests that the feeling of aggression evoked by the painting may be directly linked to its materiality and the physical process of its creation. Rather than merely describing how the artwork was made, P02's

interpretation highlights how the artist's manipulation of materials—such as scraping and layering—shapes the viewer's emotional response. This suggests a deeper level of cognitive and emotional empathy, where the participant not only engages with the physicality of the painting but also reflects on how artistic processes themselves can convey affective qualities.

Speculation About the Artist's Emotional State: While participants actively engaged with the artist's physical methods, few explicitly speculated on the artist's emotions or psychological state during the creation process. Instead, engagement remained primarily focused on material and procedural aspects, such as layering, scraping, and manipulation of forms.

4. Narrative Engagement

Participants constructed narratives to interpret the paintings, filling in gaps, attributing meanings, and personifying elements such as: "It is chirpy, but then cuts were made into the chirpiness. It is like a festival, yet something horrible falls into the cheerful event" (p01). These descriptions show how the participant is imagining a dynamic narrative unfolding within the painting, moving from "chirpiness" to "chaos" and contrasting a "festival" with something "horrible." This suggests a narrative-based understanding of the painting's visual elements, where the participant creates a story or scenario from the abstract forms.

Connection to Personal or External Narratives: Some participants related elements of the painting to real-life events, fiction, or historical references, suggesting a higher level of cognitive and emotional investment such as "There was a scene in Lord of the Rings, they were celebrating something at a picnic and then suddenly there was a big attack on the village. Just like that, as if a terror attack had fallen into something colorful" (p01) This projection shows an ability to empathize through storytelling, where they relate the abstract scene to a dramatic and emotionally charged story. The interpretation of chaos and terror interrupting a joyous moment reflects an imaginative and empathetic attempt to give the painting a relatable context.

5. Openness to Ambiguity

Participants exhibited varying levels of comfort with the abstract and ambiguous aspects of the artworks. Some embraced uncertainty and explored multiple interpretations, while others expressed frustration with unclear meanings. While

certain participants actively engaged with ambiguity, seeking multiple meanings, others struggled with the lack of a clear interpretation.

For instance, P02 expressed difficulty in "reading" or interpreting the painting, suggesting that this challenge prompted a more emotional engagement. However, rather than withdrawing from this complexity, P02 accepted the ambiguity, recognizing that the artwork was intentionally designed to evoke diverse emotional responses. This reflects a self-awareness of the interpretive challenge posed by the painting's abstract nature and a willingness to engage despite the absence of immediate clarity.

On the other hand, the ambiguity of the artwork actively influences the participants' engagement with the artwork, leading to a shift in their perspectives and building a deeper exploration. P05 reflected on this process, stating: "When you try to focus on the exact contours of any image, you realize that it is as if it is combined somewhere and completed. But for this, you really need to focus on choosing it." This suggests an active attempt to make sense of fragmented visual elements, indicating a cognitive engagement with uncertainty.

Participants who embraced ambiguity tended to engage more deeply, finding enjoyment in exploring hidden forms and multiple interpretations. In contrast, those who found ambiguity challenging often expressed discomfort or confusion, focusing instead on more concrete, material aspects of the artwork.

6. Temporal Engagement (Shifting Perception Over Time)

Participants' interaction with the paintings evolved over time, with some expressing a desire for prolonged observation. The complexity of certain artworks led to prolonged engagement, reinforcing the role of time in aesthetic perception. Certain participants noted how their feelings changed with prolonged observation, revealing a dynamic engagement with the artwork. Some participants wished to revisit the painting, while others noticed new details upon extended viewing. For example, p07 states that "I constantly notice something new while I'm talking like this... This actually makes me think that I could spend more time in front of this picture."

This statement illustrates how prolonged observation allowed for the discovery of new elements, reinforcing the evolving nature of engagement with the artwork. Similarly, P02 expressed how peeling back layers of interpretation over time deepened their

connection to the piece: "I don't know which one, but I mean it's like a painting that needs to be looked at for a longer time. I think it's successful for me because it challenges me in this respect." This highlights how the complexity of the artwork sustained their attention, reinforcing the role of time in aesthetic perception.

These six engagement categories illustrate the multifaceted nature of designers' interactions with artworks, highlighting the interplay between perception, emotion, narrative construction, and cognitive flexibility. By examining these categories in relation to participants' trait empathy levels, this analysis sheds light on the diverse strategies through which designers interpret and connect with abstract and figurative paintings. The identified patterns suggest that engagement is not a singular process but rather a dynamic and layered experience that varies across individuals. These findings set the stage for the subsequent discussion, where the relationship between **trait** empathy and engagement modes will be further examined. The next section will explore how variations in empathy levels correspond to different engagement patterns, offering insights into the cognitive and affective dimensions of design cognition.

4.8.4 Findings and discussion

The analysis of think-aloud protocols revealed key patterns of engagement across participants with varying levels of trait empathy (measured by the Empathy Quotient, EQ). The findings suggest notable differences in how participants with higher and lower empathy scores interact with paintings, particularly in their use of narrative, emotional projection, and engagement with the artist's process.

Participants with higher EQ scores (e.g., P01, P02, P07) exhibited a strong tendency to construct narratives around the paintings, often animating figures and attributing emotions or intentions to them. Their descriptions were rich with metaphorical and comparative storytelling, indicating a high level of cognitive and emotional empathy. In contrast, participants with lower EQ scores (e.g., P04, P06) engaged with the paintings through a formal and technical lens, emphasizing compositional aspects such as color, structure, and materiality rather than constructing narratives or engaging in emotional projection. Participants with moderate to high EQ scores (e.g., P02, P03, P05) frequently speculated on the artist's physical gestures, layering process, and intentionality. They imagined how the artwork was created, sometimes reenacting the implied motion of the artist's hand.

Table 4.3 presents overall engagement patterns across all participants, summarizing their interaction styles regardless of artwork type (i.e., figurative or abstract). It provides a broad view of how trait empathy (EQ) aligns with different engagement modes, offering a generalizable framework

Table 4.3 : Participants' Trait Empathy Scores and Engagement Patterns

ID	EQ	Perceptual	Emotional	Artist's Process	Narrative	Openness to Ambiguity	Temporal
01	63	High	High	Moderate	High	High	High
02	56	High	Moderate-High	High	Moderate	High	Moderate-High
03	49	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
04	30	Moderate	Low	High	Low	Low	Low
05	44	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
06	39	Low	Low	Low	Low	Low	Low
07	56	High	Moderate-High	High	High	High	High

Even participants with lower EQ scores (e.g., P04), although exhibiting limited emotional engagement, demonstrated a strong analytical approach to the artist's process. P04, for instance, examined brushwork, material application, and the technical structure of the piece—a tendency that may be influenced by their experience with painting practices such as watercolor, pencil, and illustration. Tables 4.4 and 4.5 present a comparative summary of participants' engagement patterns with figurative and abstract artworks, detailing how each individual engages with perceptual, narrative, emotional, and artistic process-related aspects of the artworks.

Table 4.4 : Participants' Engagement Patterns with Figurative Painting

Participant	Perceptual Engagement	Engagement with Artist's Process	Narrative Engagement	Emotional Resonance	Openness to Ambiguity	Temporal Engagement
p01 (EQ: 63)	Describes negative atmosphere, observes facial expressions and positioning	Infers painter's intent in creating hierarchy through negative expressions	Constructs a story of fear, power dynamics, and a lurking danger	Feels unease, sense of fear and powerlessness	Engages with hidden layers of emotion and power structures	Wants to explore further to understand characters' relationships
p02 (EQ: 56)	Associates colors with emotions (autumn colors, gloominess), observes light-dark contrasts	Speculates on artistic choices in light-dark contrast, positioning of figures	Infers that painting represents exhaustion and struggle, highlights a mysterious observer	Describes painting as evoking exhaustion, detachment, and tension	Acknowledges emotional complexity but prefers clear meaning	Finds new details with prolonged observation
p03 (EQ: 49)	Focuses on dreamlike, surreal qualities, notes manipulated facial expressions	Suggests that scale and proportions were deliberately altered by the artist	Suggests the painting represents another world-altered human figures, supernatural beings	Finds elements surreal and intriguing but not emotionally overwhelming	Appreciates surreal aspects but struggles with lack of clarity	Willing to revisit but finds ambiguity slightly frustrating
p04 (EQ: 30)	Notices disproportionate elements, questions colors (green figure, unclear clothing)	Tries to understand construction of image (fabric layers, scraping techniques)	Finds the image disturbing but struggles to construct a clear narrative	Expresses confusion and mild discomfort due to distorted figures	Frustration with unclear elements, describes figures as confusing	Less inclined to return due to confusion
p05 (EQ: 44)	Observes geometric aspects of composition (trees, forest, figures)	No reference to artist's intent, focuses more on scene description	Interprets scene as a moment of escape or hiding, speculates about figures' emotions	Describes unease, tension, and chaotic energy from expressions and brushstrokes	Finds ambiguity challenging, seeks structured interpretation	Would explore more if scene had clearer elements
p06 (EQ: 39)	Describes color palette as calming, notes visual contrast between figures and surroundings	Recognizes layering techniques and framing choice	Frames the painting as a contrast between chaos and nature, human figures trying to find balance	Mentions minor emotional reactions, focuses on conceptual aspects	Interprets abstract elements in structured ways but remains open to meanings	Enjoys prolonged engagement with painting's conceptual layers
p07 (EQ: 56)	Observes brushstrokes, color tones, and dramatic use of contrast	Comments on brushstroke direction, artist's technique in portraying mood shifts	Infers a post-disaster scenario, where characters are displaced, anxious, and lost	Strong emotional response—describes sadness, despair, and mystery	Enjoys unresolved aspects and contrasting interpretations	Feels the need to revisit painting for deeper meaning

Table 4.5 : Participants' Engagement Patterns with Abstract Painting

Participant	Perceptual Engagement	Emotional Engagement	Engagement with Artist's Process	Narrative Engagement	Openness to Ambiguity	Temporal Engagement
p01 (EQ: 63)	Describes vivid colors, dominant elements, contrasts; references movement	Associates painting with chaos and disruption; uneasy, intrigued	Speculates on artist's layering and cutting techniques	Constructs a dramatic story (terror attack in a festival)	Finds hidden elements engaging; enjoys complexity	Wants to revisit painting for deeper interpretation
p02 (EQ: 56)	Observes layers of colors, contrasts, references Cubism	Feels aggression, dynamism; considers emotional complexity	References for the layering process and materiality of paint	Interprets layered colors as hidden messages, metaphors	Curious but acknowledges struggle with ambiguous meaning	Recognizes need for prolonged observation
p03 (EQ: 49)	Focuses on color distribution, spatial layout, composition	Finds elements intriguing but expresses difficulty in interpretation	Mentions artist's approach in composing abstract forms	Mentions fragmented narratives but struggles to construct meaning	Feels uncertainty and frustration due to unclear meanings	Finds new aspects over time
p04 (EQ: 30)	Notices color layering, material texture, spatial divisions	Neutral-emotionally detached; focused on material analysis	Analyzes paint application, scraping techniques	No narrative construction; focuses on technique	Focuses on material and structure rather than meaning	Focuses on static material qualities
p05 (EQ: 44)	Comments on geometric shapes, depth perception	Feels tension and nervousness due to unclear shapes	Imagines stages of layering and revision	No significant storytelling; describes spatial elements	Finds ambiguity challenging and unsettling	Less inclined to revisit; finds the experience challenging
p06 (EQ: 39)	Focuses on the composition, colors, changing perspectives	Associates painting with shifting emotions, curiosity	Considers painting as a process of merging images	Finds hidden figures but does not construct a strong narrative	Recognizes ambiguity but remains observational	Acknowledges evolving perception with time
p07 (EQ: 56)	Analyzes symmetry, color balance, shifting forms	Feels drawn to mysterious atmosphere; finds engagement over time	Speculates on artist's stroke patterns and brushwork	Mentions fragmented figures, seeing a fox and human forms	Enjoys unresolved aspects, finding hidden layers engaging	Feels engaged over extended viewing periods

Lastly, participants' openness to ambiguity and temporal engagement varies in accordance with their trait empathy levels, influencing how they approach uncertainty and duration of engagement with the artwork. Higher EQ participants found to be more comfortable with ambiguity, exploring multiple interpretations and lingering on unresolved elements within the artwork. Moreover, they exhibited extended engagement with the artwork, expressing a desire to revisit or spend more time analyzing its details. They described how their perception evolved over time and how different layers of meaning became apparent with prolonged observation. Lower EQ participants tended to express frustration with ambiguity or avoided making speculative interpretations. They focused more on concrete aspects such as identifiable forms and surface details. Lower EQ participants were less inclined to revisit the artwork, often concluding their interpretations more quickly without seeking additional layers of meaning.

To sum up, while higher EQ participants were more likely to engage in narrative and emotional projection, lower EQ participants still exhibited meaningful interaction, particularly through engagement with the artist's process. For instance, P04, despite a low EQ score, demonstrated strong analytical engagement with brushstrokes, material application, and compositional structure, suggesting an alternate mode of connection—one rooted in technical perception rather than affective response. This finding was further nuanced in the case of P02 expressions but different than P04, P02 is more concerned with how this process affects their own emotional experience, especially through their focus on the aggression and tactile qualities. This reflects a shift from empathy towards the artist (P04) to empathy towards the self and the emotional response (P02).

These results suggest that empathy in art perception is not monolithic, and as Freedberg and Gallese (2007) argue, the movement behind the marks can activate embodied simulation in the observer. However, the findings in this pilot study extend this by showing that such activation is not solely affective; it can also be cognitive. While P04 engages with the artist's movement through a technical lens—analyzing brushwork and material application—P02 internalizes the movement emotionally, interpreting it through aggression and tactile intensity. This distinction highlights how embodied simulation can manifest both as an analytical reconstruction of artistic process and as an affective response to expressive gestures.

4.8.4.1 Transition from pilot study I to II: key insights and refinements

The first pilot study revealed distinct engagement patterns with artwork, demonstrating that trait empathy influences the depth and nature of interaction. Individuals with higher empathy exhibited broader and more immersive engagement, incorporating emotional projection, narrative construction, and embodied simulation. In contrast, participants with lower empathy primarily focused on formal and technical aspects, describing compositions in terms of structure, layers, and color relationships rather than engaging in storytelling or emotional resonance.

The implications of Pilot Study I for Pilot Study II are summarized in Table 4.6.

Table 4.6 : Transition from Pilot Study I to II: Key Insights and Refinements

Pilot Study Finding	Implication for Second Study
Emergence of the category "Engagement with Artistic Process"	Refined and integrated under Simulation of the Artist's Movement
Participants struggled with certain interview questions	Adjusted interview protocol to differentiate between emotion-driven engagement (Empathy) and motion-driven engagement (Simulation)
Low-EQ participants engaged cognitively	Expanded scope of research to explore affective, cognitive and embodied empathy
Embodied simulation was a key engagement mode	Emphasized embodied simulation as a structuring principle in the second study
Overlap between emotional engagement and narrative engagement	Distinguished between emotion-based engagement (Empathy with Figures, Objects, and Space) and motion-based engagement (Simulation of Scenes and Artist's Movement)
Perceptual engagement was tied to physical materiality	Objects and space were explicitly categorized under perceptual engagement
Need for a more structured theoretical framework	Coding structure was informed by Freedberg and Gallese (2007), distinguishing between emotion-related empathy (Empathy with Representational Content) and motion-related simulation (Simulation of Artistic Process and Actions in the Painting).

A key insight from this study was the structuring role of embodied simulation, which helped refine the second study's coding framework. Building on Freedberg and Gallese's (2007) distinction between (i) empathy with representational content

(figures, objects, emotions, and actions) and (ii) empathy with traces of the artist's creative gestures (brushwork, modeling, movement of the hand), the second pilot study distinguished emotion-based engagement (categorized under empathy) from motion-based engagement (categorized under simulation). Notably, narrative engagement was categorized under simulation, as it involves the imaginative projection of unseen elements, whereas emotional responses to the artwork remained under empathy. Similarly, brushwork and physical traces of artistic action were classified under simulation, while reflections on the artist's emotions were retained under empathy.

Additionally, Temporal Engagement and Openness to Ambiguity were removed from the coding schema in the second pilot study. These categories were highly context-dependent in the museum setting, where prolonged viewing and interpretation of ambiguity were more pronounced. However, as the research shifted toward a structured examination of embodied simulation and empathy following Freedberg and Gallese's (2007) framework, these dimensions were deemed outside the primary scope of investigation. These findings provided critical methodological refinements for the subsequent study, emphasizing the need to account for both affective and embodied engagement for the following research. Despite its contributions, the first pilot study had certain limitations. The small sample size ($N=7$) restricted the generalizability of findings, and while the museum setting provided an authentic viewing experience, it may have introduced contextual influences shaping participants' responses. To address these limitations, a second pilot study ($N=22$) was conducted in a controlled classroom environment, enabling a more systematic investigation of engagement patterns and ensuring methodological reliability.

The next phase of research builds upon these refinements by applying the revised methodological approach to a larger sample of design students. This will allow for a more comprehensive analysis of empathic engagement of design students, further advancing the understanding of how designers interact with visual stimuli and artistic representations.

4.9 Pilot Study II: Investigating Empathic and Simulation-Based Engagement with Art Among Design Students

Building on the findings of Pilot Study I, this study further explores how individuals engage with visual artworks through both emotion-based (empathic) and motion-based (simulation) processes. While the initial research focused on embodied simulation as a core mechanism of engagement, the first pilot study demonstrated that art perception cannot be fully understood through bodily responses alone. Instead, engagement emerged as a multi-dimensional experience, where participants alternated between cognitive, emotional, and embodied modes of interaction with artworks.

Pilot Study I revealed two interrelated dimensions of engagement:

1. Empathic Engagement (Emotion-Based): The participants projected emotions onto figures, narratives, and implied affect in the painting. This included resonance with the subjects depicted in the artwork, as well as imagining the artist's emotional state.
2. Simulation Engagement (Motion-Based): Participants engaged bodily with the painting by mentally simulating movement, sensing textures, and engaging with the material traces of the artist's process (e.g., brushstrokes, layering, scraping techniques).

This distinction aligns with Freedberg and Gallese's (2007) framework, which differentiates between: (i) Empathy with representational content (figures, objects, emotions, actions) and (ii) Empathy with traces of the artist's creative gestures (brushwork, materiality, movement).

Based on these insights, Pilot Study II was designed to refine and systematically test this expanded coding framework, ensuring that both empathic and simulation-based engagements were clearly distinguished and analyzed. In contrast to Pilot Study I, which was conducted in a museum setting with a small sample size (N=7), Pilot Study II expands the participant pool (N=22) and is conducted in a controlled setting, allowing for a more systematic and scalable analysis.

The research objectives of Pilot Study II are as follows:

1. To refine the coding framework developed in Pilot Study I, ensuring a clear distinction between empathic and simulation engagement in art perception.

2. To investigate how engagement modes vary across different participants, particularly in relation to their trait empathy levels.
3. To explore how design students engage with artworks compared to the experienced designers in Pilot Study I.
4. To test the reliability of the refined coding scheme across a larger sample in a controlled environment.

Both qualitative and quantitative methods were employed in this experimental research. Similar to Pilot Study I, the study followed a three-step sequential design, consisting of think-aloud protocols, a Likert-scale questionnaire specifically developed for this study, and the Turkish version of the Empathy Quotient (EQ) Test (Baron-Cohen & Wheelwright, 2004; translated by Bora & Baysan-Arabacı, 2009). This approach allowed for a comprehensive investigation into the relationship between individual empathy traits and engagement modes, ensuring methodological consistency with Pilot Study I while refining the approach for Pilot Study II.

4.9.1 Experimental setting

The qualitative component of this study involved think-aloud protocols conducted with 22 interior architecture students. Participants were asked to interpret and evaluate eight paintings aloud in a controlled experimental setting. Following this, the Turkish Empathy Quotient (EQ) test was administered to examine whether the relationship between simulation and empathy, as discussed in the literature, holds within the scope of this study.

A total of eight paintings, five figurative and three abstract—were selected from online catalogs of eight different museums (Figure 4.7). Each student individually participated in the experiment, verbally interpreting the paintings while viewing high-quality projections of the artworks in their original dimensions. The paintings were displayed using a projector in a dimly lit classroom environment (Figure 4.8), ensuring optimal visibility while maintaining consistent experimental conditions across participants.

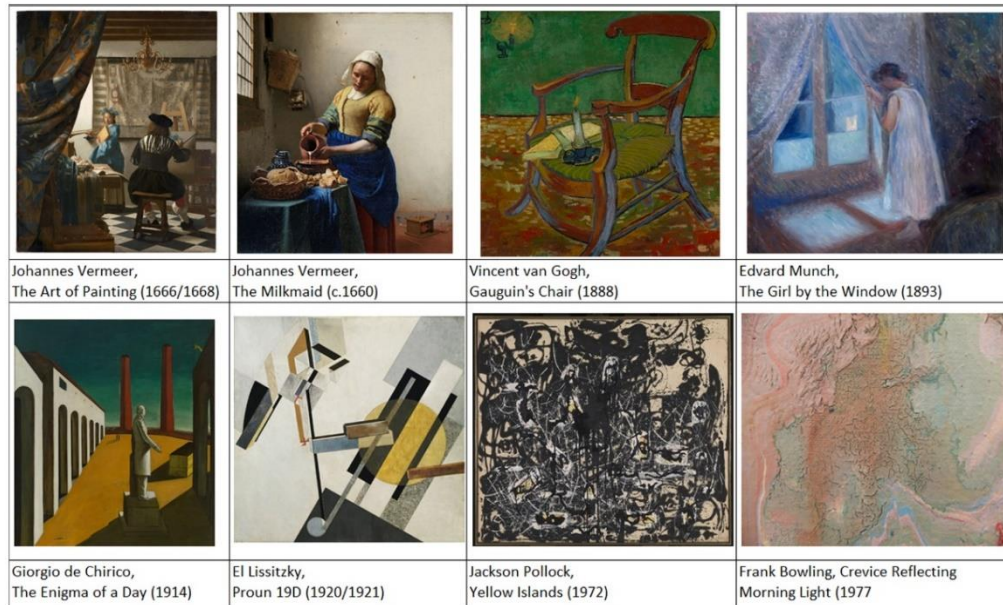


Figure 4.7 : Selected paintings for the experiments

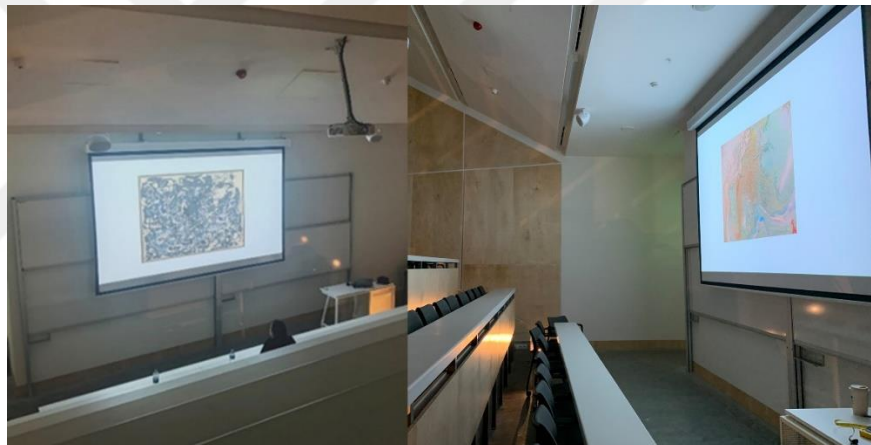


Figure 4.8 : Showing the experimental setting

Participants were positioned equidistant from the screen (3.42m) to minimize perceptual variations. The instructions provided to all participants were as follows:

1. Observe the painting for as long as you wish.
2. When ready, begin verbalizing your thoughts and feelings about the painting.
3. Once your response concludes, proceed to the next painting and repeat the process.

Each participant's responses were recorded using both a voice recorder and a video camera, ensuring a comprehensive dataset for analysis. While participants were encouraged to speak freely, they were advised not to exceed 2.5 minutes per painting.

The longest response recorded was 16.39 minutes (P14), while the shortest was 1.45 minutes (P04). Although participants were encouraged to verbalize their responses as much as possible, they were not required to speak for a fixed duration, as the spontaneity of engagement was considered integral to the study. Only when a participant exceeded 2.5 minutes per painting were they prompted to conclude their response. The protocol study of all 22 students was completed over three days.

4.9.2 Painting selection process

The paintings used in this study were selected through a systematic review of online museum collections, informed by prior empirical studies on embodied simulation in art perception (Tschacher & Tröndle, 2011; Ganczarek et al., 2015). The selection process involved a gradual narrowing of a large dataset of artworks, structured as follows:

1. Initial Review: Examination of related empirical studies and their selected paintings (Tschacher & Tröndle, 2011; Ganczarek et al., 2015).
2. Categorization and Refinement: The initial selection was progressively refined based on a framework capturing different modes of engagement with space, figures, objects, emotions, and materiality, aligning with Freedberg and Gallese's (2007) distinction between empathy actions, intentions, objects, emotions, sensations and empathy with traces of the artist's creative gestures.
3. Final Selection: A curated set of eight paintings was chosen to ensure a balanced representation of different artistic styles and modes of engagement.

To ensure expert validation, the final selection process incorporated feedback from three academic experts, including an art historian and a cognitive psychologist, ensuring historical, stylistic, and thematic diversity.

Table 4.7 presents the final selection of paintings along with their corresponding categories and selection rationale. This refined selection ensures a balanced distribution between figurative and abstract works, facilitating a nuanced examination of how design students engage with art through embodied simulation. Each painting was chosen to stimulate different modes of interaction, ranging from narrative engagement and emotion recognition to material perception and gestural simulation.

Table 4.7 : Selected paintings for the experiments and selection rationale.

Category	Artist & Painting	Key Embodied Simulation & Empathic Engagement Aspects
Realistic depiction of space (with human figures)	Johannes Vermeer, The Art of Painting (1666/1668)	Depicts interior space, actions, and objects, allowing for empathy with both figures and objects.
Figurative depiction of space (with actions, emotions, and objects)	Johannes Vermeer, The Milkmaid (c.1660)	Engages narrative empathy through action, highlighting bodily engagement and object interaction.
Expressionist depiction of space (with human figures)	Edvard Munch, The Girl by the Window (1893)	Emphasizes emotions through bodily posture and spatial composition, engaging affective empathy.
Expressionist depiction of objects (without human figures)	Vincent van Gogh, Gauguin's Chair (1888)	The chair functions as an emotional stand-in for the absent figure, linking objects to personal narratives.
Emotional depiction of space (without human figures)	Giorgio de Chirico, The Enigma of a Day (1914)	Uses atmospheric depth, ambiguous perspectives, and light to evoke psychological tension.
Abstract depiction of space	El Lissitzky, Proun 19D (1920/1921)	Geometric abstraction explores spatial relationships, depth, and motion perception.
Action painting (dynamic gestures)	Jackson Pollock, Yellow Islands (1972)	Strong gesture-based brushwork, emphasizing the movement behind the mark.
Painting with tactile values	Frank Bowling, Crevice Reflecting Morning Light (1977)	Thick impasto and layering invite haptic and material engagement, reinforcing perceptual simulation.

4.9.3 Collecting subjective reports and EQ test

In the second step, which follows immediately, participants were given a self-assessment test on a Likert scale consisting of 7 questions about these paintings. These questions are aimed at collecting quantitative data about the liking, familiarity, and embodied simulation levels of the participants for each picture. The questions were sent to the participants in their native language, Turkish. All participants except Ö20, Ö21 and Ö22 answered the test immediately after the voice protocols. Ö20, Ö21, Ö22 responded with delay. Translation of the questions used in the survey is as follows.

- 1- How much did you like it?
- 2- How much did you feel the atmosphere in the painting?
- 3- How familiar are you with this image? (Have seen this image or similar to this image before)

- 4- How much did you feel the emotions of the figures in the painting? (Only for figurative)
- 5- How much emotion did the painting evoke on you?
- 6- How much did you think of the artist's actions (gestures)?
- 7- How much did you imagine yourself as an artist him/herself when interpreting the art?

4.9.4 Coding schema

The coding schema for Pilot Study II builds upon the insights from Pilot Study I, incorporating refinements to better capture embodied simulation in art perception. While Pilot Study I identified various engagement modes, this second study adopts a structured coding approach using a deductive framework (Mamabolo & Myres, 2019), integrating both data-driven emergent codes and theoretical constructs from literature.

The coding structure aligns with Freedberg and Gallese's (2007) distinction between two forms of embodied empathetic engagement with visual art:

1. Empathy with representational content, involving engagement with actions, intentions, objects, emotions, and sensations depicted in the artwork.
2. Empathy with traces of the artist's creative gestures, referring to engagement with visible marks of artistic action, such as brushstrokes, modeling, and signs of the artist's hand movements.

Building upon this distinction and informed by the verbal data analysis, the final coding schema is structured around two primary dimensions of engagement: emotion-based and simulation-based. The final coding scheme consists of four main categories, each further divided into two subcategories, as presented in Table 4.8.

1. Empathy (with) → Emotion-based engagement

- Captures participants' affective and cognitive responses to figures' emotions.
- Includes perceived emotions, sensations, and subjective experiences evoked by the atmosphere of the painting.
- Encompasses emotions associated with material or spatial qualities of objects depicted in the artwork.

- Examine the artist's emotional state and intentions, particularly when participants speculate on the artist's mindset.

Table 4.8 : Coding schema and example codes for Pilot Study II

Embodied Empathic Engagement	Engagement (with)	Example Code	Simulation (of)	Example Code
Figures	Emotional resonance with depicted figures (e.g., sensing their emotions, states)	"She felt as if she did not want to look at herself and was frightened."	Interpretation of figures' actions, intentions, and bodily movements	"I think he is holding a musical instrument, maybe a saxophone, at the same time holding a book, trying to process every detail."
Artist	Perceived emotions, motivations, and mental states of the artist	"The artist started with enthusiasm but then got bored with something..."	Interpretation of artistic gestures (e.g., brushstrokes, movement of the hand)	"... you start scribbling, like you start throwing things like this."
Object and Space	Emotional associations with depicted objects or spatial composition	"I felt a distrust from having a candle on it." / "As if there was hope in some places in pessimism."	Imaginative projection into space and material composition (depth, , movement, structural relations)	"As if different elements are stacking on top of each other with light reflections and color transitions."
Evoked by the Painting	Personal affective response to the artwork (e.g., feeling calm, uneasy, joyful)	"Again, it felt more pessimistic and more panic-like." / "It feels more peaceful than the previous one."	Perceived dynamic or immersive qualities evoked by the painting (e.g., movement, scene construction)	"... as if the sea was surrounding me, made me feel as though it is decreasing gradually and spreading soils."

2. Simulation (of) → Motion-based engagement

- Captures mental simulation of movement, action, or material processes within the painting.
- Includes engagement with artistic gestures, such as interpreting brushstrokes and hand movements of the artist.

- Encompasses narrative construction based on visual elements, where participants infer dynamic scenes not explicitly depicted in the painting.
- Captures imaginative engagement with motion or spatial depth, including how participants perceive movement within depicted objects and spaces.

These refinements reflect the increasing emphasis on embodied simulation as a key engagement mode, distinguishing emotion-driven responses (empathy) from motion-driven responses (simulation).

4.9.5 Analysis of the data

The collected data was analyzed using different methods tailored to the nature of each dataset. First, verbal data obtained from think-aloud protocols was transcribed and systematically coded using the developed coding schema (Table 4.9). QDA Miner Lite (A computer assisted qualitative data analysis program) was used for the coding. To ensure coding reliability and consistency, an independent researcher collaborated with the primary author throughout the process. The first three transcripts were coded collaboratively to establish a consistent interpretation of codes. After finalizing the coding scheme, the remaining 19 transcripts were coded independently. A 60% initial agreement was observed between the coder and the researcher. However, all discrepancies were resolved through iterative discussions, ensuring a final 100% agreement across all coded transcripts.

This verbal analysis allowed for an in-depth qualitative understanding of how participants engaged with the paintings. Following this, the frequency of each coded category was calculated to quantify the qualitative data, thereby enabling a transition from qualitative analysis to quantitative evaluation (Sandelowski, 2001). The frequency of each relevant code in the coding schema calculated by summing the frequencies of all codes showing the empathic engagement score. Table 4.9 and Table 4.10 present a sample coding schema and scoring table for participant S17, respectively.

For the quantitative analysis, responses to the Likert-scale questionnaire were statistically analyzed. First, an internal consistency test was conducted for the embodied empathic engagement scale items (items 4, 5, 6, and 7), and reliability measures confirmed their consistency (Cronbach's $\alpha > 0.74$).

Table 4.9 : Sample coding schema

Empathic Engagement		
S17	Empathy (with)	Simulation (of)
Figures	the person whose portrait is drawn looks happy, carefully focused on her (p01), on the one hand, she felt bored and sad (p02), She felt as if she did not want to look at herself and frightened (p03)	I think he is holding a musical instrument, may be a saxophone, at the same time holding a book, trying to process every detail, seems to have drawn the flower on his head right now (p01), as if trying to prepare dinner (p02)
Artist	(artist) started the enthusiasm but then got bored with something... (p07)	... you start scribbling like you start throwing things like this (p07)
Object and Space	I felt a distrust from having a candle on it (p04), as if there was hope in some places in pessimism (p07)	when I look at the people there, the statue looks huge, according to human scales (p05) ... with light reflections and color transitions, it seems as if they are all standing on top of each other (p06)
Evoked by the painting	Again, it felt more pessimistic and more panic-like (p04), It feels more peaceful than previous (P05)	... as if the sea had around me, made me feel as though it is decreasing gradually spreading soils (P08)

Table 4.10 : Sample scoring table of S17 according to the coding scheme

S17	Objects and Space	Figures	Artists	Evoked by the painting	Total
Empathy (with)	6	5	2	13	26
Simulation (of)	9	4	4	12	29
Embodied Empathic Engagement	15	9	6	25	55

Table 4.11 presents the Cronbach's α values for embodied empathic engagement items across the questionnaires for all eight paintings. Since *liking* and *familiarity* were measured using single-item questions, internal consistency was not calculated for these variables. Cronbach's alpha coefficient is a reliability measure ranging from 0 to 1 that indicates the internal consistency of items measuring the same construct in Likert-type scales. A value greater than 0.7 suggests that the scale is highly reliable (Şahin & Güleröğlu, 2013).

Table 4.11 : Internal Consistency Coefficient (Cronbach's α) for Embodied Empathic Engagement Items Across Eight Paintings

Paintings	Cronbach Alpha
P01	0.74100999
P02	0.76790291
P03	0.90717962
P04	0.89042142
P05	0.82226216
P06	0.90520815
P07	0.74789247
P08	0.84493912

Next, participants' overall embodied empathic engagement levels, as measured by their questionnaire responses, were analyzed in relation to liking and familiarity parameters to explore potential correlations. Furthermore, the relationship between participants' self-reported empathy levels (EQ scores) and engagement captured during think-aloud protocols was examined.

Turkish empathy test was sent to the participants as an online form after all experiments were completed. The empathy score for each participant was calculated according to the scoring table within the Empathy test scale (Baron & Cohen 2004). In this test, scores equal to or below 30 are considered non-empathic, while scores above 60 indicate a super-empathic individual (Baron-Cohen & Wheelwright, 2004). Based on the Empathy Quotient test, most students in the study were categorized as empathic or super-empathic, with only one student scoring at the threshold for being considered non-empathic.

The results obtained from both talk aloud protocols and survey results demonstrate that each student constructs an embodied empathic engagement with the art object at different levels. Although this level varies for each painting, some students individually establish a stronger empathic embodied engagement compared to others. The raw scores of participants, derived from think-aloud protocols, survey responses, and EQ scores, are presented in Figure 4.7, alongside their corresponding Z-score transformations. The Z-score standardizes individual scores by expressing their deviation from the mean in standard deviation units. A positive Z-score indicates a value above the mean, whereas a negative Z-score signifies a value below the mean.

To triangulate findings across datasets, a Spearman correlation analysis was conducted between (i) empathy-related codes from think-aloud protocols, (ii) questionnaire

results, and (iii) Empathy Quotient (EQ) scores. This mixed-methods approach enabled a more comprehensive examination of embodied empathic engagement in art perception, integrating qualitative interpretations with quantitative metrics. The findings of the analysis are discussed more deeply in the following section.

Students	Empathy Score based on Talk Aloud Protocols	converted to >> Z Score	Empathy Score based on Questionnaire	converted to >> Z Score	Empathy Score based on EQ	converted to >> Z Score
S01	33	-0,603	5,71	0,053	30	0,053
S02	50	0,080	7,46	1,364	58	1,364
S03	14	-1,366	2,36	-2,450	48	-2,450
S04	11	-1,487	4,45	-0,887	37	-0,887
S05	36	-0,482	6,58	0,708	47	0,708
S06	98	2,010	6,97	0,998	48	0,998
S07	55	0,281	4,33	-0,976	43	-0,976
S08	47	-0,040	5,95	0,236	60	0,236
S09	33	-0,603	5,71	0,058	59	0,058
S10	59	0,442	5,03	-0,457	64	-0,457
S11	82	1,366	6,29	0,488	47	0,488
S12	45	-0,121	7,78	1,607	65	1,607
S13	73	1,005	7,43	1,345	44	1,345
S14	102	2,170	7,76	1,588	35	1,588
S15	39	-0,362	5,94	0,226	53	0,226
S16	58	0,402	5,48	-0,115	60	-0,115
S17	55	0,281	4,46	-0,878	48	-0,878
S18	48	0,000	6,01	0,282	64	0,282
S19	18	-1,206	4,49	-0,859	49	-0,859
S20	15	-1,326	4,50	-0,850	49	-0,850
S21	22	-1,045	4,70	-0,700	54	-0,700
S22	63	0,603	4,59	-0,780	62	-0,780

Figure 4.9 : Empathy Levels Across Different Measures and Their Corresponding Z-Score Transformations

4.9.6 Findings and discussions

4.9.6.1 Correlation across different measures of empathy

A significant correlation was found between embodied simulation scores derived from the coding schema and those obtained from the questionnaire results ($p = 0.019 < 0.05$), indicating consistency between the qualitative and quantitative measures of embodied simulation. However, no significant relationship was found between the

Empathy Quotient (EQ) test scores and empathy scores derived from the questionnaire ($p = 0.59$). Similarly, no significant correlation was observed between embodied empathy scores obtained from the think-aloud protocols and the EQ test scores ($p = 0.95$), suggesting that self-reported empathy levels did not align with the embodied empathic engagement captured in the verbal analysis. The lack of correlation between EQ scores and both self-reported engagement measures suggests that general trait empathy, as measured by the EQ test, does not necessarily predict embodied engagement with artwork. Table 4.12 presents the detailed correlation coefficients across these different measures.

Table 4.12 : Correlation coefficients across different empathy scales

Empathy Score based on Talk Aloud Protocols & Questionnaire	
Coefficient:	0.493785
N:	22
T statistic:	2.539.462
DF:	20
p value:	0.019513*
Empathy Score based on Talk Aloud Protocols & EQ (Empathy Quotient)	
Coefficient:	0.01359
N:	22
T statistic:	0.060782
DF:	20
p value:	0.952136
Empathy Score based on Questionnaire & EQ	
Coefficient:	0.119
N:	22
T statistic:	0.537874
DF:	20
p value:	0.596599

The strongest and only significant correlation was found between the talk-aloud protocols and the questionnaire responses, confirming that these two self-reported measures of engagement are aligned. This alignment suggests that the methods employed effectively capture embodied empathic engagement, providing a robust foundation for further exploration of empathy within the scope of this thesis study.

4.9.6.2 Correlation between liking, familiarity and embodied empathic engagement

A substantial body of research links embodied simulation with aesthetic experience (Freedberg & Gallese, 2007; Di Dio et al., 2007; Battaglia et al., 2011; Cross et al., 2011; Jola et al., 2012; Umiltà et al., 2012; Kirsch et al., 2013, 2015; Ganczarek et al., 2018). According to embodied simulation theory, aesthetic appreciation is influenced by the extent to which perception activates motor resonance and embodied simulation. Studies suggest that one reason observers appreciate both figurative and abstract art is their ability to engage in embodied simulation, particularly in response to visible or implied creative gestures made by the artist (Freedberg & Gallese, 2007; Umiltà et al., 2012; Gallese & Gattara, 2015).

Given these well-established relationships in the literature, one of the objectives of this pilot study was to examine whether similar correlations would emerge within the present datasets specifically between Liking, Familiarity, and Embodied Empathic Engagement. To assess this, the questionnaire responses from all 22 participants across eight paintings were pooled together, and statistical correlations were calculated between their reported levels of liking and their embodied empathic engagement scores. The results indicate a significant positive correlation between empathic engagement and liking, suggesting that participants who reported higher embodied engagement with a painting also tended to rate it more favorably. Table 4.13 presents the correlation and significance coefficients between liking and embodied empathic engagement across all paintings.

Table 4.13 : Correlation and significance of coefficients between liking and embodied empathic engagement across all paintings.

		Liking	Empathy
Liking	Pearson Correlation	1	.612**
	Sig. (2-tailed)		.000
	N	176	176
Embodied simulation and empathy	Pearson Correlation	.612**	1
	Sig. (2-tailed)	.000	
	N	176	176
**. Correlation is significant at 0.01 level (2-tailed).			

Further analysis of correlation between liking and embodied empathy within individual paintings provide important insights as well. For example, the highest correlation between embodied simulation and liking ($p < 0.0001$, $r = 0.875$) is seen in the least liked painting among all participants, which is Van Gogh's Gauguin's chair (p04). The reason that participants did not like the picture might be due to that they could not establish sufficiently strong embodied empathy with the painting. Since this picture was a depiction of everyday objects and does not contain any human figure as well. Table 4.14 shows the correlation between liking and embodied simulation for each painting. For each painting embodied empathy and liking scale items show significant and high correlations.¹

Table 4.14 : Correlation Coefficient Between Liking and Embodied Simulation for Each Painting

Paintings	Significant (p value)	Correlation Coefficient (r)
p01	0,0086	0,557
p02	0,0005	0,692
p03	0,0002	0,727
p04	0,0000	0,875
p05	0,0119	0,537
p06	0,0006	0,683
p07	0,0150	0,522
p08	0,0016	0,644

* $p = 2.01E-07$

The second strongest correlation between embodied simulation and liking ($p < 0.0002$, $r = 0.727$) was found in p03, which is Edward Munch's painting of The Girl by the Window. This painting is one of the most liked paintings by all participants among eight paintings. In addition, it has the second highest embodied simulation score. Thus, looking at the results, although the relationship between embodied simulation and liking can be seen in every picture, it can be said that this relationship is more explicit in some pictures. However, it should be noted that this result alone is not sufficient to interpret the relationship. For example, p07 seems to have one of the lowest correlations between embodied simulation and liking. When we look at the talk-aloud

¹ Pearson correlation was applied between the scale items measuring three different attitudes such as likes, familiarity, and simulated simulation within the same scale, since the data had a normal distribution. r = shows the correlation coefficient, p = significance value. A $p < 0.05$ indicates that the data are statistically significant, and the correlation coefficient of $r > 0.5$ indicates that the variables have a positive relationship with each other (Şahin & Gülleroğlu, 2013).

protocols, it has been observed that p07 evokes really strong emotions on participants, which is also relevant with embodied simulation scores. However, those feelings were mostly pessimistic due to artistic expression of the artist. Thus, participants might have a lower liking score even though they appreciate the work of art.

On the other hand, the relationship between aesthetic appraisal and familiarity appears to be less consistent compared to embodied simulation. Previous studies have produced mixed findings on this topic. For instance, Ludden et al. (2009) demonstrated that familiarity with products in design influences expectations, thereby affecting their aesthetic evaluation. In contrast, Umiltà et al. (2012) found that prior familiarity with Lucio Fontana's artworks did not significantly impact their aesthetic appraisal. However, they observed that participants who engaged with the original artworks exhibited higher liking scores than those in the experimental group. Similarly, Zhang et al. (2017) found that familiarity did not have a significant effect on participants' appreciation of both architectural and non-architectural landscape photographs.

Our findings also indicate a mixed relationship between familiarity and liking across different paintings (Table 4.15). While a significant positive correlation was found for paintings p04, p06, p07, and p08 ($p < 0.01$, $r > 0.5$), no significant relationship was observed for p01, p02, p03, and p05 ($p > 0.05$, $r < 0.5$). These inconsistent results suggest that familiarity does not systematically predict aesthetic preference and that its influence may depend on other contextual or perceptual factors specific to each artwork.

Table 4.15 : Correlation between liking and familiarity

Paintings	Significant (p value)	Correlation Coefficienty (r)
p01	0,583	0,126
p02	0,108	0,360
p03	0,081	0,388
p04	0,003	0,607
p05	0,030	0,468
p06	0,011	0,533
p07	0,000	0,744
p08	0,015	0,522

To summarize, these findings align with existing literature, which suggests that aesthetic experience is closely linked to embodied simulation processes engaged by observers while perceiving artwork (Freedberg & Gallese, 2007; Cross et al., 2011;

Jola et al., 2012; Umiltà et al., 2012; Kirsch et al., 2015). Consistent with prior research, our results indicate that the relationship between aesthetic appraisal and familiarity is less clear, and more variable compared to the well-established link between aesthetic appreciation and embodied simulation. The fact that our findings mirror trends observed in the literature further strengthens the methodological validity of this study, reinforcing the argument that empathy and embodied simulation play a fundamental role in shaping aesthetic experience.

4.9.6.3 Influence of visual representation on empathy and aesthetic appreciation

In this pilot study, participants completed a self-report questionnaire for eight carefully selected paintings, each chosen for their potential to elicit distinct empathic responses (e.g., engagement with the artist's gesture, figures, spatial composition, and emotional content). To examine the impact of representational mode on embodied empathy and aesthetic appreciation, we compared the total scores for liking and embodied empathy across all paintings. Table 4.16 presents the mean scores for each painting across the measured scale items.

The analysis shows that the participants established different levels of embodied empathy with different types of painting. In this context, p07, Jackson Pollock's Yellow Islands painting, has the highest embodied empathy score ($m = 7.18$). It is an abstract composition made by using the technique of applying the paint to the surface by pouring. The reason participants give high embodied empathy scores to this painting might be due to the reason that the gesture of the artists is very visible on canvas. The second highest embodied empathy score ($m = 6.67$) was given to Edward Munch's painting (p03), an expressive figurative painting. Ranking on embodied simulation continues with Vermeer's two paintings p02 ($m = 5.90$) and p01 ($m = 5.464$) respectively, but there is a significant decrease in mean value.

The painting with the lowest embodied simulation scale score ($m = 4.534$) is a figurative painting, Gauguin's Chair which is a distorted depiction of space and objects (p04). It has been followed by p06 ($m = 4.493$), which is a composition of abstract geometric shapes and p05 ($m = 4.996$), which is a depiction of geometric architectural elements on a pizza.

Table 4.16 : The mean value of embodied empathy, familiarity and liking scores of each painting

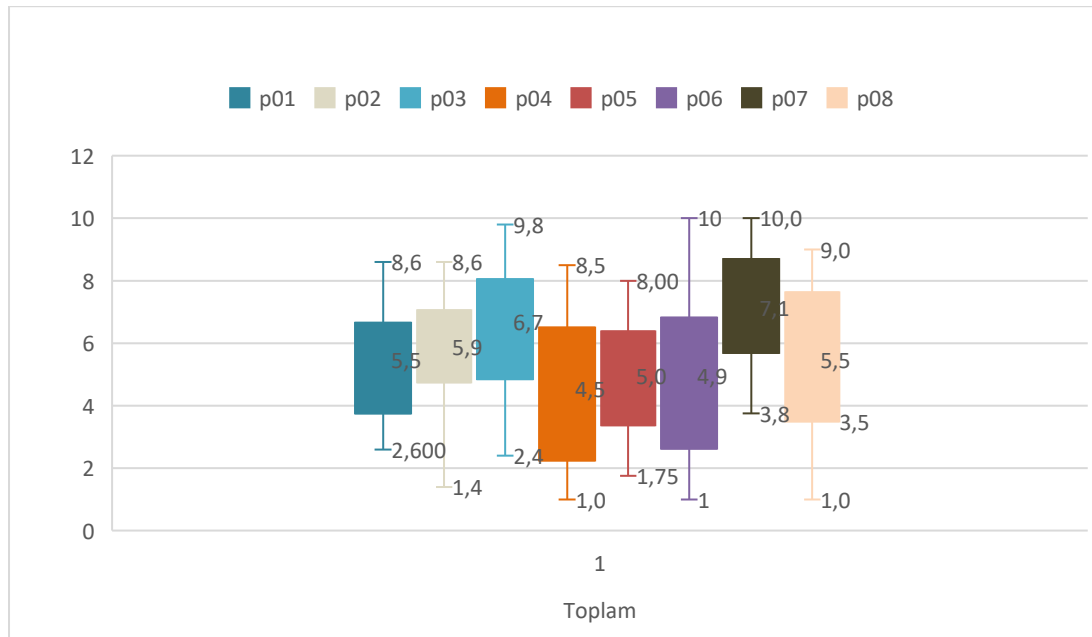
ID	Painting	Description	Mean Value for Empathy	Mean Familiarity	Mean Liking
p01	Johannes Vermeer, The Art of Painting (1666/1668)	Figurative depiction of space, actions, intentions, emotions, objects	5,464	5,682	7,136
p02	Johannes Vermeer, The Milkmaid (c.1660)	Figurative depiction of space, actions, intentions, emotions, objects	5,900	5,000	5,500
p03	Edvard Munch, The Girl by the Window (1893)	Expressive figurative depiction of emotions and feelings	6,673	4,182	6,545
p04	Vincent van Gogh, Gauguin's Chair (1888)	Expressive figurative depiction of space and objects	4,534	4,773	4,364
p05	Giorgio de Chirico, The Enigma of a Day (1914)	Figurative depiction of space containing atmospheric and emotional elements	4,966	4,045	5,500
p06	El Lissitzky, Proun 19D (1920/1921)	Abstract depiction of space	4,943	6,045	6,273
p07	Jackson Pollock, Yellow Islands (1972)	Abstract painting with strong gesture-based brushwork	7,148	6,045	5,409
p08	Frank Bowling, Crevice Reflecting Morning Light (1977)	Abstract painting with tactile qualities	5,455	3,818	6,636

Results indicate that paintings in which the artist's creative gestures—such as the scattering of paint and visible brushstrokes—are clearly discernible, such as P07 and P03, tend to have higher embodied empathy scores compared to both abstract and figurative depictions of geometric components (P05, P06). Furthermore, realistic depictions of interior spaces with human figures demonstrate relatively higher embodied empathy scores than abstract geometric compositions. These findings align with previous research (Freedberg & Gallese, 2007; Umiltà et al., 2012), which suggests that observers engage in embodied simulation in response to the movement embedded in the artist's creative gestures.

On the other hand, another expressive artwork, P04, where brushstrokes are highly visible, received the lowest embodied simulation score. This may be due to the fact

that depictions of objects elicit a weaker emotional impact on participants compared to human figures (P03, P02, P01) and complex abstract shapes (P07, P08). In other words, the lower level of embodied empathy observed for P04 may be attributed to the inherent difficulty of establishing bodily empathy with objects compared to human and abstract expressions. Table 4.17 presents the distribution of embodied empathy scores across paintings

Table 4.17 : Distribution of embodied empathy based on the questionnaire



When examining the results in terms of the mean value of liking, it is observed that complex forms tend to activate participants' simulation mechanisms more than regular, simple geometries. The most liked painting is P01, Vermeer's *The Art of Painting* ($m = 7.136$), followed by P08, an abstract painting with tactile properties ($m = 6.636$). The paintings that I like least are P04 ($m = 4.364$) and P07 ($m = 5.409$). Although P07 is the second least liked painting, it appears to have elicited strong emotional responses from participants. In other words, even though participants did not favor P07, they built powerful embodied simulations with it, as evidenced by their expressions in the talk-aloud protocols and their embodied empathy scores from the questionnaire. The composition's complex, dynamic forms and the artist's visible gestures may have triggered strong but predominantly negative emotions.

Similarly, P06, which consists of abstract simple geometries, was liked by participants ($m = 6.273$); however, it did not elicit strong emotions in terms of embodied empathy.

The findings of this study align with previous research, suggesting that complex and ambiguous forms tend to provoke strong reactions, likely linked to emotional responses in the perception of shapes, even though they may not always be highly appreciated (Shmash et al., 2017).

These findings reinforce the idea that observing empathic engagement with artwork is influenced not only by the presence of recognizable human figures but also by the dynamic qualities of the artwork, particularly the visibility of the artist's creative gestures. The results suggest that paintings featuring expressive brushstrokes and gestural techniques—such as Pollock's and Munch's works—elicit stronger embodied empathy responses than compositions dominated by rigid geometric forms or static spatial depictions.

On the other hand, the divergence between liking and embodied empathy in certain cases (e.g., P07) highlights the complexity of aesthetic experience, suggesting that heightened embodied engagement does not always translate into higher preference. Instead, participants may establish a strong but emotionally intense connection with artworks they do not necessarily favor. This highlights the importance of distinguishing between aesthetic appreciation and embodied simulation, providing further evidence that embodied responses to visual stimuli are driven by a combination of sensory, cognitive, and affective mechanisms rather than by aesthetic preference alone.

4.9.7 Key insights and refinement for the main study

The results of Pilot Study II align with findings in the literature, confirming the role of embodied simulation in shaping empathic engagement with visual stimuli. The study demonstrated that different types of paintings elicited varying degrees of embodied empathic engagement, supporting the theoretical framework guiding this research. The key insights gained from this study, as well as refinements for the main study, are summarized below.

Validation of Methodology

- The findings reinforce the theoretical underpinnings of the study by demonstrating that embodied simulation plays a central role in art perception.

- The results validate the use of think-aloud protocols and self-report questionnaires as effective methods for assessing embodied empathic engagement.
- These methods provided consistent and meaningful data, supporting their application in future research.

Reliability of Experimental Approach

- A significant positive correlation was found between talk-aloud protocols and self-reported questionnaire responses ($p = 0.019$), suggesting a strong alignment between these two different measures of empathic engagement.
- The absence of correlation between Empathy Quotient (EQ) scores and other measures indicates that general trait empathy, as assessed by psychological scales, does not necessarily predict embodied empathic engagement with artwork.
- This suggests that embodied simulation, as examined in this study, represents a distinct dimension of empathy that is not captured by traditional trait empathy assessments.
- The consistency of the experimental results suggests that the procedure is both valid and replicable across different participant groups.

Overall, Pilot Study II confirmed the reliability of the think-aloud protocol and self-report measures in assessing embodied empathic engagement. The consistency between verbal reports and questionnaire responses supports the validity of this methodological approach. Given these findings, the next phase of the study will expand beyond artworks to explore how participants engage with architectural space through visual perception. The experimental setup will be refined to integrate architectural photographs as stimuli, allowing for a more direct investigation of empathic responses to spatial environments.

5. PERCEPTION PHASE: EMPATHIC RESPONSES TO SPACE

Architectural design has long emphasized aligning physical spaces with human bodily experience. Architecture itself is essentially an embodied phenomenon, which interacts with many different areas of the brain in spatial, material, emotional, and many other sensory dimensions far beyond the merely visual (Mallgrave, 2010, p.159). Perception of architectural space is not merely a visual process but an embodied and affective experience. Recent developments in architecture place human embodied experience at the forefront, shifting architectural discourse to encompass not only functional and aesthetic considerations but also space's emotional and experiential dimensions (Gallese & Gattara, 2015; Jelic et al., 2016; Mallgrave, 2010).

This chapter investigates how individuals engage empathically with architectural space through visual perception, focusing on the mechanisms that shape embodied simulation and emotional responses to spatial environments. Böhme (1993, pp. 113–126) defines perception as “a theory of perception in the full sense of the term, in which perception is understood as the experience of the presence of persons, objects, and environments.” This perspective suggests that perception is not merely a passive act of sensing but an active, embodied engagement with the surrounding environment. It extends beyond visual recognition to encompass the felt presence of spaces, objects, and users as an integrated whole.

Building upon the findings of Pilot Study I and II, this study explores how participants interpret architectural spaces through think-aloud protocols and structured questionnaires. Studies examining the neural and behavioral responses created by architectural space or forms on the audience have also found similarities between the perception of space and the perception of art (Vartenian et al., 2013, 2014; Vecchiato et al., 2015; Banaei et al., 2017). By shifting from artistic paintings to architectural images, the study examines how embodied empathic engagement manifests in architectural space.

The results contribute to the ongoing discussion on empathy in architectural experience by providing empirical data on how users engage with affordances,

atmospheres, and movement patterns in built environments. The primary aim of this phase is twofold:

1-To investigate how the perception of architectural space elicits embodied empathic engagement

2-To examine the relationships between trait empathy, embodied empathy, and aesthetic experience in perception of architectural images.

The findings of this phase provide a foundation for understanding how designers and users engage with architectural space before moving into the design phase of the study.

5.1 Methodology for Perception Phase

The perception phase investigates participants' empathic responses to architectural images. To ensure methodological consistency, two pilot studies (Chapter 5) were conducted to develop a reliable scale for assessing empathic engagement with visual stimuli. These initial experiments tested think-aloud protocols, structured questionnaires, and the Turkish Empathy Quotient (EQ) test as tools for capturing participants' engagement. Findings indicated that verbal self-reports provided meaningful insights into participants' embodied simulation and emotional responses to paintings.

Building on these findings, the main study replaces paintings with architectural photographs to examine whether similar mechanisms of embodied empathic engagement extend to spatial perception. To ensure continuity with previous experiments, real interior photographs were selected as visual stimuli. Research suggests that perceiving an image is not solely a visual process but also involves tactile and empathic resonance (Lauwrens, 2019). Like paintings, architectural photographs evoke a bodily experience beyond vision, enabling viewers to mentally simulate touching surfaces or moving through space.

The use of architectural photographs as research stimuli in spatial cognition, aesthetic perception, and embodied engagement is well-documented (Vartanian et al., 2014; Zhang et al., 2018; Courbun et al., 2020). For example, Vartanian et al. (2014) explored how contour type influence users' aesthetic judgments and approach-avoidance decisions using architectural images. Likewise, Courbun et al. (2020) examined aesthetic responses to 200 architectural interior photographs, identifying key

psychological dimensions—coherence, fascination, and hominess—that shape spatial experience. These studies support the validity of architectural images as effective stimuli for investigating spatial perception and embodied engagement, reinforcing their use in this research.

5.1.1 Participants

A total of 26 students (18 females) aged between 19 and 23 ($M = 21.07$, $SD = 1.35$) voluntarily participated in the experiment. Participants were recruited from Özyeğin University and Istanbul Technical University, with 18 students enrolled in architecture programs and 8 in interior architecture programs. Empathy levels were assessed using the Turkish Empathy Quotient (EQ) test, with scores ranging from 39 to 69 ($M = 49.92$, $SD = 9.42$). The distribution of gender, academic standing (junior/senior), and department is shown in Figure 5.1, while Figure 5.2. presents the distribution of empathy scores.

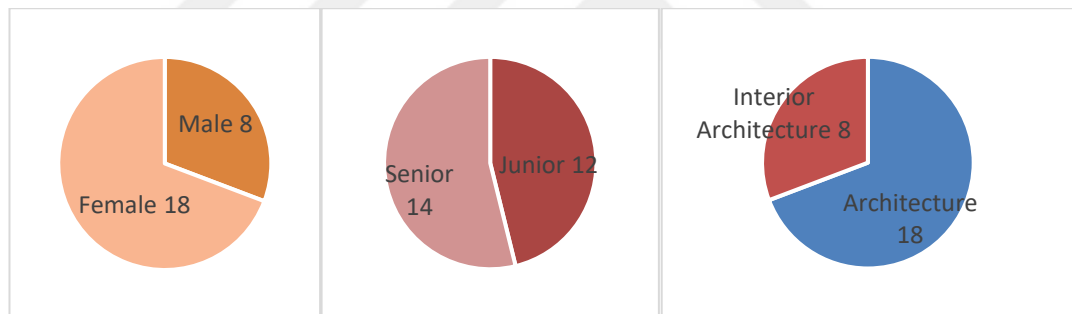


Figure 5.1 : Distribution of gender, academic standing and department of participants

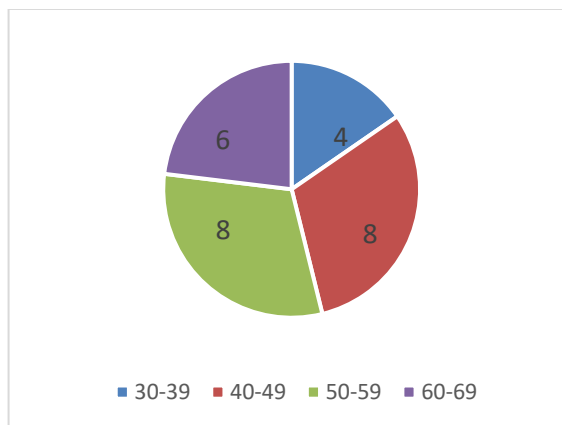


Figure 5.2 : Distribution of empathy scores of participants participating in the perception phase

5.1.2 Materials and stimuli selection

The selection of architectural images for the perception phase was carefully designed to align with existing research on embodied simulation, spatial empathy, and aesthetic perception. Since the previous pilot studies utilized paintings as stimuli, this phase required a shift toward real architectural environments while maintaining the same methodological rigor.

To ensure that the selected images effectively captured key sensorial and spatial qualities, a systematic selection process was followed. First, a literature review was conducted to identify architectural features commonly associated with embodied engagement and empathy. Based on these insights, architectural spaces were categorized under two primary dimensions:

1. Atmospheric Qualities (Daylight, Landscape, Texture & Materials)
2. Spatial Qualities (Variance in Proportion, Curvature of Surface, Sharpness of Surface)

Each of these six subcategories was represented by a diverse set of architectural photographs, ensuring a broad spectrum of spatial experiences. To refine the selection, a jury evaluation process was conducted, where eight experienced jury consist of architects and designers assessed the images based on their sensorial, emotional, and embodied impact. The final 12 photographs used in the main experiment were selected based on this evaluation.

5.1.2.1 Theoretical framework for selection

The experience of architecture is multidimensional, requiring a comprehensive approach to fully understand it from a cognitive and perceptual perspective. To ensure a systematic and research-driven selection of architectural images, a stimuli catalog was compiled by identifying key architectural qualities associated with embodied simulation and spatial empathy. In selecting stimuli for this study, features that shape the sensorial and emotional perception of space were categorized under atmospheric qualities, including landscape integration, daylight presence, and material texture—each playing a crucial role in shaping embodied and empathic engagement. Meanwhile, spatial qualities, which influence bodily interaction and spatial cognition,

were categorized based on variations in proportion, surface curvature, and surface sharpnes (Table 5.1).

Table 5.1 : The Structure of the categorization

Atmospherics Qualities		
/ Experience of light / Perception of time / Atmospheric qualities / Spatial differentiations / Experience of nature/ Experience of material qualities / Sense of touch		
Daylight (1)	Landscape (2)	Texture & Material (3)
Spatial Qualities		
Spatial Geometry / Experience of geometry / Body movements / Postural Decisions / Experience of navigation /Kinesthetic sensation / Bodily measurement / Scale / Self projection into spatial proportion		
Spatial Dimension (1)	Curvature of surface (2)	Sharpness of surface (3)

Atmospheric Qualities

Atmospheric qualities pertain to how sensory and emotional experiences are shaped by the environment. They encompass the intangible yet profoundly felt characteristics of space, such as variations in light, textures, temporal changes, and connections with nature. These elements collectively influence the perceived ambiance and emotional resonance of architectural spaces, evoking embodied and empathic responses from users. In the selection of visual stimuli, therefore, it was focused on images that depict the integration of landscape with interior spaces (1), the presence of daylight reflecting within the space (2), and spaces with pronounced tactile qualities (3).

Daylight

Architect Steven Holl viewed light as an almost tangible architectural element, stating, *“Someone asked what my favorite material was and I said, ‘Light.’ I really believe in a certain sense you can sculpt with light.”* (Holl, 2015; Erwine, 2016). While its visual experience is often emphasized, daylight also provides a profound phenomenological experience, shaping perceptions of time and spatial differentiation. As Mallgrave (2010) argues, the most fundamental perceptual sensations—such as morning light streaming through a window—serve as powerful sensory symbols, deeply embedded in architectural metaphors that resonate with basic human experiences.

The multisensory effects of daylight continuously shift and transform the atmospheric qualities of architectural space. Furthermore, light influences spatial perception and use, affecting bodily orientation, movement, and emotional response, whether by guiding us toward brighter areas or creating contrasts between quiet and active zones

(Erwine, 2016). Even its absence, through shadows and darkness, contributes to atmospheric qualities, leaving perceptual and tactile impressions.

Given the embodied role of daylight in shaping architectural experience, six interior spaces where natural light serves as a defining atmospheric element were selected as stimuli for this study. Accordingly, six architectural spaces where daylight plays a defining role in shaping spatial atmosphere were selected as stimuli for this study. The selected spaces are presented in Appendix Figure A1.

Landscape

Landscape is a design element that enriches the sensory atmosphere of the built environment, especially when closely integrated with interior spaces. Transitions from natural environments to indoor settings, such as landscape views, play an important role in shaping interior atmosphere. Studies show that landscape is key in evoking embodied aesthetic experiences from an evolutionary perspective (Kaplan & Kaplan, 1989; Whang et al., 2015; Zhang et al., 2018).

People's inclination toward natural environments is explained by evolutionary theories, which suggest that such preferences may be linked to survival and well-being (Kaplan & Kaplan, 1989; Coburn et al., 2020). For example, Zhang et al. (2018) found that both landscape and non-landscape architectural photographs evoke similar aesthetic feelings. However, based on reaction times, strong aesthetic preferences were observed for landscape architecture. They suggest that this preference is due to the evolutionary aspects of aesthetics, as human beings are naturally drawn to beauty in natural elements. Zhang et al. (2018) further propose that components of landscape architecture, such as water, trees, and plants, evoke strong evolutionary implications, which can be associated with embodied approaches to beauty.

Given its important role in both shaping the embodied aspects of aesthetics and influencing the atmospheric qualities of indoor environments, landscape scenery was used as a criterion for selecting interior photographs. Accordingly, six interior spaces that prominently integrate landscape elements were selected as stimuli for this study. The selected spaces are presented in Appendix Figure A2.

Texture & Material

Architectural space is experienced not only visually but also through haptic senses. Ultimately, architecture is a tangible medium that inherently carries *tactile values*, as

Berenson (1905) argues in the context of paintings. Similarly, architectural photographs of interiors convey a *tactile value*, allowing viewers to mentally simulate texture and materiality. The unique surface textures, forms, and density of materials create a resonance between touch and vision. The sensory level of aesthetics in design is built upon the interplay between form, material, and tactile dimension (Folkman, 2015). As a result, the design of surfaces, materials, and intricate details has always been a focal point in architectural practice.

Zumthor emphasizes the deep connection between materiality and architectural experience, stating, “*The sense I try to instill into materials is beyond all rules of composition, and their tangibility, smell, and acoustic qualities are merely elements of language that we are obliged to use*” (Zumthor, 1988, p. 11). Likewise, Franck (2008) asserts that the visual effect of a surface remains incomplete until it evokes a tactile sensation, allowing the viewer to imagine its texture and materiality (Franck, 2008; Darcan, 2014).

Building on this body of literature, it can be concluded that material qualities play a crucial role in shaping embodied perception and evoking a sense of touch. Wölfflin (1864–1945) and Benjamin (1892–1940) similarly highlight the relationship between tactility and empathic response in architectural experience (Paterson, 2014). Considering these insights, six interior spaces were selected where materiality and surface qualities are prominently featured. The selected examples, encompassing both public and private spaces, are given in Appendix Figure A3.

Spatial Geometry

Spatial qualities relate to the structural and geometric characteristics of architectural spaces and their implications for bodily interaction and spatial cognition. These aspects of spatial form and proportion directly engage the body through movement, posture, navigation, and kinesthetic sensations, thereby shaping empathic engagement through embodied experience. Drawing on studies that highlight the varying effects of spatial geometry on human perception and behavior, the selection of visual stimuli focused on three key spatial characteristics: (1) variance in proportion, (2) curvature of the surface, and (3) sharpness of the surface.

Variance in proportion

Recent studies indicate that human cognition is deeply embodied (Nöe & O’Regan, 2002; Clark, 2008). As we navigate an environment, our cognitive perception is

influenced by both sensory-motor expectations and emotional evaluations. The geometric character of a space—whether defined by smooth, curvilinear forms or sharp, angular edges—fundamentally shapes aesthetic experience.

Spatial geometry is thus a fundamental aspect of architectural design, extending spatial experience from surface textures to more complex tactile and kinesthetic engagements. The sophisticated perception of somatosensory space integrates proprioception—the relative location of adjacent body parts in space—and kinesthesia, the sense of force or effort involved in motion (Erwine, 2016).

In essence, the aesthetic impact of spatial proportions is deeply intertwined with embodied cognition; we instinctively “feel” the shape of a room with both our bodies and minds, and this somatic response strongly influences our appreciation of environments. Pallasmaa (2005, p.67) states that architectural scale is understood through bodily measurements and self-projection into spatial proportions. Considering these insights, the researcher selected six architectural spaces featuring notable variations in spatial proportions. The chosen public and private projects are presented in Appendix Figure A4.

Curvature

Geometry significantly shapes the aesthetic experience of architectural spaces. Research demonstrates that humans consistently associate curvilinear contours with positive, pleasant feelings. This preference for curvature emerges early in life; even infants gaze longer at rounded shapes than angular ones (Vartanian et al., 2019). Neurological evidence supports this inclination, as curvilinear forms activate specific brain regions such as the anterior cingulate cortex (ACC), enhancing theta wave coordination and contributing to positive emotional responses (Banaei et al., 2017).

Vartanian et al. (2013) revealed that contours in architectural spaces significantly affect beauty judgments but have a limited impact on approach-avoidance decisions. They showed participants interior photographs varied in curvilinear vs. rectilinear forms and asked them to judge each stimulus as either “beautiful” or “not”. In addition, using a five-point scale, they also gathered subjective scores of the participants on pleasantness and appearance. They found a higher aesthetic preference on curvilinear forms than rectangular shapes, but they found contours does not affect immediate behavioral decisions, such as approaching or avoiding a space. In other words, they

suggest that smooth, curvilinear forms increase aesthetic appreciation by evoking emotional resonance but do not directly dictate spatial behavior.

On the other hand, research indicates that aesthetic preferences for curvilinear or angular spaces vary based on design expertise. For example, Silvia and Borana (2009) observed that novice designers prefer rounded forms, while those with advanced design expertise prefer more complex, angular shapes. Similarly, Smesh et al. (2017) noted that non-designers prefer curved spaces, while those with design training are more attracted to sharp-angled environments. Considering these embodied implications and diverse psychological responses, six architectural examples employing curvilinear surfaces and forms were selected for this study. These selected public and private spaces are presented in Appendix Figure A5.

Sharpness

Drawing upon insights from existing literature, six architectural spaces characterized by sharply angled forms—as opposed to curvilinear geometries—were selected to investigate how angularity influences empathic and embodied engagement. These examples represent a range of angular configurations, enabling an in-depth exploration of how sharply defined surfaces influence empathic responses and spatial perception. The selected public and private architectural spaces are detailed in Appendix Figure A6.

5.1.2.2 Jury process (Narrowing down the photo selection)

To finalize the stimuli for the main experiment, a jury evaluation process was conducted involving a panel of eight experienced professionals, comprising architects and designers holding advanced degrees (master's and Ph.D.) and representing diverse backgrounds in architecture and interior design. Jury members also completed the Turkish Empathy Quotient (EQ) test. Demographic details and professional backgrounds of jury members are presented in Table 5.2. The jury evaluation process ensured a rigorous and informed selection of architectural images used as stimuli in the main study.

Table 5.2 : Table demonstrates professional profiles of the jury members.

Judges	Gender	Age	Education	Empathy Test Score
j01	F	31	Industrial Designer / PHD in Design	63
j02	M	32	Architect / Master in Interior Architecture	58
j03	F	31	Architect / PHD in Architecture	49
j04	F	27	Architect / PHD in Architecture	30
j05	F	28	Architect / PHD in Architecture	51
j06	F	27	Architect / Master in Architecture	56
j07	F	29	Architect / PHD in Architecture	56
j08	F	29	Architect / Master in Architecture	41

Each jury member reviewed a catalog of 36 architectural projects compiled by the researcher, divided evenly into public and private interior spaces. After viewing photographs of three spaces within each category, jury members completed an online questionnaire via Google Forms. This questionnaire aimed both to pre-test questions for the main study and to better understand the rationale behind jury selections.

The jury was asked to select from each set of three images, the one space that had the strongest sensory, emotional, and embodied impact. In cases where two or more spaces received equal votes within the same category, the final selection was determined based on the average questionnaire scores. Based on the results of jury evaluation, 12 venues are selected in total, consisting of one public and one private space for each category (Figure 5.4). The total evaluation took approximately 1 hour for each jury member.

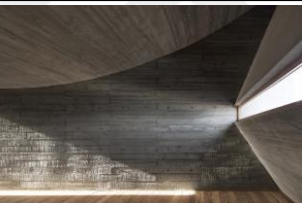
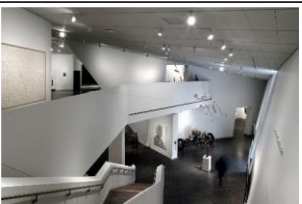
P R I V A T E	Refurbishment of a Country House / Arquitectura-G	Off Grid Home in Extremadura / Ábaton Architects	Cabin Norderhov by Atelier Oslo
	<i>Location: Emporda, Spain, 2015</i>	<i>Location: Caceres, Spain, 2010</i>	<i>Location: Norway, 2014</i>
			
	Pit House / UID Architects	House NA / Sou Fujimoto Architects	Hiroshi Nukama / Dancing trees, singing birds
	<i>Location: Okayama, Japan, 2011</i>	<i>Location: Tokyo, Japan, 2011</i>	<i>Location: Tokyo, Japan, 2007</i>
			
P U B L I C	The Broad Museum / Diller Scofidio + Renfro	Seashore Library / Vector Architects	NYU Department of Philosophy / Steven Holl Architects
	<i>Location: Los Angeles, USA, 2015</i>	<i>Location: Qinhuangdao Shi, China, 2015</i>	<i>Location: New York City, NY, USA, 2004-2007</i>
			
	The Design Museum of London / OMA + Allies Morrison + John Pawson	Denver Art Museum / Studio Libeskind	Zinnengasse Restaurant / Wuelser Bechtel Architekten
	<i>Location: London, UK, 2016</i>	<i>Location: Denver, USA, 2006</i>	<i>Location: Zurich, Switzerland, 2016</i>
			

Figure 5.3 : Selected interiors by jury members to be used in the main experiments

5.1.3 Experimental setting and procedure

The main experiment followed the same methodology as the pilot studies (Chapter 4). First, participants viewed interior architecture photographs of 12 projects selected by the jury. Think-aloud protocols were conducted while participants were viewing photographs of each space. They were allowed to view each space for as long as they wished but were given a two-minute time slot to verbally express their thoughts,

feelings, and impressions about each space. The experiment was conducted online via individual Zoom meetings. All sessions were audio-recorded with the consent of the participants, and each session lasted approximately 50 to 80 minutes. Images were presented to the participants in different orders to minimize the order effect. A representative example of the presentation setup is given in Figure 5.4.

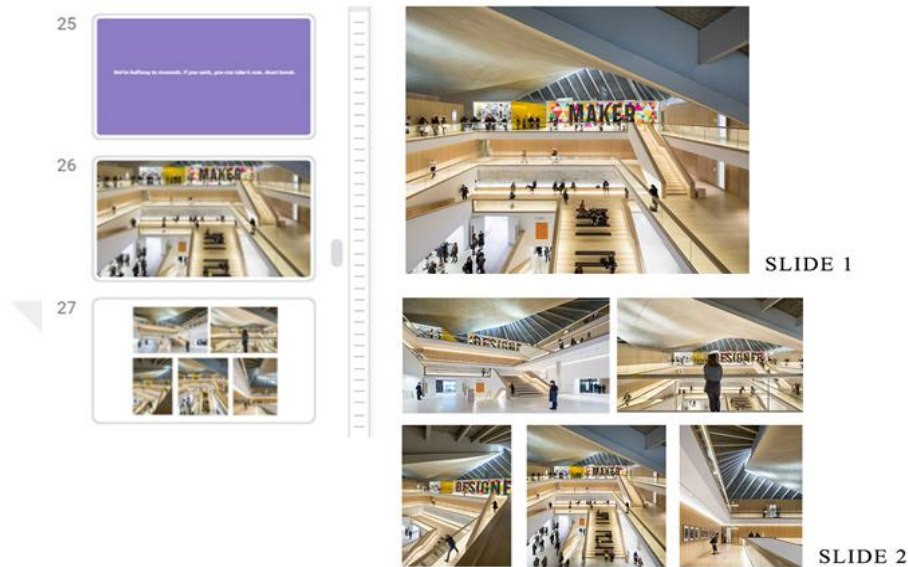


Figure 5.4 : An example from presentation given to the participants

The students were given a remote control to switch back and forth between the two slides and look at the photographs as they wished. They had two minutes of talk for each architectural space. Immediately after viewing each image, participants answered survey questions by clicking on a link provided. They were encouraged to continue thinking aloud while completing the survey as necessary.

Before starting the actual experiments, participants were familiarized with the task via a trail experiment. The instructions before the experiments were as follows.

- You can watch the photos as much as you want. Please focus on the user experience of the place in the photo while watching.
- You can start talking when you feel ready.
- When you start talking, try to express out loud any thoughts and feelings you can think of about the place and its experience.
- You can think of this experience as thinking aloud.

- Your speaking time is a maximum of 2 minutes. The researcher will warn you when your time is done.
- There are 2 slides for each venue. While talking, you can move back and forth between the two slides as you wish, and you'll be in control. When you're done speaking, you can move on to the next slide and click the link.
- Before the real experiment begins, we'll do a short exercise

Finally at the end of talk- aloud sessions participants completed the Turkish version of the Empathy Quotient (EQ) test, allowing for an assessment of individual empathy traits in relation to their perceptual experiences. The recorded verbal responses were subsequently transcribed and analyzed. An example passage from the s12 for public space 5 (The Broad Museum) is given in the Table 5.3.

Table 5.3 : Example transcripts from the protocols.

s12_ Expressions on The Broad Museum (p5)
This place attracted my attention much more than the previous images. I guess the main reason for this is that this one defines an amorphous space. I think the organicity makes the place more interesting. Almost nothing and only the escalator, two or even three stairs.... Partitions reminiscent of a cave entrance. In fact, it is like calling you to go and experience the place. Especially when the lighting is embedded directly (into ceiling) without hanging down, it emphasizes smoothness more, at least it made me feel that way. Likewise, the lightings directed to these openings also emphasize the infinity of the space. In fact, when I saw it in this photo, it seemed to me that it went into the darkness and came back to the light, actually it seemed like a very interesting definition of space. 2- I likened to an image, because less of this type of organic places in Turkey 2.1. I didn't actually see it; it resembled a movie frame. (5) 3- I felt the coldness of the place very well, I also felt the light and texture also felt this. (10) 4- The place aroused a lot of curiosity on me. It excited me. I wonder where openness is taking us rather than pressure and boredom. (10) 5- It felt like a dry place, but on the contrary, I felt a dampness as it resembled a cave. (8) 6- I would love to touch surfaces (10) 7- I positioned myself while looking at the walls while standing, not sitting. (8)

5.1.3.1 Likert Scale Questionnaire

The questionnaire used in the main experiments was developed based on existing studies in literature and refined through two pilot studies. Initially, survey questions were formulated according to relevant empirical research on embodied simulation and empathic engagement with visual stimuli. These initial questions were subsequently refined and tested during two pilot studies conducted with students.

In Pilot Study I, the initial set of survey questions was evaluated in a real museum setting with experienced designers (Aktas Yanas, 2018). Following that, in Pilot Study II, the questions were tested with a larger group of participants. The results obtained in this study were in line with the existing literature, showing that the used question set was reliable and consistent in measuring concrete empathic responses (Aktas Yanas & Gul, 2020). Based on these validations, the final questionnaire was carefully revised to accurately measure concrete empathy in architectural contexts, especially for the main experiment.

The finalized survey consists of a Likert-scale questionnaire specifically adapted to assess embodied empathy with architectural interiors present in Table 5.4. During the main experiments, participants completed the questionnaire immediately after the talk-aloud protocols. Questions were administered through Google Forms and embedded directly into the PowerPoint presentations to streamline the experimental procedure and enhance usability (Figure 5.6). Talk aloud protocols and surveys are conducted in Turkish and translated to English for the report.

1- Görselini izlediğiniz bu mekanı ne kadar beğendiniz?



1 2 3 4 5 6 7 8 9 10

oldukça az ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ oldukça fazla

2. İzlediğiniz mekan gördüğünüz bir fotoğrafa mı yoksa daha önce içinde bulunduğunuz bir mekana mı benziyordu?

☐ Gördüğüm bir imaja

☐ Bulduğum bir mekana

☐ Hiçbiri

Figure 5.5 : An example google form from the presentation

Table 5.4 : Survey questions used in the experiments

	Liking	Q1- How much do you like this place you have been shown?
	Familiarity	Q2. The place you have been shown does it like a photograph you have seen or a place you have been in before? 2.1. If you resemble a place you've seen or been in before, how much did it remind you of that place? (If your answer to the above question is none, you can give the lowest score (1))
Sensual Experience	Atmosphere	Q3- How much did you feel the atmosphere (light, texture, warmth, coldness, etc.) of the place?
	Emotion	Q4- How much emotion did the place have on you? (eg peace, comfort, curiosity, pressure, boredom, etc.)
	Sensation	Q5-How much sensory feeling did the place have on you? (e.g. sound, smell, taste, humidity, heat, etc.?)
	Touching	Q6- How much did you want to touch the surfaces? (e.g. walls, railings, carpets, etc.?)
Spatial Experience	Self-referencing	Q7- How much did you position yourself in the space? (e.g. standing, sitting, walking, looking at the ceiling, etc.)
	Presence	Q8- How much did you feel inside in this place while watching the visual?

5.2 The analysis of Verbal Data and Segmentation

The verbal data gathered from the think-aloud protocols were transcribed and analyzed using Chi's (1997) verbal analysis technique. The transcripts were coded based on the "Feeling As" framework, which was detailed in the methodology chapter (Chapter 4). Ad hoc technique is applied to code the verbal data. First the verbal data is identified and categorized into the sections that naturally developed coherent ideas, with boundaries set by their conceptual relevance within the data context. Generally, one semantic unit consists of a single sentence, but in certain instances, it may encompass two sentences. The participant discusses the same concept in the example below across different sentences. It is coded as one segment under the category 'SPACE' as the participant is referring to the sense of complexity in space.

And when I look at the photos below, I feel confused; I can't really perceive them. Again, as much as the white color is used, simplicity disappears; instead, there is a feeling of confusion [SPACE].

On the contrary, there are instances where a single sentence contains two segments. For example, the participant discusses the atmosphere and her appreciation of the space in the following excerpt.

Apart from that, I liked [Appreciation] the light it received and how it made me feel at home even with such small furniture [SPACE].

In qualitative analysis, larger units can increase complexity and create contradictions since they may involve diverse ideas in one segment, particularly in intercoder reliability assessments (O'Connor & Joffe, 2020; Hruschka et al., 2004). The segmentation method prioritizes capturing coherent ideas within manageable segments, allowing nuanced interpretation while maintaining reliability. This approach balances the need to preserve the original context with the practicalities of coding complexity and analytical sensitivity. The coding process and qualitative analysis of this data with findings from the Design Phase will be discussed in greater detail in Chapter 6.6.

5.3 The Analysis of Survey Questions

The data collected from the questionnaires were analyzed using statistical methods to identify patterns and relationships in participants' responses. First, reliability tests and factor analysis were conducted. When all responses given by the participants for 12 space were examined, internal consistency of scale items prepared to measure embodied empathy was found to be reliable (Cronbach $\alpha > 0.777$). Reliability and item statistics are provided in Table 5.5.

Table 5.5 : Reliability and item statistics of embodied empathy scale items

Reliability Statistics			
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items		N of Items
.777	.792		6
Item Statistics			
	Mean	Std. Deviation	N
Atmosphere	7.7724	1.98130	312
Emotion	7.2981	2.22618	312
Sensation	5.9167	2.74409	312
Touch	5.7500	3.16151	312
Perspective- Taking	7.2115	2.62809	312
Presence	7.1186	2.56780	312

5.3.1 Principal Component Analysis

Following the reliability tests, a principal component analysis (PCA) was conducted to identify the underlying components of the embodied empathic experience, thereby quantitatively supporting the "Feeling As" framework. The PCA results revealed two distinct factors directly aligned with the framework's conceptual structure.

5.3.1.1 Sensory Experience (Factor 1)

The first factor consists of atmosphere ($r = .499$, $p < .01$), emotion ($r = .480$, $p < .01$), sensory ($r = .399$, $p < .01$), and touch ($r = .307$, $p < .01$). This factor was labeled **Sensory Experience** since it reflects the relationship between the haptic, sensory, and atmospheric qualities of space and the emotional responses they evoke. In other words, designers engage with space not merely as a visual object but as a multisensory and atmospheric experience, mentally simulating the material and tactile details of the environment. The rotated component matrix (Figure 5.6) illustrates how these components cluster together under Factor 1.

	Component	
	1	2
Atmoshpere	.298	.701
Emotion	.401	.646
Sensory	.264	.631
Touch	-.021	.734
Pers_taking	.920	.198
Presence	.927	.231

Extraction Method: Principal
Component Analysis.
Rotation Method: Varimax with Kaiser
Normalization.^a

a. Rotation converged in 3 iterations.

Figure 5.6 : Rotated Component Matrix presenting factor loadings for Sensory and Spatial Experience

The connection between emotional and sensory experiences is consistent with existing literature. Emotion, in its most basic sense, is a reflective response of an organism to a stimulus, which in architectural terms translates to the emotional and sensory response to the built environment (Mallgrave, 2015). Pallasmaa (2014) similarly emphasizes that atmospheres are not intellectually processed but rather perceived and

mentally embodied through the interaction of multiple sensory modalities. PCA results support the Feeling As (in the Space) category by suggesting that emotional and sensory experiences are intertwined, justifying the decision to code emotional and haptic engagement under the same umbrella of atmosphere

5.3.1.2 Spatial Experience (Factor 2)

The second factor consists of presence ($r = .393$, $p < .01$) and perspective-taking ($r = .388$, $p < .01$), which reflect the sense of being physically situated within the space and imagining it from their own or another person's perspective (Figure 6.4). This factor was labeled **Spatial Experience** since it illustrates how designers engage with space not only as a visual construct but also as an embodied experience. This finding indicates that designers perceive space visually while simultaneously envisioning how others will perceive it by simulating their physical presence. In other words, designers empathize with others' bodies and actions in space or project themselves into space as they are experiencing it. The distribution of components in rotated space is illustrated in Figure 5.7.

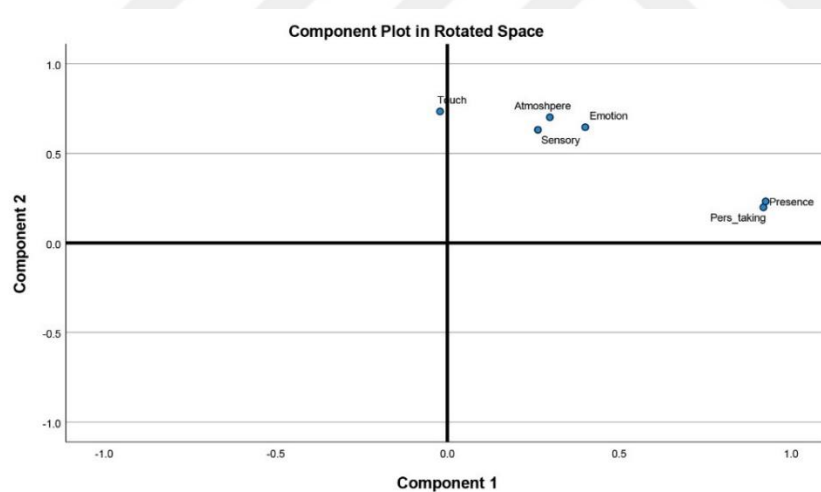


Figure 5.7 : Component Plot in Rotated Space showing the distribution of sensory and spatial factors

5.3.1.3 Absence of Movement in PCA Results

PCA results do not reveal a factor that directly supports the category of **Feeling As (the Movement)**. This aligns with the idea that movement-related empathic engagement is primarily captured through qualitative data rather than quantitative measures. While atmospheric and spatial experiences can be effectively measured through self-report and scale-based methods, the simulation of movement and dynamic

interaction with space appears to be more complex and primarily manifests in verbal protocols. In essence, the participants' verbal expressions, rather than survey outcomes, highlighted the designer's capacity to perceive or simulate movement behind static objects in a space. These results suggest that movement-based empathy is better captured through qualitative, narrative-focused analysis rather than through structured questionnaires.

5.3.1.4 Mixed-Method Insight and Theoretical Implication

These results demonstrate that the "Feeling As" framework is supported by both quantitative (PCA-based) and qualitative (verbal protocol-based) components. PCA highlights the connection between sensory and spatial experiences and empathic engagement, while qualitative data provides deeper insight into the dynamic and action-oriented aspects of embodied empathy. PCA results confirm that there is no factor directly supporting the Feeling As (The Movement) category, indicating that the empathy established by designers with movement and spatial dynamics is mostly revealed in verbal protocols and qualitative analyses. This strengthens the mixed-method nature of the study and underscores the importance of using both quantitative and qualitative methods in empathy research.

Finally, the consolidated "Feeling As" framework, integrating insights from both the perception and design phases, is discussed in greater detail in Chapter 6.

5.3.2 Correlation between liking, familiarity and empathy

After the reliability test and factor analysis, participants' mean scores for Liking, Familiarity, and Empathy were calculated. The correlation analysis, based on data from 26 participants for 12 venues (in total 312 responses), revealed a positive relationship between liking, familiarity, and embodied empathy ($p < 0.01$, $r > 0.3$). These findings are consistent with previous research demonstrating the link between embodied simulation and aesthetic perception (Freedberg and Gallese, 2007; Di Dio et al., 2007; Battaglia et al., 2011; Cross et al., 2011; Jola et al., 2012; Umiltà et al., 2012; Kirsch et al., 2013, 2015; Ganczarek et al., 2018). Table 5.6 shows the correlation between embodied empathy, liking and familiarity.

Table 5.6 : Table Correlation analysis

Variable 1	Variable 2	Pearson r	p-value
Liking	Familiarity	0.207	0.00023
Liking	Empathy	0.567	6.53×10^{-28}
Familiarity	Empathy	0.197	0.00046

- Liking and Familiarity display a weaker but still positive correlation ($r = 0.207$, $p < 0.05$). While familiarity with space does not appear to have a dominant influence on liking, the positive correlation implies that prior exposure to similar spatial qualities might subtly enhance aesthetic and empathic engagement.
- A significant correlation was also found between Liking and Empathy ($r = 0.566$, $p < .001$). This indicates that participants who reported higher liking for a space also experienced a stronger embodied empathic response, which aligns with the literature suggesting that positive aesthetic appraisal is closely linked with embodied simulation (Freedberg & Gallese, 2007; Di Dio et al., 2007)
- Additionally, Familiarity has weak but positive correlation Empathy ($r = 0.197$, $p < 0.05$), indicating that participants' sense of familiarity with a space may enhance their embodied experience of it.

Interestingly, although liking and embodied simulation are positively correlated, qualitative data from the think-aloud protocols suggest that participants sometimes felt physically present in a space even if they did not find it aesthetically appealing. For instance, several participants (p07, p09, p18, p20, p21) explicitly stated that they experienced a strong sense of bodily presence while observing p03 (NYU Department of Architecture) despite disliking it. For example, p07 remarked:

"It's very irritating. I mean, my fear of heights resurfaces. It is beautiful as a venue, but I wouldn't want to be there."

Similarly, p19 noted that the space was disturbing due to the staircase's sharp, angular design: "It makes me uncomfortable; the angles of the staircase make me feel unstable."

The verbal expressions of participants suggest that architectural spaces can elicit strong embodied reactions even when these reactions are emotionally negative. In other words, embodied empathy with architectural space is not limited to positive aesthetic responses but can also emerge from negative feelings. A similar result was observed in Pilot Study II, where participants experienced high embodied empathy while viewing Jackson Pollock's gesture painting, *Yellow Islands*, despite reporting negative emotional reactions. These findings indicate that spatial features emphasizing movement (e.g., stairs, sharp angles, height variations) strongly activate sensorimotor processes, eliciting embodied responses even in the absence of positive aesthetic evaluations. This phenomenon aligns with existing research on embodied empathy in visual art, including studies on Jackson Pollock's action paintings (see Chapter 4) and Lucio Fontana's cut canvases (Umiltà et al., 2012).

5.3.2.1 Effect of Human Presence and Landscape

In addition to the correlation analysis, the study examined whether the presence of human figures or landscape influenced ratings of liking or embodied empathy. An independent samples t-test (assuming unequal variances) was performed to determine whether the presence of human figures in architectural photographs significantly affects embodied empathy ratings. No statistically significant difference was found in the comparison of liking between photographs of spaces with human and non-human figures ($t(255) = -1.538, p = 0.125$). Similarly, no statistically significant difference was found in the comparison between the presence of human figures in screen photographs and the degrees of embodied empathy ($t(256) = -0.821, p = 0.412$). This result shows that the presence of human figures in space photographs did not significantly change the participants' liking levels of space or their empathic interactions.

However, a meaningful difference was found in the liking ratings between landscape and non-landscape architectural photographs, with landscape pictures being rated higher in both liking and empathy. A significant difference in liking ratings was observed between landscape-containing images ($M = 7.66, SD^2 = 4.68$) and non-landscape images ($M = 6.58, SD^2 = 6.55$); $t(250) = -3.66, p < .001$. This statistical outcome reinforces the qualitative insights, suggesting that architectural photographs including landscape elements are more positively evaluated. This finding aligns with

existing literature highlighting the evolutionary preference for natural environments, indicating that landscape significantly contributes to embodied aesthetic experiences (Kaplan & Kaplan, 1989; Whang et al., 2015; Zhang et al., 2018).

Regarding embodied empathy ratings, landscape-containing photographs ($M = 7.12$, $SD^2 = 2.58$) scored slightly higher than non-landscape photographs ($M = 6.75$, $SD^2 = 3.22$); $t(254) = -1.73$, $p = .042$ (one-tailed). Although the difference is smaller and less significant than the liking ratings, this result still suggests that landscapes contribute positively to empathic experiences.

The statistical findings align closely with qualitative insights derived from participants' verbal descriptions, further emphasizing the impact of landscape elements. The qualitative data aligns with this finding, indicating that natural elements like water, plants, and trees strengthen empathic resonance through sensory and emotional engagement. This effect is particularly evident in participants' verbal expressions. For example, one participant (p24) described the experience of looking at a landscape-integrated space (Figure 5.8) as follows:

"So when I look here right now, it's a place where I wish I was here. It's pretty peaceful. That view outside... just sitting there, I'm sure, is a very peaceful thing. There, even that (one) image is enough." participant p24, discussing the 'Off Grid Home')



Figure 5.8 : The landscape view from 'Off Grid Home'.

To conclude, statistical analysis and verbal data gathered from the protocols complement each other. While statistical results confirm quantitative differences in liking and empathy ratings, qualitative insights from participants' verbal responses provide deeper context, emphasizing how certain spatial attributes evoke sensory and

emotional resonance. Together, these methodological approaches underline the nuanced ways in which landscape elements contribute to empathic and aesthetic responses. Moreover, these findings support the notion that empathic experiences and aesthetic evaluations discussed later in this study are primarily influenced by spatial features such as atmosphere, light, material, and landscape, indicating that human presence is not a crucial factor for empathic engagement or aesthetic evaluation in architectural photographs.

5.3.3 The link between trait empath and embodied Empathy

Similar to the pilot study, no significant relationship was found between the Turkish Empathy Test scores and survey responses measuring embodied empathy ($p > 0.05$). This suggests that participants' trait empathy, as measured by the Turkish Empathy Test, does not directly correlate with their empathic engagement with architectural photographs. Table 5.7 presents correlation of empathy scores between survey and EQ.

Table 5.7 : Correlation Between Empathy Score Based on Survey and EQ

Turkish Empathy Test & Embodied Empathy (Based on survey)	
Coefficient	0.045898325
N:	26
T statistic:	0.225092172
DF:	24
p value	0.823813146

This result reinforces the idea that embodied empathy in architectural perception may not be strongly influenced by stable, personality-based trait empathy. Instead, it appears to be more situational and context-dependent, shaped by spatial and atmospheric qualities rather than individual differences in empathic disposition.

5.4 Summary and Transition to Design Phase

This chapter has presented a detailed analysis of the Perception Phase, investigating how architectural spaces evoke empathic and aesthetic responses. The findings from both quantitative (PCA, correlation analysis) and qualitative (verbal protocols) data offer a nuanced understanding of embodied empathy in architectural experience.

The Principal Component Analysis (PCA) identified two distinct factors that align with the conceptual structure of the "Feeling As" framework: Sensory Experience and Spatial Experience. While the PCA results quantitatively support the Feeling As framework's Sensory and Spatial Experience dimensions, the Movement dimension remains primarily grounded in qualitative findings from the think-aloud protocols. This highlights the value of employing a mixed-method approach, where quantitative and qualitative insights complement each other to provide a comprehensive understanding of embodied empathy in design cognition.

Final coding scheme based on the Feeling As framework is structured through the analysis of verbal protocols collected from both the perception and design phases. The qualitative insights drawn from the design process—particularly how designers simulate the user, space, and movement—serve to establish a deeper link between perception and action in architectural thinking.

The following chapter provides a detailed account of the design phase, outlining its methodology, the applied coding schema, and analyses based on both textual and video-based protocols. It further discusses how empathy manifests in the design process and concludes with a synthesis that bridges the findings from both the perception and design phase

6. DESIGN PHASE: FROM PERCEPTION TO ACTION

The perception phase (Chapter 5) explored how designers engage empathically with architectural images, revealing their affective and cognitive responses to visual stimuli. Building upon this, the second phase (Design Phase) investigates the empathic engagement of the same participants during the active process of designing architectural spaces.

The design phase serves several interconnected research objectives:

- First, it aims to identify the emergence of spontaneous empathic engagement during the design process and explore its potential contributions to the design process.
- Second, it examines the relationship between designers' trait empathy—measured via the Empathy Quotient (EQ)—and their empathic engagement during design activities.
- Finally, by conducting both perception and design phases with the same participants, the study aims to reveal whether a correlation exists between empathic engagement in perception and empathic engagement in design practice.

As in the perception phase, think-aloud protocols were utilized as a primary data collection method. However, this time participants were asked to verbally express their thoughts while actively solving a design problem. All think-aloud sessions were recorded, transcribed, and subsequently analyzed. The detailed methodology and procedure applied in this phase are presented in section 6.1 Methodology and Procedure for Design Phase.

The analysis of verbal data from both perception and design phases contributes to the development of the **Feeling As** framework for empathy in architectural design. This framework, comprising three key categories—Feeling As the User, Feeling As in the Space, and Feeling As the Movement.

6.1 Methodology and Procedure for Design Phase

As in the perception phase, think-aloud protocols were employed as the primary method of data collection. However, in this phase, participants were asked to verbally express their thoughts while actively solving a design problem. All think-aloud sessions were audio-recorded, transcribed, and subsequently analyzed. The methodology and procedure specific to this phase are detailed below.

6.1.1 Participants

Seventeen of the 26 students who participated in the perception phase voluntarily attended the design phase of this study. One student was removed from the analysis phase because he did not comply with the given time and rules. Thus, protocols from 16 participants (9 female), aged between 19 and 23 years (mean age = 21.18, SD = 1.27), were transcribed and analyzed. Participants' empathy scores, calculated using the Turkish Empathy Quotient Test, ranged from 39 to 69 (mean empathy = 49.92, SD = 8.98). All participants were enrolled in architecture (9 participants) or interior architecture (7 participants) programs, while eight were juniors and eight were senior students. Figure 6.1 presents the distribution of gender, gender, academic standing and EQ scores of participants.

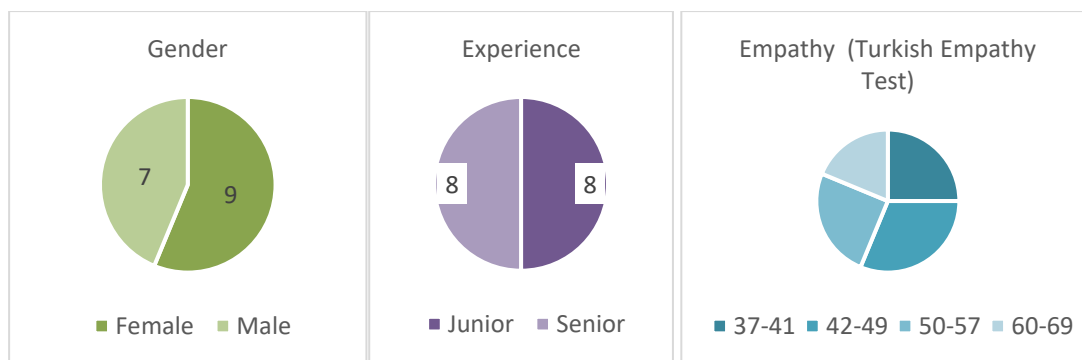


Figure 6.1: Distrubiton of gender, gender, academic standing and EQ scores of participants.

6.1.2 The design task

Participants are asked to design a playground and experience area for children aged 3–7 as an extension to an existing playground in Istanbul, Kadıköy, Yeldeğirmeni.

Designing a playground for children requires sensitivity to their unique physical, cognitive, and emotional needs, emotions, and perceptual skills. Therefore, the playground design was chosen as a compelling example of empathy-focused design thinking.

To guide participants effectively during the task, these three supporting documents are prepared in advance.

1. Design Brief: Includes satellite images, a plan view with approximate dimensions, site photos, and the problem description (Figure 6.2).
2. Activity and Idea List: Adapted from the *Istanbul95 Playground Ideas* book (Gurdoğan, Gurdoğan, and Thomsen, 2019). Participants were required to incorporate at least 4 out of 9 activities and a minimum of 2 out of 6 play ideas from the list (Figure 6.3).
3. Material Leaflet: A compilation of materials commonly used in playgrounds, prepared by the researcher (Figure 6.4).

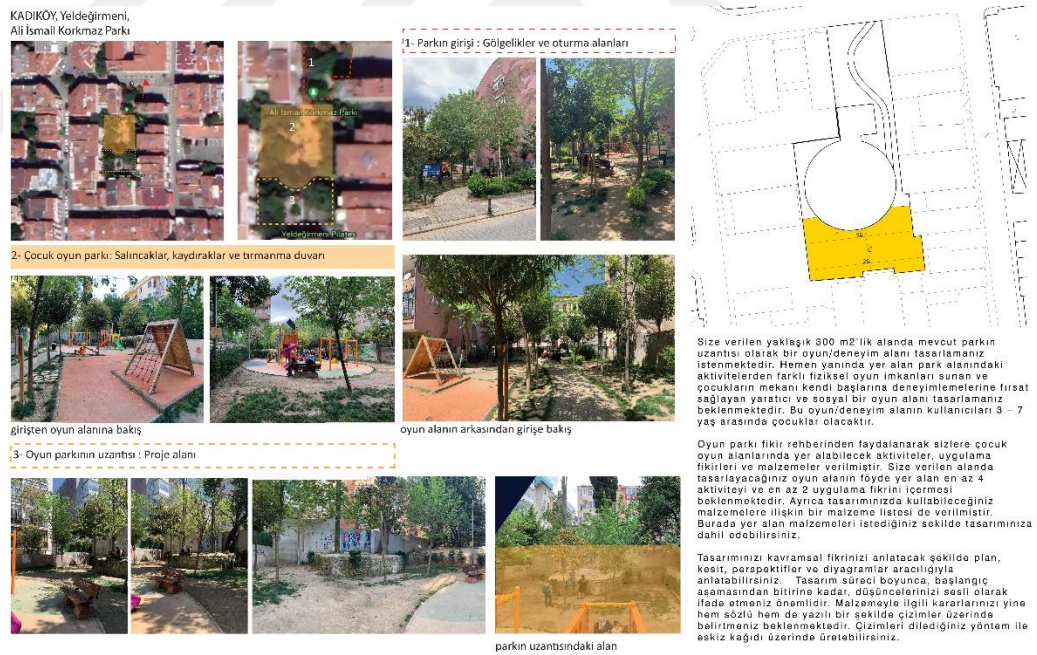


Figure 6.2: Design brief given to the participants

A pilot study with two volunteer students was conducted beforehand to identify potential flaws and refine the task. The briefing materials were sent via email at the beginning of the session, allowing participants to consult them at any point during the design process. Before starting, students were instructed to prepare pencils and sketch paper. The video recording of the area is also show to the participants since they do

not have a chance to visit the site. They were given 30 minutes to complete the task after the brief given. The protocols held online via Zoom with individual meetings.

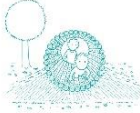
AKTİVİTELER	UYGULAMA FİKİRLERİ
 Sürünme  Yürüme / Koşma  Tırmanma	 Kum  Su
 Zıplama  Sıçrama  Dengede durma	 Ses  Yapı taşları
 Asılma  Sallanma  Kayma	 Mekan içinde mekancıklar  Bitkiler
	Görseller, İSTANBUL95 ÇALIŞMALARI:0-3 YAŞ OYUN PARKI FİKİR REHBERİ'nden alınmıştır. Çizimler: Tan Cemal Genç

Figure 6.3: Activity and Idea List (from *Istanbul95 Playground Ideas* book)

Malzemeler

Doğal Taşlar

Kayalar

Çakıl

Bezelye Taşı

Kauçuk ve türevleri

Kauçuk karolar

Kauçuk rulolar

EPDM

Ahşaplar

Ahşap
kütükler

Ahşap
dikmeler

Doğal ahşap
plakalar

Lamine ahşap
plakalar

İpler ve ağlar

Renkli ipler

Ağlar

Jüt halatlar

Diğer doğal malzemeler

Kum

Bambu

Malç (ağaç
kabuğu)

Su

Plastik ve metaller

Metal

Plastik

Kompozit

Figure 6.4: Material Leaflet produced by the author

At the end of each pilot protocol session, the following 6 questions were administered to the participants to obtain feedback on the clarity and applicability of the task.

1. Was the design problem clearly defined? If any information was missing from the problem definition, please specify.
2. Were the visuals and videos about the site sufficient for you to understand the context? Did you feel the need for additional information about the site?
3. Was the list of actions, implementation ideas, and materials in the design kit clear enough? Do you require any other information?
4. Was the allocated time sufficient to complete the task?
5. Did you find it difficult to express your thoughts out loud? Do you have any suggestions to make this process easier?
6. Finally, do you have any suggestions or criticisms for improving the overall task?

All protocols were recorded with the consent of the participants. Both volunteers who participated in the pilot study found the instructions clear. They were able to express their ideas comfortably through both drawing and verbal expression. They found 30 minutes sufficient to complete the task.

Participants were free to use any representation method they preferred without any restrictions throughout the design process. This allowed them to work comfortably, considering their individual representation skills and familiarity with different techniques. The sketches produced by the participants during the pilot study are given in Figures 6.5 and 6.6, respectively.

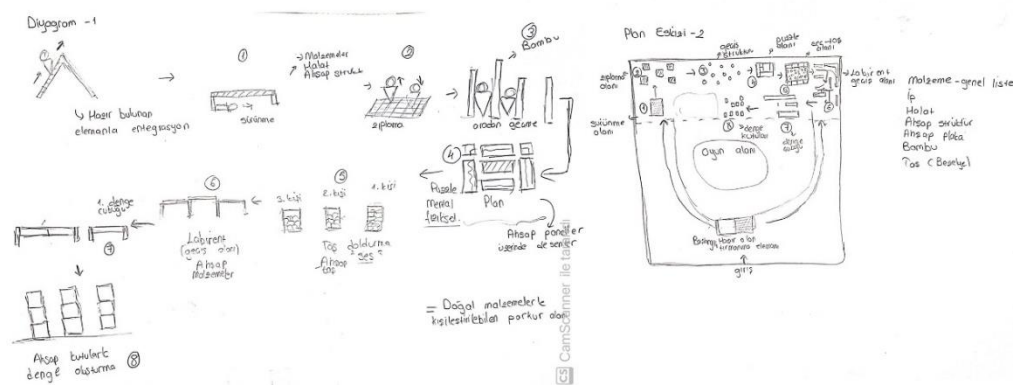


Figure 6.5: Sketches created during pilot study before real experiments.

designing. You are free to incorporate the materials into your design in any way you wish. You can explain your design through plans, sections, perspectives, and diagrams to convey your conceptual idea. It is critical to express your thoughts aloud throughout the design process, from beginning to end. You are expected to state your material decisions both verbally and in written on the drawings. You can produce drawings on sketch paper by any method you want.

The researcher also presented video footage of the site to support participants in developing a three-dimensional understanding of the area. Once participants confirmed their comprehension of both the task and the site, the *think-aloud* protocol was initiated. Each participant was allotted 30 minutes to sketch their design ideas, during which both audio and video recordings were captured. Participants were instructed to keep their sketches visible within the camera frame throughout the session (Figure 6.7)



Figure 6.7: Experimental Setting for Design Protocols

Participants were instructed to verbally express each step they undertook throughout the sketching process. The researcher interacted minimally, providing brief and clear responses only when participants posed questions, remaining passive. In instances when participants fell silent, they were reminded to continue expressing their thoughts aloud as required by the "think-aloud" method. Each session with participants lasted approximately 45 minutes, comprising 15 minutes for the briefing and 30 minutes for the protocol implementation. Appendix B provides a summary table presenting the design approaches and sketches of each participant, along with an overview of which activities and design ideas from the design brief were addressed.

6.2 Text-based Protocol Analysis

6.2.1 Segmentation: design moves and arguments

The first step involves transcribing the think-aloud data and segmenting the verbal protocols into smaller, analyzable units. The segmentation process categorizes the verbal protocols into *moves* and *arguments* following Goldschmidt's methodology (1991, 2001, 2013, 2014), which has been widely used for protocol analysis in design cognition. Design moves are fundamental, coherent operations composed of arguments, the smallest meaningful units in design (Goldschmidt, 1991). Arguments function as micro-level dialogues, capturing the presence of empathy within the design process.

This technique allows researcher to uncover designers' cognitive processes, making it the optimal method for dissecting smaller segments of the design process (Goldschmidt, 2014). As exemplified below, the first meaningful segment explaining the design intention is the design move. The subsequent meaningful segments that explain details or motivations for this decision are the arguments that make up this design move.

Move [22]: "I am thinking maybe I could use water under there (platform)..."

Arguments for Move [22]:

[22.1]: "Right now, because there is a load-bearing column here."

[22.2]: "I think they can run between (columns) and hide in, etc."

[22.3]: "Hmm. However, I think including water could damage this (platform)."

This example demonstrates how multiple arguments can support and elaborate on a single move, offering more profound insights into the designer's thought process and decision-making. Sketches and video recordings are incorporated as visual tools to support the interpretation of verbalizations, providing a more comprehensive understanding of the designers' empathic engagement when needed.

6.2.2 Coding the data based on the feeling as framework

This section presents the coding process applied to the design protocols, using the previously introduced *Feeling AS* framework to analyze empathic engagement and user-centered thinking within the design phase. As outlined in Chapter 4, the framework comprises three categories—Feeling As the User, Feeling As in the Space, and Feeling As the Movement—each capturing a distinct form of empathy expressed

in participants' verbalizations. In addition to these empathy-related codes, the analysis also identified affordances, referring to the perceived action possibilities embedded in spatial proposals. This section details how both empathy codes and affordances were systematically extracted and interpreted through selected protocol samples.

Gibson (1982) defines affordance as functional properties of objects relative to an individual, encompassing all potential interactions and uses. Affordance simultaneously constrains and facilitates behaviors. In the analysis affordances are identified according to two primary criteria related to user interaction within the designed environment.

1- How users engage with the object or space through specific physical actions

2- How the design facilitates or directs user movement and interactions.

These affordances were systematically categorized and identified using these criteria, clarifying potential user interactions within the designed spaces. Table 6.1 illustrates the affordances identified within the design moves and their related arguments using check marks (✓).

Table 6.1 : Coding from Participant P22's Protocols, Highlighting Empathy Codes and Affordances

Move	Argument	Empathy Code 'Feeling AS'	Excerpt	Affordances
15		None	Let me look at the things I drew here inside. Let me explain these plates in more detail.	
	15.1	None	Maybe they can be something digital.	
	15.2	USER	But I don't know how healthy it is, considering that the children will be unsupervised.	
	15.3	USER	But it could be something like a play area where they create a picture by sliding different colored pieces of plate.	V
16	15.4	USER SPACE	Because they love things like that Hm. But at the same time, I think of this (place) as a bright glass area	V
	16.1	USER	because small children should not be afraid	
	16.2	SPACE	I think there will always be light coming from here	V
	16.3	None	Maybe there can be openings inside from different points as well.	

For instance, argument [15.3] emphasizes specific affordances by describing how children might interact with the playground through sliding various colored panels, illustrating a design feature explicitly facilitating interaction. Similarly, arguments [16] and [16.1] highlight how spatial design can influence user movements and behaviors through environmental conditions such as lighting.

6.2.3 Reliability and validity

To ensure the reliability of the verbal data analysis, multiple coders were employed, and inter-coder reliability was calculated. All transcripts underwent a rigorous process of co-coding by the first author and an independent researcher, a crucial step to ensure the trustworthiness and reliability of our study (O'Connor & Joffe, 2020). To establish intercoder reliability, the two coders conducted the first two coding sessions collaboratively, followed by independent coding sessions. Cohen's Kappa statistics were employed to measure the agreement between coders, resulting in consistently high Kappa values ranging from 0.93 to 0.75 (Table 6.3). These values indicate substantial to almost perfect agreement in our coding process (McHugh, 2012). Any discrepancies in codes were meticulously addressed through thorough discussions until a consensus was reached, further enhancing the validity and reliability of our findings.

Table 6.2 : Intercoder reliability rate between the coders

Kappa with Linear Weighting				
	Observed Kappa	Standard Error	0.95 Confidence Interval	
			Lower Limit	Upper Limit
p07	0.7925	0.0492	0.6961	0.8889
p08	0.7557	0.0496	0.6585	0.8529
p11	0.745	0.119	0.5117	0.9783
p12	0.9336	0.0462	0.843	1
p14	0.8645	0.0461	0.7741	0.9549
p16	0.786	0.0676	0.6535	0.9185
p17	0.924	0.0529	0.8203	1
p19	0.754	0.0727	0.6115	0.8965
p20	0.8114	0.0734	0.6676	0.9552
p22	0.7586	0.0753	0.611	0.9062
p23	0.8471	0.0554	0.7384	0.9558
p24	0.7729	0.0617	0.6519	0.8939
p25	0.843	0.153	0.5431	1
p26	1*			

*all codes were agreed

6.2.4 Mapping design protocols: empathic design moves and arguments

Analysis of the occurrence of 'Feeling As' arguments across protocols revealed significant variation in empathic engagement among designers. 436 design moves and 1,659 design arguments (verbal excerpts) were identified and coded from the think-aloud protocol transcripts. According to the Feeling AS framework, 279 design moves (64%) and 602 design arguments (36%) were coded as empathic, indicating that many participants developed empathic reflections during the process. However, the analysis shows that only 91 of the 436 design moves (21%) were directly initiated with empathic arguments (see Table 6.3), suggesting that empathy more often emerged during the progression of a move rather than at its initiation.

Table 6.3 : Participant Data on Feeling AS Moves, Arguments, and Empathy Scores

Participants	Experience	Number of moves	Number of moves include Feeling AS	Number of arguments	Number of Feeling AS arguments	Number of moves start with Feeling AS	EQ
p01	Senior	34	17	89	31	9	51
p02	Senior	36	23	115	39	8	51
P07	Junior	43	34	189	84	8	45
P08	Senior	47	36	220	91	10	56
P11	Junior	16	6	46	10	1	69
P12	Junior	20	13	91	26	4	49
P14	Junior	30	25	148	76	11	37
P16	Senior	31	15	109	27	3	40
P17	Junior	26	13	73	18	6	41
P19	Senior	25	16	107	34	2	44
P20	Junior	20	12	73	26	6	47
P22	Senior	18	13	72	40	2	61
P23	Senior	28	25	103	46	9	49
P24	Senior	28	26	116	66	11	60
P25	Junior	19	4	48	4	1	57
P26	Junior	15	0	54	0	0	39
Total number		436	279	1659	602	91	

Participants' empathy scores, measured by the Turkish EQ test (Baron-Cohen & Wheelwright, 2004), were also included in the table, where scores ≤ 30 indicate low

empathy, and scores >60 indicate high empathy. Notably, high EQ scores did not consistently correspond to high empathic production. For example, P11 had a high EQ score of 69 but produced only 10 *Feeling As* arguments, while P14, with a low EQ score of 37, generated 73 empathic arguments. P26 (EQ=39) did not make any Feeling AS moves or arguments. This person may not have developed the ability to transfer empathy to design or may have difficulty expressing herself verbally.

This table reveals not only the distribution of empathy but also the level of details that participants produced in design process. According to Goldschmidt (1991), experienced designers tend to elaborate design moves more in detail, while novice designers are more likely to adopt a trial-and-error approach, quickly jumping from one move to another. Therefore, when interpreting the number of designs moves it is important to consider arguments as a serving and supporting ideas of that design moves. For example, it was observed that p11 produced 16 design moves and 46 arguments, while p12 produced 20 moves and 92 arguments. This situation reveals that although the number of design moves is close to each other, the difference in the number of arguments reveals that p12 addresses his ideas in more depth. This depth is seen, for example, in p12's arguments detailing a semi-open platform design:

Feeling As User [13] If they want to rest after climbing onto the module—the existing elevation—another alternative can be designed by creating a semi-open space.

[13.1] Let's say if this is the view (drawing the view of the well) ...

[13.2] I think the sun is coming from the top right, especially the midday sun when viewed from the front. So, this should respond to that.

[13.3] Let me also show it here (on the elevation).

Feeling As User [13.4] If I can apply a perforated metal panel in a place where children cannot reach...

[13.5] Let's see, I think there was one here.

[13.6] Yes, maybe such a perforated element (from the material leaflet).

Feeling As Space [13.7] The filtered light would also create a shadow-light effect.

This detailed approach reflects the richness of p12's design moves and the cognitive depth behind the high number of arguments produced. The detailed level of design thinking is reflected in those participants' sketches as well. Figure 6.8 shows the sketches produced by p12 and p11 respectively. Other junior participants (e.g., p07,

p12, p14) produced detailed production as well; this finding suggests that there may not always be a linear relationship between experience level and level of detail.

Figure 6.8: Sketches from design protocols p12's (on the left) and p11 (on the right)

P24, P14, and P08 represent the participants who made the most empathic design moves. An illustrative example can be found in P24's design protocol. In her fifth design move, she envisions transforming the top of an existing well into a climbing and jumping area for children. However, she immediately considers the risk of injury and responds empathically by proposing a protective net. This move reflects a direct projection into the users' bodily experience, anticipating a potential accident and adapting the design accordingly. Her verbal reasoning is as follows:

[5.3] Maybe there could be ropes around (the well)

Surma-Aho and Hölttä-Otto (2022) define user-centered approaches in design as “empathic actions.” Similarly, the *empathic design actions* observed in the protocols conducted for this thesis correspond to design moves that begin with a *Feeling As* argument. This form of reasoning illustrates how empathic foresight can evolve into a concrete design move, suggesting that empathic thinking may act as a cognitive trigger for empathic design actions.

In summary, the text-based analysis offers both quantitative and qualitative insights by examining the number of design moves, arguments, and empathic design move arguments. At the same time, it provides a deeper understanding of the reasoning behind each move and its contribution to the design process. Thus, the analysis not only maps the frequency of empathic engagement but also uncovers how such engagement unfolds and influences design thinking in context. While these data highlight the role of empathy in enriching the design process, this thesis prioritizes qualitative interpretation over quantitative metrics. Accordingly, interpreting numerical findings alongside participants’ verbal expressions yields more critical and nuanced insights, as illustrated through selected protocol excerpts.

To deepen the understanding of how empathy operates within design cognition, a video-based analysis was also conducted. This complementary analysis captures participants' non-verbal behaviors and embodied interactions during the design task. The integration of findings from both the text-based (Section 6.3) and video-based (Section 6.4) analyses will be discussed through the lens of the Seeing Through Empathy Framework in Section 6.5.

6.3 Video-Based Protocol Analysis (BORIS)

The analysis of the design protocols involved a two-stage coding process: initial text-based coding, followed by video-based coding. Video-based coding was performed **in** addition to transcript analysis to gain a deeper understanding of how empathy emerged throughout the design process. While think-aloud protocols provide qualitative insights into designers' embodied engagement, they are reliant on subjective verbalizations, which may not capture the full depth of bodily experience. To address this limitation the verbal analysis is complemented with video coding to observe and

document designers' embodied gestures during the design process. To ensure coherence, the video data were coded using the same process as the text analysis, aligning all codes from the video with those reliably coded in the text data to maintain consistency across both analyses.

The analysis was conducted using BORIS (Behavioral Observation Research Interactive Software), a tool that allows frame-by-frame description of behavioral patterns. In the video coding stage, the arguments previously coded as “Feeling AS” and “Affordance” in the texts were recorded. Additionally, three participant behaviors were coded:

1. Sketching: Instances when participants actively drew or sketched on paper.
2. Gazing: Moments when participants looked without sketching, irrespective of their focus (e.g., computer screen, paper, or elsewhere in the environment)
3. Gesturing: Bodily movements made during the design process, including hand gestures or other physical actions such as leg movements accompanying design thinking or arguments.

While text-based analysis revealed what participants expressed during the design task, video data showed how these empathic insights were physically expressed through gesture, gaze, and bodily interaction.

Figure 6.9 presents a screenshot from the BORIS (Behavioral Observation Research Interactive Software) interface, which was used for the video-based protocol analysis. The interface enables real-time annotation of observable behaviors such as Gazing, Sketching, Embodiment, FeelingAS, Affordance, and Design Concept. On the right-hand panel, time-stamped behavioral codes are listed with corresponding frame numbers and participant identifiers, allowing for a detailed chronological mapping of design cognition.

The central panel documents the participant's sketching process, creating a visual link between physical gestures and the coded cognitive and empathic states. By aligning visual, verbal, and embodied data within a single analytic framework, this multimodal approach strengthens the depth and interpretability of the *Feeling AS* framework, revealing how designers express empathy and spatial reasoning not only through speech but also through bodily enactment and design action.

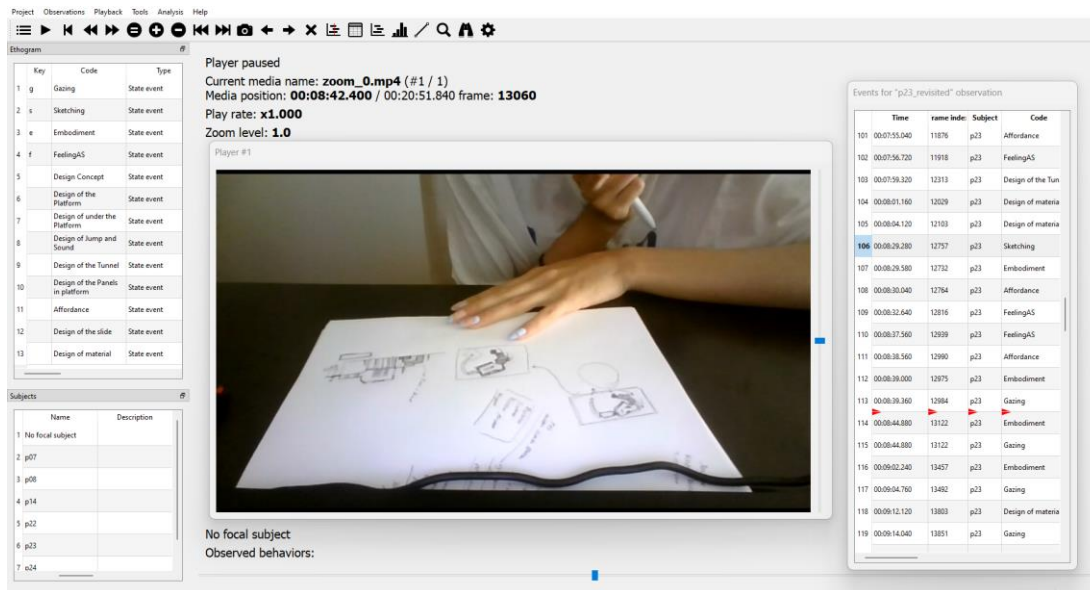


Figure 6.9: Interface used for the video-based protocol analysis, example from p23 protocol

Figure 6.10 shows a timeline of the 16 design protocols coded in BORIS. This timeline visually captures the participants' empathic expressions through the design process and highlights key sections of how empathy co-occurs with affordance, gestures, and design concepts. Selected design sections marked with orange boxes in Figure 6.10 illustrate these recurring patterns in the emergence of empathy with other elements. The inherent complexity of the design process, where various ways of expression increase empathetic comprehension and the spatial possibilities of the environment, is reflected in these co-occurrences rather than being artifacts of overlapping or inconsistent coding.

The selected design sections highlighted in orange boxes reveal a recurring pattern in the emergence of empathy. These episodes demonstrate the co-occurrence of empathic engagement with design concepts, affordances, and the designers' embodied responses. These overlaps are not artifacts of inconsistent coding but instead reflect the inherent complexity of the design process, where multiple modes of expression converge to support empathic understanding and the articulation of affordances. By analyzing these co-occurrences, we gain insight into how empathy shapes and enriches the design process.



Figure 6.10: Video coding of the protocols (the left is starting, and the right is the end of the design session)

Notably, gestures that accompany empathic expressions are not random movements but are closely aligned with the designers' cognitive and emotional engagement. These gestures reflect an effort to physically embody the user's experience and to externalize design intentions more effectively. Although not all empathic expressions are accompanied by gestures, the analysis reveals that gestures consistently co-occur with empathic arguments, suggesting a meaningful link between embodied action and empathic design thinking.

Additionally, all arguments in which affordances were identified also involved expressions of empathy. This finding suggests that empathy plays a key role in recognizing affordances—defined as the potential actions that environments or objects enable for users. Through empathic engagement, designers are able to simulate how users might perceive and interact with space, allowing them to anticipate and shape potential user behaviors within the designed environment. A detailed examination of the 16 participants demonstrated how participants utilized the 30 minutes allocated to them. Table 6.4 shows the individual and total time spent sketching, empathic arguments, and gestures.

Table 6.4 : Individual and total time spent in design protocols

	Active Sketching	Empathy Arguments	Gestures	Gesture co- occur with Empathic Arguments	Total time	EQ
p01	13,64	2,06	2,53	1,25	26,45	51
p02	18,21	3,92	3,50	2,09	28,00	51
p07	19,37	7,58	1,32	0,90	29,24	45
p08	13,53	7,55	2,13	1,73	29,19	56
p11	12,34	0,85	1,47	0,38	24,18	69
p12	15,24	2,31	2,00	1,12	27,30	49
p14	19,28	6,11	2,56	1,61	27,53	37
p16	12,51	2,95	4,36	2,00	28,04	40
p17	15,00	1,38	0,36	0,00	25,20	41
p19	13,55	4,12	0,54	0,25	24,19	44
p20	23,62	2,70	0,93	0,73	30,00	47
p22	12,46	6,34	4,60	3,43	28,00	61
p23	11,04	4,24	4,52	1,67	20,50	49
p24	15,37	8,39	3,02	2,43	25,10	60
p25	9,19	0,73	2,25	0,44	30,00	57
p26	13,76	0,00	0,08	0,00	25,09	39
Total	238,11	61,23	36,17	20,03	428,01	

Each participant uniquely utilized the given period; the mean duration of the design sessions was 27.15 minutes (SD = 2.57; range: 20.50–30.00 minutes). On average, participants spent 15.28 minutes actively sketching (SD = 4.04; range: 9.19–23.62 minutes). Regarding empathic arguments, the mean duration was 4.22 minutes, with a maximum of 8.39 minutes and a minimum of zero minutes.

In total, the design protocols spanned 428.01 minutes (7 hours and 13 minutes). Participants dedicated approximately 14% of this time (61.23 minutes) to empathic thinking. This proportion suggests that while empathic arguments are a meaningful part of the design process, they occupy a relatively limited duration. Figure 6.11 illustrates the distribution of total protocol time across sketching, empathic arguments, and gestures.

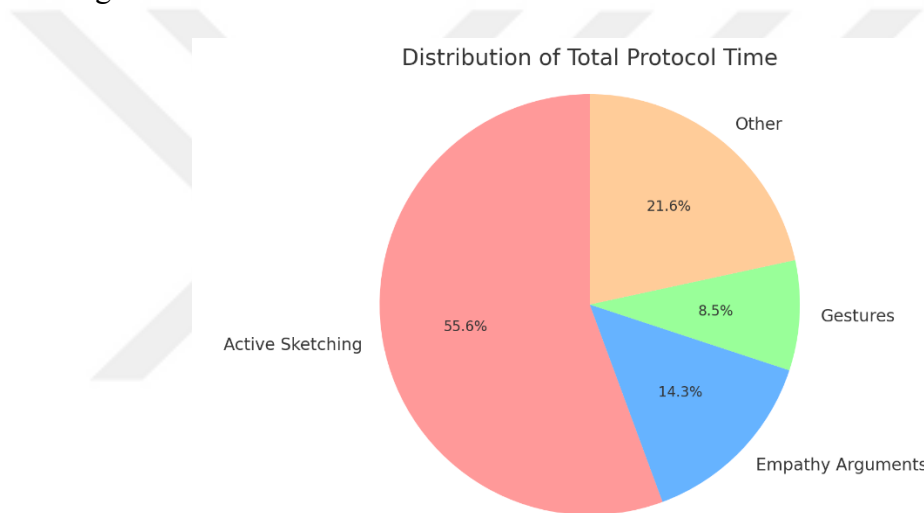


Figure 6.11: The distribution of total protocol time

The participants who spend the most time on empathic thinking is p24 (8.39 min), p07 (7.58 min), and p08 (7.55 min), p22 (6.34). They produced more empathic arguments and used empathy in the design process as a central thinking method compared to the others. The simultaneous emergence of empathic thoughts with gestures was measured as 20.03 minutes. This situation reveals that empathic arguments are supported by bodily gestures in approximately 33% (20.03/61.23), and empathy is primarily reinforced by body language. p22 (3.43 min), p24 (2.43 min), and p02 (2.09 min) are the participants who support their empathy the most with gestures. For these participants, empathy is not only a cognitive process but also an embodied process.

The relationship between empathy and sketching is not explicit. The longest active drawing time is p20, 23.62 min. However, the time this participant devoted to empathy

(2.70 min) is relatively less than the drawing time. On the other hand, p07 is relatively high in terms of both active drawing (19.37 min) and the time devoted to empathic thinking (7.58 min). However, a close examination of participants' empathic processes clearly shows occasionally they paused sketching while articulating empathic thoughts (see Figure 6.12), aligning with previous findings that designers frequently interrupt their sketching to express abstract and empathic ideas verbally (Goldschmidt, 1991; Suwa & Tversky, 1997).

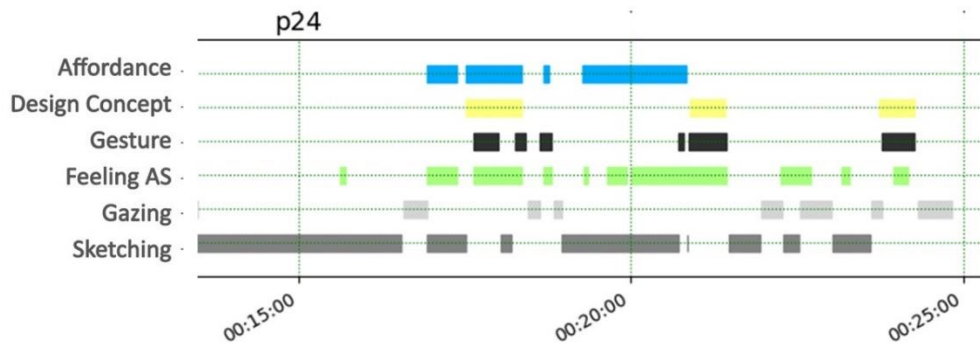


Figure 6.12: Video coding from P24 protocols between 15-25 minutes

When a distinction is made between senior and junior, it is seen that experienced designers (e.g., p08, p22, p24) have a balanced distribution in terms of time allocated to both drawing and empathy. The fact that some junior participants (e.g., p07, p14) have a high level of time allocated to empathy and gesture use, similar to experienced designers, indicates that the level of experience may not always be a determinant of empathy use.

To sum up, video-based coding offered additional insights into the emergence and characteristics of empathic expressions throughout the design process. This dual-coding approach preserves the integrity of the initial coding while adding observational detail. To ensure consistency, video data was coded using the same structure as the text analysis, and all video codes were aligned with reliably identified text codes. To ensure coherence, the video data were coded using the same process as the text analysis, aligning all codes from the video with those reliably coded in the text data to maintain consistency across both studies. Video coding added depth by revealing how empathy emerged as a multimodal phenomenon, expressed verbally and physically throughout the design process.

Section 6.5 elaborates on how empathy contributes to the design process through the lens of “seeing through empathy,” which integrates empathic framing, affordances, and embodiment.

6.4 Trait Empathy and Feeling As: Correlation Analysis

Further analysis using Spearman rank correlation was conducted to examine the relationship between trait empathy and participants' empathic engagement during design activities. The results from the Turkish Empathy Test indicated no significant correlation between trait empathy and empathic engagement, both at the design move level ($p = 0.985$) and the argument level ($p = 0.881$). This lack of correlation may be partially explained by participants' varying levels of experience, which ranged from junior to graduate-level designers. Additionally, no statistically significant difference was found between senior and junior participants in the frequency of empathic moves ($p = 0.115 > 0.05$).

Previous studies similarly report weak or no correlations between existing trait empathy measures and design-related outcomes. For example, Chang-Arana et al. (2020) found no significant link between empathic accuracy test results and design quality. Apfelbaum et al. (2021) also observed only a weak relationship between behavioral empathy scores and Interpersonal Reactivity Index (IRI) scores (Davis, 1983) among student participants. These findings suggest that empathy in design is not merely a dispositional characteristic but a context-sensitive cognitive and affective skill that must be actively engaged in response to user needs.

Moreover, the limited sample size in this study ($N = 16$) may lack the statistical power to detect subtle yet meaningful associations between trait and situational empathy. A larger and more diverse sample could offer deeper insights into these relationships. While designers are expected to complete tasks regardless of their inherent empathy levels, understanding individual trait empathy provides valuable insights into how it may influence design processes and outcomes, as well as the effectiveness of empathy-enhancing interventions (Chang-Arana et al., 2022).

Beyond numerical data, participants' verbal expressions offer further nuance in understanding the complexities of trait empathy in design. Individual cases further illustrate this point. For instance, participant P11, who had a high Empathy Quotient

(EQ = 69), showed minimal empathic engagement during the task—spending only 0.85 minutes producing empathic arguments and 0.38 minutes using gestures simultaneously with empathy. Conversely, participant P14, despite having a low EQ score (EQ = 37), demonstrated notably high situational empathy, producing 6.11 minutes of empathic arguments and 1.61 minutes of simultaneous empathic gestures. These examples highlight a critical distinction between trait empathy (a stable personality trait) and situational, task-specific empathy, which may emerge dynamically in response to the design challenge. These qualitative insights will be discussed in greater depth in the following section.

6.5 Seeing Through Empathy

This section synthesizes the key findings from both text-based and video-based analyses under the conceptual lens of “*Seeing Through Empathy*.” The framework reveals that empathy in design manifests through three interrelated dimensions: empathic framing, spatial affordances, and embodiment. While verbal protocols highlight how designers articulate user-centered perspectives, video analysis provides insight into how these empathic processes are embodied through gesture, gaze, and sketching. Together, these findings portray empathy not as a passive feeling but as an active, situated, and multimodal mode of engagement.

6.5.1 Empathic framing

In design, empathy enables designers to reframe problems uniquely, considering users’ potential needs, actions, and emotions. Designers, driven by empathic concerns, redefine problems and create innovative concepts rooted in a deep understanding of users’ experiences. This reframing is critical during the early conceptual phase, when designers define the problem and generate design concepts, and in later stages, as feedback loops refine initial ideas. According to Dorst and Cross, “a creative event occurs as the movement of insight at which a problem solution pair is framed, which Schön called ‘problem reframing’ (Dorst & Cross, 2001, p. 435).

For instance, P24 reframed design problems with a strong empathic concern for children, creating concepts tailored to introverted children’s engagement in play. Similarly, P22 began her design with the concept of ‘learning while having fun.’ Although these designers pursued different topics, their design concepts shared a

significant empathic concern for children. For them, the concept emerged in the early design process during problem reframing, playing a pivotal role in shaping the entire design process. This empathic framing resonates with Drost's (2019) notion of "naming the situation," which involves identifying key elements of the design problem and assigning them new meaning or value. To illustrate further, P24 begins her design with compassionate concern for shy children, reframing the problem as 'creating a space where kids can socialize easily,' as shown in below dialogue

Feeling AS [1] So when this problem was first introduced, the first thing I thought about parks was that the children always play together.

Feeling AS [1.1] However, many kids have problems with it, like getting involved and staying on the side.

Feeling AS [1.3] That's why I think of doing something where they can be together without difficulties and comfortably mingle.

This consistent approach allows her to maintain a cohesive design. In later phases, she elaborates on her intentions:

[21] There are trees over there.

[21.1] After that, here is the slide I created.

Feeling As [21.3] I thought they could come from here.

[21.3] Here are the trampolines.

Feeling As [21.4] They can jump from here like this.

Feeling As [21.5] Maybe they can also jump here (to the pole).

Feeling As [21.5] This is the surface (above the pole) where they climb.

Feeling As [21] Later, they can come from this surface and move to the rope surfaces I created.

Feeling As [21.1] Among these surfaces, they can also hold on like this.

[21.2] there may be slightly stronger ropes.

Feeling As [22.3] They will always have a visual interaction with each other.

This consistent approach allows her to maintain a cohesive design. In later phases, she elaborates on her intentions as below

As evident from the above dialogue, although the design brief does not explicitly address the involvement of shy children in play or facilitate their social interaction, p24 incorporates these aspects into the design space. Consequently, she establishes a designated area around the existing water well (Figure 7.12) where children can engage visually and physically while playing. This setup offers a supportive environment for introverted children to partake in group activities without the direct pressure to socialize. Figure 6.12 shows the behaviors captured in p14's selected key episode: empathic arguments co-occur with design concepts, spatial affordances, and designers' bodily gestures.

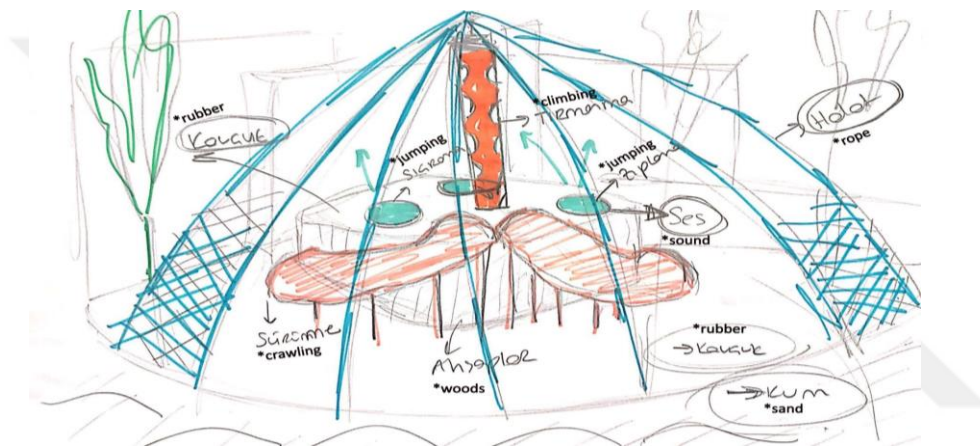


Figure 6.13: Shows the sketches of p14, where she gathered all activities in one unit around the well (* English translation given by the author).

Another participant, P22, re-frames the problem as “learning while having fun” at the beginning of the protocol. The dialogue in move 17 demonstrates how she integrates learning with playing involving plants in the following dialogue.

[17] Now I'm thinking - how I can create a play with plants.

Feeling AS [17.1] I studied at a school deeply immersed in nature. They showed us the plants. I loved the stories they told me about nature in primary school.

Feeling AS [17.2] I think plants and animals are important for children. That's why I wanted to add this to our park.

Feeling AS [17.3] They were just showing and telling us. How much fun is that for a child who are very intertwined with technology? I don't know if it would be efficient for them....

[17.4] Again some elements can be designed....

[17.5] On screens, stories about the plants can be shown. These plants can be placed below.

Feeling AS [17.6], I thought of them sitting, listening, and watching.

Incorporating digital screens in front of the plants aims to captivate children's interest and merge education with entertainment. She enhances the design, initially inspired by her experiences, by considering today's children's modern needs and routines. As suggested by Surma-aho & Hölttä-Otto (2022), in this example, the designer's awareness of contextual dilemmas helps her gain an empathic understanding of the user's experience.

P22 draws on her first-person memories (Smeenk et al. 2016) of the joy and educational value of interacting with plants during her own school years [17.1]. She acknowledges the importance of nature for children [17.2] and recognizes the potential insufficiency of her own experience for today's children, who are deeply intertwined with technology [17.3]. Accordingly, she uses her empathic insight to create a solution to address this dilemma, proposing the integration of digital screens to make the learning experience more engaging and relevant for modern children [17.4], [17.5]. This example demonstrates how the transformation of *empathic understanding* into *empathic design action* (Surma-aho & Hölttä-Otto, 2022) helps the designer to introduce a novel play element into her design.

Designers' consideration of users' emotions often prompts a shift in perspective, occurring not only at the initial stage of the design process but rather in later phases. We selected a segment from P23's protocol to demonstrate how empathy shapes her design decisions. In this section, she devises a platform raised above ground level, accessed through a tunnel. However, she realizes that crawling through a narrow, dark tunnel might not suit every child, particularly those under three years old. In the subsequent dialogue she reflects:

Feeling AS [18] Perhaps it's necessary to consider something else. Crawling might appeal to some kids but not all. It might evoke fear in others.

[18.1] Maybe another alternative could be added here.

Feeling AS [18.2] Maybe they slide directly (without passing the tunnel).

She reflects on the feelings of the potential user and reframes the problem as an alternative way to reach down from the platform (Table 6.10). Accordingly, she

revisits the prior design move [19], alters the tunnel's inclination, and introduces an alternative way to reach the ground [20].

[19] That's why I can make this tunnel more inclined.

[20] Another slide could be installed from this point.

Feeling AS [20.1] there might be a quick descent right now for kids who don't want to crawl out of here.

Feeling AS [20.2] Because some children are afraid to enter such narrow places without their family - Considering there will be three-year-olds, I thought about it now.

In this example the designer's empathic mental process combines the cognitive and affective understanding of others (Surma-aho & Hölttä-Otto, 2022). She first imagines the emotional responses of different children ([18], [20.2]) and recognizes the potential fear (affective dimension). Then, she uses this insight to reframe the design problem and devise alternative solutions (cognitive dimension), such as altering the tunnel's inclination and adding an alternative slide ([19], [20]). According to Surma-Aho and Hölttä-Otto (2022), this empathic mental process—which encompasses both automatic and deliberate empathic responses—is a critical internal mechanism that fosters *empathic understanding*. Similarly, Hess and Fila (2016) suggest that design processes encompass both affective and cognitive aspects of empathy, which may be activated automatically or operate subconsciously, independently concurrently, and often cyclically. These findings demonstrate that empathy functions as a dynamic cognitive process, oscillating between cognitive and affective dimensions throughout the design process.

In all three cases—P22, P23, and P24—the participants' empathic tendencies, as reflected by their EQ scores (61, 49, and 60, respectively), appear to align with their approach to problem reframing and concept development. P22, with an EQ score of 61, demonstrates her empathy by conceptualizing an environment that integrates learning with play, addressing both educational and recreational needs. Similarly, P24, with an EQ score of 60, demonstrates a high level of empathy by redefining the design problem to create a supportive space for introverted children, allowing them to socialize comfortably. On the other hand, P23, with a mid-range EQ score of 49, shows that effective empathy in design is not solely dependent on high trait empathy; instead, it can emerge through the design process itself, particularly during problem reframing.

This supports Apfelbaum et al.'s (2021) argument that a direct correlation to trait empathy is not essential for effective design; instead, applied empathic behavior leads to solutions that meet user needs.

To sum up, each participant concluded their creative process with reflective evaluations of how their consideration for the user turned into tangible design implementations, ultimately embodying *empathic design action* (Surma-Aho & Hölttä-Otto, 2022). These instances demonstrate that while EQ scores provide an initial foundation for understanding empathic tendencies, the design process—mainly through reflective practices—plays a critical role in nurturing and eliciting empathy.

6.5.2 Affordances

The analysis of both verbal and video coding highlights the pivotal role of empathetic thinking in structuring possibilities for intention that leads to action. A pervasive manifestation of empathetic emergence across all participants involved their engagement with user actions and intentions within the envisioned space. This cognitive faculty, imagining actions in an imagined space (Hutchins, 2008), aligns seamlessly with the organic flow of design. Architects influence individuals' perceptions and interactions by providing potential actions or movements to engage with the environment (Kraftl & Adey, 2008). They craft structures with specific affordances for potential activities (Jelic et al., 2016). This empathetic understanding extends beyond anthropometric properties, allowing designers to create spaces that provide meaningful affordances for diverse activities, promoting creativity and engagement.

P14 envisions children's physical interaction within the designed environment through the following design move;

Feeling AS [14] the children will follow this path when I examine this place.

Feeling AS [14.1] They come with the trees.

Feeling AS [14.2] They reach an area with plantations, not trees, but small saplings.

Feeling AS [14.3] They continue to play games (in the existing park) if they want.

Feeling AS [14.4] If they want and curious, they can experience this place (his design).

Feeling AS [14.5] First, they see a well in front of them, right across from the park (existing).

Feeling AS [14.6] Here is a small platform where they can get water from the well.

Furthermore, he proposes that children could use the water well to water the plants;

[15] Actually, systems can be created here that children can use.

Feeling AS [15.1] (water) is drawn from here, and the bucket comes directly to the child's hand.

Feeling AS [15.2] and the child takes it and brings it to this planting field according to the parent's instructions.

As Surma-Aho, Björklund, and Hölta-Otto (2018) found that novice designers explicitly tied user actions to design decisions while focusing on understanding others. In design moves [14] and [15], P14 focuses on user engagement with the existing water well, enabling him to design meaningful affordances for diverse activities involving the well, thereby promoting creativity. This example underscores the practical application of empathy in design processes, where understanding user needs translates directly into practical design solutions.

This design move is followed by another one [move 16], which is initiated with the act of *seeing*;

Feeling AS [16] Afterward, a point is formed here, where movements in both this and the other direction will gather.

Feeling AS [16.1] Maybe from there, to get to this area, children will have to crawl and squat at a height of one and a half meters, at the scale of a small child - not the parents.

[16.3] I can create a space (tunnel) with holes on the sides to receive sunlight.

In this example, while P14 examines users' physical interactions with space, he pinpoints a specific area on the sketch to emphasize the intensity of the movement (Figure 6.16). For Goldschmidt (1991), designers heavily rely on "visual reasoning" when contemplating sketches, as the feedback loop is grounded in shape, form, and inherent characteristics.

In p14's case, while looking at his sketches and animating the users' circulation within the space, he recognizes a specific point where all movements converge [Move 16]. As Hutchins (2008) points out, designers introduce dynamic elements into inherently static drawings. Within this reflective conversation, empathetic envisioning comes into play. Figure 6.16 presents the sketches P14 produced between design moves 14-16 in the selected design episode.

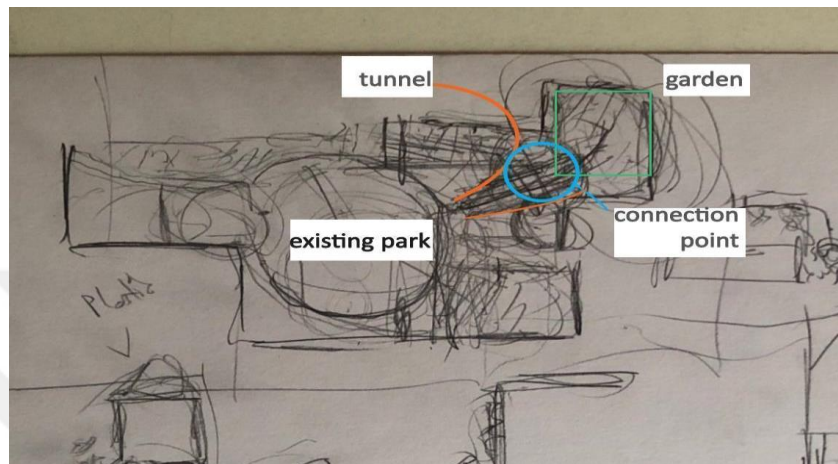


Figure 6.14: Showing the sketches of p14.

Participant p14, with an EQ score of 37, demonstrates a high level of empathic engagement in the design process despite a relatively low baseline empathy score. P07 introduces the spatial dimension of empathy by envisioning how users move, explore, and physically interact with both existing and designed architectural elements. For example, his conceptualization of a tunnel space tailored to a child's scale and movement patterns—allowing crawling and sunlight to filter through—illustrates a nuanced empathy that responds to body scale, posture, and sensory experience within the designed environment. He imagines the children's journey through space, engaging with natural elements like trees and plants, while anticipating their curiosity to foster interactions that extend beyond basic spatial functionality. P14 clearly ties user actions to affordances, reflecting Surma-aho, Björklund, and Hölta-Otto's (2018) observation that novice designers often explicitly connect user actions to their design decisions.

On the other hand, for example, participant P11, despite having a high EQ score of 69, produced only 10 empathic arguments during the design task. This discrepancy suggests that a high trait empathy score does not necessarily translate into high empathic engagement in task-based contexts. In this case, P11's low empathic

production may reflect a more cognitive or passive form of empathy that does not manifest actively in the design process. Through the "Feeling AS" framework, which captures the spatial dimension of empathy, p14's approach reveals a profound, embodied connection with the user's interaction within the space. This framework allows us to identify a distinct form of empathy that may not be fully captured by traditional trait-based measures like the EQ.

6.5.3 Embodiment

Empathy also manifests in designers' understanding of users' bodily responses and experiences within designed environments, enabling them to create spaces that resonate with users on a visceral level by considering object affordances and bodily interactions. The embodied aspects of empathy align with Gibson's idea that we have a bodily understanding of certain places or specific objects, about how to use them or how to behave in them. Gibson (1982) explains this: 'We do not perceive stimuli or retinal images or sensations or even just things; what we perceive are things that we can eat, or write with, or sit down on, or talk to' (Gibson, 1982, p. 60). In the subsequent three design episodes extracted from p04's protocol, we endeavor to illustrate how empathy intertwines with the designer's embodiment of the user.

In the initial dialogue, p08 conceives a bridge to link the water well with the jumping area and later realizes the potential to incorporate a balancing activity using the bridge.

[23] 'There's a bit of jumping around here... - I think there's a water well there now.'

Feeling AS [23.1] 'After a bit of climbing and jumping, maybe there could be a bridge here (prior to the well).'

[23.2] 'Precisely. A bridge within that castle structure would be nice.'

Feeling AS [23.3] 'Moreover, this bridge could involve maintaining balance or something similar - You know, it sways a bit.' (He moves his legs and hands while expressing this)

Feeling AS [23.4] 'Yes, those footboards make a jiggle-jiggle sound.' (He imitates the sound and sways his body from right to left.)

Feeling AS [23.5] 'Children can ride on it and deliberately shake the bridge even more (for play).'

He continues exploring further potential uses of the bridge.

Feeling AS [23.7] They can also ascend to this bridge after jumping.

Feeling AS [23.8] 'Then I've conquered the castle here. Super.'

P08's imaginative anticipation of children's interaction with the bridge leads to another potential use, encouraging children to test their balance as they traverse it. It gently sways upon stepping onto the bridge, providing a playful and dynamic crossing experience. Adding a touch of creativity to the design, he likens the experience to a scene from a movie:

Feeling AS [26.3] Actually, it would be great. Let me describe how the bridge could work. Children might imagine the bridge has collapsed and think they need to cross it by hanging.'

Feeling AS [26.4] 'It's like in those movies where the step falls when someone steps on it.

Another clear example of the designer exploring affordances through bodily empathy is in Design Move 41. In previous moves, he devised a solution by extending a net from the bridge, allowing children to climb down by holding onto it. Unexpectedly, at move 41, he realizes the potential of the net material, which children can also utilize for crawling;

[41] Then this. Hah, okay things happen on this platform. Mesh from both top and bottom.

Feeling AS [41.1] I remember them too from my childhood. It can be done like this. Of course, I show it to myself, but you don't see it. (climbing gesture with his hands)

Feeling AS [42] Hah, you can even do something by going down and holding the nets from down.

[42.1] Yes, even crawling happens here.

Feeling AS [42.2] He can do the same thing. They do not necessarily have to climb over it by stepping on it with their feet.

Feeling AS [42.3] They can get out of there like this (climbing gesture with his hands)

[42.4] Yes. TRUE. I'm giving them (crawling) that too

P08 uses bodily gestures to communicate ideas, illustrating vivid empathic engagement. As Freedberg and Gallese (2007) suggest, object affordances trigger the simulation of motor areas associated with actions related to that object, such as grasping and touching. His imaginative gestures and envisioning of how children might balance on a swaying bridge or crawl portray a form of bodily empathy that anticipates user interaction with the environment. Exploring these newfound affordances would not be possible without a connection to the user's embodied experience. P08's example demonstrates that designers empathize with users on an affective or cognitive level and 'see through' the users' eyes and bodies within a given environment.

Another participant, P19, similarly explores spatial possibilities through embodied empathy during design.

[13] Now I will draw this jumping, crawling, climbing, hanging area on the other side.

[13.1] It is like this again. If I were to draw this area as the ground...

[13.2] This would be a rubber area. There would be a rubber area under the hanging area... This is rubber.

Feeling AS [13.3] We have a hanging thing here. Here is the hanging bar... they do things with their hands (showing the movement with their hands).



Figure 6.15: Showing the hanging gestures of p19

By imitating the hanging movement with their hands, P19 visualizes in his mind how children will interact with this area and expresses this interaction through bodily gestures. Such design movements represent an empathic participation that not only understands the user but also acts like the user and anticipates their potential actions in space.

Selected design episodes from p08 and p19 highlight that incorporating the spatial aspect into the broader discourse underscores that empathy transcends emotional resonance, encompassing complex interactions among designers, users, and their environment. As Stephan (2023, p. 9) posits, empathy necessitates a triangulation between an individual's *consciousness, the shared world, and others' embodiment*. The examples highlight how empathizing with user behavior is reflected in the designer's gestures, indicating a clear connection between the *designer's consciousness, the designed world, and users' embodiment*.

6.6 Synthesizing Perception and Design: Empathic Engagement through the Feeling As Framework

This section presents a cross-phase synthesis of how empathy emerges in the perception and design of space, grounded in the Feeling AS framework. The framework captures how designers immerse themselves in the experiential qualities of architectural environments by mentally positioning themselves as users, attending to the spatial characteristics and affordances of the setting, and imagining movement through and within space.

Examining how the three key categories—Feeling As the User, Feeling As in the Space, and Feeling As the Movement—manifest across both the perception and design phases provides deeper insights into the implicit structure of empathic engagement. This section first presents examples and discussions from protocol analyses for each category, illustrating how empathy is expressed through designers' verbalizations and spatial reasoning. A comparative analysis of the quantitative data that follows provides a more thorough picture of how empathy influences perception and creation of space by examining recurring patterns of empathetic engagement in both phases

6.6.1 Feeling As (the) user

This section explores how participants empathically engaged with architectural environments by mentally simulating potential users' experiences, emotions, and bodily actions. Drawing from the perception and design phases, the examples reveal that even static architectural imagery can evoke sensorimotor responses, prompting designers to anticipate how users might feel, move, and behave within a space. As Jelić et al. (2016) argue, this anticipatory process reflects a form of embodied simulation,

where spatial understanding is rooted not in detached observation but in the projection of action and experience.

Design protocols revealed that participants frequently imagined how users would interact with certain spatial features (e.g., crawling in tight spaces, climbing high surfaces, or avoiding certain areas due to discomfort or fear). Participant 23 simulates (move 18) how children with different temperaments might interact with a tunnel space she was designing. Accordingly, she alters her design in response (move 20) to the imagined experience of children who may fear enclosed spaces, illustrating how empathic reasoning directly informs spatial decisions (Table 6.5).

Table 6.5 : Excerpt from p07's protocol showing empathy with user's emotion

Move	Argument	Empathy Code 'Feeling AS'	Excerpt	Affordances
18		USER	One might actually have to think about something... this crawling (in a tunnel) might not be something every kid would love.	
20		USER	I think it could be a quick landing for kids who do not want to crawl out of here.	V
	20.1	USER	Because some kids are afraid of getting into narrow spaces without their family.	
	20.2	USER	Considering that they will be three-year-old children, I just thought about that now.	

These reflections demonstrate a high sensitivity to bodily and emotional variation across users. Empathy here enables anticipatory design thinking, adjusting spatial elements for physical access, emotional reassurance, and psychological comfort.

Designers' attention to the bodily and emotional responses of the user is evident in the following example from p07's protocol (Table 6.6). He adjusts spatial elements such as the slide orientation and visual access for children playing in space in the following design move.

Table 6.6 : Excerpt from p07's protocol showing empathy with user behavior

Move	Argument	Empathy Code 'Feeling AS'	Excerpt	Affordances
13		None	I mean, I thought of changing the direction of these (slide and stairs), but this time, it is quite suitable.	
	13.1	USER	If I moved the slide to this side, that experience would be ridiculous.	V
	13.2	USER	They will slide towards the wall like this.	V
	13.4	USER	(Now) they will look at their friends playing here (in the current park) and so on.	V

Another example from p01 demonstrates that she considers also the caregivers as the user of the park. She reflects on her design: "Therefore, between these platforms, both children can jump and play, and parents can sit and watch. She states, "I think the caregivers waiting in the park are also important as kids. While they (caregivers) are waiting, they can socialize with each other.

Table 6.7 : Excerpt's from p01 protocols showing empathy towards mothers.

Move	Argument	Empathy Code 'Feeling AS'	Excerpt	Affordances
15		None	I thought like this. (Draws the perspective of the sitting area and the walking area with the water in front of it).	
	15.1	USER	You know, in this park, I think that those who wait like this are also important, rather than the children	
	15.2	USER	You know, mothers, for example, must wait.	
	15.3	USER	Maybe they also wait like this, interactively.	V
	15.4	SPACE	There could be at least more interesting places where they can socialize like this.	V

These examples demonstrate how empathic thinking shapes even subtle design decisions. By visualizing children's actions and perspectives, the designer builds a socially and physically responsive space.

The empathetic simulation was also evident in the perception phase. Participants projected themselves—or imagined users—into the spatial environments presented in architectural photographs. These projections frequently involved comfort, movement, visibility, or spatial comprehensive assessments. As suggested by Freedberg and Gallese, designers respond not just to the image's content but to its implied bodily states and affective tones.

For instance, participant p23, when viewing a high and open residential structure (*House NA*, *Figure 7.20*), remarked:

“Merve, our friend, has panic attacks and fear of heights... as if someone like her would panic. I cannot imagine such people in this space at all.”

Here, p23 not only empathizes with another person's emotional state but also evaluates the spatial environment's inclusivity and psychological effect.

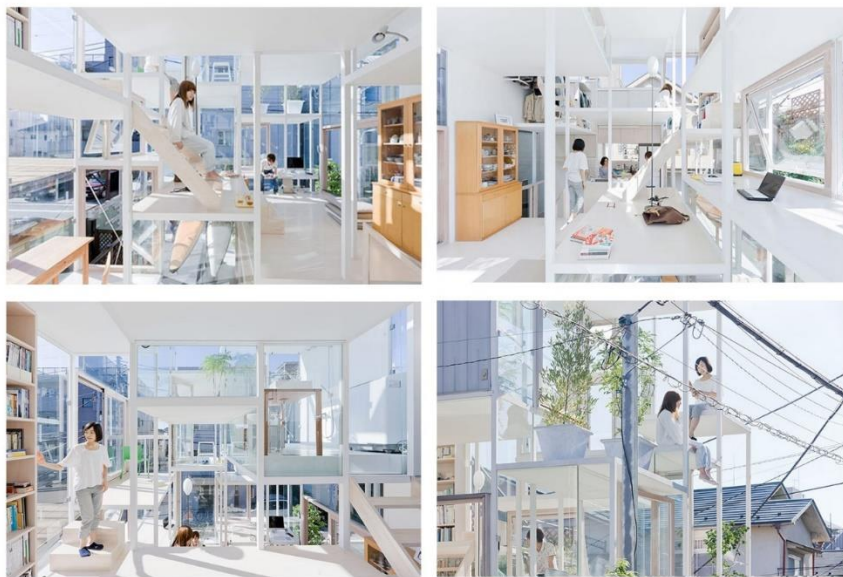


Figure 6.16 : Images from House NA provided to the participants

Similarly, p07, upon viewing the enclosed reading alcove in *Dancing Trees, Singing Birds*, reflected:

“Probably won’t go there to read a book... it’s too narrow to draw something as well. It’s like a little room reserved for a writer.”

This statement illustrates how the participant envisions a user's physical behavior and psychological state within space, projecting their embodied response to its proportions and ambiance.

Across both the design and perception phases, this embodied empathy underscores the notion that designers “think through others’ bodies. Empathy becomes a perceptual and intuitive tool that guides spatial reasoning and user-centered adaptation as they simulate users’ movements, anticipate discomfort, or imagine emotional reactions.

6.6.2 Feeling As (in the) space

In the design protocols, *Feeling As in the Space* was frequently expressed through designers’ references to light, material, sound, scale, and spatial comfort. These qualities were not merely described as functional attributes but as affective stimuli that could evoke sensations such as calmness, oppression, invitation, or liveliness. Participant p14, for example, while designing a play garden, articulated a layered spatial experience—one that went beyond assigning functional uses and instead emphasized atmosphere and emotional resonance (Tanle 6.8).

Table 6.8 : Excerpt from p14’s protocol depicting space category

Move	Argument	Empathy Code 'Feeling AS'	Excerpt	Affordances
8		None	This could work, this area is already a green zone and the place I referred to as soil, linoleum was surrounded by walls.	
	8.1	SPACE	This area can be used as a place where they plant things, where there are flowers and bugs.	V
	8.2	USER	They can carry water from here to there.	V
	8.3	USER	So, we instill awareness of planting in children.	
	8.4	USER	Their parents are with them, they also learn something.	
	8.5	None	There would be flowers and bugs here.	
	8.6	None	And, well, it gets sunlight too.	
	8.7	SPACE	We turn it into an area where they produce things in a fun way.	V
	8.8	SPACE	So this place turns into an enjoyable place such as a little local garden of the Yeldeğirmeni.	V

In the excerpt presented in Table 6.8, p14 constructs a scene that integrates tactile elements (soil, flowers), sensory stimuli (sunlight), and communal narratives (parents and children engaging together). Excerpt from p14's protocol depicting space category. This segment demonstrates how the designer blends spatial programming with an affective imagination: not only shaping what users might do in space but how they might feel *within* it. Especially in arguments 8.1, 8.7, and 8.8, the designer envisions the space as both productive and emotionally meaningful, ultimately framing it as a familiar, neighborhood-like garden that invites joyful, shared activities

Similarly, in the perception phase, *Feeling As in the Space* encompasses factors such as lighting, color, texture, spatial layout, and design elements that collectively shape the emotional tone or atmosphere of an environment. This dimension of the *Feeling As* framework aligns closely with insights from neuroscience and phenomenology, which argue that space is not merely visual or geometric but fundamentally embodied, multisensory, and personally experienced (Robinson, 2019).

Participants described how light might feel on their skin, how silence or openness might influence their mental state, or how the materiality of surfaces would shape their bodily experience—demonstrating a richly intuitive and situated engagement with space. A compelling example comes from p23's reflection on *Cabin Norderhov*. In her detailed description, she does not simply comment on aesthetics but engages with the spatial atmosphere on a deeply embodied level:

"Again, it receives a very nice light from the outside to the inside, and this light causes certain shadows or lights in the space. Moreover, when we look at the shadows, the exterior seems as if it is inside the interior with its shadows."

This statement reflects more than a visual observation; it is a felt sense of spatial permeability, an atmospheric blending of inside and outside, perceived through emotional and bodily resonance. The designer momentarily *becomes present* in the imagined environment, evoking peace, warmth, or even discomfort, thereby forming empathic ties not with people but with the architectural atmosphere itself. Such expressions support Böhme's view that atmosphere arises from the multisensory co-presence of subject and environment—an empathic space where design decisions are functional and affective.

In summary, the spatial dimension of empathy highlights how architects engage with the atmosphere of a space, not merely by organizing spatial arrangements based on logic or function, but by attuning to its sensory and emotional qualities. This mode of empathy moves beyond the umbrella notion of “putting oneself in the user's shoes”, emphasizing its role in shaping architecture's conceptual and experiential dimensions through perceptual, social, and aesthetic insights.

6.6.3 Feeling As (in the) movement

The third dimension emphasizes the designer's ability to simulate and internalize dynamic qualities within static architectural forms. Unlike "Feeling AS the USER," which focuses on individual bodily experiences, "Feeling AS MOVEMENT" refers to the designer's projection of choreographed, dynamic flows within the space. For instance, in the protocol of p14 below, the participant simulates a choreographed flow through space—not by focusing on how a specific user might act, but by designing a movement logic that is spatially embedded and collective:

Table 6.9 : Excerpts from p14’s protocol showing how moments structure affordances

Move	Argument	Empathy Code 'Feeling AS'	Excerpt	Affordances
30		MOVEMENT	I left these four undefined because all the movement happens here in the center; I mean, they pass through here.	V
	30.1	SPACE	This is the region I use as a connection to link the spaces.	V
	30.2	None	In terms of access, I think it ended somewhere around here. They come from the road and it ended here.	
	30.3	MOVEMENT	This path continues here and this time they will determine their own orientation.	V
	30.4	None	And my first area is the one with the park, where there are slides, swings, and a seesaw.	

Here, the designer simulates a looping, guided user flow, imagining not only how people move but also how the space orchestrates this movement through its form,

constraints, and affordances. The notion of movement here is both literal and conceptual: it is the imagined momentum that guides and choreographs experience. In this sense, movement becomes an architectural narrative—structured yet open—where empathy lies not in mirroring the user’s body, but in anticipating how multiple users might collectively flow, gather, or diverge across a spatial sequence.

Another compelling example of *Feeling As the Movement* comes from p22’s proposal, where the participant imagines a path that begins at the entrance and gently leads children to different destinations without their conscious awareness. This segment does not focus on individual bodily actions or emotions but on a designed flow of movement that becomes part of an experiential learning process. The participant choreographs an educational journey embedded in spatial logic—one where children are subtly guided, encouraged to take different paths, and discover playful or informative areas as part of their natural movement (Table 6.10).

Table 6.10 : Excerpts from p22’s protocol showing how moments structure affordances

Move	Argument	Empathy Code 'Feeling AS'	Excerpt (English)	Affordances
4		None	I think at this point I will define my design approach more like learning through fun.	
	4.1	MOVEMENT	This path that starts from the entrance could lead children somewhere without them even realizing it—learning unconsciously, as I said.	V
	4.2	MOVEMENT	(There will be) different points where they could exit the path.	V
	4.3	USER	A place where they will play with plants but also learn about them at the same time.	V

Here, empathy is directed toward how movement can structure experience, shaping what is learned and how it is encountered. The space itself becomes a silent educator, offering exit points, turns, and progression without explicit direction, enabling a passive yet engaging sense of navigation.

These examples reveal how *Feeling As the Movement* operates not through empathizing with a particular body but through an embodied projection of spatial logic, how one-part leads into another, how rhythms of arrival, pause, and continuation are embedded in form. It reflects the designer's ability to think kinesthetically, not just about what happens *in* space, but how space itself *moves* its users. This abstract, designer-driven choreography distinguishes *Feeling As the Movement* from *Feeling As the User*, which is more about individual bodily experience and emotional resonance.

Participants in the study's perception and design phases exhibited such responses. In the perception phase, some viewers interpreted architectural images as embodying movement:

“In other words, something is going on all the time—as if it is in a lot of broken glass, but it is constantly breaking.” (p07 at Denver Art Museum)

“Here is such an origami. Ceilings, walls, and stairs from the space as if they are folding. (p01 at Denver Art Museum)

These expressions reveal that participants perceive form and feel the forces shaping it—folding, tension, breakage, flow. The static visual input of Denver Art Museum (Figure 6.17) evokes an internal motor simulation akin to witnessing a motion in real-time. This embodied understanding of architectural form reflects the viewer's ability to "read" the gesture behind the design.

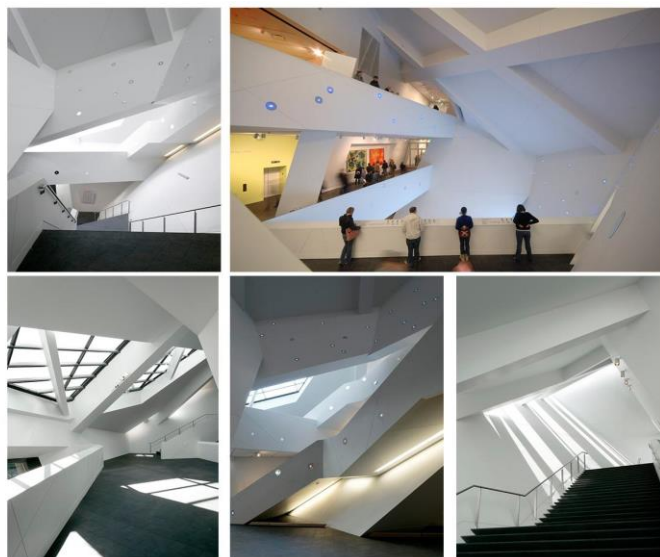


Figure 6.17: Visuals from Denver Art Museum

While this category appeared less frequently than others, its presence underscores a unique spatial intelligence and a nuanced understanding of how architecture can communicate motion. Its relative scarcity in verbal protocols may reflect the difficulty in articulating such embodied insight, but its significance lies in its ability to animate space through empathy.

In summary, *Feeling As the Movement* captures the designers attune the dynamic forces embedded in architectural form. It encompasses a kinesthetic imagination that shapes space through bodily intuition and perceptual sensitivity—qualities often found in highly developed design practices. By sensing and simulating movement within static environments, designers engage in a deeply embodied, empathic mode of architectural thinking.

6.6.4 Comparative analysis of empathy in perception and design

A total of 965 coded excerpts were identified in the perception phase, encompassing participants' verbal reflections during their encounters with architectural spaces. According to the Feeling AS framework, 553 excerpts were categorized under Feeling AS the User, 295 under Feeling AS in Space, and 117 under Feeling AS Movement. These results show that participants predominantly focused on user-centered interpretations; however, many also engaged significantly with spatial and kinesthetic aspects of their environments. This distribution indicates a layered form of empathic perception, incorporating imagination of the user's emotional experience alongside intuitive grasps of spatial atmospheres and bodily affordances.

In the design phase, 618 coded excerpts were collected from participants' think-aloud protocols. Specifically, 453 excerpts were coded as Feeling AS the User, 61 as Feeling AS in Space, and 104 as Feeling AS Movement. These findings suggest that while user-centered empathy continued to dominate during the generative design process, spatial and movement-based empathic engagements were evident, albeit more selectively. Compared to the perception phase, the design phase exhibited a more function-oriented and user-centric approach, with fewer instances reflecting atmospheric or kinesthetic sensitivity. This reveals that designers, despite their richly embodied perceptions of space, do not always fully integrate these perceptual depths into their design strategies.

Compared with the perception phase, the design phase reflects a notable decrease in total empathic reflections—particularly within the Space and Movement categories. This shift suggests that although embodied empathy strongly informs spatial perception, it might become subdued or reprioritized during generative design tasks. Figure 6.18 illustrates the distribution of empathy codes across the phases

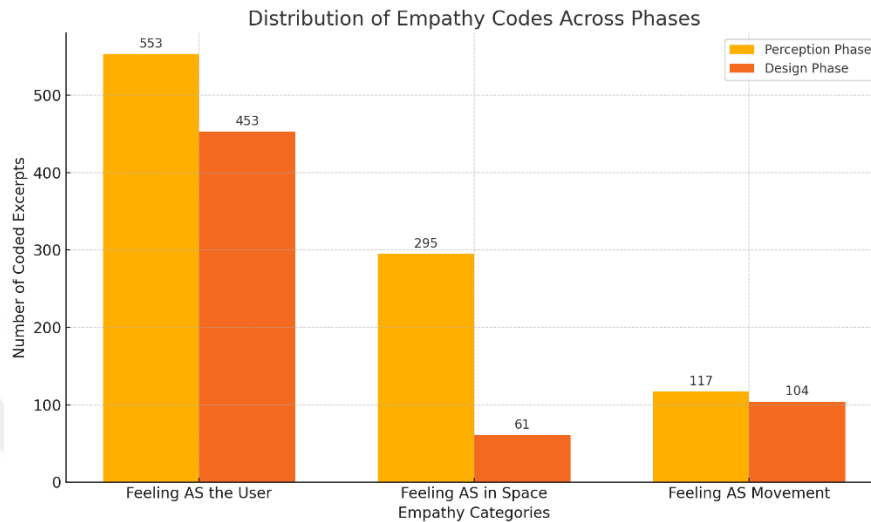


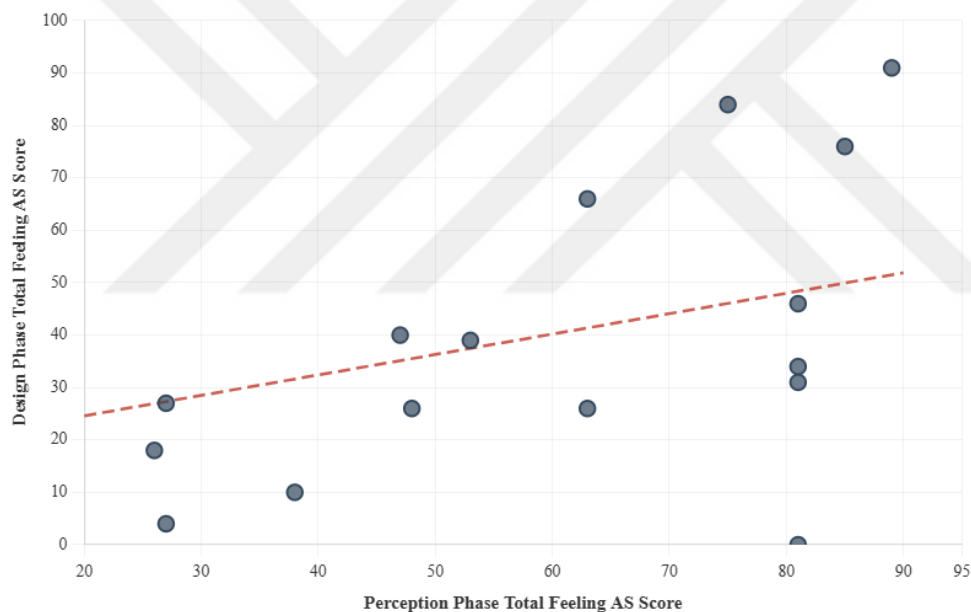
Figure 6.18: Distribution of empathy codes across the phases.

Although Feeling AS in Space was coded less frequently during the design phase, this decrease can be partly attributed to the absence of direct visual input. Without immersive sensory engagement with an actual environment, it becomes more difficult for participants to evoke the atmosphere of a space. However, working through abstract representations—such as sketches or diagrams—is familiar and essential in architectural practice. From this perspective, the ability to envision and express atmospheric qualities despite limited time and material becomes a rare but significant form of empathic engagement. Even though they are rare, these occurrences show a level of sensitivity that goes beyond practical or user-focused issues and has significant design significance.

To further explore the continuity of empathic engagement across different modes of design thinking, a correlation analysis was conducted between participants' Feeling AS scores in the perception and design phases. These scores represent the total number of empathic design codes—Feeling As the User, Feeling As in Space, and Feeling As Movement—assigned to each participant during each phase.

6.6.5 Cross-phase consistency in spatial and kinesthetic empathy

A Pearson correlation test revealed a moderate positive correlation between total Feeling AS scores across the two phases ($r = 0.56$, $p = .023$), indicating a statistically significant relationship. As shown in Figure 6.19, participants who exhibited higher levels of embodied and empathic engagement during the perception of architectural environments also tended to express greater empathic sensitivity in their design processes. Scatter plot showing the moderate positive correlation ($r = 0.560$, $p = 0.023$) between total Feeling AS scores in the perception phase (x-axis) and design phase (y-axis). Each point represents one participant ($n = 16$). The dashed regression line indicates the overall trend, demonstrating that participants with higher empathic engagement during architectural perception tend to maintain empathic sensitivity in their design processes, though with considerable individual variation.



$r = 0.560$

Pearson Correlation

$p = 0.023$

Significance Level

$n = 16$

Sample Size

$$y = 0.389x + 16.84$$

Figure 6.19: Correlation between total Feeling AS scores in the perception phase (x-axis) and design phase (y-axis).

Put simply, the more intensely participants engaged empathically in the perception phase, the more likely they were to approach the design phase with a similar empathic

mindset, though often to a lesser extent. However, this relationship is not absolute. A participant who displays high empathy during perception may not always sustain the same depth during design. Empathic behavior in design is influenced by perceptual empathy and additional factors such as creativity, functionality, expressive goals, and cognitive load.

The prominence of the *Feeling AS the User* category in initial analysis led to a closer examination of *Movement* and *Space* dimensions, which appeared as more differentiating elements in the empathic design process. A focused analysis explored whether embodied sensitivity to spatial and kinetic dimensions during perception might be a foundation for broader empathic engagement in design (Figure 6.20).

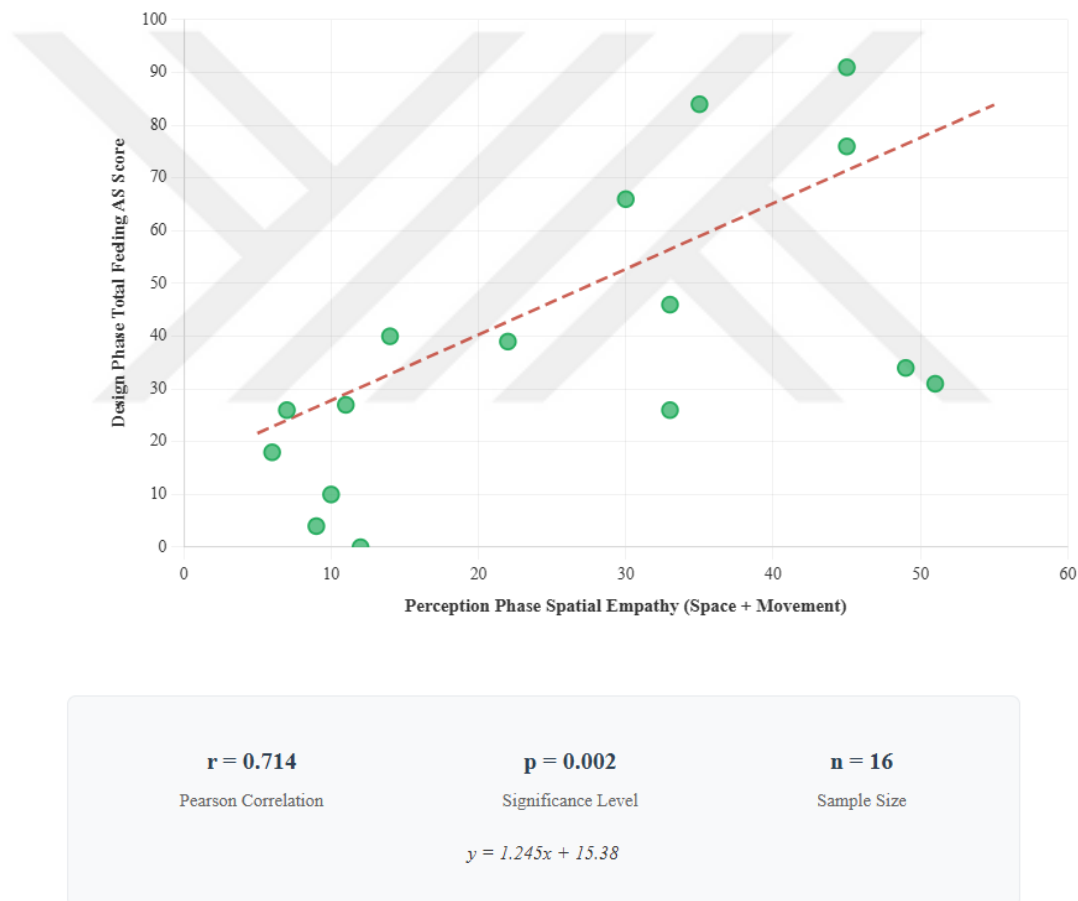


Figure 6.20: Correlation perception-phase spatial empathy (combined Space + Movement scores, x-axis) and total design-phase empathic engagement (y-axis).

Rather than examining like-for-like correlations between spatial categories, this analysis investigated the relationship between perception-phase spatial empathy (combined *Feeling AS in Space* and *Feeling AS Movement* codes) and overall design-

phase empathic engagement (total Feeling AS scores). This approach tests whether spatial sensitivity is a foundational skill that enhances empathic design thinking across all categories. The analysis revealed a strong positive correlation ($r = 0.71$, $p = .0021$) between participants' spatial empathy during the perception phase—encompassing *Feeling AS in Space* and *Feeling AS Movement* dimensions—and their overall empathic engagement throughout the design process. This finding demonstrates that designers who exhibited heightened sensitivity to spatial atmosphere and movement dynamics during initial perception showed significantly stronger empathic engagement across all dimensions of the design process.

These empathic responses often emerge in the perception phase through intuitive interpretations of sensory and structural elements such as light, material, surface, and flow. When this spatial sensitivity is developed, it broadly enhances empathic capacity, shaping how space is formed, how users are guided through it, and how designers comprehensively approach user needs and movement dynamics.

In this context, the perception of spatial atmosphere and movement becomes a key foundational factor, potentially more impactful than focusing solely on user empathy in isolation. This suggests that architectural education might benefit from emphasizing spatial and kinesthetic empathy as core skills that support broader empathic design competencies.

Ultimately, these findings highlight the capacity of the Feeling AS framework to capture not only direct empathic engagement with users but also the foundational role of spatial and kinesthetic sensitivity in developing comprehensive empathic design thinking. They resonate with phenomenological and embodied cognition perspectives, arguing that perception and the creation of space are inherently coupled through sensorimotor experience. They suggest that this coupling may be fundamental to empathic design practice.

6.7 Closing the Loop: Empathic Engagement from Perception to Action

This chapter begins with a detailed description and analysis of the design phase and concludes by demonstrating the findings from both the perception and design phases. The findings reveal that empathic thinking, perception, and creation of architectural space are not a uniform or static quality but rather a multifaceted phenomenon shaped

by verbal reasoning, perceptual engagement, and embodied actions. Drawing on the Feeling AS framework findings, this chapter integrates participants embodied, emotional, and spatial responses across perception and design phases. Through analysis of empathy's manifestation in user-oriented reasoning, spatial immersion, and imagined movement, this section reveals the continuous yet evolving nature of empathic thinking in the perception and creation of space. The evidence demonstrates that perception and action function not as discrete domains but as interconnected modalities through which empathy mediates engagement with architectural space.

A closer examination of think-aloud protocols of 16 participants revealed that empathy significantly influences the initial stages of the design process, including problem identification, ideation, and understanding user needs at both subconscious and conceptual levels. Empathy allows designers to engage deeply with the users' needs, potential actions, and emotions guiding the framing of design problems. Furthermore, it facilitates feedback loops that enrich design alternatives as the process evolves by introducing new solutions and refining initial moves. These feedback loops are central to reflective practice. As Drost (2019) notes, high-level co-evolution involves revisiting and revaluing problem elements, a process mirrored in what we refer to as empathic framing. As designers move from abstract concept generation to detailed design, empathy guides decision-making, ensuring the design solutions are user-centered and contextually relevant.

Moreover, the comparative analysis of perception and design phases strengthens this framework. Correlation analysis revealed that total Feeling AS scores in the perception phase positively predicted scores in the design phase ($r = 0.56$, $p = .023$), indicating that participants who engaged more deeply with space during perception tended to carry that empathic awareness into their design process. The stronger correlation between Space and Movement categories ($r = 0.71$, $p = .0021$) was even more compelling, highlighting that spatial and kinesthetic sensitivity—more than user-centered empathy—translates more directly into design behavior. Interestingly, participants with the highest Feeling AS the User scores did not consistently demonstrate the most potent design empathy, suggesting that empathic awareness alone may be insufficient if constrained by limited creative or structural expression. These findings reinforce the Feeling AS framework's central argument: empathic imagination in architecture involves simulating user experience and intuitively sensing

material, spatial, and bodily relationships. Empathic design emerges from top-down intention and through a multisensory, iterative dialogue between perception and making.

Empathy with space is fundamentally somatic rather than merely cognitive. The strong correlation between Space and Movement scores in perception phase and total Feeling AS score in the design phases underscores the significance of spatial and kinesthetic awareness in architectural thinking. Empathy in design, therefore, must be reconceptualized not only as understanding the user's perspective but as sensing and engaging with the atmosphere of the space through the body. Designers do not simply "design spaces for users"; they shape environments by engaging bodily with materials, movements, and spatial flows, forming a relational understanding of the space itself.

A space's emotional and physical resonance is profoundly shaped by how designers manipulate light, color, texture, form, and arrangement. These visual and tactile elements create somatic experiences not only for users but for designers themselves. Empathy thus becomes the capacity to anticipate and shape the relational field between user, space, and movement, not as separate domains but as continuous embodied interaction. The next chapter serves as the conclusion of the thesis, outlining the key findings from both the perception and design phases and the broader implications of the Feeling AS framework for architectural theory, education, and practice.

7. CONCLUSION

7.1 From Perception to Action : How Architects Engage Empathically with Spatial Environments

Empathy is often cited as a crucial factor in human-centered design, yet its application in architecture has remained conceptually vague and methodologically underdeveloped. This thesis addresses that gap by introducing the Feeling AS framework—an original contribution that makes the implicit, embodied nature of empathy in architectural thinking both visible and analyzable. Unlike existing empathy frameworks that focus primarily on user consultation or universal design principles, the Feeling AS framework captures the embodied, sensorial engagement that occurs during the design process itself. By shifting the focus away from predefined user profiles and toward the lived, sensorial engagement of designers with space, the framework offers a new vocabulary for understanding how empathy manifests throughout the design process.

Specifically addressing the first research question, this research has revealed that architects engage empathically with spatial environments through a sophisticated, multi-layered process that extends far beyond conventional user-centered design approaches. Through the analysis of design and perception protocols, this dissertation has identified and elaborated a three-dimensional framework for architectural empathy: Feeling AS the USER, Feeling AS in SPACE, and Feeling AS MOVEMENT. Together, these dimensions reveal how architects engage empathically with spatial environments during both the perception and design processes.

The correlation analyses between perception and design phases further support the foundational role of spatial and kinesthetic empathy in architectural design thinking. The continuity between perceptual and generative processes shows that empathy functions as foundational capacities that enhance designers' overall empathic competence. Specifically participants who demonstrated stronger spatial and kinesthetic awareness in the perception phase also showed greater empathic capacity

in design. This finding provides strong support for the hypothesis that spatial and kinesthetic empathy may be key to developing broader empathic capacity in design. When designers develop embodied awareness of spatial choreography, the material and immaterial qualities that constitute space, and the ways people move, pause, and engage within environments, this sensitivity appears to permeate their entire approach to design problem-solving. This empirical evidence reinforces theoretical perspectives from phenomenology and embodied cognition, which argue that perception and spatial creation are inherently coupled through sensorimotor experience.

Consequently, Feeling AS framework provides a robust conceptual and methodological foundation for investigating how architects naturally employ empathic strategies, thereby significantly advancing our understanding of empathy's role in the perception and design of architectural spaces. The ability to "think through others' bodies" and "feeling into" the space as a form of empathic engagement enables architects to create spaces that are not only functionally appropriate but also emotionally and psychologically responsive to human needs.

7.2 Seeing Through Empathy: The Contribution of Empathy to the Early Design Process

The findings of this study reveal that empathic engagement contributes to the early design process in two fundamental ways. First, it functions as a critical cognitive tool during the conceptual stage, facilitating problem identification, stimulating ideation, and fostering a nuanced understanding of users' needs. When designers engage empathically from the very beginning, they naturally adopt a human-centered mindset that guides the rest of the design process. Second, empathy is a reflective mechanism that enables designers to continuously refine their solutions by revisiting decisions and reframing problems from multiple perspectives as the design evolves. This iterative empathic reflection allows designers to identify potential experiential issues that might otherwise remain undetected until much later in the design process.

This research conceptualizes this dual contribution as "seeing through empathy," a process encompassing three interrelated components: empathic framing, affordances, and embodiment. These three components work synergistically. Empathic framing identifies what to design for, placing human centered approach at the core of design, "naming the situation" to give empathic meaning to design challenges. Affordances

define how space enables action and structures possibilities for user activity—creating environments that afford diverse movements, spatial readings, and atmospheric experiences. Embodiment ensures an authentic bodily connection with the user, allowing designers to anticipate how people will physically engage with the designed space and its materials.

Together, they expand the designer's capacity to create meaningful, human-centered architectural experiences from conceptual stages through design development. Analogous to how sketching enables designers to engage in a "conversation with the drawing" (Schön, 1987), empathic vision dramatically expands the designer's capacity to anticipate, simulate, and optimize how architectural decisions will influence human experience.

Analysis of the design protocols reveals that empathic engagement occurred both verbally and through bodily expression. Participants' gestures often accompanied their empathic reflections, highlighting the critical role of bodily involvement in design thinking. As designers sketched or gestured, they not only communicated ideas but also actively explored spatial possibilities—physically simulating experiences such as balancing on a bridge or crawling through a tunnel. This finding supports previous research emphasizing that empathy is fundamentally rooted in bodily participation rather than being solely a cognitive or emotional act (Freedberg & Gallese, 2007; Freedberg, 2017).

Further evidence emerged from participants who engaged in extended sketching sessions. These individuals demonstrated more profound empathic connections with their designs, suggesting that drawing—especially when integrated with reflective and embodied awareness—activates a situated mode of perception that amplifies empathic cognition (Schön, 1987; Goldschmidt, 1991). In these moments, empathy is not merely an imagined or emotional projection, but a fundamentally physical condition—felt through the body and grounded in pre-cognitive, embodied experience (Freedberg, 2017).

Building on these observations, the close coupling between gesture, sketching, and empathic thought underscores the importance of body awareness as a foundational dimension of design cognition. The findings of this study affirm a key insight from the literature: design thinking is shaped not only in the mind but also through the body and

its simulative mechanisms. In this context, *how* we design becomes just as important as *what* we design. Whether sketching, modeling on a computer, working collaboratively, speaking aloud, or designing in solitude, the modality of design activity influences the emergence of empathic insight. This suggests that moving beyond isolated drawing practices toward design methods that activate the designer's body can foster more empathic modes of thinking. For instance, sharing physical simulations of spatial experiences during the design process—such as enacting movement through space—can help convey and refine empathic perspectives. Similarly, engaging in group critique sessions that include users, clients, or other stakeholders may enhance empathic framing and facilitate the discovery of affordances. These embodied and dialogical approaches not only support design development but also cultivate deeper empathic attunement throughout the process.

These findings also help explain why empathic engagement with space and movement appeared more vivid and frequent during the perception phase compared to the design phase. The immersive quality of architectural imagery—its ability to evoke atmosphere and suggest movement—enables viewers to empathize more readily with spatial environments. In contrast, generating similar levels of embodied engagement through sketching requires greater effort and skill. This discrepancy highlights a key challenge in design education: fostering representational practices that sustain perceptual and bodily resonance throughout the entire creative process.

To address this, it is essential to reconsider the timing and role of spatial, material, and atmospheric decisions. Rather than deferring such considerations to the later stages of refinement, they should be integrated from the very beginning of conceptual exploration. By incorporating diverse media—such as visual references, physical models, embodied enactments, and layered drawings, immersive technologies designers can access multiple sensory channels and sustain a more empathic connection with the evolving space. This multimodal engagement allows spatial qualities to emerge not as afterthoughts but as generative elements that shape empathic insight.

In this way, empathy in the early design process expands beyond user-centered intentions to include a multisensory, embodied exploration of spatial potential. It bridges cognitive understanding with bodily resonance, enabling architects to navigate the intertwined relationships between user needs, atmospheric cues, and physical

experience. Empathy thus emerges not as an abstract aspiration but as a trainable, observable design capacity—one that actively informs problem framing, ideation, and decision-making. As such, it should be positioned as a core design skill, systematically cultivated through educational practices that foreground its intuitive, spontaneous, and bodily dimensions.

7.3 Trait Empathy Versus Dynamic Empathic Engagement

This research demonstrates that the contextual and dynamic nature of the design process gives rise to forms of empathy that static psychological metrics cannot fully capture. The empathic engagement observed during think-aloud protocols often involved designers mentally and physically projecting themselves into imagined spatial environments—simulating movement, sensing atmosphere, and attuning to bodily experience. Such context-specific engagement reflects a situated cognitive and affective process that extends well beyond what conventional trait-based empathy measures are designed to assess.

To explore this distinction empirically, the third research question asked: Does the designer's level of trait empathy influence their empathic engagement with architectural space? To test this, participants' trait empathy levels were assessed using the Turkish version of the Empathy Quotient (EQ) test, and these scores were compared with their empathic engagement data across both the perception and design phases.

The results were conclusive: no significant correlations were found between trait empathy scores and the frequency or depth of empathic expressions in either phase. This finding aligns with recent studies that also report weak or non-significant links between trait empathy and design outcomes, suggesting that trait-based measures do not adequately account for the embodied and contextual nature of design cognition.

This distinction between static (trait) and dynamic (situational) empathy highlights a critical contribution of the *Feeling AS* framework. It reconceptualizes empathy in architectural design as a responsive, embodied, and trainable skill—emerging from the designer's reflective and imaginative engagement with users, space, and movement, rather than as a fixed personality trait. In this sense, empathic engagement is not a question of being “naturally empathic,” but of cultivating spatial and kinesthetic

sensitivity through practice. This repositions empathy as context-sensitive, learnable, and integrated within design practices—not something passive or innate. This realization opens up important pedagogical and professional implications, which are further outlined in the next section, highlighting how these findings contribute to the development of a more empathic design environment.

7.4 Contributions for a More Empathic Design Environment

This thesis developed its research questions, methodology, and ultimately the “Feeling As” framework from the observation that, despite its widespread use, empathy in architectural design remains undertheorized and difficult to operationalize. While many frameworks approach empathy through universal accessibility or predefined user profiles, this study challenges such static views. Instead, it conceptualizes empathy as a dynamic phenomenon—emerging through the perceptual and bodily engagement of designers. This redefinition broadens empathy beyond the emotional or cognitive realm, offering researchers, educators, and practitioners a vocabulary and method to analyze embodied and spatial forms of empathic thinking

The “Feeling As” framework defines empathy in architectural design not merely as understanding users’ needs, but as sensing spatial qualities, attuning to atmosphere, and imagining movement. Designers engage in an embodied dialogue with space—thinking, feeling, and moving within the environments they shape. These mental processes are rooted in bodily encounters with space, where designers intuitively construct spatial relationships through imagined movement. This bodily awareness becomes a precursor to empathic connection. Empathy, in this context, aligns with what Husserl termed ‘passivity’—a subtle, continuous, and often overlooked layer of spatial experience. As Stephan (2023) argues, this dimension of spontaneous bodily resonance is critical to understanding empathic design. Pallasmaa (2017) similarly emphasizes that activating these imaginative, embodied capabilities is essential in contemporary design discourse. By acknowledging empathy’s somatic and perceptual foundation, designers can move beyond purely intellectual problem-solving toward more holistic creative processes that engage the full spectrum of human spatial experience.

Nonetheless, this active role of the body is often overlooked in digitalized design environments; screen-focused design practice weakens the sensory connection

between the designer and the space. While rooted in pedagogical traditions such as the Bauhaus, this perceptual grounding has been diminished by screen-based, digital design tools, weakening sensory engagement. Reintroducing bodily awareness into design education is therefore essential—not only for crafting skill but also for cultivating perception, intuition, and empathetic insight.

One of the most significant findings of this study is the strong correlation between the perception and design phases. Participants who demonstrated heightened spatial and kinesthetic sensitivity during perception—those able to vividly imagine atmosphere, materiality, and movement—also exhibited stronger empathic engagement during design. The Feeling AS framework successfully captures this coupling, revealing how designers' embodied engagement with space serves as the foundation for more comprehensive empathic design thinking. Notably, this sensitivity proved to be a better predictor of empathic design than trait empathy scores. These results suggest that empathy in architectural design is not a static trait, but a skill cultivated through bodily engagement and reflective practice.

This research points to a critical pedagogical challenge in contemporary architectural education: the weakening of bodily and sensory engagement due to increasingly screen-based, digital design practices. Yet, as the findings demonstrate, bodily awareness and perceptual experience are essential preconditions for empathic design. The ability to imaginatively project oneself into a spatial situation—what this study frames as “Feeling As”—depends not only on visual perception, but also on kinesthetic and atmospheric sensitivity.

Therefore, it is imperative to re-enrich design education with pedagogical strategies that support embodied simulation and empathy. Studio-based learning can foster spatial empathy through exercises that emphasize bodily awareness and reflective simulation. The following methods are proposed:

- Performative practices: Techniques drawn from theatre, dance, and physical improvisation can help students cultivate spatial and bodily awareness. Movement exercises and role-playing can sharpen their sensitivity to user experience and spatial dynamics.

- Sensory and situational immersion: Site visits, museum experiences, and environmental walks engage the full range of sensory modalities and situate design thinking within real-world atmospheres and contexts.
- Physical and material sketching: Drawing with the whole body—through large-scale sketching, physical model making, and material manipulation—bridges perception and action.
- Critiques that focus on body-space-user interplay: Design reviews should include discussions of how bodies move, feel, and act within the designed environments, making empathy an explicit part of the critical dialogue.
- Digital tools for embodied simulation: New technologies such as virtual reality, motion capture, and haptic modeling can support empathic engagement when thoughtfully integrated. However, they must be framed not merely as representational tools but as bodily extensions of the designer's thinking process.

These practices develop not only perceptual and imaginative skills, but also foster empathic design thinking as a core professional competency. Crucially, the findings demonstrate that empathic design capacity is not an innate talent but a learnable, trainable skill. This insight offers a powerful justification for positioning empathy as a core design competency in architectural education.

Moreover, ethically, if architecture aims to be inclusive and attuned to diverse users, embodied empathy must be cultivated as a core design value. The “Feeling As” framework repositions empathy as emergent, learnable, and embedded in design processes—offering a vocabulary and method for integrating these values into both education and practice.

In summary, this research offers three major contributions:

First, it establishes spatial and kinesthetic empathy as a core design competency, reshaping how empathy should be taught—through drawing, reflection, and embodied design practices.

Second, it makes a theoretical contribution by bridging architecture with embodied cognition, phenomenology, and *Einfühlung*, showing that empathy is not just imagined but enacted through bodily engagement.

Third, it emphasizes the ethical importance of empathy: creating inclusive, humane, and responsive spaces requires cultivating embodied empathy as a foundational value in both education and practice.

Ultimately, by redefining empathy as an embodied, multidimensional, and dynamic process, the Feeling AS framework opens new avenues for understanding how designers engage with architectural space, intellectually or emotionally, and through their whole sensing bodies. The Feeling AS model thus serves not only as a tool for immediate analysis but also as a foundation for long-term research into ethical, embodied, and inclusive design.

7.5 Limitations and Future Research Directions

While the Feeling AS framework offers valuable insights into empathic engagement in architectural design, several limitations must be acknowledged. Alzayed et al. (2021) highlight significant practical constraints in applying empathy to design processes, including limited access to end-users and the complexity of engaging with diverse user groups, particularly across cultural and economic differences. This challenge is further emphasized by Li and Hölttä-Otto (2020), whose research demonstrates that designers achieve higher empathic accuracy when understanding users from similar cultural backgrounds compared to those from different contexts. Such limitations can be addressed through more comprehensive contextual information about users' living environments and by employing complementary methods of direct and indirect user engagement.

Additionally, as designers and researchers position themselves as somatic experts, they risk imposing their subjective interpretations of bodily experience onto diverse user groups. This potential bias underscores the importance of balancing empathic projection with critical self-reflection. The present study's sample, consisting primarily of design students in a specific cultural context, also limits the generalizability of findings to professional practice across diverse architectural traditions.

Future research could investigate how empathy manifests across different cultural and professional design contexts to overcome this limitation. While this study focused on design students, expanding to practicing architects and interdisciplinary teams may reveal further dynamics of empathic engagement. Methodologically, integrating

contextual user data and critically reflecting on designer bias will be crucial to responsibly expanding the framework.

The growing availability of immersive technologies may further facilitate 'seeing through empathy' by providing designers with dynamic, multi-sensory contexts that deepen their engagement with spatial possibilities. Pallasmaa's (2017) concerns about the potentially distancing effect of digital tools deserve reconsideration through the lens of thoughtful, critical application. Rather than viewing digital technologies as detached technical aids, they can be reconceptualized as active participants in the design process that potentially enhance rather than diminish embodied engagement. As Tursack (2022) notes, digital environments—when designed thoughtfully—can foster resonant, bodily connections with space. Surma-aho and Hölttä-Otto (2022) note that empathic knowledge emerges from specific contextual interactions, suggesting that different design tools—whether digital modeling, virtual reality, or physical model-making—may facilitate distinct forms of empathic engagement. Future pedagogies can draw from these insights to structure tool use around embodied rather than abstract interaction.

The potential future implications of the research include architectural education and practice as well as broader design disciplines. To design inclusive, sensitive and human-centered spaces, embodied empathy is no longer a choice but a necessity. For the discipline of architecture, which is faced with current challenges such as climate change, social inequality and urban alienation, this approach, which places empathy at the center of design thinking, opens new possibilities for a more sensitive and responsible architectural practice.

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APPENDICES

APPENDIX A: Selected projects by the researcher



APPENDIX A: Selected projects by the researcher

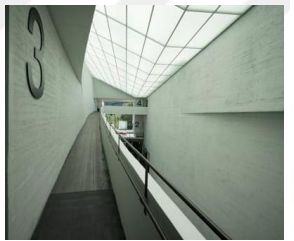
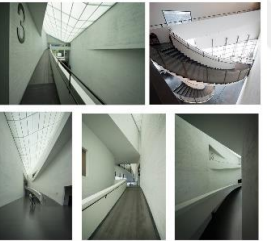
House Daylight (HDL)		
HDL 1 -Cabin Norderhov by Atelier Oslo Norway, 2014	 	URL-1
HDL 2 - Phra Pradeang House /All(zone) Samut Prakarn, Greater Bangkok, Thailand, 2018	 	URL-2
HDL 3 - Casa Giraldi / Louis Barragan, Mexico, 1976	 	URL3
Public Daylight (PDL)		
PDL 1 -Kiasma Museum of Contemporary Art/ Steven Holl, Helsinki/ Finland, 1988	 	URL-4
PDL 2 - NYU Department of Philosophy/ Steven Holl Architects, "New York City, NY, USA 2004-2007	 	URL-5
PDL 3 - Simmons Hall at MIT/ Steven Holl Cambridge, USA, 2020	 	URL-6

Figure A.1 : Selected projects for daylight

House Landscape (HL)		
HL 1 - Ex of in House / Steven Holl Architect, Rehinebeck / USA, 2016		URL-7
HL 2 - House N / Sou Fujimoto Architects Oita / Japon, 2008.		URL-8
HL 3 - Off Grid Home In Extremadura / Ábaton Architects Caceres / Spain, 2010.		URL-9
Public Landscape (PL)		
PL 1 - Eystur Town Hall / Henning Larsen Norðragöta/ The Faroe Islands, 2018.		URL-10
PL 2 - Sayama Lakeside Cemetery Community Hall / Hiroshi Nakamura		URL-11
PL 3 - Seashore Library / Vector Architects Qinhuangdao Shi / China, 2015. Library		URL-12

Figure A.2 : Selected projects for landscape

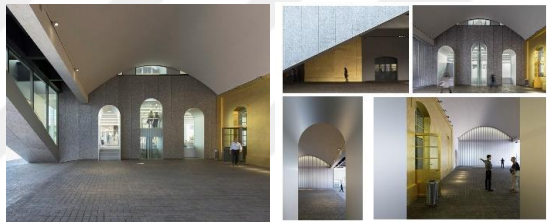
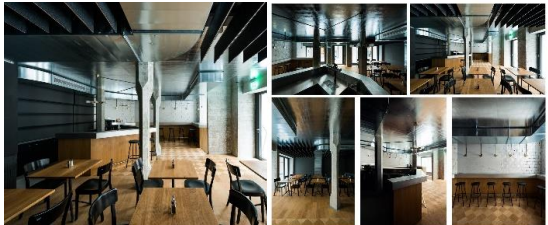
House Texture (HT)		
HT 1- Crusch Alba / Gus Wüstemann Architects Barcelona / Spain, 2009		URL-13
HT 2- Refurbishment of a Country House / Arquitectura-G Emporda / Spain , 2015.		URL-14
HT 3 - Villa Mairea / Alvar Aalto, Noormarku / Finland, 1939		URL-15
Public Texture (PT)		
PT 1- Fondazione Prada / OMA Milan / Italy, 2015.		URL-16
PT 2- Zinnengasse Restaurant / Wuelser Bechtel Architekten Zurich / Switzerland, 2016		URL-17
PT 3- Central Office For Architecture And Urbanism / NP2F Brussels / Belgium, 2020		URL-18

Figure A.3 : Selected projects for texture

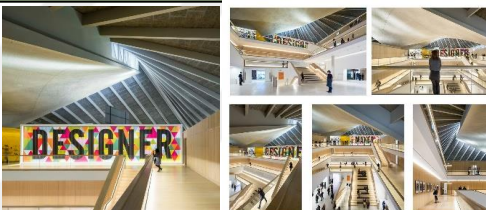
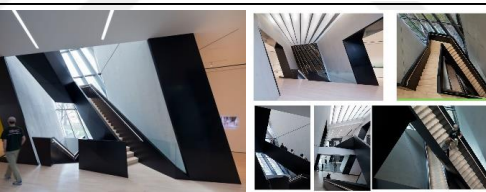
House / Spatial Dimension (HSD)		
HSD 1- Kozuki House / Makiko Tsukada, Tokyo / Japan, 2010.		URL-19
HSD 2- Ant-house / mA-Style Architects, Shizuoka, Japan, 2012.		URL-20
HSD 3- House NA / Sou Fujimoto Architects, Oita / Japon, 2008.		URL-21
Public / Spatial Dimension (PSD)		
PSD 1 - The Design Museum of London / OMA + Allies & Morrison + John Pawson London / UK, 2016.		URL -22
PSD 2- Eli & Edythe Broad Art Museum / Zaha Hadid Architects Michigan / USA, 2012.		URL -23
PSD 3- MoAE – Huamao Museum of Art Education / Álvaro Siza + Carlos Castanheira		URL -24

Figure A.4 : Selected projects for spatial geometry

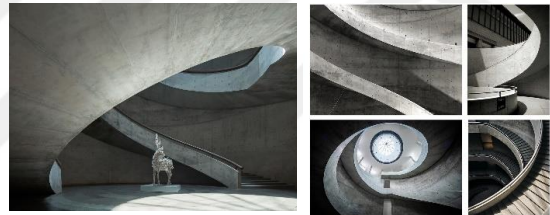
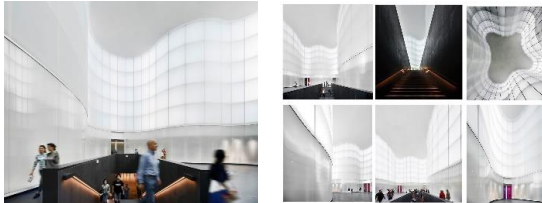
House / Curved Spaces (HCS)		
HC 1 -House in Byoubugaura / Takeshi Hosaka Architects / Yokohoma/ Japan, 2012		URL-25
HC 2 - Pit House / UID Architects , Okayama, Japan, 2011		URL-26
HC 3 - SH House, Hiroshi Nukarama, Tokyo/ Japan, 2005		URL-27
Public / Curved Spaces (PCS)		
PC 1 - He Art Museum / Tadao Ando, China, 2020		URL -28
PC 2 -The Broad Museum / Diller Scofidio + Renfro /Los Angeles, USA, 2015.		URL -29
PC 3 - MUDEC / David Chipperfield Milan / Italy, 2015		URL -30

Figure A.5 : Selected projects for curvature

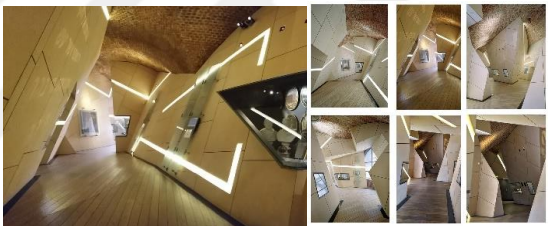
House / Sharp Spaces (HSS)		
HS 1 -Walmer Yard / Peter Salter, London/ UK, 2016..		URL-30
HS 2 - Apartment – House / Kochi Architect's Studio, Chiba / Japan, 2014.		URL-31
HS 3 - Hiroski Nukarama/ Dancing trees, singing birds Tokyo/ Japan, 2007.		URL-32
Public / Sharp Spaces (PSS)		
PS 1 -Danish Jewish Museum / Studio Libeskind Copenhag / Denmark, 2003		URL -34
PS 2 -Denver Art Museum / Studio Libeskind Denver / USA, 2006		URL -35
PS 3 - Perth Arena / ARM Architecture + CCN Perth / Australia, 2012		URL -36

Figure A.6 : Selected projects for sharpness



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PUBLICATIONS, PRESENTATIONS AND PATENTS ON THE THESIS:

- **Aktaş Yanaş, E., & Gül, L. F. (2025).** Uncovering the implicit dimensions of empathy in architectural design: seeing through empathy. *International Journal of Design Creativity and Innovation*, 1–24. <https://doi.org/10.1080/21650349.2024.2448950>
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- **Aktas Yanas, E. (2018)** "Investigating the Role of Imagistic Imagery in Aesthetic Experience", Poster presented at the 7th International Conference on Spatial Cognition, 09/2018, Rome, ITALY, 10-14 September 2018.

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