The Digital Navigator

How Digital Navigation Systems Reshape Spatial Understanding and Urban Experience.

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Abstract

This thesis examines how digital navigation systems influence spatial awareness, spatial knowledge acquisition, and the emotional experience of navigating unfamiliar urban environments. While previous research has demonstrated the efficiency and convenience of digital tools when navigating, their broader cognitive and experiential implications remain less consistently explored. Building on existing work in spatial cognition and environmental perception, this study investigates how digital devices shape navigational strategies and engagement with urban space. A mixed-method approach was employed, combining in-field navigation tasks, a cognitive mapping exercise, and semi-structured interviews. Participants (N=10) were divided into two groups: one navigating with digital assistance and the other using written instructions. The findings largely confirm earlier research by indicating that digital navigation promotes a more efficiency-oriented yet passive approach of movement, characterised by reduced cognitive effort and increased reliance on the device. In contrast, non-digital navigation encourages more active and self-directed engagement, supporting richer spatial awareness while evolving cognitively richer representations of space. Emotional experiences also diverged where non-digital navigation generated greater sensory engagement and affective connection to the urban environment, while digital navigation produced smoother but less immersive experiences.

Overall, the study suggests that digital navigation systems do not necessarily diminish navigational abilities, but rather configure how individuals interact with and attend to space, often at the cost of perceptual richness and spatial learning. These findings reinforce the importance of considering, not only the functional benefits of navigation technologies, but also their influence on spatial experience. Future research may further explore how digital tools can be designed to better support both efficient navigation and meaningful engagement with urban environments.

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1. Introduction

In contemporary urban life, the way people find their way through cities has become increasingly shaped by an increased use of digital technology. What was once a process of exploration, observation, and memory is now often guided by step-by-step prompts on a digital screen. This shift raises important questions about how these tools influence, not only the way people move, but also how they perceive, remember, and emotionally experience the spaces they travel through. Understanding these changes is important for exploring how technology affects our everyday relationship with urban environments.

1.1. Background

Over the past few decades, the way in which individuals navigate urban spaces have undergone a noticeable transformation. Where navigation once depended on spatial awareness, memory and environmental engagement, the increased widespread reliance on digital navigation, including GPS-enabled smartphones and real-time mapping applications, has ultimately transformed the way of navigation into a technologically mediated process (Ishikawa et al., 2008; Dickmann, 2012; Ahmadpoor, 2019; Ahmadpoor & Smith, 2020; Dahmani & Bohbot, 2020). While these technologies provide efficiency and convenience, their widespread adoption raises pressing questions regarding the cognitive and experiential consequences of digital assisted tools in unfamiliar urban spaces. The ability to recognize and move through structured space has long been considered a fundamental cognitive process rooted within the basic skills of the human species (Ahmadpoor, 2019; Ahmadpoor & Smith, 2020), involving a complex interplay of perception, memory-storing, decision-making and spatial reasoning (Dalton et al., 2019; Gillet & Heersmink, 2019; Dahmani & Bohbot, 2020). These abilities enable individuals to form mental representations, also known as cognitive maps, of urban layouts, facilitating orientation and promote a deeper understanding of place before, during and after a navigational task (Lynch, 1960; Montello, 2012).

In the past two decades, there has been a growing surge of research interest in understanding how digital navigation mediates the experience of moving through urban space, examining not only the efficiency and accuracy these technologies provide but also the ways they reshape individuals perceptual-, cognitive-, and emotional engagement with the physical space. Empirical research shows that individuals who rely heavily on navigational tools tend to recall fewer landmarks, display weaker

spatial awareness, and construct less accurate mental maps than those navigating unaided (Ishikawa et al., 2008; Münzer et al., 2012; Ruginski et al., 2019). Ahmadpoor (2019) suggests that this shift toward externalized navigation undermines experiential engagement, potentially diminishing both cognitive mapping abilities and emotional attachment to place. As Lynch (1960) argues, the 'legibility' of the city depends on active perceptual participation. If these interactions are replaced by digital step-by-step guidance, individuals may navigate efficiently yet remain perceptually detached, traversing urban landscapes without truly experiencing them.

Although numerous field studies have examined the practical efficiency of digital navigation, focusing primarily on metrics such as task completion, route accuracy, and error rates (Young et al., 2008; Huang et al., 2013), far fewer have explored how such systems shape the deeper cognitive processes involved in forming spatial knowledge, including the awareness, organisation, and internalisation of spatial relationships within an environment. This process is essential to how individuals orient themselves, remember places, and build meaningful connections to urban space. Recent interdisciplinary work has begun to illuminate these subtler cognitive consequences and to compare the effects of passive and active navigation (Mirowski et al., 2018; Ahmadpoor, 2019; Ruginski et al., 2019; Ahmadpoor et al., 2020; Dahmani et al., 2020; Vaez et al., 2020, Huston & Hamburger, 2023). Yet, empirical understanding remains incomplete, particularly regarding the emotional consequences where research remains limited, fragmented and visibly lacking. This thesis therefore seeks to deepen the understanding of how digital navigation shapes the acquisition of spatial knowledge and the emotional experience of moving through unfamiliar urban environments.

1.2. Research Problem

Despite the widespread integration of digital navigation systems into everyday urban traveling, there's still limitations in understanding their broader cognitive and psychological consequences. While much of the existing research has focused on performance-based outcomes, such as route efficiency, travel speed, and error reduction (Young et al., 2008; Huang et al., 2013), the more nuanced dimensions of spatial awareness, environmental perception, and experiential engagement have often been overlooked or insufficiently explored. However, many scholars such as Ishikawa et al. (2008), Dickmann (2012), Ahmadpoor (2019), Ruginski et al., 2019; Vaez et al., 2020; Ahmadpoor and Smith (2020), and Dahmani and Bohbot (2020), among others, have begun to address these overlooked dimensions,

exploring how digital navigation influences spatial knowledge acquisition, awareness, and the experiential quality of space.

What remains underexamined is how continued reliance on digital navigation affects, not only individuals' ability to perceive, store memory, and process spatial features as they navigate, but also how to maintain perceptual engagement in an unfamiliar urban space while being engaged in the experience. Within this context, Gartner (2012) was among the first to introduce the notion of emotional responses to space within cartographic research, emphasizing that spatial understanding extends beyond geometry and navigational accuracy. His work highlights how emotions and affective engagement contribute to a richer and more integrated spatial knowledge, offering insight into how individuals feel and interpret a place rather than merely locating themselves within it. However, such perspectives remain scarce, as most navigation-research continues to privilege cognitive and functional dimensions over the affective ones, leaving an empirical gap in understanding how technical mediation shapes our emotional experience of urban environments.

1.3. Research Aim & Questions

This thesis aims to address the existing gaps in understanding how digital navigation systems influence the cognitive, behavioral, and emotional dimensions of urban experience. Specifically, it explores how reliance on digital navigation affects individuals' perception and memory of spatial features, their ability to form cognitive maps, and their emotional engagement with unfamiliar environments. Grounded in environmental psychology, spatial cognition, and urban studies, the research responds to the limited empirical focus on the experiential and affective aspects of mediated navigation. By comparing digital and non-digital navigation practices, this study seeks to clarify whether the convenience afforded by digital navigation enhances or undermines spatial awareness and the meaningful, embodied connection to place. Building upon the identified research gaps, this study seeks to explore how digital navigation systems reshape both the cognitive and emotional dimensions of human interaction with urban environments. To investigate these dynamics, the research focuses on two interrelated areas: the formation of spatial knowledge, and the affective experience of navigating through space. These focal points form the basis of the following research questions:

- How does the use of digital navigation systems influence individuals' spatial awareness and acquisition of spatial knowledge while navigating through unfamiliar urban environments?

- In what ways does the use of digital navigation systems affect individuals' emotional engagement and experiential interaction to unfamiliar urban spaces.

Together, these questions address both the cognitive and affective dimensions of mediated navigation - two aspects that have remained underexplored in existing research. The first question examines how and if digital navigation may alter spatial awareness and knowledge acquisition, offering insight into whether users still develop coherent cognitive representations of urban space when navigation becomes digitally mediated. The second question extends this inquiry to the emotional and experiential realm, exploring how mediated navigation shapes users' affective ability to connect and relate to place. By integrating these perspectives, the study aims to provide a more holistic understanding of how digital navigation systems influence not only individuals behaviour while traversing, but also how they perceive, experience, and relate to the urban environment at the same time.

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2. Literature Review

Understanding how individuals acquire, interpret, and utilize spatial knowledge while navigating through physical environments has long been a central focus across various disciplines, including cognitive science, environmental psychology, and urban design (Lynch, 1960; Siegel & White 1975; Montello 2012; Ahmadpoor & Heath, 2018; Mirowski et al., 2018; Ahmadpoor, 2019; Vaez, Burke, & Yu, 2020). Navigation in its essence is often signified by the continuous knowledge of self-localization ("I am *here*") alongside a defined goal ("I am going *there*"), where our spatial awareness and cognitive interpretation of urban space enhances navigational behaviour and experience within a place (Mirowski, et al., 2018). Thus, in this digital age, the meaning of 'place' becomes increasingly relevant as the reliance on digital navigational systems continues to grow. A place is not just a point on a map; it is socially and experientially constructed, shaped through memory, emotional connection, and sensory engagement (Relph 1976; Tuan, 1977; Xu & Sun 2025). As users follow prompts from digital navigation systems, they may physically travel through space, but ultimately fail to construct a meaningful sense of place. Often described in human geography, "*place* is *space made meaningful"* that emerges through lived experience, cultural practices, emotional attachment, and memory (Tuan, 1977; Relph, 1976; Cresswell, 2015). It is asserted that places gain identity and significance through human perception and engagement with space (Relph, 1976; Gartner, 2012).

2.1. The process of cognitive mapping

The process of cognitive mapping describes how individuals move from spatial awareness, to spatial knowledge, and ultimately to the formation of a cognitive map. The process begins with **spatial awareness**, which refers to "*the ability to understand the body's position in relation to the surroundings*" (Seladin-Schulman, 2020). This is further defined as the immediate perceptual understanding of an individual's self-position, orientation, and movement within a space. Spatial awareness functions as the perceptual foundation, allowing individuals to attend to and interpret environmental cues in real time. Through repeated exposure and engagement, these perceptual experiences are encoded and organized into spatial knowledge, which contributes to an evolving mental representation of the environment (Lynch, 1960; Anderson, 1996; Golledge et al., 2000; Ahmadpoor, 2019). In other words, awareness provides the sensory input, while knowledge represents the cognitive outcome of that perceptual process (Montello, 2012; Ahmadpoor & Smith, 2020).

Spatial knowledge encompasses awareness of place names, the relative distances and directions between locations, and the relational organization of places within an environment. Such knowledge enables individuals to navigate from home to work, plan routes between destinations, and provide directions to others. Stored and processed in the brain as cognitive representations, this spatial knowledge fundamentally shapes human interaction with the environment. In other words, spatial behaviour is guided by one's internalized mental model of the physical world. The development of spatial knowledge is influenced by multiple factors, including environmental complexity, individual experience, and method of navigation (Appleyard, 1969; Golledge et al., 2000; Dogu & Erkip, 2000). Building on this understanding, researchers emphasize that spatial knowledge does not develop in isolation but through continuous interaction between individuals and their surrounding environments.

The term **cognitive map** is broadly used to describe the mental processes involved in acquiring, representing, and interpreting spatial information about real-world environments. Although researchers across disciplines employ various terms, such as mental maps, mental images, or mental representations, these concepts generally refer to the same underlying phenomenon: the internal organization of spatial knowledge within the human mind (Lynch, 1960; Downs & Stea, 1973; Ahmadpoor & Shahab, 2019). Thus, cognitive maps represent the cognitive outcome of spatial awareness as well as the knowledge gained when individuals engage with their surroundings. Rather than functioning as static or objective reproductions of space, cognitive maps are considered to be dynamic and interpretive constructions that are selective, incomplete, and continuously updated through sensory experience and interaction with the environment (Lynch, 1960; Siegel & White, 1975; Kaplan & Kaplan, 1982; Anderson, 1996; Mirowski et al., 2018; Ahmadpoor & Smith, 2020).

They are composed of meaningful fragments that encode the relative distances, orientations, and hierarchical organization of physical elements (Evans, 1980; Ahmadpoor & Shahab, 2019). Moreover, Kaplan and Kaplan (1982, p. 63) describe a cognitive map as “a compact, orderly collection of knowledge” that enables route planning and decision-making, which serves not only as mental representations of spatial layout, but also as functional tools for navigational behaviour in urban space (Montello, 2012; Ahmadpoor & Shahab, 2019).

Research emphasizes that these maps are continually shaped by embodied experience. Perception and memory operate interdependently in their formation, where remembered cues, such as distinctive landmarks, typological elements, or intersections along a route, strengthen an individual's orientation within space (Kelly & McNamara, 2008). Spatial awareness, therefore, emerges not from passive recognition but from the embodied memory of movement through the environment. This integration of sensory perception, memory, and spatial reasoning forms the foundation for effective navigation and supports a deeper, affective connection to place (Siegel & White, 1975; Golledge et al., 2000; Vaez, Burke, & Yu, 2020). In addition, Montello (2012) explains that movement through space is crucial for building spatial knowledge. Direct interactions with the environment, i.e. walking along streets, acknowledging landmarks and making navigational decisions supports a richer, more accurate spatial understanding than passive observation alone.

2.2. Spatial Knowledge Acquisition

Acquiring spatial knowledge from large-scale environments, such as urban settings, has long been a central concern in spatial cognition research (Lynch, 1969; Siegel & White, 1975; Montello, 1998; Ishikawa & Montello, 2006; Ahmadpoor & Shahab, 2019; Ahmadpoor, 2020). Unlike the perception of discrete objects, which can be apprehended from a single viewpoint, understanding large-scale environments requires active movement and exploration through space. As Ittelson (1973) contends, individuals cannot perceive the spatial layout of a city in its entirety from one fixed position - rather, they must traverse it, continuously integrating visual, sensory, and experiential information from multiple perspectives (Ahmadpoor & Shahab, 2019). Having established that cognitive maps are formed and developed through consistent exploration, movement and repeated interaction with an environment, it is worth to note that when individuals engage with a ‘new' large-scale environment, this process of spatial knowledge formation is referred to as spatial **microgenesis.** In addition, its accumulation across the lifespan is referred to as **ontogenesis** (Siegel & White, 1975; Montello, 1998;

Ishikawa & Montello, 2006; Ahmadpoor & Shahab, 2019). This thesis will focus on microgenesis, as the aim is to explore the participants' navigational behaviour and experiential engagement to ‘new' large-scale environments while using digital navigation systems.

Siegel and White (1975) proposed a framework that explains the process of microgenesis which outlines how spatial knowledge is acquired and developed over time. This framework suggests that spatial knowledge develops progressively though three stages: landmark knowledge, route knowledge, and survey knowledge. **Landmark knowledge** refers to the recognition of discrete objects, locations, or other prominent features within the environment. Siegel and White (1975) explain that “*landmarks are unique patterns of perceptual events at a specific location; they are predominantly visual for human adults; they are the strategic foci to and from which one travels*” (Siegel & White, 1975, p. 225). In this sense, landmarks designate specific geographical locations that serve as reference anchors during navigation. For example, “the intersection of Broadway and 42nd Street is as much a landmark as Prudential Centre in Boston, the Eiffel Tower in Paris, or the billboard advertising Winston cigarette” (Siegel & White, 1975, p. 23). They further suggest that the conscious knowledge of destination, such as knowing one is “coming from the office” or “going to the park”, also constitutes as landmark knowledge (Siegel & White, 1975; Ahmadpoor & Shahab, 2019). Landmarks, therefore, help define beginnings and endings of journeys, as well as intermediate markers that support accurate navigational direction within the environment (Ahmadpoor & Shahab, 2019; Vaez, Burke, & Yu, 2020).

Route knowledge represents the second stage of spatial knowledge development, in which individuals begin to connect landmarks into ordered sequences associated with navigational decisions, e.g. ‘Turn right after two blocks and then turn left at that landmark.’ According to Siegel and White (1975), when an individual anticipates encountering a particular landmark or a series of landmarks during navigational travel, they possess a mental route. If these expected landmarks fail to appear, the individual may experience disorientation and question whether they are on the correct path. Further, “*the space between landmarks is at first ‘empty’, and then gains ‘scaling’ with accumulative experiences*” (Siegel & White, 1975, p. 29). Thus, route knowledge emerges gradually as individuals learn to integrate sequences of landmarks and decisions, transforming isolated spatial cues into coherent pathways for accurate navigation.

Within this framework, landmarks and routes are regarded as essential components of cognitive representation and navigation. Routes provide structure to individuals’ understanding of urban space, transforming discrete landmarks into organized spatial knowledge. The formation of **survey knowledge** is an integrated, map-like comprehension of space that depends on the interconnection of

landmarks and routes, including those that are not directly linked through immediate experience. Consistent with the perspectives of e.g. Montello (1998), Ishikawa and Montello (2006), Ahmadpoor and Shahab (2019), and Ahmadpoor (2020), this thesis adopts Siegel and White's (1975) model as one of the dominant frameworks for explaining the development of spatial knowledge acquisition alongside the framework of Kevin Lynch (1960)..

2.2.1. The Image of the City and the Cognitive Organization of Urban Space

A foundational contribution to understanding how spatial knowledge translates into urban legibility is Kevin Lynch's book: The Image of the City (1960). Lynch's work remains pivotal in linking cognitive mapping to the physical design of cities, illustrating how people mentally organize and navigate complex urban environments. Based on empirical studies in Boston, Jersey City, and Los Angeles, he identified five key spatial elements: **paths, edges, districts, nodes, and landmarks** as the structural components of how individuals perceive and remember urban form. Together, these elements determine a city's imageability, or its capacity to be clearly visualized, organized, and recalled. Paths, such as streets or walkways, provide channels of movement and orientation; edges, like rivers or walls, define boundaries; districts offer recognizable areas with shared identity; nodes act as decision points where spatial attention intensifies; and landmarks serve as reference anchors that stabilize orientation and memory.

Lynch's model emphasizes that spatial knowledge is not abstract but grounded in sensory experience and interaction with environmental form. The legibility and coherence of urban design, therefore, directly influence how effectively individuals can construct and retain cognitive maps. Yet, while Lynch's framework remains central to environmental psychology and urban design, contemporary scholars question whether its focus on visual clarity fully accounts for the multisensory, social, and technological dimensions that now shape spatial experience (Wessel et al., 2018; Ahmadpoor & Smith, 2020). As digital navigation increasingly mediates human–environment interaction, the relevance of physical cues and urban legibility warrants renewed examination. In sum, Lynch's theory provides a vital conceptual link between the perceptual foundations of spatial awareness and the structural organization of the urban environment. His work establishes the groundwork for later models, such as Siegel and White's (1975) developmental framework by indicating how environmental features are cognitively encoded into coherent representations of space.

The framework of spatial knowledge acquisition proposed by Siegel and White (1975) has often been viewed as an extension of Lynch's (1960) theory. Both frameworks emphasize the structural organization of spatial knowledge, although the developmental stages proposed by Siegel and White (1975) have received limited empirical validation. Their model suggests that individuals entering a new environment do not initially acquire spatial knowledge during the early stages of landmark and route learning, but instead develop such knowledge only after repeated exploration and accumulated experience. In contrast, subsequent research challenges this assumption, indicating that even with minimal exposure to a new space, individuals can acquire configurational knowledge sufficient to perform navigational tasks, including orientation, route deviations, distances, and engagement to the space (Rieser et al., 1980; Klatzky et al., 1990; Loomis et al., 1993; Montello, 1998; Montello, 2012). These findings suggest that spatial understanding may develop more rapidly and flexibly than Siegel and White's discrete-stage model implies. Moreover, the Siegel and White (1975) framework has been critiqued for being overly descriptive and lacking precision regarding the mechanisms and temporal dynamics of spatial knowledge acquisition. While it outlines a general progression from landmark- to route- to survey knowledge, it does not specify how much time, experience, or cognitive effort is required to transition between these stages. Addressing these limitations, Montello (1998; 2012) proposed that reconceptualizes spatial knowledge development as a continuous process. He argues that "(...) knowledge begins to acquire on first exposure to a novel environment" (Montello, 1998, p. 146), opposing the idea that spatial knowledge progresses through separate, qualitative stages. This perspective is supported by several researchers who also view spatial knowledge development as a gradual and overlapping continuum (Evans, 1980; Hirtle & Hudson, 1991).

2.3. Digital Navigation and its Impact on Spatial Knowledge and Emotional Engagement

Navigating through urban space has historically been considered a cognitively demanding task, requiring individuals to perceive, interpret, and remember physical features such as landmarks, paths, and spatial boundaries. As discussed earlier, this process is essential to the development of spatial knowledge and cognitive maps (Lynch, 1960; Siegel & White, 1975; Montello, 2012). However, the rise of digital navigation systems has significantly altered this relationship between individuals and their environments. GPS-enabled applications such as Google Maps and other navigational aid are

now central tools in everyday navigation, often used even in familiar places, which have redefined how people move through, engage with, and understand urban spaces.

Initially developed for vehicular navigation, digital navigation systems became deeply embedded in urban life with the emergence of smartphones in the late 2000s. These systems integrate real-time GPS positioning, digital cartography, and algorithmically generated route planning to offer seamless in-situ and turn-by-turn guidance. They operate through either passive or active modes: in passive use, individuals follow spoken or visual instructions without much interpretation of their surroundings whereas in active use, users still interact with maps and spatial information, making their own decisions (Ishikawa et al., 2008). However, both modes tend to reduce the need for spatial reasoning and environmental observation when compared to traditional methods of navigation.

The convenience and accuracy of digital navigation offer clear benefits, such as reduced travel time, lowered stress, and improved confidence when navigating complex or unfamiliar environments (Brügger, Richter, & Fabrikant, 2019). However, these systems also shift cognitive responsibility from the user to the device. Rather than engaging with spatial features like landmarks, intersections, or urban edges, users often rely entirely on automated instructions. As Speake (2015) and Ahmadpoor (2019) argue, this technological mediation can result in surface-level familiarity, rather than deeper attachment, which diminish spatial awareness, memory, and users' capacity to establish emotional connection to space.

2.3.1. Cognitive Response to Digital Navigation

As already established, when navigating through an unfamiliar environment, individuals must actively attend to their surroundings while being spatially aware about their orientation while using the ability to perceive, interpret and utilize spatial knowledge of an urban space. According to many researchers, the use of digital navigation systems largely eliminates these demands, making navigation less cognitively effortful (Ishikawa et al., 2008; Speake, 2015; Ahmadpoor, 2019; Ahmadpoor & Smith, 2020). Consequently, individuals who follow routes with assistance from digital navigation tend to acquire less spatial knowledge, including routes as well as landmarks, in comparison to those who navigate independently, use written instructions, or receive direct guidance from another individual. Empirical research increasingly supports concerns that digital navigation is reshaping the way individuals process and retain spatial knowledge while interacting with urban space. Ishikawa et al.

(2008) found that participants who relied on digital mediated guidance remembered significantly fewer landmarks and spatial features compared to those who navigated using traditional paper maps or through direct environmental instructions. This suggests that when navigational tasks are externally guided by automated systems, individuals engage less with their surroundings, resulting in a reduced encoding of environmental cues that are critical for building cognitive maps and developing spatial understanding. Similarly, Münzer et al. (2006) demonstrated that traditional map users developed stronger route and survey knowledge compared to participants who relied on GPS. These results suggest that although digital navigation supports immediate navigation goals, they may weaken long-term spatial learning. Ahmadpoor and Smith (2020), using sketch maps and recognition tasks, found that participants who used digital apps produced less accurate and less detailed representations of routes, particularly in environments that lacked clear visual cues or legible structure. In such spaces, the reduced need for environmental attention further inhibits cognitive map formation.

The reliance on digital guidance also raises concerns about a broader disengagement from the urban environment. As users follow automated instructions, their attention is often directed toward the screen rather than their surroundings. This shift undermines situational awareness and spatial memory, resulting in a form of ‘navigating without noticing’ (Downs & Stea, 2017). The phenomenon is further reinforced by automation bias where the tendency to trust digital systems over one’s own judgment (Parasuraman & Riley, 1997). Consequently, users may become less capable of reversing routes, adapting to sudden changes, or navigating at all without digital support (Bakdash et al., 2008). Underlying this transformation is the concept of cognitive offloading, i.e. transferring cognitive tasks to external tools or systems (Ruginski et al., 2019). While offloading improves short-term performance and reduces cognitive load, it can lead to the gradual erosion of skills that were once exercised through repeated spatial interaction. Over time, individuals who frequently rely on digital navigation may experience reduced spatial awareness, including weaker sense of direction and diminished memory of urban layouts (Ishikawa & Takahashi, 2014).

These digital shifts also challenge cognitive frameworks developed in an era of embodied navigation, e.g. Siegel and White’s (1975) framework regarding the progression from landmark to route to survey knowledge, as well as Montello (2012), who emphasized that movement and attention is essential to spatial memory. Today, however, individuals tend to traverse urban spaces with minimal engagement, raising questions about what it means to ‘know’ a city. Are cognitive maps still being formed, or are we outsourcing not just navigation, but spatial knowledge itself? In sum, the cognitive responses to digital navigation reveals a broader transformation in how urban space is perceived, remembered, and understood. While digital navigation enhances convenience and confidence, they may compromise users’ ability to form cognitive maps, adapt to change, and navigate independently. As cities continue

to evolve alongside digital tools, this tension between technological assistance and cognitive development becomes an essential area of inquiry for both urban studies and cognitive science.

2.3.2. Active vs Passive Navigation

Huston and Hamburger (2023) offer a valuable framework for understanding how different modes of interaction with navigation aids, specifically, *active* versus *passive* navigation, shape spatial learning and cognitive engagement. Their findings demonstrate that the extent to which users actively process spatial information determines how effectively they acquire spatial knowledge. In **passive navigatio**n, individuals simply follow digital instructions, offloading cognitive effort to the device. This reduces engagement and limits opportunities for spatial learning and weakens the formation of cognitive maps. In contrast, **active navigation** requires deliberate attention to environmental cues and spatial relationships, promoting stronger spatial memory and orientation skills.

Importantly, Huston and Hamburger emphasize that these outcomes are not caused by the technology itself, but by how users interact with it. When digital navigation prompts users to attend to landmarks or remember routes, spatial learning improves significantly, even within digital contexts. Their framework thus highlights engagement as the key determinant of spatial knowledge acquisition. Moreover, by acknowledging the role of attention and emotional involvement in navigation, their work connects spatial cognition with experiential and affective dimensions of movement through space. This distinction between active and passive navigation provides a useful conceptual lens for this thesis research, which examines how digital mediation influences both spatial awareness and emotional engagement with urban environments. It further provides a useful conceptual basis for comparing participants' navigational behavior and learning outcomes, which will be revisited in the discussion section.

2.3.3. Emotional Connection and Affective Engagement with Space

While extensive research has been done exploring the cognitive consequences of digital navigation, the emotional dimension of spatial experience remains relatively underexamined. Emotional

engagement, i.e. the affective bond individuals form with places through sensory, experiential, and mnemonic processes, has long been recognized as integral to spatial awareness and place attachment (Relph, 1976; Tuan, 1977). Yet, in the context of digital navigation, this affective component has received limited empirical attention over the recent years. Gartner (2012) was among the first to introduce the notion of emotional responses to space within cartographic research, proposing that emotional reactions to spatial stimuli play a vital role in navigation, spatial awareness, and the formation of cognitive maps. According to him, such interactions are essential for developing emotional attachment and forming memorable spatial experiences: "The emotional significance of a particular space may enhance its remembrance and increase the accuracy of direction decisions" (Gartner, 2012. p. 474). His work, however, remains primarily conceptual and exploratory, calling for empirical validation. Related strands of research in emotional mapping and urban affective geography, such as those by Nold (2009), Mavros et al. (2012), and Zeile et al. (2015), have sought to capture the affective qualities of urban experience using tools like biometric sensors, geolocation tracking, and self-reported emotion maps. These studies highlight how emotional responses to the built environment fluctuate with spatial context, movement, and sensory stimuli.

Despite these advances, few studies have explicitly examined how the use of digital navigation might alter emotional engagement with space. The vast majority of emotional mapping research focuses on how individuals feel in particular locations rather than how *n*avigation technologies mediate those feelings. Consequently, it remains unclear whether the heavy reliance on digital navigation, which may externalize spatial decision-making and reduce environmental attention, diminishes users' emotional salience of place. As Gartner (2012) argues, emotion and episodic memory are deeply intertwined; when navigators are less perceptually and cognitively engaged with their surroundings, the emotional encoding of spatial experience may also weaken. Indirect evidence supports this possibility: digital navigation's tendency to foster divided attention and reduce situational awareness could attenuate affective connection to urban space, leading to a more detached and instrumental experience of movement through urban space (Speake, 2015; Ahmadpoor & Smith, 2020). However, such claims remain largely inferential. Systematic, empirical research comparing emotional and affective engagement under digital navigation versus non-digital navigation is still absent, leaving a critical gap in understanding how digital mediation reshapes not only spatial cognition but also the emotional and phenomenological dimensions of urban experience.

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3. Method

3.1. Research Design

This thesis adopts an empirical comparative research design using a mixed-method framework with a qualitative emphasis. By combining multiple forms of data collection, such as 1) observational data through an in-field navigation task, 2) written data from a cognitive mapping exercise, and (3) verbal data from a semi-structured interview, this approach was selected for its suitability to examine how the use of digital navigation systems influences individuals' spatial awareness and environmental interaction within an unfamiliar urban space. Together, these methods enable exploration of both perceptual and emotional dimensions of urban wayfinding, addressing not only how individuals navigate and recall spatial features, but also how they emotionally experience and engage with space. The thesis is grounded in the idea that individuals acquire spatial knowledge and form mental representations of space through both their navigational behaviour and their personal experiences of the environment, even in unfamiliar spaces.

The methodological approach is grounded in established theories of spatial cognition and environmental perception, particularly those of Lynch (1960), Siegel and White (1975), Gartner (2012), and Huston and Hamburger (2023), among others. These frameworks collectively inform how spatial knowledge is acquired, imagined, and sorted. Integrating them within the methodological design ensures that both perceptual and experiential aspects of navigation are systematically addressed.

3.2. Participants

A total of 10 participants (N=10) were recruited for this thesis research study through voluntary response sampling. Participants were acquaintances to the researcher's extended social network (friends and family contacts) who agreed to take part in the study. The sample included adults aged between 25 and 60 years, where 50% were males and 50% were females. All participants reside in cities other than the designated study area and reported no prior familiarity with the specific urban route used in the experiment. This ensures that spatial learning during the navigation task would be authentic and not influenced by previous knowledge of the environment. The study employed a comparative design in which participants were randomly assigned to one of two navigation

conditions, with five participants in each group. Participants completed the navigation task individually, not in groups.

- The Digital Navigation Group: Participants navigated a pre-assigned urban route using digital navigation systems, e.g. Google Maps accessed via a smartphone.
- The Non-Digital Navigation Group: Participants navigated the same pre-assigned route without digital navigation systems, relying instead on brief written environmental instructions.

This structure enables a direct comparison to how different navigational tools mediate attention to environmental cues, spatial awareness, and emotional connection to place. Given the exploratory nature of the field-study and the use of in-depth qualitative methods, a sample size of 10 participants was considered appropriate to generate detailed and analytically manageable data aligned with the thesis aim. To ensure a consistent baseline across participants and reduce potential confounding variables, the following selection criteria were applied:

- Technology usage: Regular users of smartphones and digital navigation tools, e.g. Google Maps.
- Health status: No known cognitive or visual impairments.
- Urban experience: A mixed level of familiarity with urban environments.
- Study area: Participants had no prior familiarity with the designated study area to ensure authentic spatial learning during the in-field navigation task.

These criteria strengthen the validity of the study by supporting the assumption that differences in navigational performance of spatial recall are more likely to be attributed to the assigned navigation method rather than prior familiarity or individual background factors.

3.3. Study Area

The data collection was conducted in the central district of Västerås City, Sweden. This medium-complex urban environment was selected due to its diverse spatial attributes and

accessibility. A pre-chosen loop-route was selected, beginning and ending at the entrance of the city's central cinema (Biofilmstaden Västerås). This location was chosen for its centrality, recognizability, and accessibility - making it an ideal starting point for participants unfamiliar with the area, as well as a suitable location for the cognitive mapping exercise and semi-structured interviews. The selected loop-route ensured that all participants experienced the same urban features from a consistent perspective, allowing for reliable comparison between the two navigation groups. Additionally, the closed-loop format minimized directional bias and facilitated clearer assessment of cognitive mapping and spatial recall, as participants would return to a known point of origin (Cinetto, et al; 2025):

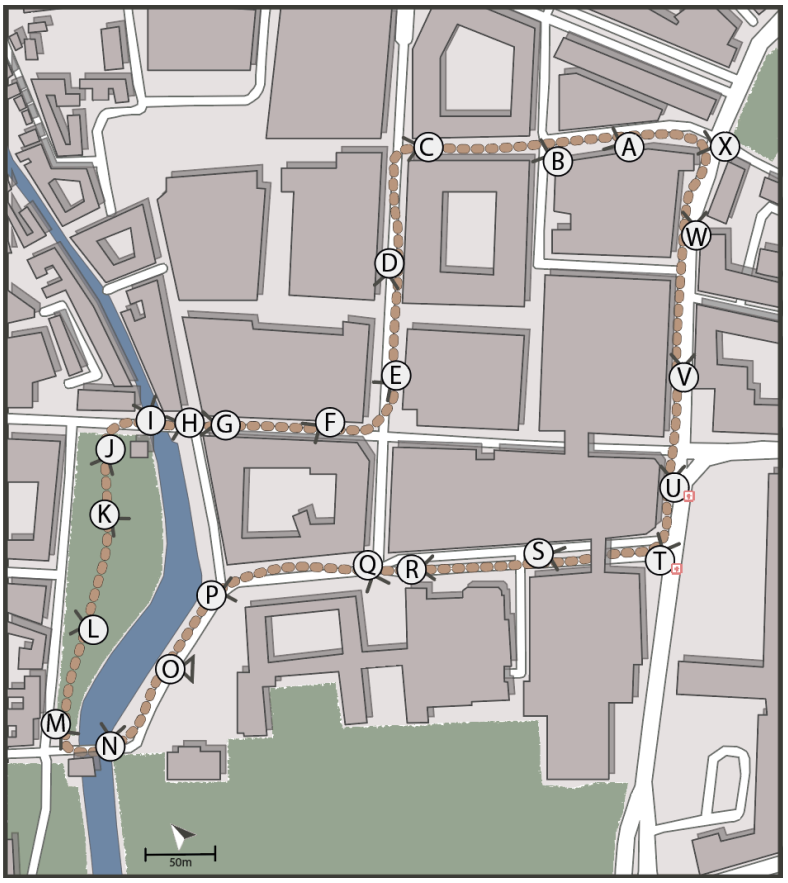

Fig. 1 - Showing the selected route of Västerås City, originating from A. See fig 2-26 for marking A-X.

The area consists of a mix of both legible and ambiguous urban features, making it particularly suitable for investigation of spatial awareness, navigation and memory. Västerås City's urban network offers a dynamic testing-ground for the theoretical framework based on Kevin Lynch's (1960) five key elements of city imageability, alongside Siegel and White (1975). The chosen route traversed a variety of spatial typologies, including pedestrian plazas, narrower alleyways, shopping streets, greenspace, water elements (fountain and river), and both modern and historic architectural zones,

allowing participants to interact with both familiar and unfamiliar environmental cues.

Fig. 2-7 - Indicating marking A-F on map in fig.1.

Fig. 8-13 - Indicating marking G-L on map in fig.1.

Fig. 14-19 - Indicating marking M-R on map in fig.1.

Fig. 20-26 - Indicating marking S-X on map in fig.1.

3.4. Data Collection Procedure

The data collection followed a sequential, triangulated mixed-method design, combining behavioral observation, visual representation, and verbal reflection to capture a holistic view of participants'

navigational experience. Data were collected through three sequential components: an in-field navigation task, a post-task cognitive mapping exercise, and a semi-structured interview. Each stage was designed to build upon the previous one, linking immediate behavioral responses with post-task cognitive and emotional reflections. This sequence aligns with the thesis framework of Active and Passive Navigation, as theorized by Huston & Hamburger (2023), allowing comparison between digital mediated and self-guided spatial learning processes - addressing the central research questions concerning spatial awareness, cognitive mapping, and emotional experience within unfamiliar urban environments.

Data collection took place over multiple days during daytime hours in Västerås City. Participants were scheduled individually to meet the researcher at the predetermined starting point outside the cinema (Biofilmstaden Västerås). Upon arrival, participants were welcomed and briefly informed about the purpose and procedure of the study. A consent form and ethical considerations were read and signed, before the participants were randomly assigned to either Digital- or Non-Digital Group. The weather conditions during the days of data collecting were typical for the season, with stable daylight and no extreme weather events that would significantly affect navigational behaviour. All tasks were conducted in Swedish to ensure participants' comfort and fluency in expressing their experiences.

3.4.1. In-Field Navigation Task (observation)

The first stage consisted of an in-field navigation task, where participants completed a pre-selected looped route within Västerås City. One group relied on digital navigation systems, while the other one followed brief written instructions. The task was designed to last approximately 15-20 minutes per participant. During the navigation task, the researcher followed at a discreet distance to conduct non-intrusive observation and field note documentation, focusing on behavioral indicators such as walking pace and task focus, visible reliance on navigation tools, engagement with the environment, and verbal expressions of confusion, reaction and recognition. This stage aimed to document behavioral engagement and environmental interaction in real time, revealing how participants attended to the task at hand, as well as urban cues and spatial properties (Lynch, 1960; Montello, 2012).

3.4.2. Cognitive Mapping Exercise (written output)

Upon completion of the looped route, participants returned to the starting point, where they immediately proceeded to the cognitive mapping task, followed by the semi-structured interview. This post-task exercise assessed participants' spatial knowledge through route comprehension, and landmark recollection. The maps were analyzed qualitatively to evaluate the richness, structure, and clarity of the participants' internal spatial representations, following principles of spatial knowledge acquisition, survey knowledge and imageability, as theorized by Lynch (1960) and Siegel and White (1975).

3.4.3. Semi-Structured Interviews (verbal reflection)

The final stage involved a semi-structured interview, lasting approximately 10-15 minutes. The interviews provided insight into the subjective experience of spatial knowledge acquisition, as well as emotional engagement to the space (Montello, 2012; Ahmadpoor, 2019) and further complementing the behavioral and cognitive data collected in the previous stages. This allowed the participants to reflect on their navigational strategies and use of navigational aid, sense of orientation, as well as route- and landmark knowledge, cognitive mapping experience, and emotional engagement with the urban environment. The format was intentionally open-ended to encourage depth and to identify patterns or contrasts between digital and non-digital users. .

3.5. Data Analysis

The analysis draws upon three primary data sources collected during the field study: 1) in-field observational notes, 2) participant-produced cognitive maps, and 3) semi-structured interview transcripts. Each dataset was first compiled individually and presented as the results before being cross-examined comparatively to in the discussion to capture the interrelation between behavioral, cognitive, and experiential dimensions of navigation. All interviews were transcribed using Turboscribe and later translated, alongside the field notes, from Swedish to English. Grounded in the theoretical frameworks of primarily Lynch (1960), Siegel and White (1975), and Huston &

Hamburger (2023), the analytic strategy integrates concepts of the ‘five elements of legibility’, ‘spatial knowledge aquisition’, and ‘active- vs. passive navigation’.

All collected data were analyzed through an integrated qualitative approach combining thematic and content analysis. Observational field notes from the navigation task were inductively coded to identify patterns in walking behavior, task focus, reliance on navigational aids, and engagement with the surrounding environment, revealing variations in spatial attention, orientation, and embodied navigation (Lynch, 1960; Montello, 2012). The produced cognitive maps were examined through its qualitative content, assessing the richness and organization of spatial elements (Lynch, 1960) and Siegel and White’s (1975) model of spatial knowledge acquisition. Rather than cartographic accuracy, emphasis was placed on how these sketches reflected internalized spatial understanding and mental representation while analyzing the amount of details and spatial context. The transcript from the semi-structured interviews were thematically analyzed to explore participants’ navigational strategies, spatial awareness, and emotional engagement, drawing on Gartner (2012), as well as Huston and Hamburger (2023) to interpret how technological mediation influences spatial cognition and emotional engagement. Finally, in the discussion, findings from all three datasets were cross-compared, linking behavioral, visual, and verbal evidence to identify convergent and divergent patterns between the Digital Group and the Non-Digital Group participants.

3.6. Participant consent/Ethical Consideration

A consent form was drafted and signed before the start of the study, outlining the overall purpose of the thesis, potential risks (minimal), data handling procedures, and the intended use of the results. Participants were assured that all data collected, including observations from the in-field navigation task, cognitive exercise, and the interview transcripts, would be anonymized and treated confidentially. Audio recordings of the semi-structured interviews were conducted with the participants’ explicit consent. No personal identifiers were recorded, and each participant was assigned a unique participant-ID for analysis and reporting purposes (e.g. D1, D2 etc for participants in the Digital Group or N1, N2 etc for participants in the Non-Digital Group). Participation was entirely voluntary, and participants were informed of their right to withdraw from the study at any time without providing a reason and without any negative consequences. By addressing ethical considerations transparently and rigorously, the study aimed to protect participant rights while ensuring the integrity and credibility of the research process.’

Fig. 27 - Flowchart of methodology process.

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4. Result

This chapter presents the empirical findings of the study, derived from the in-field navigation task, the subsequent cognitive mapping exercise, and the semi-structured interviews. The results are organized to reflect the central research questions, focusing on how reliance of digital navigation systems impact individuals' ability to perceive and recall spatial features, including how it affects individuals' level of interaction, and emotional connection to an unfamiliar urban space. To provide a clear comparison,

the results are structured around the two participant groups: the Digital Group, who completed the navigation task with digital assistance, and the Non-Digital Group, who navigated without digital assistance. Each section presents observed behavioral patterns, the richness and uniqueness of cognitive maps, and participants' subjective accounts of their navigational experiences. The findings are presented separately and descriptively, without interpretation, to allow for an unbiased overview of how different navigation methods influenced participants' experience with the urban setting.

4.1. In-Field Navigation Task

The in-field navigation task generated observational data on participants' real-time movement, attention, and environmental interaction while completing a designated walking route through central Västerås. The task was designed to examine how different navigational strategies influence on-site behavior and spatial engagement. Analysis of field-note observations identified four main themes that capture participants' navigation styles, attentional patterns, and interaction with the urban surroundings. The themes were developed through iterative observation and comparison across participants, emphasizing recurring behaviors and situational responses as they unfolded in real time. Each theme synthesizes common tendencies while retaining the specificity of individual navigational actions and expressions.

4.1.1. The Digital Navigation Group

<u>Walking Pace & Task Focus</u>

Participants generally walked at a brisk, steady and purposeful pace throughout the route, maintaining efficient coverage of streets and intersections. Walking speed was often correlated with interaction with the digital navigation system - slowing when consulting the device and resuming a steady, confident pace when focused on the environment or destination. Most participants appeared calm, focused, and task-oriented, with limited time for pauses. For instance, D1 and D3 walked with steady steps and minimal hesitation, while D4 and D5 paused briefly at the start before quickly resuming a determined pace.

Use of Aid

The reliance on the navigation tool was frequent at the beginning of the route, especially near intersections when confirming direction for upcoming turns. D1 and D4 checked the device multiple times early on, while D3 and D4 verified their position when approaching intersections or changing direction.Towards the end of the route, the use of aid was noticeably decreasing where D3 closed the device with the comment "*nearly there*", while D1 and D4 similarly reduced attention to the screen as they approached the final segment.

Visible & Verbal Interactions with Environment

Environmental engagement was generally brief and intermittent, emerging between task-focused moments. When noticing their surroundings, participants tended to comment on landmarks, architectural details, or passing events, often in a lighthearted or casual tone. The main comments that stood out were:

- D1: Interacted with a shop window, noticed music playing, and an ongoing bachelorette party. Commented: "*Nice by the water*", "*cozy houses*" referring to historical buildings. D1 also wondered what type of building the city hall was and checked the device for confirmation.
- D2: Mentioned the park, and stopped for a second to look at live music, "*cool*" before moving on.
- D3: Commented and pointed out "*nice building with the awnings*" , and "*nice weather*".
- D4: Checked the device before choosing an alternate route based on perceived pleasantness - "*more enjoyable street to walk*".
- D5: Noted architectural details on Stora Gatan - connecting them to a previous school assignment, and briefly commented on nearby water features.

Route Deviations & Stops

Minor route deviations and adjustments occurred where D1 briefly veered off within the park area before returning to the planned route, and D4 deliberately took an alternate street for personal enjoyment. D5 momentarily strayed from the route but quickly backtracked. Other participants e.g. D2 made small adjustments at crossings without losing direction. Stops were minimal: D1 (2), D2 (1), D3 (0), D4 (1), D5 (1), excluding those caused by traffic. These short pauses typically coincided with checking the device or momentary environmental observations rather than hesitation.

4.1.2. The Non-Digital Navigation Group

Walking Pace & Task Focus

Participants moved at a slow and varied pace, frequently alternating between short bursts of walking and extended pauses. Movement was interrupted by moments of checking instructions, verifying street signs, or reorienting themselves in the environment. Participants occasionally turned or spun around while scanning for visual cues, N2 hesitated at the start while searching for the street sign, and N3 paused at the first crossing to confirm directions. N5 walked more briskly but otherwise maintained a calm, steady rhythm, while N1 and N3 stopped repeatedly to observe or comment on their surroundings.

Use of Aid

Instructions were generally frequently used, while cross-checked with street signs. Several participants verbalized directions as they proceeded, such as N3 stating "*Stora Gatan to the right*" when approaching a turn. N1, N2, N3, and N5 verified intersections by reading street signs aloud, while N4 examined a shop door for confirmation. Some participants also sought social verification, with N4 asking passersby for information about a nearby square and the location of a street. As the navigation-task progressed, the instructions were sometimes held more casually, with N2 and N5 letting the sheet hang at their side during later segments, including pointing out the location of origin from a distance.

Visible & Verbal Interactions with Environment

Participants demonstrated strong engagement with their surroundings, often stopping to comment on architectural, environmental, and sensory details. Their remarks were inquisitive, descriptive, and occasionally humorous or reflective, indicating an active awareness of place. The main comments that stood out were:

- N1: Interacted with shop windows, noticed restaurants, and shook a bicycle stand - wondering how it was constructed. Commented "*Nice playground*", "(...) *large building, what type of facade is that*?", "*What type of building is that*?", "*Wow*" - regarding a tall hotel building, as well as pointing out various brick buildings, stating the fondness for this type of building and linking it to previous trips. N1 also paused by the river, pointing out a handbag in the water.
- N2: Noted the sound of water in the park and looked around a lot with limited commentary. Pointed out the playground and the city hall.

- N3: Described the city hall as cool - but institution-like, as well as interacting with a "*funny trashcan*", taking photos of historical buildings from the bridge, and commented on the waterfall as "*beautiful*".
- N4: Was curious, asking many questions about the different buildings: "*Is that apartment or a hotel*?", "*Is this building famous in Västerås*?" hinting at the city hall, as well as asking passerby pedestrians of the name of a town square.
- N5: Compared a park fountain to a similar one in Belgium, including the river and its similarities to one in his hometown - "*only wilder*". Also made a comment regarding a statue of a golden bull, wondering "*why does one have a bull statue in gold*?" N5 also wondered what type of building the city hall was, and looked at the facade for confirmation.

Route Deviations & Stops

Route deviations were infrequent, mainly within the park area where participants chose slightly different paths, alternating walking closer to the water or closer to the buildings. Stops were frequent: N1 (7), N2 (4), N3 (8), N4 (6), and N5 (4), excluding those caused by traffic. These pauses typically coincided with checking directions, observing or interacting with surroundings, or brief conversations.

4.2. Cognitive Mapping Exercise

The cognitive mapping exercise provided visual and descriptive data on participants' spatial recall, structural understanding, and representational emphasis following the navigation task. Each participant was asked to draw the route from memory, including elements that stood out and other environmental features they could remember. The maps revealed consistent differences between the two navigation groups in how they represented routes, landmarks, and environmental details.

4.2.1. The Digital Navigation Group

The cognitive maps produced by the Digital Group (fig. 28-32) were primarily route- and street-focused, with a clear emphasis on linear movement through the environment with a few

surrounding landmarks. Based on Lynch's elements of urban form, the cognitive maps produced by the Digital Group were characterized by a strong emphasis on paths, represented through continuous walking routes and directional flow. Most participants depicted the main route clearly, with connecting streets and intersections. D3 highlighted the route in red, D2 used arrows to indicate direction, and D1 outlined the general path shape without including street structures. Nodes appeared where paths intersected or changed direction, particularly near the park, the bridges, and intersections. Landmarks were selectively included, focusing on major or visually prominent features. Commonly depicted landmarks were the City Hall, the Brasserie in the park, the bridges, and the cinema - marking the start and end point. Additional minor landmarks such as H&M (D1), Subway (D3), Taco Bar (D4), and an Asian restaurant (D5), were present in some maps but with limited detail. The edge element was consistently represented by the river, which defined spatial boundaries and oriented the walking path across all maps. Districts were identifiable through the recurring representation of the park area and, in some cases, a town square. A small number of participants also included contextual or environmental details, such as music playing (D1), a live band (D3), and some construction work (D4), indicating momentary sensory impressions within the mapped environment. Street names were rarely included, and secondary routes or perpendicular streets were largely absent. Overall, the maps displayed simplified spatial organization centered on path continuity and larger key landmarks, with limited depiction of broader spatial relationships or interactive details.

Fig. 28 & 29 - Cognitive Maps of the Digital Group (from left): D1, D2

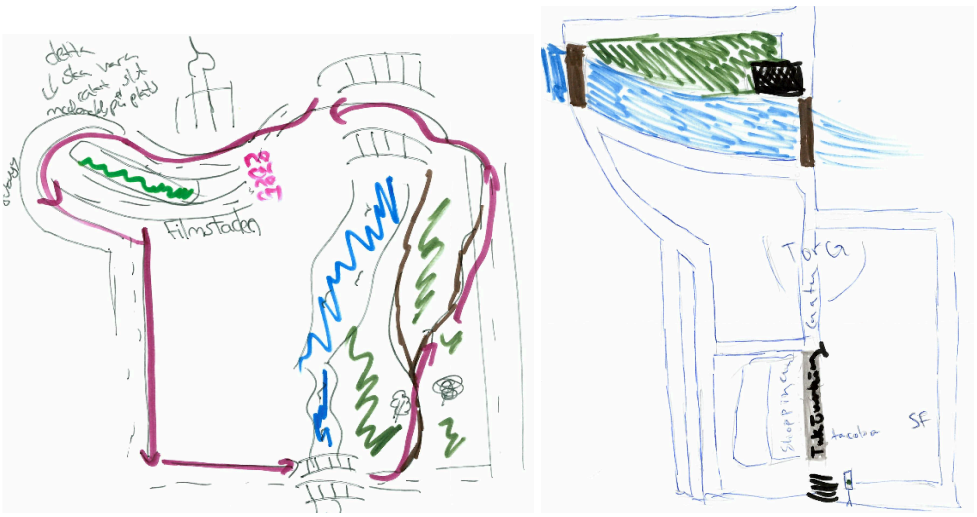

Fig. 30 & 31 - Cognitive Maps of the Digital Group (from left): D3, D4

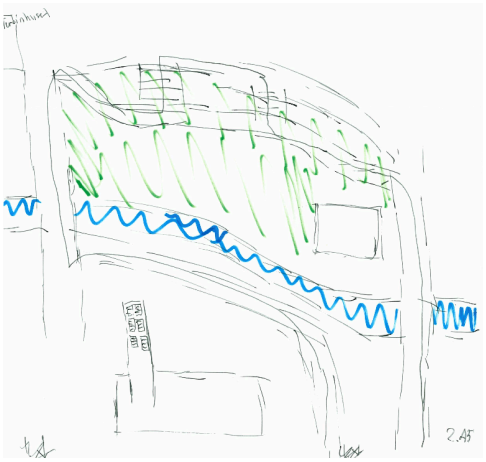

Fig. 32 - Cognitive Maps of the Digital Group: D5

4.2.2. The Non-Digital Navigation Group

The cognitive maps produced by the Non-Digital Group (fig. 33-37) demonstrated a balanced urban representation, emphasizing the recognition of both small and large urban features, including the route itself and interactive details. All participants correctly located the main elements: the park area, the river, and cinema, while extending the spatial field to include additional architectural, cultural, and material features observed during navigation. Analyzed through Lynch's framework of urban elements, the cognitive maps in the Non-Digital Group demonstrated a landmark-oriented structure with notable variation in spatial density and detail. Paths were present in most maps, represented

either as the explicit route or through streets connecting major locations and landmarks. Several maps integrated intersections and crossings (N2, N3, N4), linking the walking trajectory to surrounding features. In others, the paths were less defined, with attention instead concentrated on the route itself, and the immediate environment around landmarks (N1, N5). Landmarks in different scales were the dominant element, ranging from major urban structures, such as the City Hall, bridges, hotel (N1, N4), town squares (N4), and the Brasserie (N1, N2, N5), to smaller urban details including statues (N1, N5), trashcans (N39, bicycle stands (N1), seating areas (N1, N4, N5), city signage (N5), fountains (N4), and playgrounds (N1, N3, N5). Participants in the Non-Digital Group also frequently identified commercial and cultural sites such as Subway (D3), an asian restaurant (N1, N3), café (N1), theatre (N5), hair salon (N5), a car wash (N1), among others. Other descriptive notations occasionally referenced material qualities in the cognitive maps, such as the granite facade of City Hall (N1), as well as sensory and interactive details like the waterfall in the river (N1, N2, N5) and taking a photo of historical buildings (N3). THe edges included in the maps were consistently defined by the river, which acted as a key spatial boundary and orienting feature. THe districts most frequently represented were the park area, forming identifiable spatial clusters with varying degree of elaboration. Several maps also demonstrated social or situational instances, illustrated through depictions of people or brief contextual annotations (e.g., “helpful people,” “drunk people”). Street names appeared in most maps (N3, N4, N5), contributing to a clearer and more structured representation of the navigational layout. Overall, the Non-Digital Group’s cognitive maps displayed a somewhat balanced, although landmark-dominant spatial structure, integrating paths, edges, and districts with a high degree of environmental and sensory recall, reflecting detailed visual and contextual awareness of the urban setting.

Fig. 33 & 34 - Cognitive Maps of the Digital Group (from left): N1, N2

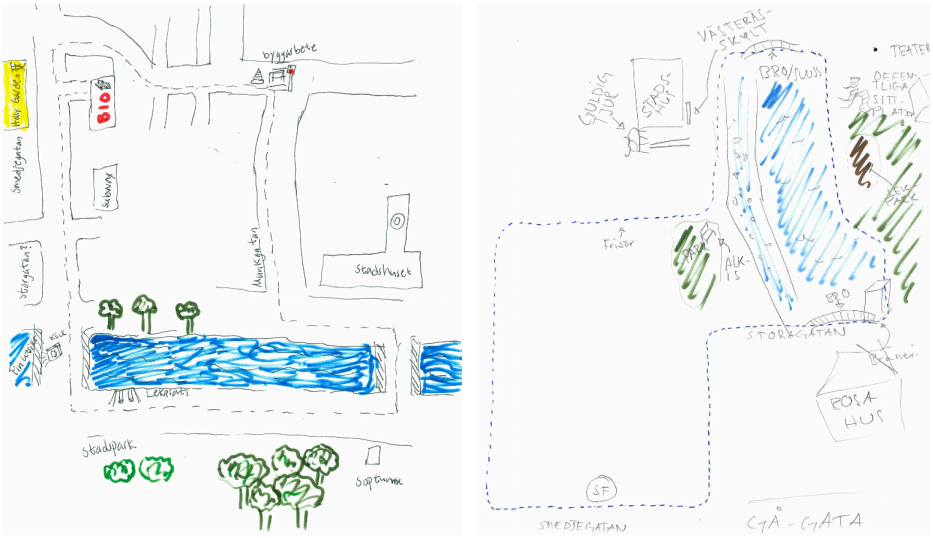

Fig. 35 & 36 - Cognitive Maps of the Digital Group (from left): N3 & N5

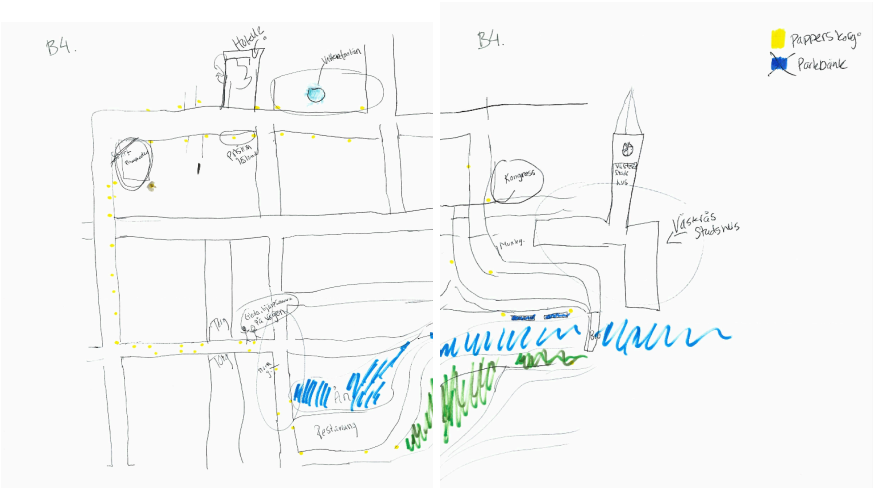

Fig. 37 - Cognitive Maps of the Digital Group: N4

4.3. Semi-Structured Interviews

The semi-structured interviews provided qualitative insights into how participants experienced, interpreted, and remembered the walking route through the central area of Västerås City. Analysis of the transcripts revealed five main thematic areas that together capture participants' spatial reasoning, sensory impressions, and affective engagement with the urban environment. The themes were derived through an inductive, iterative thematic process, allowing recurring patterns, strategies, and reflections to emerge directly from participants' own descriptions rather than from predefined categories. Each

theme synthesizes shared tendencies while preserving the individuality and contextual nuance of participants' accounts.

4.3.1. The Digital Navigation Group

Navigational Strategy and Use of Navigational Aid

Participants using GPS described the task as straightforward and familiar, reflecting habitual patterns of digital navigation. The device served as both a directional tool and a source of reassurance, allowing them to maintain confidence in their movement through the environment. While individual strategies varied slightly, participants generally alternated between glancing at the screen for confirmation and attending to their immediate surroundings.

- D1 described an organized, segmented approach to the route, relying on the map display to visualize upcoming turns: "*It went well, I think I followed the description. (...) I'm used to reading GPS, and seeing where I am on the map. Then I know that at the next intersection, I'll turn. It's easy to see, since I know where I am on the map*." They further explained how their visual attention was structured around route segments, checking the phone primarily at transition points: "*More at the beginning, since I don't know the city. (...) It was like I divided it into sections — I'll get to this part first, then maybe check again.*"

- D2 similarly emphasized habitual reliance on GPS, using it primarily for reassurance rather than constant direction-finding: "*It went well, easy. No problems. I'm very used to walking with digital maps. (...) I don't really look at street names (...) I just checked the phone to confirm — okay, one block left, turn here - more for confirmation*."

- For D3, the GPS offered both guidance and a sense of security. They reported frequent screen checks and a preference for following the suggested route closely: "*It went okay. (...) I hesitated a bit between following the GPS exactly or taking shortcuts. Sometimes I cut across, but mostly I followed the GPS. (...) I looked at the phone quite often. If I have it, I check it a lot - no need to test my luck.*"

- D4 described focusing primarily on the directional cues provided by the GPS rather than the continuous map view, using street signs as visual confirmation: "*I usually don't look too much at where the line goes, but more at which exits and streets I should turn at. Then I look for the*

signs with those street names." They estimated that most of their visual attention was directed toward the GPS: "*I'd say it was maybe 70% on the GPS and 30% on what I saw*."

- D5 described the route as easy to follow, occasionally deviating when distracted by environmental features but quickly correcting course with the GPS: "*It went well. I had a pretty brisk pace. It was easy to follow the path. Sometimes I got distracted, but then I went back the correct way (…) I followed the GPS completely. I mainly looked at the phone when I was about to turn, just to see if it was the next or the following intersection.*"

Sense of Orientation and Route Knowledge

Participants reported varying levels of spatial awareness and overall confidence in their orientation during the GPS-guided route. For most, the digital map provided a reassuring sense of positional certainty, even when their broader understanding of the city remained limited. If asked, most participants expressed a general sense of control and confidence at the thought of navigating the route independently a second time.

- D1 expressed confidence in navigating the route and described how the GPS enabled flexibility in following the path: "*It wasn't that I felt lost; in the park, the map showed that I should go up and then down again, but I felt I could deviate a little from the route and still follow it*." Although unfamiliar with the city overall, D1 felt confident within the immediate area and believed they could retrace the route independently: "*I think I could do it again without any problem. From where I am now, I could find all the same places again*."

- D2 reflected a more passive spatial awareness, noting that reliance on the GPS reduced their active sense of position: "*When walking with a map, I'm not very attentive to where I am. It wasn't until near the end that I realized - ah okay, we're back here*." They described a partial grasp of the area's structure, stating: "*A little, not too much. I find it hard to get a sense of where the city center is (...) I think I could do the same route again pretty well*."

- D3 noted limited awareness of their surroundings until reaching the end where the point of origin has a noticeable landmark: "*I didn't know where I was until the end where I saw the cinema sign - on the big street there. Before that, I had no idea where I was.*" Despite this, they acknowledged forming a general mental formation or outline of the route: "*I think I got a sense that we were walking in a loop, not just one direction. I could probably get back, maybe with a ten-minute detour.*"

- D4 described maintaining steady orientation with help from the GPS, resulting in a relatively coherent understanding of the area's layout: "*I had a pretty good idea of where I was*

according to the phone. (...) If I saw an aerial image, I could point out roughly where I walked, and where the main road runs." They felt certain they could repeat the route unaided: "*Very well*."

- D5 also reported confidence throughout, aside from a brief moment of uncertainty in the park: "*A little unsure in the park - I didn't check the GPS properly on where to go up, so I kept walking. Nothing more than that.*" They concluded with a positive assessment of their spatial grasp: "*I think I got a good understanding of the area. It's newer architecture, kind of square-shaped. I could probably find the same route again.*"

Landmark Knowledge

The participants demonstrated varying levels of environmental attention and recall of landmarks. Most references to landmarks related to visually prominent or contextually meaningful elements, such as bridges, buildings, parks, and water features. These often functioned as incidental anchors rather than deliberate navigational cues.

- D1 provided a rich account of environmental awareness, describing a series of distinctive landmarks observed throughout the route. Their recollections were detailed, connecting places with both appearance and activity: "*I don't really look at people when I walk, I look around instead. I heard music (...) and wondered what they were doing. Then I saw H&M, then Scandic, that's where I had to turn. When I crossed the bridge the first time, I noticed the nice houses and the bistro and I thought: that's a nice place to eat. In the park there was a bachelorette party. Later, when I crossed the bridge again near City Hall, I saw a very pretty waterfall-like thing. The City Hall itself was special with its tower. After that, I noticed a little square with some kind of shield. But when I saw Filmstaden, I stopped noticing things, I just focused on getting there.*"

- D2 recalled a distinctive architectural feature that helped situate the turning point of the route: "*That glass house by the city park stood out, it lined up exactly with where you were supposed to turn down into the park. Very clear.*"

- D3's attention to landmarks was more general, "*The houses was nice with the awnings (...)"* while emphasizing the atmosphere rather than discrete features: "*It was nice walking in the park. It's a different kind of environment.*"

- D4 similarly focused on broader environmental transitions, noting changes in setting rather than specific objects: "*Not necessarily anything in particular. I reacted to the bridges, and when the park area began; it felt like entering a new environment.*"

- D5 emphasized the presence of the water as a key spatial reference and identified the Turbine House as notable: "*The river stood out. When I reached it, I thought: 'okay, I'll probably have to cross back later' (...) I also noticed the Turbine House we passed.*"

Cognitive Mapping & Survey Knowledge

When asked to recreate their route on a map, participants generally described the task as difficult, revealing limited formation of an integrated spatial overview. Their recollections often began with uncertainty, followed by attempts to reconstruct segments of the route through landmarks or sequential associations rather than metric accuracy.

- D1 expressed initial anxiety about the mapping task and reflected on how little of the environment they had encoded intentionally. However, through the act of reconstruction and discussion, more details surfaced: *"When you said we were going to draw it, it felt really difficult. I thought, how am I going to remember? You don't think about remembering when you walk. I got a bit nervous. Then I started thinking — how was it? I remembered the music, H&M and Scandic. Then I crossed the bridge and thought the houses were pretty. You remember more as you talk about it."*

- D2 also found the translation from walking experience to map representation challenging, reflecting on the difference between visual familiarity and spatial comprehension. Their strategy involved reconstructing the route from recognizable segments: *"When you walk, you think you'll remember how it looks. But when I started to draw, I got unsure: 'how far did I go? Where did I turn?' So I just tried to remember different spots. I started from the city park; I remembered the band, that we turned after that, crossed a bridge, then went back over another one (...) I tried to recall landmarks and fill in the gaps in between."*

- D3 expressed surprise at their own ability to recall the route once they started drawing, emphasizing process over precision: *"It went better than I thought. I really thought I wouldn't be able to draw anything, that the paper would stay blank. But once I started, I remembered a little. I know I missed big parts, but I decided to just keep going so I'd have something on the paper."*

- D4 described having a basic mental model of the route, though without strong positional accuracy: *"I'd say I've built an okay image of the route itself, but not necessarily of where everything is. I have a general sense that this street is a shopping area, and if I go that way, I'll reach the water."*

- D5 found it difficult to reconstruct the route and focused instead on recalling specific buildings and connections to prior knowledge: *"It was hard to recreate. I got down Troyes Garden and Domus, that's what I remembered passing. I think I was more focused on the buildings themselves, since my thesis work was about architecture. I was stuck on the buildings rather than what was inside them."*

Emotional and Experiential Dimensions

Participants' emotional experiences while navigating the route reflected a spectrum from relaxed curiosity to task-oriented focus. Overall, most described the walk as calm and pleasant, with moments of attentional engagement triggered by either aesthetic features or personal associations. Few reported strong affective reactions, suggesting that their engagement remained primarily observational and cognitively directed toward task performance rather than spontaneous exploration.

- D1 described feeling "*relaxed and curious",* emphasizing a positive impression of Västerås as a pleasant and inviting environment. The participant noted both aesthetic appreciation and a mild sense of self-awareness due to being observed during the task: "*I felt relaxed. I was curious to see how the city looks, it's always fun. I like looking at cute and charming houses. Västerås felt cozy, with the water and everything. I didn't feel stressed about finding my way. It was a bit stressful to be observed, but that's part of it*."

- D2 similarly highlighted a sense of calm and familiarity, noting how the urban atmosphere, particularly the live music and park environment evoked associations with everyday life in their home city: "*(...) The band playing made me think: 'ah, there's always stuff like that happening back home in Stockholm'. It gave a familiar feeling. And the city park felt very calm, very pleasant*."

- D3, by contrast, expressed a more task-focused and detached orientation. They reported concentrating on performing the navigation assignment correctly rather than exploring the surroundings emotionally or aesthetically: "*I was mostly focused on doing the task right. If I'd been walking freely, (...) I might have taken in more. But now I wanted to focus on the assignment"* Still, D3 described noticing small aesthetic and nostalgic cues, e.g. street art and architecture, that subtly engaged attention and familiarity: "*I noticed the chalk drawings on the ground, and the big building behind them. And McDonald's and Subway, I registered those*."

- D4's experience was characterized by selective curiosity and pragmatic navigation choices, revealing an element of environmental preference: "*Nothing special really. What I reacted to*

was choosing to deviate from the straight path. I thought: 'if I go straight, there's nothing to look at, but if I turn left, there are shops and more to see'. I knew from before that this was the shopping area."

- D5 reflected a mild sense of interest and personal connection. Their affective engagement was tied to recognition of familiar environmental types, particularly water and architecture: "*It was mostly interesting to be in a part of Västerås I hadn't been in before. It reminded me of my high school project, and when I came to the water, I thought of Örebro. There's something similar about it, but this felt a bit more charming.*"

4.3.2. The Non-Digital Navigation Group

Navigational Strategy and Use of Navigational Aid

Participants in the Non-Digital Group generally reported that the navigation task proceeded smoothly, though several noted moments of initial uncertainty at the start of the route. The absence of digital guidance required them to rely on written cues and environmental verification, fostering a more deliberate and reflective style of movement. Most developed personal strategies for checking their progress, confirming street names, and ensuring directional accuracy.

- N1 described a methodical, verification-based strategy, emphasizing the importance of street signage and cross-checking locations before proceeding. Their approach was characterized by attentiveness and systematic control: "*I put my thumb on each point, step by step. It's mainly the street names that matter for me. I want to make sure I'm on the right street. That can mean walking in the opposite direction just to confirm the street sign. I don't just follow the instructions blindly; I double-check.*"

- N2 also experienced a brief challenge in the early stage, noting a missing street signage that caused initial hesitation, but quickly adapted by applying a spatial efficiency strategy - aligning body position and movement with the next directional cue: "*It went well. It was just at the very beginning that I wasn't sure which street I was on - there was no street sign until after the first crossing. My main strategy was to be as efficient as possible. If I knew I'd be turning left ahead, I stayed on the left side of the street, and vice versa.*"

- N3 approached the task cautiously at first but became more confident as the route progressed. They described starting out by closely following the written instructions before gradually relying more on memory and recognition. However, they noted that this shift sometimes led to lapses in attention: "*I was a bit uncertain in the beginning. I understood the instructions, but I thought it might be more difficult. It wasn't really hard until near the end when I wasn't sure if I'd passed three intersections or not - that's where I hesitated. I was stricter with the paper at first, but toward the end, I lowered it more, thinking, 'I know this now.' Then I realized I was less attentive and it became harder at the crossings*."

- N4 emphasized accuracy and correctness, maintaining steady focus on following the instructions precisely. Although initially concentrated on "doing it right," they later allowed themselves to look around and engage more with the surroundings: "*It went really well - nice squares, cheerful people. At first, I just focused on getting to the right street and following the instructions so I wouldn't go wrong."*

- N5 similarly described the navigation as straightforward, with the only difficulty arising at the starting point before locating the first street sign. Their strategy focused on sequential processing: reading and completing one instruction at a time before moving on: "*It went really well. The biggest challenge was early on, figuring out which street I was on. I couldn't see the sign at first but found it after ten meters. After that, navigation was very easy. My strategy was to read one step at a time instead of all of them at once. I focused on one instruction, turned, and then checked the next*."

<u>Sense of Orientation and Route Knowledge</u>

Participants described maintaining an active awareness of their spatial position and orientation throughout the task. The absence of automated guidance required them to rely on self-directed strategies, such as confirming street names, referencing intersections, and mentally relating their current position to the starting point. Most participants expressed a strong sense of control and confidence in navigating the route independently a second time, if asked.

- N1 described a methodical approach to confirming their location, emphasizing a habit of verifying street names to ensure correct orientation: "*I double-check all the time. (...) It can mean that I need to walk the wrong way to see the street sign.*" Reflecting on the potential to repeat the same route, N1 noted: "*Yes, I would be able to do that. (...) I would get much more out of it the second time. Then you wouldn't have to focus on following the instructions but could observe more.*"

- Similarly, N2 expressed confidence in maintaining a clear sense of position throughout the route, despite unfamiliarity with the city's landmarks: "*I think I had a pretty good idea of where I was in relation to where I started. I don't know any landmarks in Västerås, so I have nothing like that to navigate by, but in relation to the start I think I knew where I was*."

- N3 described how written street names provided reassurance in maintaining orientation, particularly when uncertainty arose near the end of the route: "*It was probably at the end when I was going back to Smedjegatan again. But what saved me a couple of times were the street names, I think. Without the names it might have gone differently, but when I saw the sign, it was clear - a confirmation that I was on the right path.*"

- N4 also felt secure in their sense of direction and demonstrated initiative by verifying directions socially: "*I was confident during the whole route. I did ask once, just to make sure I wasn't on the wrong square or street. I just wanted to double-check with a person or a couple to make sure I was right. It turned out I was going in the right direction."*

- N5 expressed a strong internalized sense of spatial understanding, describing an ability to orient toward the starting point at any given moment: "*I felt quite confident. I mean, I'm not familiar with the area, but I felt confident that I could have pointed to the starting point from wherever I was.*"

<u>Landmark Knowledge</u>

Participants expressed environmental cues such as bridges, the river, distinctive buildings, and social spaces served as primary reference points. Many participants demonstrated a high level of environmental awareness, describing architecture, textures, and atmospheres in detail, often integrating affective impressions into their spatial awareness.

- N1 demonstrated architectural and material awareness, recalling distinct façades, textures, and compositions across the route. The participant further commented on several primary landmarks, particularly around the river crossing, while also noting more unusual or strange urban details: "*I crossed the water and there was this cool glass building, a bar with an outdoor terrace. Cozy. I wondered what direction it faced and if it got the evening sun. On the other side, there was a beautiful brick building, and across from that, old red cottages. There was also a statue we passed that looked like a screw, which stood out.*" They mentioned noticing a large, dome-shaped building visible in the distance, smaller urban amenities, and ordinary but spatially significant elements e.g. benches bicycle stands: "*I saw, I don't remember where it was, but in the background there was a big, round dome, quite high,*

sticking up (...) it was at the end somewhere. There were a lot of park benches and a bicycle stand that I touched. There was the park, a playground. The city hall. It was a gym, we saw people who were dressed for training who were probably on their way to the gym."

- N2 similarly emphasized primary architectural landmarks, while pointing out asymmetric by the water. The river and nearby restaurant provided strong orientation anchors, not only visually but acoustically: "*That brasserie (...) right after the river. It really stood out. It was beautifully placed. And the water itself was asymmetric, which made it easy to know which side you were on, because on one side there was a waterfall, you couldn't hear anything but that.*"

- For N3, familiarity and recognition were central to what stood out in the environment. They noticed both known franchises and unique architectural features, connecting these with personal references: "*I noticed Subway, probably because we have that in Örebro. You recognize certain things. I also noticed the nice buildings by the river. The City Hall was cool, though a bit like an institution, so I wondered what it was.*"

- N4 focused on the experiential and social character of landmarks, particularly those that suggested gathering and activity. Their descriptions intertwined architectural noticing with imagined use: "*It was probably the City Hall that stood out most. And then that restaurant we passed before entering the park by the river. You could imagine sitting there in summer, having a drink, watching the river and City Hall. It felt like a nice spot."* The participant also noted the park's pathways and a central square that conveyed a sense of openness and social potential: *"It seemed nice. There were different gravel paths you could take. It reminded me a bit of the city park in Örebro. And then I'd say the square - I don't remember the name, but it was quite large. It felt like a gathering point, maybe for events or activities. It felt very pleasant, with a water fountain there. It seemed like a good central destination for Västerås and a nice meeting place*."

- N5 described a dense sequence of visual and spatial landmarks, often blending architectural noticing with sensory and associative detail. Several sites stood out as distinct reference points along the walk: The participant also described the riverside and surrounding structures with visual specificity and comparative reasoning: "*On the right side there was a pink house, I don't remember exactly what it was. And right where you were supposed to turn left, there was a brasserie (...) we came into a park with green areas. There was a playground that looked extra equipped. I noticed there was a river on the left. That was nice*." Further along the route, particular landmarks such as the theatre, City Hall were highlighted for their

aesthetic and symbolic presence, including reflections on the river view and the contrast between more scenic and mundane areas: "*Then I noticed the theatre on the right a bit further up. The City Hall, very tall, seemed quite new. The Västerås sign was grey and looked new too. There was a tall pillar with a golden bull on top. Looking back towards the first bridge, the view was beautiful with the bridge and the pink house behind it. That whole part looked really nice. Then later we passed garages and driveways, a less interesting street - it didn't feel like a tourist area.*"

Cognitive Mapping & Survey Knowledge

Participants demonstrated varying degrees of spatial reconstruction ability when asked to redraw the route. Many began their drawings from a single memorable anchor point, reconstructing the route through remembered relationships. The task revealed how participants relied on distinct environmental cues such as parks, buildings, and water features to organize their mental representations of the area.

- N1 described the process as challenging, noting difficulties in sequencing and situating elements despite recalling many details: "*It's really hard. I know what I saw when I walked, but I lost track a bit at the crossings - how many turns there were and which street I was on. We passed so much. I know there was a car wash or garage that we passed, so I think I put that fairly accurately on the map. If I walked it once more, I'd definitely recognize and remember even more.*"

- N2 expressed confidence in their ability to reproduce the route correctly, emphasizing procedural structure over visual accuracy: "*Yes, I think I got it. I'm quite sure I got all the turns right. It's not to scale, but instruction-wise I think I captured everything — and the memorable details I remembered from the route*."

- N3 described partial recall, noting that the end of the route was clearer than the beginning: "*I thought it wouldn't be that hard when you said it. I noticed the beginning was harder. The end I remembered - three streets, I turned by the river and City Hall. But at the start, I don't think it's totally correct. I remembered Smedjegatan and that we crossed maybe two intersections, but that's where it got tricky, so I guessed.*"

- N4 relied primarily on the city's linear street network to reconstruct the route and recalled several urban features with confidence: "*Good. I'm not that good at drawing, but I tried to fully draw out the streets. The streets were very clear, they didn't crisscross too much, which*

made it easier when sketching. I could follow the streets, then I drew City Hall, the squares, and the things I remembered."

- N5 provided a detailed sequential reconstruction, recalling a series of landmarks and transitions with strong spatial anchoring: "*Yes, I think the route was good. The things that stood out are what I drew. For example, at the beginning where we turned left: there was a pedestrian street straight ahead, with outdoor seating. Then the next street felt more like a transport route, nothing special. Then we turned right onto a bigger road, 'Stora gatan'. When we reached the bridge, I noticed the open space, (...) we turned left into the park. There was a river on the left (...). I noticed the theatre on the right a bit further up, then we crossed the bridge again. The current was faster there, divided in two parts. Then City Hall (...), the Västerås sign in grey and a golden bull statue on a pillar. There was a park where people were sitting and drinking beer. Looking back towards the first bridge, the view was beautiful. Then we walked towards an area with garages, driveways, and less interesting streets. When we came up to the last turn, I felt we were close to the goal, so I stopped thinking much about it. Overall, a pleasant route with a lot to see.*"

<u>Emotional and Experiential Dimensions</u>

Participants described their navigation experiences as emotionally engaging and personally reflective. The slower, instruction-based process appeared to encourage curiosity, nostalgia, and sensory awareness of the urban environment. Their reflections reveal how certain places, materials, and atmospheres resonated with personal memories and associations.

- N1 expressed fascination with the city's architecture, particularly its brick buildings, which evoked comparisons to their previous trip to England and a sense of aesthetic appreciation: "*(...) the brick buildings. There are so many beautiful brick buildings in England, and there were quite a few here that I commented on during the walk, and some slightly crooked houses too, which I associate with older architecture. It reminded me a bit of England actually. I was there just last week, traveling around, and there's so much history and old buildings there… It was quite exciting; we passed the City Hall with its granite façade—a big, beautiful building. And the little bridge house was interesting too, a small square one. I'm not sure how much it's used today, but it was something different.*" They also described moments of spontaneous curiosity, where the physical setting invited exploration: "*I think I did, yes—I walked a bit to the right to look at those houses along the water instead of turning left by the glass building.*"

- N2 emphasized a sense of freedom and mindfulness compared to digital navigation. Without the strict prompts of a GPS, they felt able to notice and appreciate the environment more

freely: "*It was nice not to follow a GPS route slavishly: 'now turn here, now turn there.' You think more for yourself that way. This time it was more like, 'I'll turn somewhere over there,' so I could look around more - at shop windows, at people cycling past. Things like that*."

- For N3, the experience was infused with a mix of curiosity and nostalgia. They connected what they saw to past memories and familiar associations: "*We go to the cinema a lot, so for me it became like a place I could imagine coming back to. It felt pleasant and interesting. The river caught my attention; I thought I'd like to go further down toward what I assumed was the old town. And seeing Subway brought back memories of one of my friends who worked there when we were in high school. So it triggered a kind of nostalgia and curiosity at the same time.*"

- N4 described an emotional connection grounded in familiarity. The city reminded them of their own hometown, which contributed to a sense of comfort and belonging: "*I think the whole city felt a bit like my home city. The city center was quite similar with many restaurants, shops, and squares, so it actually felt a bit like Örebro (...) it felt pleasant and nice*".

- N5 provided a rich sensory and emotional reflection, describing vivid impressions of specific landmarks and public spaces. They were particularly drawn to the area near the water and its atmosphere of liveliness and beauty: "*The City Hall even reminded me of Stockholm's City Hall, though in a different color. The theater reminded me a bit of the one in Örebro. I also noticed the golden bull statue - it made me think of the one in Milan, where you spin on it for luck. There was a nice view toward the pink house and the first bridge, it felt cozy like a place to sit. There was also a fountain that reminded me of one in Brussels, with a little child and water streams. The whole area by the water and Brasseriet was the most interesting part. It had open squares, green spaces, and more life than the river in Örebro. It felt more natural, almost wild. It even made me think of kayaking.*"

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5. The Implications of Digital Navigation For the Wayfinding Experience

This chapter interprets the findings of the empirical study in light of the theoretical frameworks on the process of navigation (Lynch, 1960; Montello, 1998; 2012), spatial knowledge acquisition (Siegel & White 1975), active vs passive navigation (Huston & Hamburger (2023), and emotional engagement (Gartner, 2012), among others. The discussion directly addresses the central research questions concerning how reliance on digital navigation systems influences individuals' ability to perceive, recall, and emotionally engage with an unfamiliar urban space. Drawing upon in-field observations, cognitive mapping, and interviews, the chapter demonstrates how digital mediation reshapes navigational behaviour, restructures spatial knowledge acquisition, and produces a comparatively thinner form of experiential and emotional engagement to place.

5.1. Digital Navigation Reshapes Navigational Behaviour

The comparative findings between the Digital Group and the Non-Digital Group regarding navigational strategy and spatial awareness is based on the observations from the in-field navigation task and the subsequent interview transcripts. The results indicate contrasting yet partially overlapping patterns in how participants oriented themselves and maintained spatial awareness, depending on whether their navigation was digitally or non-digitally mediated.

Participants using digital navigation systems adopted an efficiency-driven, goal-oriented pace characterized by steady movement, minimal pauses, and frequent screen-checking at intersections or decision points. Their attention was primarily centered on the device, particularly when approaching intersections or for route confirmations. This pattern reflects a shift in cognitive responsibility, where navigational decision-making is partially transferred from the individual to the digital device, also referred to as cognitive offload (Downs & Stea, 2017; Ahmadpoor, 2019; Ruginski et al., 2019). Rather than scanning the environment for cues such as street names of spatial alignment, participants in this group relied on the device for confirmation and orientation where one person conveyed their familiarity in using a digital map for instant route confirmation, while another participant expressed how they glanced at their phone quite often and rarely looked at street names. Such reliance corresponds to what Downs and Stea (2017) describe as 'navigating without noticing', and aligns with

‘automation bias’, where technological guidance is trusted over one’s own spatial judgement (Parasuraman & Riley, 1997, Ruginski et al., 2019). This behaviour reduces the active perceptual and cognitive engagement essential for situational awareness (Montello, 2012; Ahmadpoor & Smith, 2020; Vaez, Burke, & Yu, 2020). Spatial awareness involves perceiving one’s position and movement in relation to environmental cues (Seladin-Schulman, 2020); yet, under digital mediation, this attentional orientation appears redirected toward the screen rather than the surrounding environment (Mirowski et al., 2018).

In contrast, participants navigating with written instructions demonstrated a greater situational awareness, moving at a slower pace and paused frequently to interpret environmental cues and verify their route through spatial reasoning. Some participants took extra care to confirm their route, occasionally walking back to verify street signs or asking others to make sure they were on the correct street or square. Early challenges often involved identifying the correct street, prompting careful cross-checking with the environment or social cues to ensure accurate navigation. These behaviours indicate a more self-reliant and environmentally responsive navigation style. Such patterns align with research emphasizing that effective wayfinding depends on active perceptual engagement and continuous environmental feedback (Ishikawa et al., 2008; Speake, 2015; Wessel et al., 2018; Ahmadpoor, 2019; Ahmadpoor & Smith, 2020). Such active attention corresponds to what Lynch (1960) conceptualized as imageability: the clarity and memorability of spatial form. By scanning intersections and confirming street identity, participants actively reinforced environmental legibility through embodied interactions while being spatially aware. Together, these contrasting navigational behaviors illustrate two ends of a continuum between active and passive approaches of navigation (Ishikawa et al., 2008; Huston & Hamburger, 2023). As previously discussed, digital navigation facilitated cognitive offloading (Ruginski et al., 2019) which reduced the need for spatial problem-solving by transferring route calculation and decision-making to the device instead of direct engagement with environmental cues. This tendency aligns with Huston and Hamburger’s (2023) description of passive navigation, in which technology mediates spatial behavior and attenuates direct environmental engagement. Such mediation may explain why the Digital Group moved faster and paused less, as the continuous digital feedback provided in-situ reassurance, minimizing the necessity to scan and interpret the physical surroundings. In contrast, the intermittent pauses and environmental confirmations observed in the Non-Digital Group reflect a more embodied and self-directed orientation to place, fostering deeper spatial learning through the process of active navigation (Montello, 1998; 2012; Huston & Hamburger, 2023).

However, the findings also reveal nuances beyond established theories. Despite employing different navigational tools, both groups exhibited comparable procedural tendencies in how they structured

their movement and decision-making behaviour. Participants described their approach as sequential and goal-oriented, where the route was divided into manageable segments. These parallels suggest that navigation practices exist along a continuum of spatial awareness rather than a fixed division between digital- and non-digital processes (Huston & Hamburger, 2023). Moments of exploratory engagement occurred even among digitally guided participants, where one participant chose an alternative street for aesthetic reasons, and another briefly diverged from the route before reorienting. Conversely, the efficient and task-oriented approach from one participant in the non-digital group resembled the procedural focus typical of passive navigation. Such nuances reinforce Huston and Hamburger's (2023) argument that the cognitive and experiential effects of digital navigation are not determined by the technology itself but by how users interact with it. Spatial awareness, therefore, depends on the quality of attentional and perceptual involvement rather than the mere presence of digital mediation. This interpretation echoes Ahmadpoor's (2019) view that while digital navigation can diminish direct environmental engagement, it simultaneously reshapes, rather than eliminates, the conditions under which spatial awareness emerges.

5.2. Place Becomes a Complex Cognitive Configuration

With the navigational strategies and spatial awareness of digitally mediated navigation now established, we shift our focus to the perceived impressions of the urban space and how these impressions transformed into cognitive representations of urban space. Grounding in the cognitive maps produced by both groups as well as the verbal recounters of the route, the result revealed a distinct yet overlapping pattern of spatial representation, highlighting how different tools of navigation shaped environmental engagement and the formation of spatial knowledge. In the following section, the focus shifts from how participants navigated to what they were able to recollect, examining whether and in what ways digitally guided navigation influenced their ability to form coherent mental representations of the urban setting.

Among participants using digital navigation systems (the Digital Group), their cognitive reconstructions of the urban space were predominantly linear and route-bound. Their maps focused heavily on the sequential progression of movement, often highlighted through arrows or colour. This pattern is reflecting what Lynch (1960) characterises as path-dominated representations. Only a small set of key environmental features, such as City Hall, the water, the park, and the cinema, appeared with any regularity, while minor features and contextual details were largely absent.

These findings further aligns with the phenomenon of ‘cognitive offloading’ (Ruginski et al., 2019), and what Downs and Stea (2017) describe as ‘navigating without noticing’, indicating a narrowed perceptual field shaped by reliance on digital prompts rather than the environment itself. This restricted engagement was also reflected in the Digital Group’s verbal descriptions. Participants often provided fragmented or minimal contextual details, particularly when referring to elements not directly tied to the instructed route. Environmental features were typically recalled only when they functioned as navigational reference points, such as the glass building near the park that signalled where a turn should be made, or the river as a feature that indicated a point where the route would later require crossing back. In these accounts, environmental elements were primarily recognized for their functional role within the route, rather than as integrated components of the broader spatial setting. At the same time, these responses did suggest a limited but present awareness of broader spatial structure despite their reliance on digital mediated navigation. A few participants demonstrated basic insight into their position in relation to larger environmental features, such as the recognition of the river as a recurring spatial reference or noticing when the route returned to previously encountered locations. This indicated that even within digitally mediated navigation, participants were not entirely detached from their surroundings, but maintained a partial awareness of spatial relationships. This nuance was further illustrated by one participant who provided a notably richer account of the environment compared to others in the Digital Group. This description included observations of music heard along the route, recognizable storefronts and hotels, social events occurring in the park, and distinctive architectural features including the tower of City Hall and a small square marked by symbolic sigils. Rather than describing isolated route markers, this account linked multiple sensory impressions, landmarks and social observations along the way. Such recollection suggests a more developed sense of spatial relationship and environmental awareness. Notably, this account stands out within the Digital Group, indicating a more developed sense of spatial relationship in comparison to the fellow participants. This nuance reinforces the earlier argument that the cognitive and experiential effects of digital navigation are not determined solely by the device itself but by how users interact with it (Huston & Hamburger, 2023). In this case, heightened perceptual attention allowed the participant to gather and retain more environmental information despite using the same technological aid as the rest of the group. With that said, the overall pattern remains consistent. Both the cognitive maps and verbal recountings produced by the Digital Group remained largely route-centred and limited in contextual detail. Environmental features were generally recognized as isolated waypoints rather than as interconnected elements within a broader urban configuration, resulting in a spatial representation that emphasised directional progression while providing limited insight into the surrounding urban structure.

In contrast, participants who navigated with written instructions (the Non-Digital Group) produced cognitive maps that extended beyond the dominant linear route structure found in the Digital Group. Although the route remained central, it was accompanied by a richer and more varied set of environmental elements. In addition to the key landmarks identified by the Digital Group, participants in the Non-Digital Group incorporated a broader range of environmental features such as statues, fountains, benches, storefronts, material textures, and even references to social activity. This resulted in a more balanced and complex spatial representation. Within Lynch's five elements, the Non-Digital Group demonstrated a wider distribution of landmarks, nodes, and path, reflecting a more active perceptual engagement during navigation and a extended situational understanding of the urban environment as a whole. Participants frequently described the environment as a sequence of connected spatial scenes rather than isolated turning points. Their accounts included observations of distinctive buildings such as cafés and older residential structures, as well as transitions between different types of focal points, streets and urban atmospheres. Several participants also described how the spatial character shifted along the route, for example, moving from pedestrian-oriented streets with outdoor seating to larger traffic routes, crossing bridges with open views of the river, and entering green park areas before reaching prominent civic landmarks such as City Hall. Taken together, these descriptions illustrate a markedly different approach of environmental processing than that observed in the Digital Group. Participants in the Non-Digital Group not only recalled a greater number of landmarks but also related these features to one another, noting their positions, the transitions between districts, and shifts within a broader narrative structure. Their recollections included material details, shifts in atmosphere and spatial openness, variations in street character, and the relational positioning of features. Such descriptions indicate an emergent configurational understanding of the urban setting. Rather than recounting isolated points along a path, participants wove together multiple environmental elements into a coherent spatial storyline, demonstrating both continuity and contextual awareness. This suggests that their navigation involved more than simply following instructions, also entailing an ongoing interpretive engagement with the surrounding urban environment.

These patterns between the two groups closely reflect the distinctions outlined by Siegel and White (1975). The Non-Digital Group's verbal accounts demonstrate an integration of both landmark knowledge, as seen in their recognition of distinctive buildings, public art, and street character, as well as route knowledge, as they described the sequential movement between these landmarks with increasing specificity. More importantly, their coherent linking of environmental features, attention to spatial layout, and ability to situate elements relative to one another indicate the beginnings of survey knowledge, in which spatial relations become more map-like and topological. Their cognitive maps, with their multiple cross-connections, distributed landmarks, and contextual detail, align with this

interpretation. Thus, the Non-Digital Group's navigation appears to have supported a progression through Siegel and White's stages, enabling participants to move beyond a purely sequential representation of space toward a more relational, integrative understanding. The Digital Group, by contrast, showed limited movement through these stages. Their maps and verbal descriptions were dominated by isolated landmarks used primarily as functional waypoints, reflecting the earliest forms of landmark knowledge. Although some participants demonstrated elements of route knowledge, such as recalling the direction of turns or recognising the river as a feature crossed twice, these were often disconnected and lacked the continuity necessary for forming a coherent route structure. Furthermore, the integration of landmarks into a broader spatial framework was largely absent. Where the Non-Digital Group linked features relationally, the Digital Group tended to recognise features only at the moment of encountering them, with little indication that these impressions were retained in an organised, topological form. This limited progression is consistent with their reliance on digital guidance, which reduced the need to sequence landmarks independently or construct spatial relations (Ishikawa et al., 2008; Speake, 2015; Wessel et al., 2018; Ahmadpoor, 2019; Ahmadpoor & Smith, 2020). Consequently, the Digital Group remained largely within the first two stages of Siegel and White's model, exhibiting minimal transition toward survey knowledge.

While Siegel and White's framework offers a useful lens for distinguishing between different forms of spatial knowledge, the findings here highlight its limitations. The participants' representations, especially the subtle variations within each group, suggest that spatial learning does not unfold in discrete, sequential stages, but rather along a continuum in which landmark, route, and survey elements can emerge simultaneously and evolve gradually. This aligns with later critiques and refinements in the literature (e.g., Montello, 1998; Ishikawa & Montello, 2006), which argue that spatial knowledge acquisition is dynamic, overlapping, and shaped by the nature and depth of perceptual engagement rather than by a fixed stage-based progression. In this sense, the maps and narratives produced by participants reveal spatial understanding as an incremental, fluid process that is continually recalibrated through interaction with the environment and the tools mediating that interaction.

5.3. Digital Mediation Produces Thinner Emotional Engagement

Building on the cognitive dimension discussed previously, the emotional and experiential perspective reveals yet another layer of comparison between digital and non-digital navigation, one that unfolds

gradually and relationally, much like the acquisition of spatial knowledge itself. Whereas the cognitive findings focused on how participants became aware of space and integrated new spatial information into coherent internal representations, the emotional dimension concerns the way in which participants interacted, engaged, and resonated with their surroundings while moving through them. This affective process, as Tuan (1977) and Relph (1976) emphasize, is fundamental to place attachment and to the lived experience of space.

For participants navigating with digital systems (the Digital Group), emotional engagement tended to be noticeably subdued and instrumental. Although participants expressed generally positive feelings such as calmness, curiosity, or mild appreciation, their emotional tone was secondary to the navigational task. Their comments were short and situational without depth, often consisting of simple acknowledgements of pleasant features such as the waterfront or surrounding houses. This reflects what Speake (2015) and Ahmadpoor (2019) describes as surface-level familiarity rather than a deeper engagement. Interaction with the environment tended to occur in gaps between task-oriented attention to the device, resulting in fragmented sensory and affective awareness, which might be linked to the shallow spatial knowledge showing in their cognitive maps and verbal recounting. Nonetheless, the Digital Group's data do not indicate a complete absence of emotion. Several participants expressed connections between visual impressions and personal experiences, such as perceiving similarities between the urban environment and other cities they had visited or recognizing architectural elements that reminded them of their hometown. These moments of spontaneous association suggest that even within digitally mediated navigation, emotional engagement and personal references can emerge episodically, further supporting Huston and Hamburger's view that the device itself is not inherently alienating, but that reduced attentional immersion limits affective depth. With that said, in comparison to the environmental engagement of the Non-Digital Group, the differences were evident.

By contrast, the participants who navigated without digital assistance (the Non-Digital Group) described their experiences in markedly affective and multisensory terms. Their reflections from the interviews revealed curiosity, nostalgia, and aesthetic appreciation, often triggered by architectural details, materials, or environmental sounds. For example, one participant associated the brick architecture with memories of a previous trip, while another connected specific landmarks, such as the golden bull statue or a fountain, to cities they had visited. These associations illustrate how spatial experience activated personal and cultural memories while dwelling in an urban space. These forms of associative resonance align with Gartner's (2012) argument that emotional significance enhances the memorability of space, as well as with Ahmadpoor's (2019) claim that sensory and emotional engagement deepens spatial understanding. The qualitative richness of the Non-Digital Group's accounts, alongside the frequent pauses, spontaneous comments, and tactile interactions, suggests that

their slower, self-directed navigation fostered a more embodied and engaging form of place experience, in comparison to the Digital Group - where the faster pace and rare pauses limited opportunities for sensory engagement and emotional reflection. This contrast highlights how the mode of navigation itself can shape the depth of experiential involvement indicating that when movement is guided by external digital prompts, attention tends to narrow toward the task of arrival rather than the experience of passage. Conversely, when navigation remains self-directed and more cognitive demanding and interactive, perceptual openness and emotional resonance are more likely to emerge. This corresponds with Huston and Hamburger's emphasis on engagement as the mediating factor linking cognition and engagement: when individuals attend to their surroundings, both spatial and emotional memory become more vivid and integrated.

Interestingly, while the broader literature often frames digital navigation use as inherently diminishing emotional connection to space (Speake, 2015; Ahmadpoor & Smith, 2020), the present findings complicate this assumption. Participants in the Digital Group did not report negative or detached feelings toward the environment; rather, their affective experience appeared attenuated - pleasant yet shallow. This nuance suggests that digital mediation may not eliminate emotional experience but decreases its intensity and focus. At the same time, the richer emotional engagement among the participants in the Non-Digital Group underscores the interdependence between sensory awareness, spatial reasoning, and emotional response. When using written instruction for navigation, that requires cognitive activity and environmental confirmations, as stated above. It promoted attentiveness to atmosphere, materiality, and social context - qualities consistent with what Mavros et al. (2012) and Zeile et al. (2015) identify as the experiential core of urban affective geography. In this sense, emotion functions not merely as a by-product of navigation but as an active component of spatial learning. The act of noticing, comparing, and associating with environmental stimuli reinforces memory through affective encoding (Gartner, 2012), effectively merging cognitive mapping with experiential immersion. Nevertheless, the results also highlight individual variability that diverges from theoretical expectations. Not all non-digital participants demonstrated deep emotional reflection, and some digital users still experienced localized affective responses. These deviations suggest that emotional engagement is not determined solely by navigation tools but by the quality of attention and personal disposition of the navigator. This observation reinforces Huston and Hamburger's (2021) contention that engagement, rather than technology itself, mediates both cognitive and affective outcomes. Thus, while the overall trend supports the literature linking active navigation with heightened emotional connection, this study also reveals that affective engagement persists in hybrid forms even under digital mediated guidance.

In summary, the comparative findings demonstrate that digital navigation mediates not only how people move through space but also how they feel in it. The non-digital group cultivated a more reflective, sensorial, and emotionally resonant experience of place, aligning with theories of embodied and affective spatiality (Tuan, 1977; Gartner, 2012; Ahmadpoor, 2019). In contrast, digital navigation users experienced a smoother yet perceptually thinner engagement, consistent with technologically assisted spatial awareness that prioritizes efficiency over exploration. This underscores a central tension in contemporary urban mobility: as navigation becomes increasingly automated, the experiential and emotional dimensions of place risk being transformed from participatory engagement into passive observation.

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6. Discussion

This thesis set out to investigate how digital navigation systems influence individuals' spatial awareness, the acquisition of spatial knowledge, and the emotional experience of navigating unfamiliar urban environments. In doing so, it addressed an empirical gap in existing research, where efficiency, convenience and performance have received the most exposure in comparison to the cognitive and affective consequences of digitally mediated navigation. By combining in-field navigation tasks, cognitive mapping exercise, and semi-structured interviews, the study provided a holistic understanding of how different navigational approaches shape, not only the movement, but also the conditions under which spatial understanding and experience emerge.

In relation to the first research question, the findings suggest that digital navigation reshapes spatial awareness and knowledge acquisition by redistributing cognitive effort and focus rather than simply reducing it. While participants remained capable of orienting themselves and completing the task, their engagement with the environment appeared more selective, routebound and shallow, reducing the environmental scanning. This pattern can be interpreted through Huston and Hamburger's conceptualisation of passive navigation, where external systems assume parts of the cognitive process, allowing users to rely less on active environmental interpretation and more on the digital device. As a result, spatial awareness becomes sufficient for task completion, but less supportive of deeper spatial learning. This shift is further illuminated through Siegel and White's framework of spatial knowledge acquisition. Rather than demonstrating a clear progression toward integrated spatial understanding, digital navigation users appeared to remain anchored in earlier forms of knowledge, particularly landmark- and route-based recognition. This suggests that the presence of continuous navigational

support may interrupt or slow the development of more complex, survey-level representations. However, the findings also indicate that this process is not entirely inhibited. Instead, spatial knowledge appears to emerge in partial and fragmented forms, reinforcing the idea that spatial learning is not eliminated by digital mediation but reshaped into a more situational and less integrated structure. From the perspective of Kevin Lynch, this can be understood as a weakening of the overall imageability of the urban environment. While participants were still able to recognise individual elements such as paths and landmarks, these elements were less frequently integrated into a coherent mental image of the city. This suggests that digital navigation may support movement through space without necessarily supporting the construction of a unified spatial image, highlighting a distinction between knowing how to move and understanding where one is within a broader urban context.

In contrast, non-digital navigation appeared to foster conditions more conducive to integrated spatial understanding. The increased need for interpretation, verification, and environmental attention suggests a more active cognitive engagement, which supports the development of relational spatial knowledge. Rather than simply following a route, participants engaged in an ongoing process of situating themselves within the environment. This indicates that cognitive effort, often framed as a limitation, may instead function as a critical mechanism for deeper spatial learning.

Turning to the second research question, the findings indicate that navigational aids also shape the quality of experiential engagement with urban space. While emotional responses were present across both groups, their depth and character differed. Participants navigating without digital assistance described their journeys through affective, sensory, and often personal associations, suggesting a more immersive and interpretive engagement with place. This aligns closely with Gartner's argument that spatial understanding is not purely cognitive, but also affective. The findings suggest that emotional engagement is not a secondary outcome of navigation, but an integral component of how space is processed and remembered. When individuals attend to sensory and contextual aspects of the environment, spatial experience becomes layered with meaning, supporting both memory formation and place attachment. By contrast, digitally mediated navigation appeared to narrow the conditions under which such engagement could emerge. Emotional responses were not absent, but they were more episodic and less elaborated. This suggests that digital navigation does not eliminate emotional experience, but may reduce its intensity by limiting sustained attention to the surrounding environment. A possible interpretation is that when attentional focus is directed toward instruction-following, fewer cognitive resources are available for reflective or associative processing, resulting in a thinner experiential engagement. Importantly, the findings also complicate deterministic assumptions about technology. Variations within both groups indicate that navigation tools do not fully dictate experience. Instead, they shape the *conditions of possibility* for engagement. This

supports Huston and Hamburger's argument that the effects of navigation technologies are mediated by user behaviour, attentional habits, and individual disposition. In this sense, digital navigation should not be understood as inherently diminishing spatial or emotional experience, but as reconfiguring how and when such experiences emerge.

Across both research questions, the findings underscore that the effects of digital navigation are not absolute but mediated by attentional habits, personal disposition, and the degree of engagement individuals bring to the task. Some digital users still exhibited meaningful perceptual or emotional responses, while not all non-digital participants demonstrated deep affective involvement. This nuance supports the argument that technologies do not determine experience outright; rather, they reshape the conditions under which spatial awareness and emotional engagement emerge.

Overall, this study demonstrates that digital navigation systems transform both the cognitive and affective dimensions of urban experience. They offer efficiency and certainty but often at the cost of perceptual richness, spatial learning, and emotional depth. Non-digital navigation, by contrast, encourages exploration, sensory openness, and more meaningful encounters with place. These findings highlight an important tension in contemporary urban mobility: as urban movement becomes increasingly automated, the qualities of attentiveness, immersion, and reflective engagement risk being diminished. Recognising these dynamics is essential as cities continue to integrate digital systems into everyday navigation. Understanding not only how people move through space, but how they experience it, remains crucial for fostering meaningful and resilient relationships between individuals and their urban space. In conclusion, the process of navigating, like the process of perceiving and experiencing a place itself, is not simply a matter of reaching a destination. It is a dynamic, ongoing interplay between awareness, knowledge, and emotion. This thesis demonstrates that the tools through which navigation unfolds have a profound influence on this interplay - shaping what people notice, what they remember, and how they connect with the cities around them.

6.1. Methodological Reflections and Future Research

This study employed a mixed-method, qualitatively oriented design that combined in-field observations, cognitive mapping, and semi-structured interviews. This approach proved effective in capturing the behavioural, cognitive, and experiential dimensions of navigation, allowing the analysis to move beyond task performance and toward a more holistic understanding of how individuals attend

to, interpret, and emotionally experience unfamiliar urban environments. Using several types of data strengthened the credibility of the findings. The behaviours observed during navigation, the cognitive maps, and the interview accounts often supported one another, showing similar patterns or adding useful nuance. This consistency across datasets increased the internal validity of the study, as conclusions were not based on a single form of evidence. The methodological approach was further reinforced by being grounded in established theories of spatial cognition and environmental perception (Lynch, 1960; Siegel & White, 1975; Huston & Hamburger, 2023), which provided a solid foundation for both the design and the interpretation of the results. These theoretical anchors structured both the data collection and interpretation, enabling systematic comparison between digital and non-digital navigation and providing a clear conceptual lens for examining spatial awareness, imageability, and emotional engagement. Despite these strengths, several methodological limitations must be acknowledged. First, the small sample size (N = 10), while appropriate for in-depth qualitative fieldwork, restricts the generalisability of the findings. The results are best understood as exploratory rather than representative of broader populations. Although participants had no prior familiarity with the study area, individual differences in navigational skill, confidence, or personal interests may have subtly influenced their approach to the tasks. While the selection criteria aimed to control for major confounding variables, such individual differences remain an inherent challenge in naturalistic field-based research.

The study area, although offering a mix of clear and ambiguous features, represents only one type of urban setting. Different city structures, such as grid-like layouts, organically developed historic centres, or highly uniform public spaces, might result in different patterns of attention, spatial recall, and emotional response. Conducting the navigation task in a more or less legible city (Lynch, 1960) could therefore have influenced how participants noticed landmarks or formed mental maps. The loop-route used in this study also added consistency but may have made some aspects of recall, such as orientation or route closure, easier than in a more open-ended route.Further, external conditions such as time of day and weather may also have influenced the findings. Although conditions during the data collection for this thesis were relatively consistent, factors like crowd levels, temperature, rain, or noise can shape how people move through space, what they notice, and how comfortable or emotionally engaged they feel. Because the study took place in a real public environment, these uncontrollable variables may have affected participants differently, especially those already cognitively occupied by the navigation task. Such contextual elements should be taken into account if this method were to be repeated, as different environmental circumstances (or a different city altogether) could lead to variations in spatial awareness, engagement, and emotional experience.

Future research could build on this study by expanding sample sizes or incorporating additional participant groups, such as habitual non-users of navigation technologies or individuals with varying levels of spatial competence. Comparative studies across different urban morphologies would allow for deeper investigation into how environmental structure shapes imageability, emotional engagement, and technology dependence. Longitudinal designs could examine how repeated navigation, digital or non-digital, affects the gradual accumulation of spatial knowledge, addressing the limitations of single-exposure studies. Methodologically, combining qualitative approaches with GPS tracking, eye-tracking, or physiological measures could provide richer insight into attentional patterns and embodied emotional responses. Additionally, future studies might investigate whether hybrid navigation modes (e.g., minimal digital prompts supplemented by environmental cues) can support more balanced spatial learning and engagement. Overall, these methodological reflections highlight both the strengths and constraints of the present study while pointing toward opportunities for broader, deeper, and more technologically integrated explorations of urban navigation and spatial experience.

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7. References

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7.1. Original Quotes

“Fint vid vattnet” (27), “Mysiga hus” (27), “Coolt” (27), “Fin byggnad med markiserna” (27), “Fint väder” (27), “Nästan framme” (27), “Trevligare gata att gå på” (27), N3: “Stora Gatan till höger” (28), “Rolig papperskorg” (29), “Vad fint” (29), “Fin lekpark” (29), “(...) stor byggnad. Vad är det för fasad?” (29), “Vad är det för byggnad?” (29), “Wow” (29), “Är det här lägenhetshus eller hotell?” (29), “Är det huset känt för Västerås?” (29), “fast vildare” (29), “Varför har man en tjurstaty i guld?” (29), “Hjälpsamma människor” (31), “Fulla personer” (31), “Det gick bra, jag tror jag följde beskrivningen. (...) Jag är ju van att läsa GPS och se vart jag är på kartan. Då vet jag ju att vid nästa korsning ska jag ju svänga. Det blir ju lätt att se, eftersom jag vet vart jag är på kartan (34), Mer i

början, eftersom jag inte kan staden (...) Det var som att jag delade in det i sektioner - Jag ska ta mig till den här biten nu. Sen kanske jag behöver kolla igen (34), “Det gick bra, enkelt. Inga konstigheter. Väldigt van att gå med kartor (...) jag inte kollar så mycket efter gatunamn (...) jag kollade mobilen för att bekräfta, ‘okej, ett kvarter vänster, sväng här’ - mer för att bekräfta” (34), “Det gick okej. (…) Jag velade lite med att bara följa GPSen exakt eller köra lite genvägar. Så jag sneddade lite ibland, men för det mesta följde jag GPS:en (...) jag kollade på mobilen ganska ofta. Har jag den så kollar jag mycket – känns onödigt att testa ödet liksom.” (35), ”Jag brukar inte kolla så jättemycket på var själva linjerna går utan mer vilka avfarten och gator de vill att man ska vända vid. Och så letar jag efter de skyltarna” (35), ”Jag skulle säga att det var kanske 70 procent på GPSen och 30 procent på det jag såg.” (35), ”Det gick bra. Jag höll ett ganska raskt tempo. Det var lätt att följa vägen. Ibland blev jag lite distraherad, men då gick jag tillbaka rätt igen. (…) Jag följde GPS:en helt. Jag tittade främst på telefonen när jag skulle svänga, bara för att se om det var nästa eller nästnästa korsning.” (35), ”Det var inte så att jag kände mig vilse; i parken visade kartan att jag skulle gå upp och sedan ner igen, men jag kände att jag kunde avvika lite från rutten och ändå följa den.” (35), “Det tror jag att jag skulle kunna göra, utan problem. Utifrån där jag är nu så hade jag ju kunnat hitta till alla de här ställena igen.” (35), När man går med karta så är jag inte så uppmärksam vart jag är någonstans. Det var inte förrän egentligen framåt slutet som jag reagerade: ‘ah okej vi är tillbaka här'". (35) “Lite, inte för mycket. Jag tycker det är svårt att få en känsla för var stadskärnan är (...) Jag tror att jag skulle kunna gå samma rutt igen ganska bra.” (36), “Jag visste inte var jag var förrän i slutet när jag såg bio skylten - på den stora gatan där. Innan dess hade jag ingen aning om var jag var.” (36), “Jag tror att jag fick en känsla av att vi gick i en loop, inte bara i en riktning. Jag skulle nog kunna ta mig tillbaka, kanske med en tio minuters omväg.” (36), “Jag hade en ganska bra uppfattning om var jag var enligt telefonen. (…) Om jag såg en flygbild skulle jag ungefär kunna peka ut var jag gick, och var huvudvägen går.” (36), “Väldigt bra.” (36), “Lite osäker i parken - jag kollade inte GPS:en ordentligt på var jag skulle gå upp, så jag fortsatte gå. Inget mer än så.” (36), “Jag tror att jag fick en bra förståelse för området. Det är nyare arkitektur, ganska fyrkantig. Jag skulle nog kunna hitta samma rutt igen.” (36), “Jag tittar inte riktigt på människor när jag går, jag tittar runt istället. Jag hörde musik (...) och undrade vad de gjorde. Sedan såg jag H&M, sedan Scandic, det var där jag skulle svänga. När jag korsade bron första gången lade jag märke till de fina husen och bistron och tänkte: det där är ett trevligt ställe att äta på. I parken var det en möhippa. Senare, när jag korsade bron igen nära stadshuset, såg jag en väldigt fin vattenfalls-liknande sak. Stadshuset i sig var speciellt med sitt torn. Efter det lade jag märke till ett litet torg med någon slags sköld. Men när jag såg Filmstaden slutade jag lägga märke till saker, jag fokuserade bara på att ta mig dit.” (36-37), “Det där glashuset vid stadsparken stack ut, det låg exakt i linje med där man skulle svänga ner i parken. Väldigt tydligt.” (37), “Husen var fina med markiserna (...)” samtidigt som atmosfären betonades snarare än enskilda objekt: “Det var trevligt att gå i parken.

Det är en annan typ av miljö.” (37), “Inte nödvändigtvis något särskilt. Jag reagerade på broarna, och när parkområdet började; det kändes som att gå in i en ny miljö.” (37), “Ån stack ut. När jag kom fram till den tänkte jag: ‘okej, jag kommer nog behöva korsa tillbaka senare’ (...) Jag lade också märke till Turbinhuset som vi passerade.” (37), “När du sa att vi skulle rita det, kändes det verkligen svårt. Jag tänkte, hur ska jag komma ihåg? Man tänker inte på att minnas när man går. Jag blev lite nervös. Sedan började jag tänka — hur var det? Jag mindes musiken, H&M och Scandic. Sedan korsade jag bron och tyckte att husen var fina. Man minns mer när man pratar om det.” (37), “När man går tror man att man kommer ihåg hur det ser ut. Men när jag började rita blev jag osäker: ‘hur långt gick jag? Var svängde jag?’ Så jag försökte bara minnas olika platser. Jag började från stadsparken; jag mindes bandet, att vi svängde efter det, korsade en bro, och sedan gick tillbaka över en annan (...) Jag försökte minnas landmärken och fylla i luckorna däremellan.” (37-38), “Det gick bättre än jag trodde. Jag trodde verkligen att jag inte skulle kunna rita någonting, att pappret skulle förbli tomt. Men när jag väl började mindes jag lite. Jag vet att jag missade stora delar, men jag bestämde mig för att bara fortsätta så att jag hade något på pappret.” (38), “Jag skulle säga att jag har byggt upp en okej bild av själva rutten, men inte nödvändigtvis av var allting ligger. Jag har en allmän känsla av att den här gatan är ett shoppingområde, och om jag går åt det hållet når jag vattnet.” (38), “Det var svårt att återskapa. Jag fick med Troyes Garden och Domus, det var det jag mindes att vi passerade. Jag tror att jag var mer fokuserad på byggnaderna i sig, eftersom mitt examensarbete handlade om arkitektur. Jag fastnade vid byggnaderna snarare än vad som fanns i dem.” (38), “Jag kände mig avslappnad. Jag var nyfiken på att se hur staden ser ut, det är alltid roligt. Jag gillar att titta på söta och charmiga hus. Västerås kändes mysigt, med vattnet och allt. Jag kände mig inte stressad över att hitta. Det var lite stressigt att bli observerad, men det hör till.” (38), “(...) Bandet som spelade fick mig att tänka: ‘ah, det händer alltid sådana saker hemma i Stockholm’. Det gav en bekant känsla. Och stadsparken kändes väldigt lugn, väldigt behaglig.” (39), “Jag var mest fokuserad på att göra uppgiften rätt. Om jag hade gått fritt, (...) hade jag kanske tagit in mer. Men nu ville jag fokusera på uppgiften” (39), “Jag lade märke till krit-teckningarna på marken, och den stora byggnaden bakom dem. Och McDonald’s och Subway, dem registrerade jag.” (39), “Inget särskilt egentligen. Det jag reagerade på var att jag valde att avvika från den raka vägen. Jag tänkte: ‘om jag går rakt fram finns det inget att titta på, men om jag svänger vänster finns det butiker och mer att se’. Jag visste sedan tidigare att detta var shoppingområdet.” (39), “Det var mest intressant att vara i en del av Västerås som jag inte varit i tidigare. Det påminde mig om mitt gymnasieprojekt, och när jag kom till vattnet tänkte jag på Örebro. Det finns något liknande med det, men detta kändes lite mer charmigt.” (39), “Jag satte tummen på varje punkt, steg för steg. Det är främst gatunamnen som är viktiga för mig. Jag vill vara säker på att jag är på rätt gata. Det kan innebära att gå i motsatt riktning bara för att bekräfta gatunamnet. Jag följer inte bara instruktionerna blint; jag dubbelkollar.” (40), “Det gick bra. Det var

bara i början som jag inte var säker på vilken gata jag var på - det fanns ingen skylt förrän efter första korsningen. Min huvudsakliga strategi var att vara så effektiv som möjligt. Om jag visste att jag skulle svänga vänster längre fram höll jag mig på vänster sida av gatan, och vice versa." (40), "Jag var lite osäker i början. Jag förstod instruktionerna, men trodde att det skulle vara svårare. Det blev inte riktigt svårt förrän mot slutet när jag inte var säker på om jag hade passerat tre korsningar eller inte - det var där jag tvekade. Jag var striktare med pappret i början, men mot slutet sänkte jag det mer och tänkte 'jag kan det här nu.' Sedan insåg jag att jag var mindre uppmärksam och det blev svårare vid korsningarna." (40), "Det gick väldigt bra - fina torg, glada människor. I början fokuserade jag bara på att komma till rätt gata och följa instruktionerna så att jag inte skulle gå fel." (40), "Det gick väldigt bra. Den största utmaningen var i början, att lista ut vilken gata jag var på. Jag kunde inte se skylten först men hittade den efter tio meter. Efter det var navigeringen väldigt enkel. Min strategi var att läsa ett steg i taget istället för alla på en gång. Jag fokuserade på en instruktion, svängde, och kollade sedan nästa." (40-41), "Jag dubbelkollar hela tiden. (…) Det kan innebära att jag måste gå åt fel håll för att se gatunamnet." (41), "Ja, jag skulle kunna göra det. (…) Jag skulle få ut mycket mer av det andra gången. Då skulle man inte behöva fokusera på att följa instruktionerna utan kunna observera mer." (41), "Jag tror att jag hade en ganska bra uppfattning om var jag var i förhållande till var jag började. Jag känner inte till några landmärken i Västerås, så jag har inget sådant att navigera efter, men i relation till startpunkten tror jag att jag visste var jag var." (41), "Det var nog i slutet när jag var på väg tillbaka till Smedjegatan igen. Men det som räddade mig ett par gånger var gatunamnen, tror jag. Utan namnen hade det kunnat bli annorlunda, men när jag såg skylten var det tydligt - en bekräftelse på att jag var på rätt väg." (41), "Jag kände mig säker under hela rutten. Jag frågade en gång, bara för att vara säker på att jag inte var på fel torg eller gata. Jag ville bara dubbelkolla med en person eller ett par för att vara säker på att jag hade rätt. Det visade sig att jag gick åt rätt håll." (41), "Jag kände mig ganska säker. Jag menar, jag är inte bekant med området, men jag kände mig säker på att jag hade kunnat peka ut startpunkten från var jag än var." (41-42), "Jag korsade vattnet och där var en cool glasbyggnad, en bar med uteservering. Mysigt. Jag undrade vilket håll den låg åt och om den fick kvällssol. På andra sidan fanns en vacker tegelbyggnad, och mitt emot den gamla röda stugor. Det fanns också en staty vi passerade som såg ut som en skruv, som stack ut." (42), "Jag såg, jag minns inte var det var, men i bakgrunden fanns en stor, rund kupol, ganska hög, som stack upp (...) det var någonstans i slutet. Det fanns många parkbänkar och ett cykelställ som jag rörde vid. Där var parken, en lekplats. Stadshuset. Det var ett gym, vi såg människor som var klädda för träning som troligen var på väg dit." (42), "Den där brasseriet (...) precis efter ån. Den stack verkligen ut. Den låg väldigt fint. Och själva vattnet var asymmetriskt, vilket gjorde det lätt att veta vilken sida man var på, eftersom det på ena sidan fanns ett vattenfall, man hörde inget annat än det." (42), "Jag lade märke till Subway, troligen för att vi har det i Örebro. Man känner igen vissa saker. Jag lade också märke till de fina

byggnaderna vid vattnet. Stadshuset var coolt, även om det kändes lite som en institution, så jag undrade vad det var." (42), "Det var nog stadshuset som stack ut mest. Och sedan den där restaurangen vi passerade innan vi gick in i parken vid vattnet. Man kunde föreställa sig att sitta där på sommaren, ta en drink, titta på ån och stadshuset. Det kändes som en fin plats." (43), "Det verkade trevligt. Det fanns olika grusgångar man kunde ta. Det påminde mig lite om stadsparken i Örebro. Och sedan skulle jag säga torget - jag minns inte namnet, men det var ganska stort. Det kändes som en samlingsplats, kanske för evenemang eller aktiviteter. Det kändes väldigt behagligt, med en fontän där. Det verkade som en bra central plats för Västerås och en trevlig mötesplats." (43), "På höger sida fanns ett rosa hus, jag minns inte exakt vad det var. Och precis där man skulle svänga vänster fanns en brasserie (...) vi kom in i en park med gröna ytor. Det fanns en lekplats som såg extrautrustad ut. Jag lade märke till att det fanns en å till vänster. Det var trevligt." (43), "Sedan lade jag märke till teatern på höger sida lite längre upp. Stadshuset, väldigt högt, verkade ganska nytt. Västerås-skylten var grå och såg ny ut också. Det fanns en hög pelare med en gyllene tjur ovanpå. När man tittade tillbaka mot den första bron var utsikten vacker med bron och det rosa huset bakom. Den delen såg verkligen fin ut. Senare passerade vi garage och uppfarter, en mindre intressant gata - det kändes inte som ett turistområde." (43), "Det är verkligen svårt. Jag vet vad jag såg när jag gick, men jag tappade bort mig lite vid korsningarna - hur många svängar det var och vilken gata jag var på. Vi passerade så mycket. Jag vet att det fanns en biltvätt eller ett garage som vi passerade, så jag tror att jag placerade det ganska korrekt på kartan. Om jag gick det en gång till skulle jag definitivt känna igen och minnas ännu mer." (44), "Ja, jag tror att jag fick till det. Jag är ganska säker på att jag fick alla svängar rätt. Det är inte i skala, men instruktionsmässigt tror jag att jag fångade allt — och de minnesvärda detaljerna jag kom ihåg från rutten." (44), "Jag trodde att det inte skulle vara så svårt när du sa det. Jag märkte att början var svårare. Slutet mindes jag - tre gator, jag svängde vid ån och stadshuset. Men i början tror jag inte att det är helt korrekt. Jag mindes Smedjegatan och att vi korsade kanske två korsningar, men det var där det blev svårt, så jag gissade." (44), "Bra. Jag är inte så bra på att rita, men jag försökte rita ut gatorna ordentligt. Gatorna var väldigt tydliga, de korsade inte varandra så mycket, vilket gjorde det lättare att skissa. Jag kunde följa gatorna, sedan ritade jag stadshuset, torgen och det jag mindes." (44), "Ja, jag tycker att rutten var bra. Det som stack ut är det jag ritade. Till exempel i början där vi svängde vänster: där fanns en gågata rakt fram, med uteserveringar. Sedan kändes nästa gata mer som en transportsträcka, inget särskilt. Sedan svängde vi höger in på en större väg, 'Stora gatan'. När vi kom till bron lade jag märke till det öppna rummet, (...) vi svängde vänster in i parken. Det fanns en å till vänster (...). Jag lade märke till teatern på höger sida lite längre upp, sedan korsade vi bron igen. Strömmen var starkare där, uppdelad i två delar. Sedan stadshuset (...), Västerås-skylten i grått och en gyllene tjurstaty på en pelare. Det fanns en park där folk satt och drack öl. När man tittade tillbaka mot den första bron var utsikten vacker. Sedan gick vi mot ett område med

garage, uppfarter och mindre intressanta gator. När vi kom till sista svängen kände jag att vi var nära målet, så jag slutade tänka så mycket på det. Överlag en trevlig rutt med mycket att se." (44-45), "(...) tegelbyggnaderna. Det finns så många vackra tegelbyggnader i England, och det fanns ganska många här som jag kommenterade under promenaden, och även några lite sneda hus som jag förknippar med äldre arkitektur. Det påminde mig faktiskt lite om England. Jag var där så sent som förra veckan och reste runt, och där finns så mycket historia och gamla byggnader… Det var ganska spännande; vi passerade stadshuset med sin granitfasad—en stor, vacker byggnad. Och det lilla brohuset var också intressant, ett litet kvadratiskt. Jag är inte säker på hur mycket det används idag, men det var något annorlunda." (45), "Jag tror att jag gjorde det, ja—jag gick lite åt höger för att titta på de där husen längs vattnet istället för att svänga vänster vid glasbyggnaden." (45), "Det var skönt att inte slaviskt följa en GPS-rutt: 'sväng här, sväng där.' Man tänker mer själv då. Den här gången var det mer som 'jag svänger någonstans där borta', så jag kunde titta runt mer - på skyltfönster, på människor som cyklade förbi. Sådant." (45), "Vi går ofta på bio, så för mig blev det som en plats jag kunde tänka mig att komma tillbaka till. Det kändes trevligt och intressant. Ån fångade min uppmärksamhet; jag tänkte att jag skulle vilja gå längre ner mot det jag antog var gamla stan. Och att se Subway väckte minnen av en av mina vänner som jobbade där när vi gick i gymnasiet. Så det väckte både en känsla av nostalgi och nyfikenhet samtidigt." (45), "Jag tycker att hela staden kändes lite som min hemstad. Stadskärnan var ganska lik med många restauranger, butiker och torg, så det kändes faktiskt lite som Örebro (...) det kändes trevligt och fint." (45), "Stadshuset påminde mig till och med om Stockholms stadshus, fast i en annan färg. Teatern påminde mig lite om den i Örebro. Jag lade också märke till den gyllene tjurstatyn - den fick mig att tänka på den i Milano, där man rör vid den för tur. Det fanns en fin utsikt mot det rosa huset och den första bron, det kändes mysigt som en plats att sitta på. Det fanns också en fontän som påminde mig om en i Bryssel, med ett litet barn och vattenstrålar. Hela området vid vattnet och Brasseriet var den mest intressanta delen. Det hade öppna torg, gröna ytor och mer liv än ån i Örebro. Det kändes mer naturligt, nästan vilt. Det fick mig till och med att tänka på kajakpaddling." (45).