Motion and Emotion: Understanding Urban Architecture through *Diverse* Multisensorial Engagements

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Abstract: *Understanding how (dis)abled human bodies interact with the built environment is critical in Urban Design. We examine if somaesthetic theory combined with a neuro-architectural framework can help advance our understanding of human bodily interaction with the built environment. We do so first from a theoretical point of view, and second with an analysis of the situated context: Budolfi Square in Aalborg, Denmark. Our take-home-message is that architects and urban designers need to move beyond the established understanding of the multi-sensory soma, into an understanding of a* situated mobile-emotional soma.

Keywords: *Somaesthetics, neuro-architecture, human body spectrum, situated relational interaction, mobile-emotional soma.*

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Figure 1 *Budolfi square in Aalborg, Denmark*

Introduction

Even though cities and buildings appear solid and static, urbanism and architecture are all about movement and emotions. We, as human beings, move and are moved by buildings and urban spaces; understanding the built environment only as solid, static, and sedentary objects is a mistake. The human *body*, with its diverse capacities for movement and emotional experience, is the key to comprehending how buildings become architecture, and how spaces become urban ecologies. In this paper, we apply a theoretical framework to appreciate the multisensorial, embodied, and mobile engagement with the city, focusing on an urban plaza. We examine if the Somaesthetic theory combined with a neuro-architectural framework could uncover how motion and emotion affect *diverse* human bodies in different intimate and unique ways. We take as an example a variety of situated experiences at the newly renovated Budolfi Square in the city center of Aalborg, Northern Denmark.

The Experience of a City

Picture 1 illustrates Budolfi Square, a plaza in the Danish city of Aalborg. Completed in 2020 by Landscape Architecture studio SLA, Budolfi Square is part of a major urban redevelopment in the historic center. The square sits next to the 400-year-old Church of St. Budolf (known as Budolfi Kirke in Danish). In this setting, local authorities envisioned a central meeting place to encourage urban livability and health-promoting recreational activities, as well as incorporating climate-adaptive solutions to secure biodiversity and rainwater collection (Aalborg Kommune, 2019). Budolfi Square is a hybridization: a mix of an urban plaza, parking garage, and "pocket park." This project lies in the intersection of landscape, urban, and building design. Mixed public services and hospitality activities offer opportunities for rest, exercise, and entertainment. A variety of textures, colors, scales, and scents amuse the five senses — in addition to the sophisticated material choices in surfaces and urban interiors. In 2021, the Budolfi Square renovation was nominated among six Danish projects for the renowned European Green Cities Award (Nielsen, 2021). Unfortunately, the project did not win, and despite international recognition, the local community expressed divergent opinions on the architectural quality and everyday livability of the place (Sonne & Søndberg, 2020).

Recently, one of the authors went to Budolfi Square with her family: two children aged six and ten, and the grandmother and grandfather, both sixty-two years old. The 6-year-old daughter had been there before: upon reaching the corner of the street, she immediately recognized the square. This recognition triggered a retelling of her experience when was there with her classmates. With great confidence and enthusiasm, she joyfully talked about running up and down the several labyrinth-like pathways, touching the blended vegetation, and climbing the benches and staircases. The girl, very dynamic and minute in the bodily figure, explored with great curiosity the play opportunities, paying less attention to the surrounding shops, restaurants, and historic buildings. The grandparents, on the other hand, who are less mobile, overweight, visually impaired, and suffering from a series of chronic diseases (like diabetes and arthritis), had never been there before. Their immediate reaction to the urban setting was a series of speculations on how to avoid climbing the stairs or walking up the inclined pathways. Their conversation revealed the anticipation of a time-consuming and strength-demanding effort, as well as great concern and insecurity about their bodily abilities. When asked about their specific worries, they disclosed concerns about blood pressure, heart rate, and the risk of breathing problems. They anticipated how extra bodily activities would cause more pain and discomfort than already present. We might call this "present" situation their "everyday bodily state." As Critchley and Nagai argued, "bodily states shape mental content" (2012, p. 163). Furthermore, with reference to neuroscientist Antonio Damasio (2010), Critchley and Nagai elaborate on *how* "body-mind interactions are of particular interest to understanding emotions and motivations" (2012, p. 163). Finally, in contrast to the little girl and grandparents, the 10-year-old son paid little attention to the urban setting or passing of pedestrians. He took the urban landscape for granted as his conversation and bodily movements seemed strictly determined by the forthcoming restaurant experience. His chatting circulated on what he was going to eat, what he expected of the meal experience, and how to get there as fast as possible. He used the guidance of his parents, and different visual cues provided by signposts and restaurant front facades, to wayfinding through the site.

The takeaway of this *family narrative* is that specific urban settings ostensibly triggered very different spatial experiences within a small group walking together. This walking situation is referred to as a "mobile with" by Ole B. Jensen (2013), and underlines how the city fabric

is assembled through a series of entangled human bodily experiences and environmental affordances [1] construed from a continuous oscillation between "what was," "what is," and "what if". Yet, this curious situation further illustrates how different bodily states and their associated "feeling stamps" prime divergent reactions and contradictory perceptions of the "same" built environment. According to the theory developed by Damasio (2010, 2018), feelings are a "value stamp" of our conscious experience in the homeostatic state of the living body. Humans can simulate bodily states and anticipate feeling *as if* an event happened simply from a memory recollection. The family narrative sparked a series of questions on human movement, spatial perception, and emotions that triggered further academic curiosities about the built environment and its relationship with the human body, affect, and wellbeing. Along with speculations on how divergent bodily states and feeling stamps are encountered throughout life, we studied feeling stamps' relevance for future urbanism, architectural design thinking, and professional practice.

Methodology and Structure

Based on these informal observations, the topic of exploration is understanding the relationship of moving, sensing human bodies within an urban environment. We propose a *body-centered approach* that may enact new emotional dimensions traditional planning and modern architecture overlook. Ultimately, we are curious about unfolding the body-centered perspective to understand the implications of Somaesthetics in an urban setting. Our research's short-term goal is to advance our understanding of the relationship between the human body and the built environment by articulating the relevance of human consciousness and feelings. In the long term, we hope our findings will inform contemporary and future designers in academia and the building industry.

With the Somaesthetics theory, an interdisciplinary approach rooted in philosophy and insights from cognitive science, we hope to gain a deeper understanding of a body-centered perspective in design research, practice, and education. To do so, our research is based on a theoretical approach (framing the thinking), using the exemplary case of Budolfi Square in Aalborg, Denmark (questioning the practice). So, first, we move inward: to the body itself. To best understand the body's relationship with its environment, we turn to Richard Shusterman's Somaesthetics theory (2008, 2012a), specifically from his essay *Somaesthetics and Architecture* (2012b). Additionally, we study the notion of soma design, developed within the field of interaction design by Kristina Höök (2018), on the background of Shusterman's writings. It should be noted, we apply a narrow focus on the theoretical perspectives of Shusterman, deliberately excluding his practical studies and actual somatic training. We then handle a brief introduction to the concept of neuro-architecture, absorbing valuable insights from neuro/cognitive science. We limit ourselves from going into detail about the human neural system, neurobiology, or detailed accounts of neural activities.

It is difficult to address this topic on a theoretical and abstract level because it is situated by nature: a specific situation, with unique constraints and personal embodied experiences. To accomplish this situation, we move outward: to analyze the above-mentioned family situation and the built environment of Budolfi Square. Recall the grandparents' reaction to the fundamental site elements providing access to the square: the stair, ramp, and elevator. The anticipated result is a weaving together of the parts learned from Somaesthetics theory and the neuro-architecture

1 As coined by James Gibson (2014 [1979]), but extended by Andy Clark (1999), *affordances* refer to opportunities for use and action that the physical world provides an agent and are determined by the "fit" between the agent's physical structure and skills and the environment's action-related properties. It is a central concept in ecological psychology but has since been extended to numerous disciplines resulting in altered definitions (Djebbara, 2022).

to help scrutinize the inside-to-outside relationship between different human bodies and the built environment.

Theoretical framework

Human Bodies in an Entangled City Fabric

Understanding the body's reaction with the built environment is neither new nor particularly significant. Ten thousand years ago, prior to Mesopotamia, humans have been practicing urban design and architecture. This is evident by the vast number of buildings and urban spaces constructed throughout time, and the significant human ability to evaluate, envision, and improve the built environment for comfort and our ever-evolving needs (Fazio, Moffett & Wodehouse, 2013; Höök, 2018). This attention to the interrelationship between human needs and the built environment reached a new level in 1933. The International Congresses of Modern Architecture (CIAM) with the *Charter of City Planning* sparked a series of design principles meant to guide modernism and functionalism, highly influencing building practice throughout the twentieth century and early twenty-first century. The design principles focused on objectivism and standard measurements (Tvedebrink & Jelić, 2018). Many architectural scholars and practitioners have studied the psychological and behavioral effects of the built environment.

In a Danish context, we have Steen Eiler Rasmussen (1959), Jørn Utzon (2008 [1962], 2009 [1948]), Ingrid Gehl (1971), and Jan Gehl (1971), who each argued for a continued focus on the interaction between people, buildings, and urban spaces. Among others, these individuals prioritize the human condition, human perception, human scale, and a variety of people's needs within their respective disciplines: architecture, city planning, and psychology (Sim, 2019). In parallel, a series of international scholars, including Richard Neutra (1954) and Kent C. Bloomer & Charles W. Moore (1977), described the problems with modernist city planning and advocated for a more humane, empathetic perspective in architectural theory by drawing on psychology, Gestalt experiments, and studies of sense perception. Neutra (1954) applied knowledge from biological and behavioral sciences to architecture and community planning. Bloomer & Moore (1977) highlighted how they, dating back to the mid-1960s, attempted to introduce architectural thinking and practice to students from the standpoint of how buildings affect the individual and community. Rather than simply tectonic structure, a series of prescribed technical goals and standardized construction principles, architectural design is a "sensual social art responsive to real human desires and feelings" (Bloomer & Moore, 1977, p. ix). Based on a historical review of the philosophy of beauty, aesthetic theory, and environmental psychology, we know the body is fundamentally three-dimensional, and body movement and memory are essential to understand architectural and urban form.

Other, more recent advocates of a body-centered architectural perspective are Frampton (2002), Mallgrave (2013), Robinson & Pallasmaa (2015), Goldhagen (2017), and Robinson (2021) who, similar to Neutra (1954) and Bloomer & Moore (1977), strongly oppose the visual dominance and philosophical alienation of the body from the mind in postmodern and late twentieth-century architectural theory and practice. Instead, with a foundation of neuro-architecture, they advocate for a multisensorial and embodied approach. Over the centuries, inspired first by the Vitruvian thesis, architectural theory evolved several notions of *embodiment* (Pasqualini, Llobera & Blanke, 2013). They emphasize kinesthetic movement above vision and highlight the importance of tactile sensory inputs from material choices. Throughout the years, this perspective translates to an increased awareness of the multisensory bodily experience: a

focus on *designing for all the senses* (Malnar & Vodvarka, 2004; Gehl, 2010; Sim, 2019; Roe & McCay, 2021).

From an urban perspective, scholars like Timothy Cresswell (2006), John Urry (2007), Albena Yaneva (2012), and Ole B. Jensen (2013) have criticized urban planning for studying the built environment as static objects, disregarding cities as complex, richly diverse, situated, and embodied settings. As highlighted by Jensen, "the 'mobilities turn' has, for two decades, provided us with new, detailed and at times provocative insights into the 'meaning of moving' and the cultures of mobilities" (2021, p. 67). The notion "mobility" grows out of a "pragmatic shift" referring to more than physically traveling from A to B. It denotes a rich societal phenomenon addressing everyday urban life. Mobility is a way of theorizing on what *forms* today's cities, to better understand the *lived* social, cultural, sensorial, emotional, and material experience. Because everybody and every *body* is unique, each have unique movements and social interactions. Thereby highlighting both the act of moving itself, and the experiences and emotions that are created *while* moving in the urban fabric (Lanng, Wind & Jensen, 2017). Yet, as argued by Wang, Sanches de Oliveira, Djebbara & Gramann (2022), a deeper understanding of *how* the built environment possibly affects bodily perception and everyday experiences remains uncovered in most urban and architectural writings, as well as in urban and architectural design guidelines. Not to forget the lacking attention in established educational programs and the pedagogical methods used to teach and train future urban design thinkers (Tvedebrink & Jelić, 2021). Unfortunately, urban designers and architects rarely relate their design to the human body and its multiple forms of embodiment (Imrie, 2013; Mallgrave, 2013). When the body is regarding in design practice, it is usually imagined as a "normal" body or one characterized by standardized geometrical proportions (Imrie, 2013; Tvedebrink & Jelić, 2018; Condia, 2020). We could claim a gap exists between philosophical speculations in contemporary theoretical frameworks and the knowledge used to inform design practice on a deeper understanding of how (diverse) bodies interact with the built environment.

Nonetheless, moving outside the traditional borders of the architectural and urban disciplines, we find the more recent writings on Somaesthetics put forward by Richard Shusterman (2008, 2012a). On a pragmatist philosophical foundation, he highlights the human body (which he refers to as *soma*) is a "medium" through which the built environment is experienced and co-created. Shusterman argues the body constitutes and relates to the surrounding world in a sensorily, emotionally, and cognitively dynamic relationship, thereby pushing the entanglement and possible translation of established urban and architectural theoretical frameworks even further into the domains of neuro/cognitive science.

Somaesthetics and Architecture

Richard Shusterman is, in his own words, "integrating Western philosophy, cognitive science, and somatic methodologies with classical Asian theories of body, mind, and action" (2012a, p. I). He advocates greater attention to "the role of body consciousness in knowledge, memory, and behavior" (p. I), as well as a plea for a deeper understanding of how the rich dimensions of human bodily senses intertwine with human actions and experience. Shusterman introduces a body-centered perspective, highlighting the term "soma," that the body is more than a physical object and a mere sensory instrument (pp. 1–4). He derives the term "soma" from the Greek word for "body" and frames the living body of a person — thereby suggesting a dynamic ever evolving organism, rather than a static object (p. 5). So, the emphasis on the term "soma" indicates an understanding moving beyond the bodily senses of sight, hearing, smell, and

taste. Shusterman accentuates the feelings of skin (touch), proprioception, kinesthesia, bodily temperature, balance, and pain (p. 6). He emphasizes the *lived-living body*, core issues of human embodiment, and the ongoing processes of perception, consciousness, and feeling.

The expression "lived-living body" refers to the holistic complexity of human corporeality. The human body as a biological organism (namely, the *living body*, an anatomical infrastructure responsive to sensory impressions) is integrated by life experiences that make every individual unique (as embedded in the lived body, which allows the perceiving subject to grasp the personal meaning of the world with which they interact). From a methodological perspective, the study of architectural experience has been dominated by a phenomenological approach, focused on the observation of the lived body. In recent years, a greater biological emphasis on the living body has been promoted by breakthroughs in natural human sciences (neuroscience, among others). This research may shed new light on the lived body by complementing the living body, of which the brain and autonomic nervous system are constituent parts (Condia, 2020, pp. 6–8).

For Shusterman (2012a), taking a point of departure in Pragmatism includes the recognition of social, cultural, and political forces in the experience of architecture. Thereby further emphasizing the relevance of human perception of built environment, not only as an architectural object, but as social and cultural patterns in an urban and public domain. Returning to the disciplines of architecture and urban design, this understanding of the human perception of built environment indicates, in accordance with the before-mentioned "mobilities turn" (Jensen, 2017, 2020), a close attention to the multisensory experience, specifically the *movement* through space and related *spatial experience*. Most importantly, Shusterman indicates the body is more than a universal embodied consciousness and normalized body. It is a subjective and individual co-construction. To repeat the words of Shusterman: "somatic consciousness is always shaped by culture and thus admits of different forms in different cultures (or in different subject positions within the same culture)" (2012a, p. 4). A viewpoint which diverts from the more universal embodied consciousness argued in classical phenomenology.

Richard Shusterman states "the basic somaesthetic logic is that rather than rejecting the body because of its sensory deceptions, we should try to correct the functional performance of the senses by cultivating improved somatic awareness and self-use, which can also improve our virtue by giving us greater perceptual sensitivity and powers of action" (2006, p. 8). We can interpret his reasoning in terms of *empathic design skills*. As designers, a somaesthetic approach may improve our "somatic awareness and self-use" (2006, p. 8) by permitting us to better comprehend our inner experiences. Becoming more attuned and sensitive to our bodies and the internal sensations arising from them (interoceptive processing) is a fundamental step to enhancing our bodies as a *design* tool. Thanks to a somaesthetic education, designers can address the need for an empathetic understanding of others' experiences, by acquiring a "greater perceptual sensitivity and powers of action" (2006, p. 8). The timely argument put forward in Shusterman's theory on Somaesthetics is to address the *diversity* of human bodies and the different ways we experience the world with them. Designers should learn and implement this principle, starting with tuning into their bodies and consequently improving their empathetic sensibility.

Unfolding the Bodily Experience in Design Thinking

In 2018, the interaction designer Kristina Höök developed a soma-grounded design approach, based on her interest in Shusterman's Somaesthetics theory (2008). Her argument for the soma-grounded design approach was in line with those by Robinson & Pallasmaa (2015). Höök argued

to "reincorporate the body and movement into a design regime that has long privileged language and logic" (2018, p. XVI). Hence, an argument for a much stronger focus on the bodily spatial experience beyond mere visual sensory stimuli. In addition to the inspiration from Shusterman (2012a), Höök (2018) draws on the recent developments in neuro/cognitive science, emphasizing the writings by the neuroscientist Antonio Damasio (2010, 2021). Damasio's thesis is that there is no distinct separation between the (physical) body and the (mental) mind. In line with Shusterman (2012a), Höök emphasizes empathic engagement not only with other people but with surroundings in general. She highlights the movement through space; the perception and emotional engagement with space; how the movement triggers specific bodily rhythm and various postures; attention to the tactile and kinesthetic experiences causing tension and relaxation of muscles, as well as the activation of the nervous system (2018, p.3); the embodied interaction with surroundings; but, simultaneously, a series of behaviors, actions, reactions, experiences, and feelings. In summary, our bodies are not passive objects, but embodied subjectivities, and, as argued by Höök, "movement is always varied, always adapting and always in dialogue with the changing world around us" (2018, p.13). In that sense, there is an inseparable link between movements, emotions, experiences, and thinking (2018, p. 2): merging the mind and body.

Neuro-Architecture: Experiencing through the Body

The increasing interest in the discipline of neuro/cognitive science and architecture (often referred to as "neuro-architecture") are sparked by an overall aim to better understand how human bodily experiences are affected by interactions with the built environment — with the goal of improving future design solutions to better support human wellbeing and everyday thriving (Eberhard, 2007; Arbib, 2021).

Modern technologies, such as mobile brain/body imaging techniques, allow for a new horizon of neuroscientific and cognitive experimental research findings (Makeig et al., 2009; Gramann, Ferris, Gwin & Makeig, 2014) and computational analysis. Updated research methods allow us to scrutinize the inner workings of the human body and mind, the neural network, and sensory and motor systems. New insights and better empirical evidence are now possible regarding the long-standing debate about human perception and spatial cognition (Bower, Tucker & Enticott, 2019; Gramann, Hohlefeld, Gehrke & Klug, 2021; Djebbara, Jensen, Parada & Gramann, 2022; Wang et al., 2022). Despite the existing methodological limitations in neuro-architectural research (Higuera-Trujillo, Llinares & Macagno, 2021), new methods show promising results to perform better empirical research studies on how human bodies and brains process spatial experiences and atmospheric moods (Canepa, 2022).

The field of neuro-architecture combines insights from neuroscience, cognitive science, architecture, and environmental psychology to address questions relevant to architectural features and the experience thereof. The theoretical backdrop is grounded in a philosophical framework, drawing among others from James J. Gibson's ecological psychology (2014 [1979]) and a phenomenological focusing on the body's experience and its impact on cognitive skills — namely, embodied cognition (Thompson & Varela, 2001; Thompson, 2007; Gallagher, 2017). Neuro-architecture has a biogenic framework where the human body is a living organism undergoing the process of autopoiesis to maintain its homeostatic balance. Crucially, it is the maintenance of the homeostatic balance which adjusts internal parameters in response to fluctuations in the environment, ensuring the organism remains alive. Homeostatic balance is a fundamental principle of all living systems. Human beings, specifically, rely on this balance for our everyday survival, reflecting a basic measure of thriving and wellbeing.

An important task of *homeostasis* is to prevent lethal errors from happening by anticipating environmental changes based on cues learned through previous lived experience (Sterling, 2012). Having this error-correcting mechanism implicitly engaged is fundamental to an organism's ability to survive due to the numerous surprising observations it can make about its environment. By sensing and acting upon its environment, a living organism can both alter and be altered by external conditions. When an organism senses, for instance, the thermal conditions of the environment are too cold, the organism can either change internal states by shivering to generate heat or change its external conditions by simply moving into a warmer condition. This important interaction between sensation and action is referred to as *sensorimotor dynamics*, and can reveal a great deal about human behavior and experience. Importantly, architectural affordances have been demonstrated to have a fast and continuous impact on these dynamics (Djebbara, Fich, Petrini & Gramann, 2019; Djebbara, Fich & Gramann, 2021).

The brain, body, and environment produce sensations and responses allowing sensory and motor dynamics to co-exist. The result of considering interaction to be *process-oriented* rather than substance-oriented is an allowance for sensory flow and human experience to exhibit fundamental principles of continuity (Rescher, 2000; Spivey, 2008; Thompson, 2007). Therefore, objects, other humans in the environment, and our behavior are continuously shaped by the flowing trajectory of these interactions. Our actions and potential for action are directly related to sensations and our processing of them encaptured as the ecological concept of *affordance* (Gibson, 2014 [1979]). Here, perception is understood as the potential for action — an emerging predictive feature of the living system (Friston, 2010). As stated by Djebbara et al. (2022), "in the biogenic sense, affordances reflect the essence of allostasis, which is the anticipatory process that proactively predicts the outcome of a situation before it can have a potentially lethal impact on the homeostatic. By predicting the environment and the appropriate actions, we adapt and improve our chances of remaining alive, which is the objective of a living organism" (p. 12).

As argued by Wang et al. (2022, p. 5), the Gibson's ecological view takes its point of departure in the co-dependent relationship between "organism and environment," where human perception is understood as "an act, not a response, and act of attention, not a triggered impression, an achievement, not a reflex" (1966, p. 149). In this statement, James J. Gibson concludes "perception is also for action" (Gibson as cited in Wang et al., 2022, p. 5) and coins both an enactive and a predictive perspective with relevance to affordances. He underlines that the brain cannot be separated from the body nor the environment, suggesting that an embodied and dynamic interaction between brain, body, and surrounding environment governs human perception and behavior.

The conscious experience of feeling is typically associated with a bodily sensation and is the result of a two-step process. This consists of 1) a *bodily reaction*, and 2) a *cognitive appraisal*, which seeks to find an appropriate explanation for the bodily reaction in the given context. After experiencing a stimulus, the bodily reaction comes first, by activation of the sympathetic nervous system, and is largely non-specific in relation to which emotions is later consciously produced. As early as the 1960s, research showed activity related to the sympathetic nervous system acts itself as stimuli, and "physiological changes are considered to function as stimuli or cues and are represented cognitively as feelings or sensations. These feelings, in turn, arouse further cognitive activity in the form of attempts to identify the situation that precipitated them" (Schater as cited in Valins, 1966). The bodily sensation experienced is not in itself a feeling, but an experience of autonomic reactions (e.g., elevated heart rate). The next step is a cognitive attempt to find an explanation for the bodily sensation appropriate in the given context. Furthermore,

both steps can be manipulated. An injection of epinephrine artificially induces an autonomic reaction that can cause experimental manipulation of the context, resulting in diverse feelings like euphoria or anger. The same sensations are not present in test persons who have received a placebo (Schachter & Singer, 1962). Likewise, the sensation of amusement can be manipulated by injecting epinephrine, placebo, or chlorpromazine — a drug that inhibits autonomous reactions (Schachter & Singer, 1962). An illusion of an autonomic reaction can even be produced just by playing a previous recording of a participant's elevated heart-rate (Valins, 1966). Conversely, if there is no interoceptive autonomic sensation, for example, a threatening context will not produce a feeling state (Schachter & Singer, 1962). Both the relative non-specific bodily reaction and the cognitive context-determined appraisal are necessary for an emotion to occur.

The findings so far are based on psychological experiments, which took place in the late 1950s and early 1960s based on the James-Lange theory (James, 1884). The neurophysiological background has since been clarified (Critchley, 2005; Gray, Harrison, Wiens & Crithley, 2007; Craig, 2009; Damasio, 2010). The point is that architecture can produce both steps, as context (e.g., for rituals, plays, and performances) or other guided behaviors designed to induce emotions. Most recently, Iodice et al. (2019) have shown false auditory heart-rate feedback can produce a bodily response like an interoceptive illusion of effort. As an example of architecture's impact on bodily responses, consider how an effort of climbing stairs or ramps is a vertical movement and emotional "trick", deliberately used throughout architectural history: from the Ziggurat of Ur to Egyptian temples like Hatshepsut; from the Mayas pyramids to Greek and Roman temples; from the stairs in the renaissance, baroque, and classical architecture to the modernistic promenades of Le Corbusier, or the Stadtkrone motive frequently used by Alvar Aalto in townhalls and other important institutions of society. One would imagine the effort associated with ascending the stairs to town hall in Säynätsälo (Finland) adds a tone of seriousness to the negotiations occurring inside the monumental space.

Analysis: Situated Context

Budolfi Square, Aalborg, Denmark

Now, let us return to the example of Budolfi Square. We would like to pause a bit and linger on our family episode from before, to analyze how different bodily states contribute to different spatial experiences and investigate these moments from the perspective of the theoretical framework outlined above. Thereby understanding the human experience prior to designing a physical place.

When we allow ourselves to zoom in on mundane moments in everyday human relational interaction with the urban environment, we find (with insights from Somaesthetics and neuro/cognitive science) that our bodies are constantly met with numerous external and internal sensory stimuli. *Externally*, one may experience the subtle changes in pavement from cobblestone to gravel, traffic noises, odors from passing pedestrians and surrounding restaurants, or the spatial transition from a narrow pedestrian alley to a large inclining landscape (as is the case in Budolfi Square). As argued for by Ole B. Jensen, "practicing situated mobilities in everyday life may be seen as a constant juggling of material spaces, social interactions, embodied performances and networked technologies. As we move across time and space, we may find ourselves placed at different levels of the mobility skills ladder" (2013, p. 137). *Internally*, one may experience the sense of hunger and or an increased heart rate. Yet, we typically are not aware of most external and internal stimuli. In the everyday, it is impossible to constantly take notice of every movement

in our joints and muscles, or to be attentive to one's bodily and feeling states, detecting small changes in, for instance, temperature and light conditions. Instead, the brain "narrates" the collection of sensory stimuli and bodily attention. This narration allows us to be consciously aware of a small percentage of any situation; the rest operates as a nonconscious backdrop (Djebbara et al., 2022).

According to the neuro-architectural framework, every situation in our daily lives is met with previous experiences: previous sensorimotor schemes, attached feeling states, and associations. Triggering a series of predictions and expectations in the current situation based on a selection and modulation of these history-dependent situations. This is a *future-oriented attunement* process, as previously argued. Given the limited energy available and the cost of neuronal activity, humans are naturally frugal creatures regarding the use of environmental features to guide behavior (Djebbara et al., 2022).

Now, let us take a closer look at fundamental architectural elements of transition in the example of Budolfi Square: 1) the *stair*, 2) the *ramp*, and 3) the *elevator*.

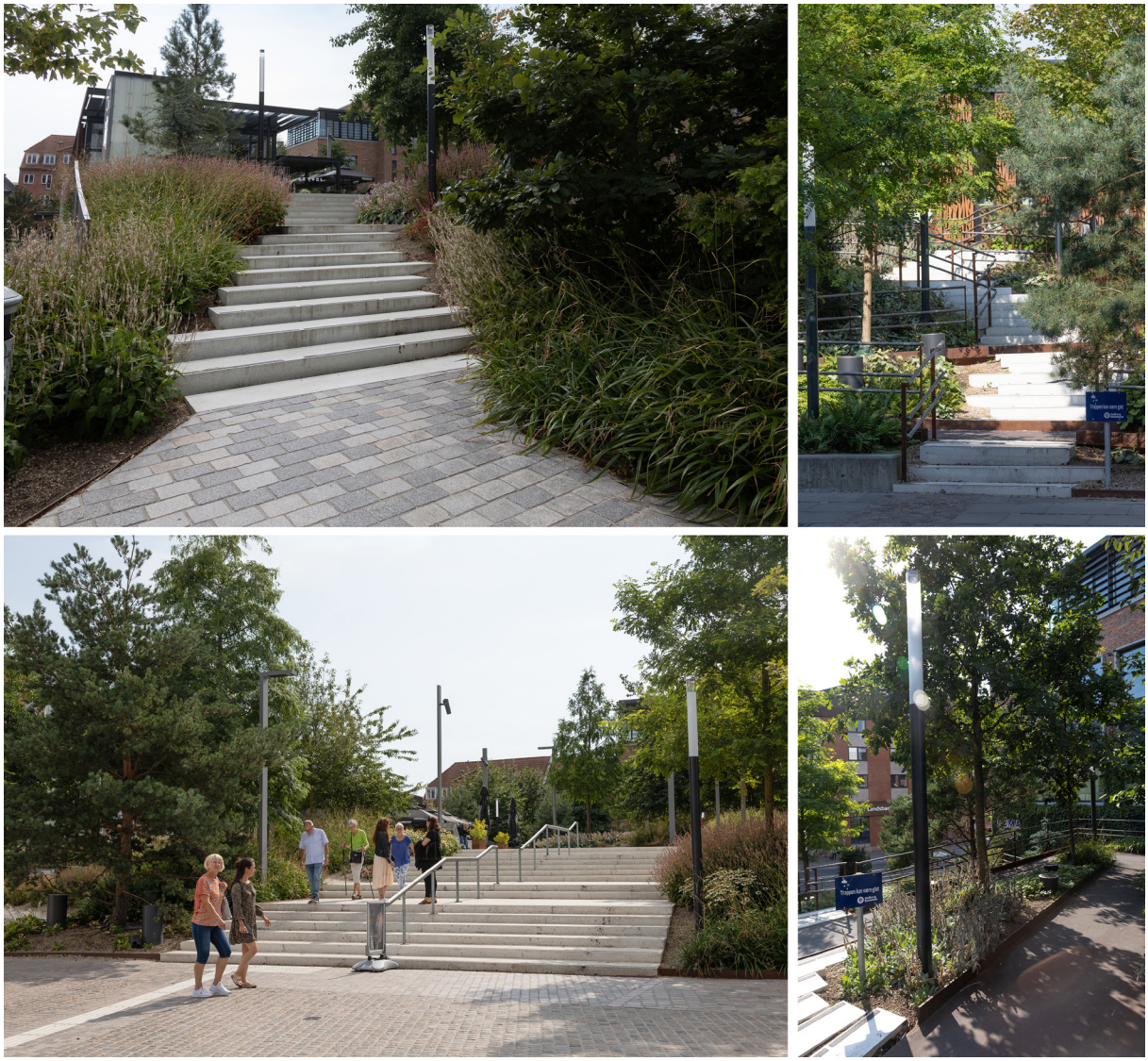

Figure 2 *Different staircases in Budolfi Square. A broad staircase facing north with a central position and direct entry point to the plaza. A more ziggurat staircase facing south providing an explorative walk in the urban landscape*

The stair

As seen in Figures 1–4, we find different staircases in Budolfi Square. A stair is an architectural element allowing for a transition between two separate spaces with a vertical movement either up or down. It brings increased attention between the foot and the surface of the step, further enhancing the kinesthetic movement of leg muscles, nerves, and tissue engaging the vestibular system. Recalling Somaesthetics, Richard Shusterman (2012a) dwells on the staircase when debating architectural design. He emphasizes that "in descending a staircase, we are rarely aware of our kinesthetic movement, our proprioceptive feelings of balance and extension in space, [or] the tactile qualities of contact that our feet make with the steps" (p. 235). Shusterman refers to the situation as an "implicitly felt quality," which is both a central core of spatial atmosphere and an explicit part of our experience, with strong influence on our behavior, attitudes, and moods. In the case of the grandparents visiting Budolfi Square, they were both aware — before the actual walking experience — of the implications climbing the stairs would trigger. When confronted with the worries about their body abilities in the urban setting, the grandparents revealed a twofold perspective: 1) a personal worry related to the fear of muscle pain and lack of strength; and 2) a deeper concern for what might be framed as "social situated inequality" related to their appearance in front of others: the worry of sweating and heavy breathing is ill-regarded by "urban etiquette" or "urban civility" (Goffman, 1959). This is a clear example of the *action-perception loops* and *co-dependent relationship between the human body, brain, and built environment*. Consequently, a stair could be a dangerous and exhausting element for people unable to easily climb the steps, thereby excluding parts of the human bodily spectrum. In design practice, to accommodate for human diversity, the shaping of a staircase demands adhering to building codes with technical, measurable considerations to safety and accessibility. Too little attention is given to how the stair makes different people *feel* in a sociocultural context.

The ramp

In-between the staircases in Budolfi Square we find two ramps: a metal ramp and a gravel pathway (Figure 3). Compared to the stairs, ramps and pathways as architectural elements offer the potential of uninterrupted continuity and transition through an inclining or descending terrain. The ramp and pathway afford a steadier walking rhythm and a less strength-demanding or balance-dependent access point. In design practice, the ramp is frequently referred to as a more utilitarian device with a gradual angle of inclination, allowing for universal accessibility: people with wheelchairs or strollers and those walking with the support of walkers or canes can use a ramp. Not to forget the potentials for sack trucks, shopping bags, bicycles, and other convenient transportation devices. As with the scenario of the staircase, the grandparents visiting the square immediately noticed the prolonged pathway and length of walking this route offered compared to the staircase, before appreciating the vegetation or scenic views of the surroundings. So again, despite the functional design, the anticipated effort and related feeling prevented the grandparents from using that access opportunity.

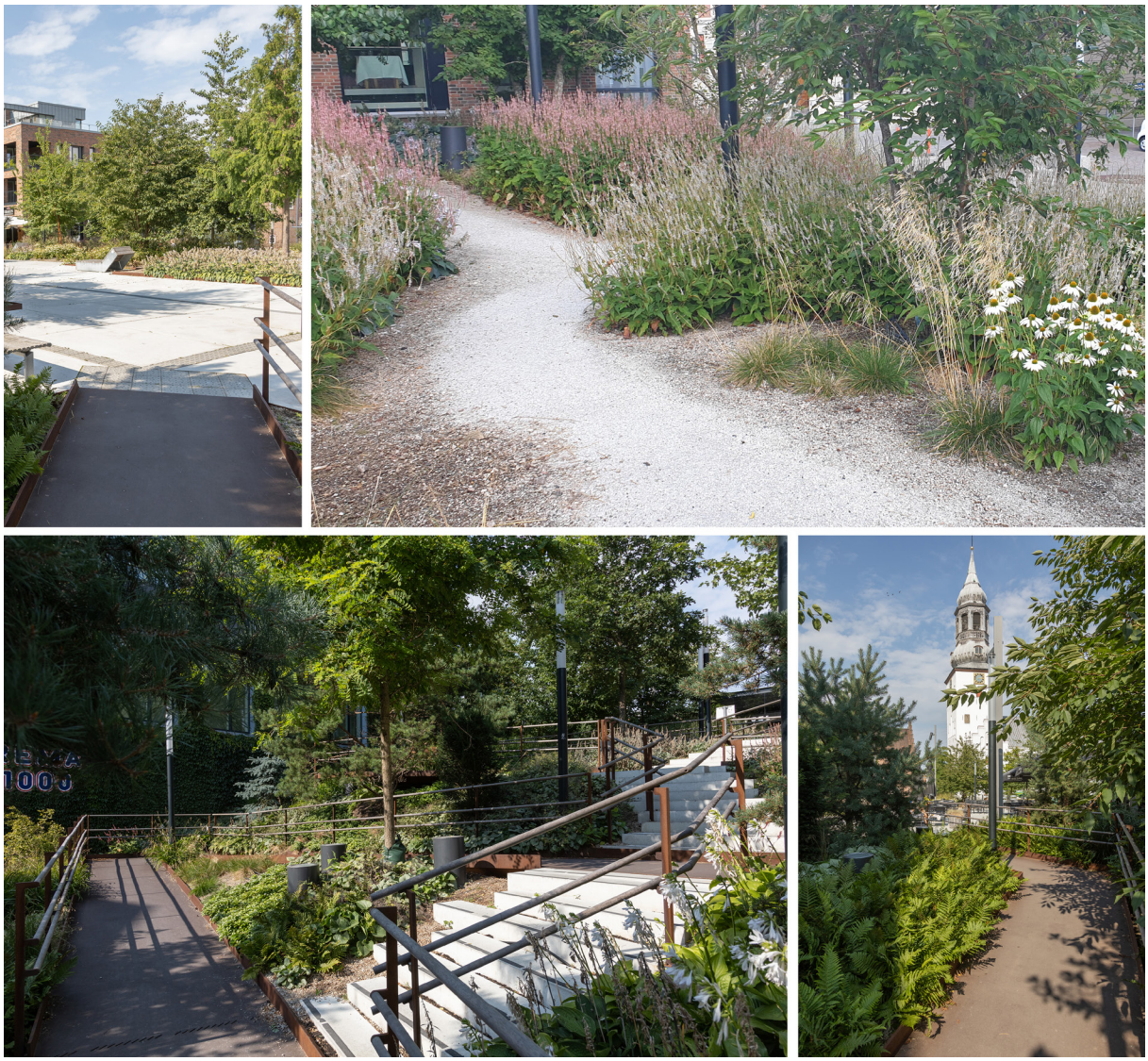

Figure 3 *Above: gravel pathway from eastern side of the plaza*
Below: metal ramp from south side of the plaza

The elevator

Finally, we have the elevator. In Budolfi Square, it is located on the eastern side, next to the parking garage entrance. As an architectural element, the elevator strongly depends on electric technologies. It is a radically different sensory input and has different movement requirements compared to the stair or ramp. The human body does not move by itself but is transported mechanically in a vertical direction. This experience is in stark contrast to the slower, horizontal walking required with a ramp, pathway, or the rhythmic climbing of stairs. Simultaneously, the elevator, with a small enclosed interior space, often contains odors which can trigger a series of safety concerns around the risk of being trapped inside a small, dim space. If you feel you *need* to use the elevator because you are not able — or comfortable — with climbing the stairs or walking the ramps, you are excluded from the essential sociocultural interactions defining Budolfi Square. Your opportunities for participating in social rituals, like strolling through the labyrinth landscape admiring the varied vegetation, are restricted. This robs individuals of

engaging in equitable social interactions. The placement, form, and materiality of the stairs, ramps, and elevator all contribute to this spatial segregation. This urban environment favors people with a "normalized" body.

Below, we outline three key findings on the background of our theoretical exploration and analysis, advocating for change in future research and design practice.

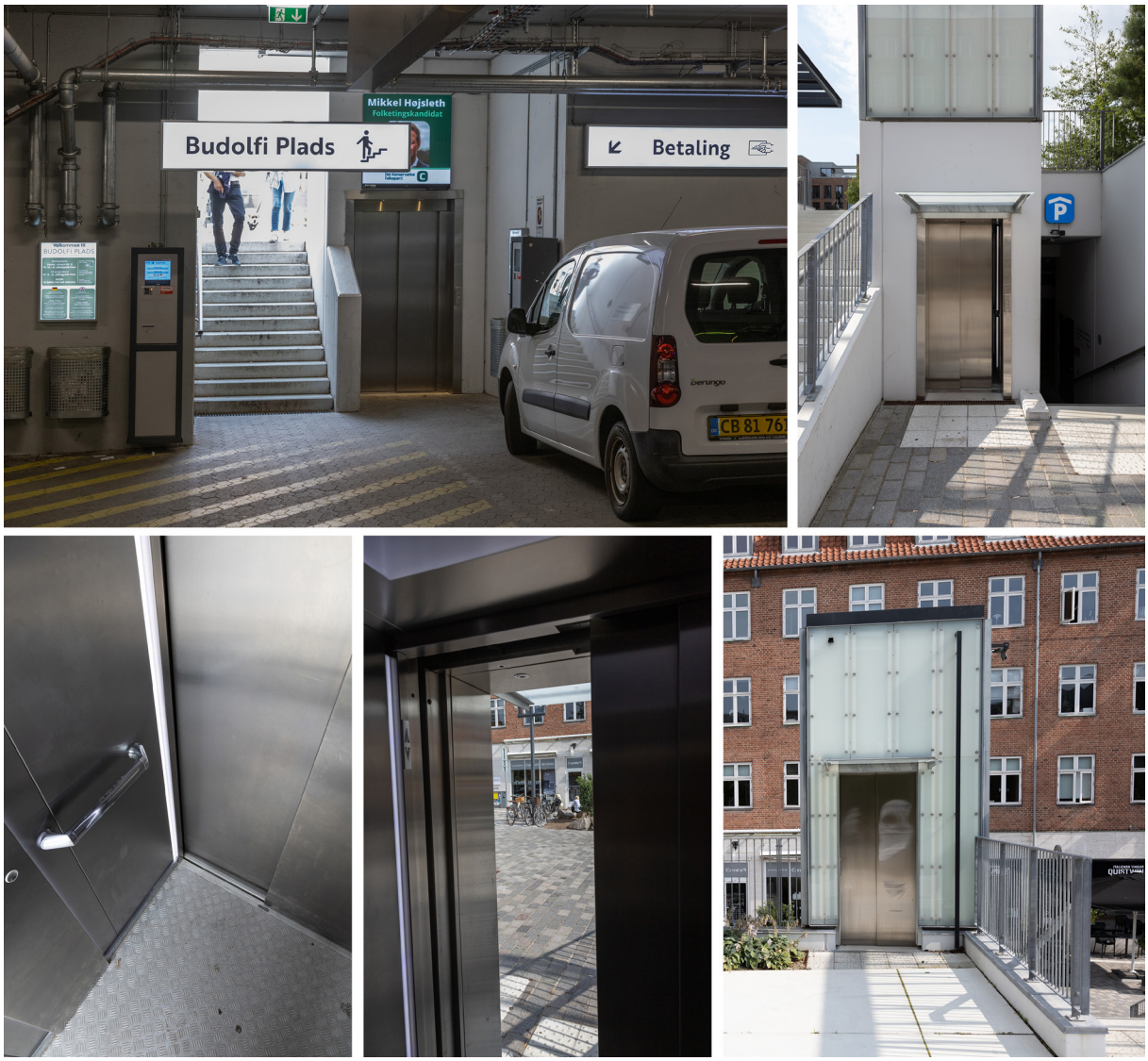

Figure 4 *The elevator, parking house, and stair in the eastern side of the plaza*

Key Findings

Challenge 1: Greater Awareness to Motion and Emotion

This theoretical framework suggests as we move, we are simultaneously moved by emotion. The emotional process is not restricted to specific "beautiful" environments. It is an ordinary, everyday state of being which is continually evolving (Damasio, 2010, 2021). Emotions can be both positive and unsettling. They are triggered by perceiving external seemingly mundane events,

or by simply the thought of past experiences. Each interaction and encounter are associated and interpreted according to our levels of attention and awareness, providing distinctly personal meanings. Due to stairs', ramps', and elevators' distinct sensorimotor dynamics, they induce distinct emotions, feeling, and behaviors through action-perception loops.

The subtle difference between *attention* and *awareness* should be noted. How we individually alter our movements are moment by moment, not an automatic, general response. Rather, this process is a dynamic and ongoing attunement to the series of situated events. Sarah Goldhagen poetically refers to this *situatedness*: "the stories and narratives we develop [...] are the ones that we write and rewrite all our lives; they are the stories of what we have seen and done and been, when we were in the places and spaces and buildings of the world" (2017, p. 202). The experiential richness of existence is mediated by the built environment, always relating to shifting perspectives of embodied movement and mobility. Our spatial perception and experience are linked to the contextual cultural and social settings we engage in. In hindsight, the grandparents' actions and behaviors became *co-created* based on their emotional states of being and preconceptions/expectations of the situations unfolding around them rather than from a sensory stimulus-response relationship suggested by contemporary design practice. This dynamic is a narration of the "what was," "what is," and "what if."

Additionally, the stairs, ramps, and elevator have three different physical locations in relation to the center of the urban plaza. They differ in materiality and possess fundamentally different architectural *gestures*, each affording a variety of body postures and actions — including vertical and horizontal movements coming from the front, back, or sides. This is positive in the sense it allows different modes of mobility and differentiated experiences, inviting inhabitants to use the stair for a central positioning or the ramp and elevator for a partly hidden overlook. However, we conclude the setting, through the different movements and emotions connected with the stairs, ramps, and elevator, *directly* and *indirectly*, excludes persons with specific body abilities.

Challenge 2: From Human Body to Human Spectrum

Most urban spaces are designed according to international standards — based on the statistics of an average able-body and accompanied by a series of strict technical considerations on accessibility. For the three urban architectural elements analyzed, most people are unaware of the urban qualities that shape each architectural element. The awareness of urban qualities arrives from the implications on their individual bodies and perceived abilities. This understanding highlights how crucial are the inner subjective experiences of people. It is a recognition of the *value* each subjective self holds. Thereby underlining the need for architects and urban planners to not only design for various body states, but to develop better ways to capture the *human spectrum* and understand how to translate this "data" in early design processes.

As emphasized by design researcher and professor in engineering Sara Hendren "disability is not a fixed or permanent label that belongs only to some people; it arrives for each of us. Short-term injury and long-term illness, changes in our perception and mobility" (2020, p. 1). "Every day, every body is at odds with the built environment [...] How we meet the built environment depends on both bodies *and* worlds" (p. 31: original italics). Looking back at the family episode in Budolfi Square, it is revealed how every person is on a spectrum of unique body states, and various motor and sensory abilities.

With the above theoretical and analytical insights, it becomes clear how much we take for granted in the subtle act of evaluating distances, negotiating street spaces, and adjusting walking paces. Furthermore, how we use different architectural elements in our everyday surroundings

to help orientate, navigate, and reconsider our movements and directions. As human beings, we continually act, react, and adapt to our environment. Simultaneously, our bodies and brains are continuously changing throughout life. Yet, the question of how to consider body diversity as urban designers and architects is seldom discussed in scholarly circles or in discussions around capturing and measuring different bodily experiences and varying emotions. Throughout education, students of architecture, urban design, and engineering make many assumptions about how people (of a certain able bodily statue) act and behave. Thinking about human bodily diversity and individuals with different temporary or permeant abilities is often seen as extra demanding, only to be addressed with a specialist approach (Tvedebrink & Jelić, 2021). For years this caused a design perspective favoring the legacy of standards and habitual statistical thinking, broadly applied to perspectives on human bodies and their abilities.

Designing for a *spectrum* of human bodily experiences and emotions means paying greater attention to diversity and body movements. As urban and architectural design thinkers, this does not mean removing all obstacles and constraints, but instead considering a democratic orchestration of spaces. This approach allows for a greater spectrum of human body diversities. Additionally, we should consider what the urban settings *do* and *invite for* (in other words, what affective and motor affordances we design), second to how spaces visually look and brand themselves. The lived-living experience of an urban environment is an assemblage of various social practices, interactions, and behaviors. The notion of assemblage is commonly acknowledged in urban theory and practice; however, we are arguing for more attention to the actual movement to better engage distinct types of movement, enhancing the multisensory focus. Simply, urban- and architectural spaces that are designed with great inclusivity will omit disturbing and discomforting emotions, because inhabitants will not *feel* excluded or in conflict with sociocultural norms.

Challenge 3: Advancing Research Methods and Design Vocabulary

The plea for a broader understanding of the *multisensory* perspective invites greater attention to the aspects of movement beyond orientation, navigation, and kinesthetic skills. As urban and architectural design researchers, practitioners, and educators, we need to move beyond the common misunderstanding that spatial perception happen to us as a direct result of five basic sensations. We need to understand spatial perception as a dynamic experience continuously co-created. This understanding is based upon concepts like *affordances*, *atmospheres*, and *emotions*, which support the plea for greater awareness of architecture and urban design's sociocultural impact. Thereby, prioritizing a broad spectrum of experience, instead of simplifying the human experience to binaries like able/disabled bodies.

One of the most complicated challenges of existing research methods is capturing and documenting the lived-living and embodied experiences while moving through an urban setting and distinguishing between the levels of consciousness (i.e., attention and awareness, nonconscious behaviors versus conscious acts). Existing design tools help move research findings and data on lived-living experiences into the development of future design solutions and the creative act of formgiving. From a research point of view, it would be ideal to capture the human bodily interaction with built environment from a first-person perspective. Nevertheless, as argued for by Shusterman (2012a), the spatial atmosphere is experienced (and felt) as an intangible and temporary bodily feeling: a given quality in a specific situation. From a research-oriented perspective, the biggest challenge is that bodily feelings are experienced somatically and beneath full consciousness. So, at present, with the technologies and methodologies available,

it still seems impossible to do so. In asking people to pay attention to their own movements, we trigger conscious attention, bringing subject matter to the foreground.

With the above insights, we want to conceptualize a new way of design thinking by adjusting the urban design vocabulary and theoretical framework, which guide the principles for how we plan and design cities. Lastly, this analysis highlights our need to develop research methods necessary in capturing and documenting the theories we speculate.

Concluding Remarks

In conclusion, we analyzed somaesthetic theory within the neuro-architectural framework to help advance our understanding of human bodily interactions with the built urban environment. We took a point of departure in the interpretation and redefinition of existing architectural and urban design conceptualization using somaesthetic theories and neuroscientific research insights. We focused on the body itself and the effort associated with its *movement through space* as the locus of the *emotional experience* in the context of urban environments. The aim is to develop preliminary steps towards an advanced theoretical framework or design vocabulary, putting experience and emotions at the forefront to inform future design practices.

As established with the existing urban theory and mobilities turn, contemporary cities are constantly transformed, rearranged, and reassembled in different urban patterns. We need a more dynamic perspective to contrast the current static understanding and sedentary approach. What we further learn from the theoretical framework and analyzation of Budolfi Square is to move beyond the established design understanding of the human body as a fixed entity. The body is an everchanging, adaptive, and responsive living organism — and diverse by nature. We should be intimately familiar with the human experience, acknowledging the multiple, parallel lived-living realities.

Although many scholars study the body and its interaction with the built environment, perhaps we should focus on the *mobile* body to understand how *body diversities within the human spectrum impact perception*. Ultimately, moving beyond established strategies of average bodies, generalization, and standardized measurements into weaving diverse, contradictory narratives and perspectives together. This suggestion indicates a fundamental shift in urban and architectural thinking to embrace a broader and more dynamic view on human bodies. It emphasizes a shift from thinking about people as disabled, to understanding existing *disabling environments*. Thereby unfolding a set of ideas and concepts to develop a nuanced, interdisciplinary design toolbox and relevant design taxonomy.

With that said, we would like to end with the words of the Danish architectural thinker, practitioner, and educator, Steen Eiler Rasmussen:

> If we believe that the object of architecture is to provide a framework for people's lives, then the rooms in our houses, and the relation between them, must be determined by the way we will live in them and move through them [...] The design of buildings, which must be stationary, should be based in the movement that will flow *through* them (*1959, pp. 136, 150: original italics).*

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