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Wayfinding, Public Art, Contextualization, and Communicating Neighborhood Identities: An Introduction

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INTRODUCTION

As is the nature of an interdisciplinary academic journal, this issue of the *Interdisciplinary Journal of Signage and Wayfinding* again presents a range of scholarly work reflecting IJSW's disciplinary breadth and the different approaches of scholars to both signage and wayfinding research. The title of this issue, "Wayfinding, Public Art, Contextualization, and Communicating Neighborhood Identities," conveys a number of important but seemingly disparate research topics that on closer inspection show a surprising degree of overlap.

Perhaps the strongest overlaps exist between two articles on the increasingly common use of smartphone mapping technology for wayfinding, both reporting on studies to gauge its use, and its potential advantages and disadvantages. Ferri, Popp, and Wulfhorst in "Digital Directions: Smartphone Usage while Performing Wayfinding Tasks in Munich's Public Transit System" document the challenges of wayfinding in spatially complex public transit environments, and the unique navigational challenges presented. Issues such as transfers, delays, barriers, and user capacity all influence the usability of a system. Clearly how we navigate through these systems and interact with the surrounding environment has changed as a result of the ubiquitous presence of smartphones, providing a spatial-temporal strategy "that removes the reliance on our immediate environment and personalizes the wayfinding process" (p. 7), unlike using signs, maps, and transit schedules. Based on how travelers navigate the public transit system in a large city, the study found smartphone apps have replaced signs as source of directions, especially for confirmation during navigation. In a closely related study, Vaez, Burke, and Yu, in "Understanding the Effects of Urban Form and Navigational Aids on Wayfinding Behavior and Spatial Cognition" ask if navigators "can simply follow the

represented route on their smartphone to get to their desired destination, is there any need for signage and urban legibility?" (p. 22). Their three-group research design showed subjects using signage and urban form clues without "personal navigational aids" (i. e. paper maps or smartphones) had better landmark recognition than the paper map users, but the paper map users performed best on route accuracy and street-naming tests. The smartphone users score in-between the other two groups, in terms of acquired spatial knowledge.

Three other contributions to this issue, while seemingly focused on very different signage and placemaking issues, emerge to have significant overlap in terms of the implications and applications of the work for design and use of visual communication. Ellen Babcock's "Intersection: Road Signs and Public Art" documents in words and images how the opportunistic conversion of derelict signs along major streets and highways to highly visible and meaningful public art works provides an opportunity for placemaking and community renewal. Babcock notes that "many mid-century road signs … that remain in their original locations, still widely visible and accessible, offer unique opportunities as sites for public art because of their combination of changing and unchanging features" (p. 41). Babcock argues that the "already spatially and temporally contextualized sites of road signs as places for public art offer a model that is not neutral because most viewers assume that a sign is meant to directly communicate to a broad, moving public, and that the content is likely to be about wayfinding, products and services, or public service messaging" (p. 42). She goes on to highlight what some will interpret as the democratizing and social capital building potential of the conversion of abandon signs to public art, noting that "art in a sign is not detaching itself from everyday activities, it elbows itself into an often-crowded field of text and images in an adamantly not-white-cube, non-elite space" (p. 42).

In their field report, "Exploring Vernacular Signage Along America's Legacy Roadscapes," Auffrey and Hildebrandt explore the impact of vernacular signage design (especially when integrated with vernacular building architecture) and the importance of how signs respond to the natural, built and socio-cultural environments in which they are placed, and how they ultimately contribute to the creation and modification of that context. They argue that "the context in which a sign is displayed and viewed, reflecting the surrounding natural, built, and socio-cultural environments in which a sign is located, is equally important is essential for how well a sign is able to perform perform its intended function" (p. 47). Like Babcock's view of the potential of well-placed public art, Auffrey and Hildebrandt see the potential for well-done vernacular signage, to a greater extent than conventional signage following standardized designs, to contribute to the positive image of a business or organization, as well as the area in which it is located. As such, they argue that then explicit consideration of contextual sign design and placement is critically important"for understanding how past, present, and future signs have

and will serve to orient, inform, persuade, and regulate" (p. 48).

In the third contribution focused on context and placemaking issues, Mehta and Rahman describe in Visualizing and Communicating Neighborhood Identities their work on understanding, visualizing, and communicating neighborhood identities. Like the work of Babcock, and Auffrey and Hildebrandt, but to a greater extent with urban and graphic designers' eyes, Mehta and Rahman recognize that "Place quality, sense of place, and authenticity are sensory, psychological, and social constructs that are perceptible in forms, activities, and meanings of places" (p. 55). As they go on to note, "Much of this is visible in the material culture of places—in the architecture, art, public spaces, show windows, signage, artifacts in public spaces, as well as those that are in private space but visible to the public, and more" (p. 55). Given this foundation, Mehta and Rahman use a design perspective to communicate a sense of place and distinct quality for each of the neighborhoods in Cincinnati. They use qualitative and quantitative approaches to define a set of consistent elements that are then used to generate a single postcard for each neighborhood to represent each of the 52 neighborhoods of the city. The cards are intended to "comparatively present the individual identities of each neighborhood along with a collective identity for the city" (p. 55).

Finally, this issue concludes with a book review by Kyle Katz of Amanda Gluibizzi's 2021 book, Art and Design in 1960s New York, that "explores the intersectionality of art, design, advertising, and signage during the period of great social unrest" (p. 63). Katz notes the turmoil and transformation of the period, and "It is within this context, a city in crisis, that Gluibizzi examines the ways in which artists began to incorporate elements of the city, its design, its civic and commercial signage, into their art" (p. 63). Those interested in the history of cities and art, and the ways in which they influence each other, will enjoy the review.

Digital Directions: Smartphone Usage while Performing Wayfinding Tasks in Munich's Public Transit System

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Abstract /

Wayfinding in spatially complex public transit environments poses unique navigational challenges. Transfers, delays, barriers, and user capacity all influence the usability of a system. Because of the smart phone, how we navigate through these systems, and interact with the surrounding environment is changing. The smartphone provides a spatio-temporal strategy that removes the reliance on our immediate environment and personalizes the wayfinding process — unlike that of transit schedules, signs, and maps. How does smartphone usage influence performance and the wayfinding experience? This paper looks at smartphone usage of twelve participants through a shadowed commented walk, known as a Destination-Task Investigation, in Munich's public transit system. The study provides insights into the role and the influence of smartphones during the wayfinding process. Furthermore, it shows that apps providing integrated spatio-temporal information, such as Google, were used most frequently, especially for confirmation during navigation.

Keywords /

Smartphone Technologies; Public Transit; Wayfinding

INTRODUCTION

The ubiquity of mobile and communication devices today is a result of a rapid societal adoption of new technology over the last few decades. Part of this acceptance of new technologies includes the success story of the smartphone and its advanced level of communication and geo-positioning capabilities on a higher resolution and interactive display (Boulos, et al., 2011; Fullwood, et al., 2017; Perrin, 2017; Melumad, et al., 2019). As smartphones gained popularity, so did the way they infiltrated the many aspects of everyday life — including the way we navigate, particularly focusing on helping us in environments that are unknown, by customizing wayfinding (Schwering, et al., 2017; Melumad & Pham, 2020). This customization can either aid a user, by presenting a concise route and clearly labeled connections, or hinder a user by producing contradictory information compared to their physical surroundings. For example, a smartphone provides a user with navigational options through applications, or apps. These apps are either third-party entities with their own strategic goals, or apps directly controlled by local transit authorities and not always able to capture all scheduling delays, nor provide all different transfer options to the user (Bian, et al., 2021). Quite often the information provided contradicts and/or overlaps with other sources of information provided by other apps or websites, leading to fragmented and incoherent provision of navigation information. This, in turn, results in the user having conflicting advice during their transit experience.

For a quickly growing portion of the population, the wayfinding process now incorporates the use of smartphones. In Germany, like many other Western nations, over the last decade, the smartphone has become more com-

monplace, as ownership levels have been trending upward and nearing 60% of the total German population by 2019 (VuMa, 2019). With the emergence of extensive availability of WiFi and GPS technologies in public spaces, the opportunity to use one's smartphone has become convenient, and in many cases, more preferred than using one's physical surroundings during navigation.

Wayfinding is a purpose-filled action that includes both a *'decision-making'* and *'decision-execution'* process in order to get to a chosen location (Arthur & Passini, 1992; McDonald & Pellegrino, 1993; Allen, 1999). When individuals are in an unfamiliar environment and wish to better understand their physical positioning, they formulate a navigational plan using their surroundings while moving through the environment. *Wayfinding* can be further understood as the cognitive ability to sense the space one is in, and problem solve to get to one's destination. When viewed through the lens of goal-making and goal-achieving, the success of wayfinding depends on whether the spatial and temporal limitations are met by the individual doing the navigating (Arthur & Pasini, 1992).

The wayfinding process in public transit environments is a spatio-temporal activity with a particular emphasis on the temporal component compared to other forms of wayfinding due to the heavy reliance of transit schedules and timing (Dziekan, 2003; Woyciechowicz & Shliselberg, 2005). The process can be broken into three crucial wayfinding practices: *Preparation*, *Confirmation*, and *Adjustment*, which are stages experienced in one's personal wayfinding (Denis, 1997; Timpf, 2006).

A smartphone provides individuals with both spatial and temporal solutions. Instead of relying on their immediate surroundings, with help from a smartphone, an individual can tailor and personalize their wayfinding experience in public transit. The smartphone has become like a digital "*Swiss Army Knife*" for wayfinding – allowing users to manipulate their wayfinding experiences unlike that of a paper based map and schedule, as it provides users with a dynamic interface, and instantaneous spatio-temporal alternatives (Brakewood, et al., 2014; Melumad, et al., 2019; Bian, et al., 2021).

The readiness of smartphones and their ability to access a wide range of navigational information allows individuals to perform wayfinding tasks using a surplus of information outside of their physical environment. On one hand, this allows for the ability to customize one's wayfinding. On the other hand, competing ontologies increase the complexity of navigational options and conflicting informational intake (Timpf, 2002; Richter et al., 2010). From this, our understanding of expected wayfinding behavior in public transit begins to shift, as the aspect of a step-by-step navigational route summary provided by the smartphone becomes used as a personalized and fragmentary path selection strategy by the user.

Smartphone technologies in wayfinding have only recently been studied. Bian et al. (2021) provide one of the first systematic literature reviews of existing smartphone transit app research, where they also indicate that more comparative research surrounding the difference between private and public app services is needed. Reilly et al. (2009) approach the topic of shared mobile devices in wayfinding situations – the focus being on social interactions and group navigation with mobile technologies. Several other studies have shown that mobile technologies have shaped the way individuals approach and behave in public transit. For example, Line et al. (2011) point out the significance of how quickly mobile technologies have integrated into daily life, including wayfinding experiences. They further explain how mobile technologies help users to better understand and navigate the uncertainties of public transit by contributing to a *'time-space co-ordination',* further emphasizing the spatio-temporal aspects of wayfinding, (Gollege, 1999; Golledge, et al., 2000; Montello, 2005; Timpf, 2006). This time-space coordination plays an essential role for wayfinding to be successful and for the user to reach their destination goal. The inclusion of smartphone usage in the wayfinding process further adds to the certainty of an individual's time-space coordination, while the complexity of combining the ontologies of both virtual and physical worlds increases uncertainty of their personal process as users struggle to switch between the two worlds (Timpf, 2002; Willis, 2005; Waters & Winter, 2011). Münzer discusses the shortfalls of mobile and computer based navigational systems versus map-based navigation and the implications this has on spatial learning (Münzer et al. 2006; Münzer, et al. 2012). The combination of research about both human wayfinding and

public transit is relatively niche, with works such as Fontaine and Denis (1999) looking at route descriptions, and Rüetschi and Timpf (2004) who discuss the description of network (public transit network) and scene space (nodal environments, such as stations and platforms, found within public transit systems), that have formed notable contributions to the state of the art. The addition of smartphone technologies to the niche field of public transit wayfinding systems adds another layer of intricacy, but also helps to connect the two research fields by focusing on an increasingly important aspect of both human wayfinding and public transit design – the smartphone. The 'smartphone usage' in this paper refers to the multitude of functions, including apps, a smartphone provides a user during wayfinding.

The explorative study presented in this paper addresses the gap in literature surrounding smartphone usage in transit wayfinding by observing users' wayfinding experiences. Its main goal is to better understand spatio-temporal changes in the wayfinding process related to customization of wayfinding information by smartphones, and provides implications for how much of a role the smartphone, and subsequent navigational apps, play in human thought process and decision-making. The paper focuses on the individual user experience during the wayfinding journey, as a positive user experience is a central aspect of public transit system mobility.

The Setting

With 1.3 million people, Munich is Germany's third largest city. Its public transit network is made up of two partner transit authorities; the local transit authority (the MVG), and the national Deutsche Bahn (DB) services. Both authorities share some stations and hubs, and transit options occasionally overlap. The entire system is extensive with over 95 km of underground lines, 79 km of tram tracks, and a bus network of 467 km, serving over 1.5 million rides per day (MVG, 2015). In 2015, the MVG surveyed residents' usage of the public transit network and reported that 67% of residents are regular users of U-Bahn, bus, and/or tram at least once a week, and 38% of residents claimed to use the multi-modal network daily. The MVG found that there were over 566 million passengers on public transit in 2015 alone (MVG, 2016).

A third player in the Munich public transport system is the Münchner Verkehrs- und Tarifverbund (MVV), the overarching tariff association integrating MVG and DB services. All three authorities provide wayfinding information which results in overlapping wayfinding systems. With its multitude of transit options and indoor-outdoor transfers, the Munich public transit system provides an optimal location to observe individuals navigating through complex wayfinding situations, and can shed light on underlying theories in wayfinding design and cognitive engineering.

METHOD

We used qualitative mobile interviewing technology that was able to capture the wayfinding process and practices of individual participants. Mobile interviewing techniques, such as commented walks and participant shadowing, have gained importance with the shift to studying mobility in the social sciences (Sheller and Urry 2006; Büscher and Urry 2009). These methods allow for a participant-centered approach (e.g. Levy 2001 (for main station wayfinding); Holscher, et al. 2007; Kazig & Popp 2012 (for inner-city and main station wayfinding); Meissonier & Dejoux, 2016). They elicit real-life qualitative empirical insights about how users perceive, process, and interact with smartphones in the wayfinding process. Drawing examples of this paradigm, a special Destination Task Investigation (DTI) was developed for the project consisting of two parts:

i. Destination-Task Investigation (*a shadowed commented-walk, and observation of wayfinding behavior of participants while they navigate through the transit system*); *and*

ii. A subsequent interview based on a Cognitive Map (*self-reflection drawing by the participant of the wayfinding experience (Lynch, 1960)*).

Additionally, a short, guided introductory interview was employed at the beginning of the DTI to understand how the participant prepared for the DTI, their use of the public transit system, and their opinions towards public transit in general. This information was important during the

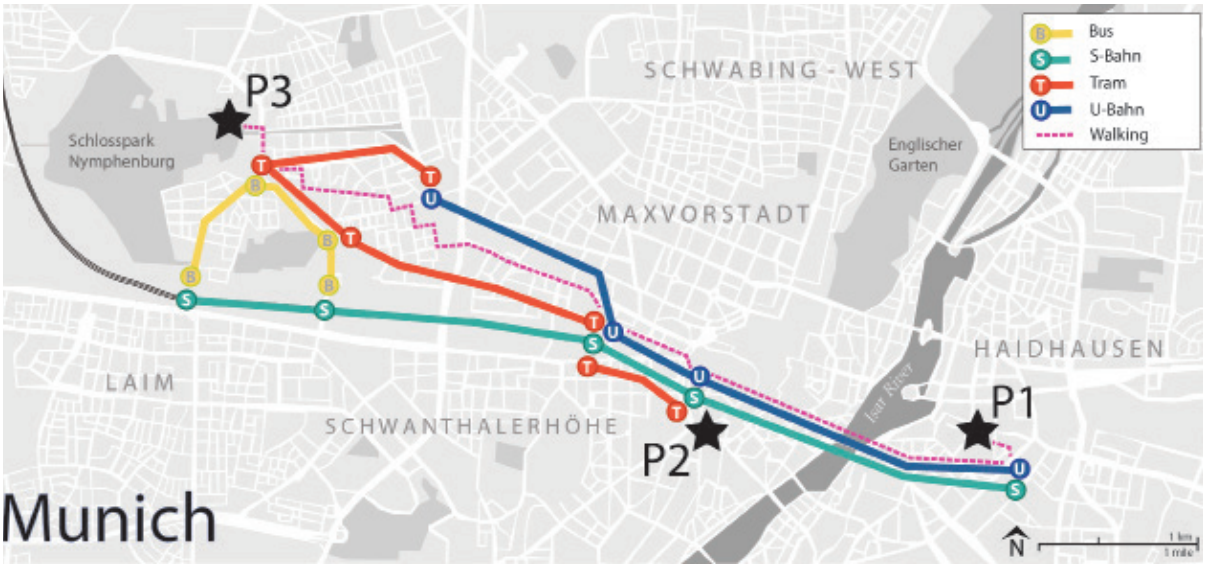

Figure 1 /

The route (including P1, P2, and P3) and mode options participants had during the DTI

interpretation process as it enabled us to better understand the behavior and navigational choices of the participants during the DTI experience. The structure of the DTI made it possible to investigate the first-hand transit experience of participants in transit hubs, transfer stations, and so called 'scene spaces' (Rüetschi and Timpf, 2004), and helped to shed light on participant smartphone reliance and behavior.

Destination-Task Investigation

The study consisted of twelve participants (seven men and five women) between the ages of 25 and 45, all of whom have lived in the Munich region at least one year. Participants were selected on the basis of being familiar with Munich's transit sytem. All participants had used Munich public transit before. Some participants were already familiar with the destinations in the DTI, but, as the focus of this study was on public transport usage in everyday mobility, this was not a significant issue. Furthermore, due to the scope of the study, newcomers and tourists were not included. Additionally, all participants had an advanced knowledge of English as the DTI and interviews were conduced in English. Some homogeneity within the study group was established through this decision, which was appropriate given the scope of the study. Data collection was carried out between June 2019 and January 2020. Participants were selected through recommendations of colleagues. As all participants were tasked with finding the same pre-determined destinations, this helped guarantee the researcher was able to observe the participant experience through multiple mode changes. The DTI route [Figure 1], began in the eastern part of Munich (Haidhausen– P1), and took participants 9.1 km (5.65mi), to the western side of the city (Nymphenburg-Neuhausen – P3), with a mid-point at a transit hub, near the city's center (Karlsplatz/Stachus – P2).

The origin-destination locations were chosen due to their distance from one another, with the intention that an individual cannot travel to these locations directly and must transfer between modes to get there. The mid-point stop was added as a safeguard, to guarantee to the researcher a transfer would occur during the DTI.

The researcher sent the participants the meeting point and destination information 24 hours before the DTI started, to reflect more authentically real-life mobility preparation from the participant. Figure 2 gives an overview about the participants and their individual background.

Participant	Age/ Gender Identity	Public Transit Frequency	Frequented Modes	Preferred Mode	Preferred Navigation Tool	Prepared for DTI	Familiar with Route
Lita	29, F	Daily	U S B	S-Bahn	S X	Yes	No
Samuel	33, M	Daily	S T	S-Bahn	S	Yes	Yes
Marek	35, M	Monthly	B T	U-Bahn	L S X	No	No
Tobias	33, M	Daily	U S B	U-Bahn	M S	No	Yes
Amy	30, F	Daily	U S B T	Tram	I S	No	Yes
William	43, M	Daily	U B	Tram	S	Yes	No
Trevor	32, M	Monthly	U S	U-Bahn	M S X	No	No
Felix	29, M	Daily	U S B T	S-Bahn	S	No	Yes
Mina	31, F	Weekly	U B	Tram	S	Yes	Yes
Serena	31, F	Daily	U B	U-Bahn	L M S X	No	No
Raye	32, F	Seasonally	U	Tram	I L M	Yes	No
Simon	28, M	Daily	U B	None	I S	Yes	No
	M=Male F=Female		U=U-Bahn S=S-Bahn B=Bus T=Tram		I=Intuition/Feeling L=Landmarks M=Maps S=Smartphone X=Signs/Arrows		

Figure 2 /

Participant Overview

After the introductory interview, participants were set up with recording equipment (both audio and video) for their DTI. Participants were instructed that they could use any form of help or assistance during the DTI. Emphasis was made that they were to do what they would normally see fit for navigating through the public transit network. For example, if they felt they wanted to ask for directions, look at a map, or use their smartphone, then they were encouraged to do so. Participants were to make their own navigational decisions with no interference from the researcher—accepting the fact that the presence of the researcher in itself brings along some interference. A main principle of the commented walks is that they are not so much organized by questions as by settings. This means that participants were asked to think aloud during the task: to speak about everything they perceive, decide, or do. The main objective of the researcher was to encourage spontaneous comments on the wayfinding process, but maintain no influence over a participant's decisions. The researcher would interject with questions when he felt he needed a better understanding of a certain navigational decision, but only when said question would not interfere with the participant's process. The shadowing allowed the researcher to observe a participant's immediate experience, which permitted the observation of performance and behavioral outcomes. This revealed further details of the wayfinding experience that would otherwise be overlooked through survey and questionnaires (Thibaud 2004; Popp 2018).

At the mid-point destination, seven of the participants were given a "rush factor" (for getting from P2-P3) from the researcher, stating there was a hypothetical individual impatiently waiting for them at P3. This rush factor was given to spot behavioral differences in participants in comparison with those who were not given any form of time pressure. At the end of the trip, both the participant and the researcher sat down at a local café and completed the subsequent interview and cognitive map portion of the investigation. Each DTI plus introductory interview lasted between 40 and 120 minutes.

The subsequent interview and cognitive map portion took another 15 to 30 minutes. All interviews took place during day time and with no rain – to further foster comparability of the trips.

Subsequent Cognitive Map Based Interview

While the DTI itself captured the immediate wayfinding experience and practices in situ for the journey, the perspective was changed in the subsequent interview. Here, a reflexive analysis of the journey was undertaken. The interview took place at a local café at the DTI end destination. The café was chosen for its casual and relaxed atmosphere – as the intention was to remove the participant from the DTI activity. Participants were asked to draw their experiences, as a cognitive map and to mark each section of their drawing with green, yellow, or red to indicate positive, neutral, or negative wayfinding experiences in the corresponding section of their drawing. The intention behind expressing their experience through drawing was to allow for an exploration of emotions and communication (Reason, 2010). Building on these drawings, participants were asked to verbally communicate to the researcher their wayfinding experiences out loud, and in as much detail as they could remember, to reflect on their actions during the journey.

Data Collection and Analysis

After completion of the DTI and the subsequent interview, all verbal materials were transcribed verbatim and coded for analysis using MAXQDA. For the coding scheme, the division of the wayfinding process practices of Preparation, Confirmation, and Adjustment were used to organize the protocols. The data was visualized through a modified Customer-Journey Map (CJM) by the researcher, which allows for a general overview and summary of a participant's journey (Bucolo & Matthews, 2011; Van Lierop et el., 2019). Observational notes were also taken by the researcher during and after the DTI. Interpretation of the modified CJM was based on coded transcripts, audio and video recordings, cognitive maps, and the documentation of observational findings. Specific participant experiences elicited through the study are organized along basic wayfinding practices of *Preparation, Confirmation, and Adjustment.*

RESULTS

Overview

Four transit modes (U-Bahn, S-Bahn, Bus, and Tram) were used during the DTI where most participants used between two or three modes [Figure 3]. For the first section of the DTI (P1-P2) participants were able to travel by S- or U-Bahn as the other options provided only indirect connections, which was considered too inconvenient by the participants. For the second section of the DTI (P2-P3), participants had access to more mode options and were also able to combine modes to reach P3.

Although not required for the study, all participants owned and brought their smartphone with them. In 11 of the 12 of the DTI journeys, the smartphone had influence in how a mode or route was chosen. The smartphone was an important navigational tool, as all 12 participants referred to it during their journeys. Between the 12 participants, there were 195 verbal indications

Participant	Mode Choice *(P1-P2)*	Rush	Mode Choices *(P2-P3)*		
Lita	S-Bahn		Tram		
Samuel	S-Bahn		Tram		
Marek	S-Bahn		Tram		
Tobias	S-Bahn		Tram		
Amy	S-Bahn		S-Bahn	Bus	
William	S-Bahn		S-Bahn	Bus	
Trevor	S-Bahn		S-Bahn	Bus	
Felix	S-Bahn		S-Bahn	Bus	
Mina	U-Bahn		S-Bahn	Bus	
Serena	U-Bahn		S-Bahn	Bus	Tram
Raye	U-Bahn		Tram		
Simon	U-Bahn		Tram		

Figure 3 /

DTI Mode choice for sections P1-P2 and P2-P3. Participants highlighted in gray experienced a rush factor during their DTI

Participant	Preparation	Confirmation	Adjustment	Total Smartphone Usage
Lita	2	5	3	10
Samuel	1	1	1	3
Marek	1	0	0	1
Tobias	1	0	1	2
Amy	0	0	0	0
William	1	3	2	6
Trevor	2	4	1	7
Felix	0	1	1	2
Mina	2	6	3	11
Serena	2	11	5	18
Raye	1	7	2	10
Simon	2	1	0	3
Total	15	39	19	73

Figure 4 /

DTI smartphone indications and usage per participant, including the usage breakdown based on type of wayfinding strategy

of smartphone usage, and 73 smartphone usage events during the DTI. The analysis of the data indicated that smartphone usage occurred during *Preparation, Confirmation, and Adjustment* practices of the wayfinding process. Of those smartphone usage events, 15 fell into the Preparation category, 39 into Confirmation, and 19 into Adjustment [Figure 4]. The results help to reinforce the idea that Confirmation is a very important step in the wayfinding process. This reiterates the findings of Denis (1997), Allen (2000), and Schwering, et al. (2017).

Smartphone as a Comfort

Participants were more likely to use their smartphone as a navigational aid due to higher levels of stress, uncertainty, confusion, or perceived complexity during the DTI which often took place in the *Confirmation* and *Adjustment* practices. For example, a participant may enter an unfamiliar corridor and indicate they feel lost or stressed, they then use their smartphone to help pacify and get them out of that particular situation, regardless if the smartphone was able to provide such detailed navigational information. If a participant struggled to find navigational information in their physical surrounds, they knew they were still able to access route details through their smartphones, helping to appease any navigational stress. This was also discussed by Brakewood et al. (2014) and Melumad & Pham (2020) who found that users have a tendency to gravitate towards their smartphones over any other form of technology to find comfort in stressful situations.

Smartphone Mobility Culture

Every participant referred to their smartphone as a form of navigational or wayfinding aid at some point during their DTI which underscores the role of the smartphones for transit wayfinding situations, regardless of signage given throughout the system. Smartphones provide a customized wayfinding approach for participants, which felt benefitted their navigational experiences. Customization includes GPS guidance, route calculations, updated schedules, and mode/connection options. Participants indicated they prefer the smartphone in transit wayfinding situations over any other navigational tool, due to their ability to provide instantaneous information and that they themselves are familiar with their own smartphones, therefore know where and how to request information quickly. A user's preference to customizability and preference to use their own smartphone device

was also found by Kaplan et al. (2017), Melumad et al. (2019), and Melumad & Pham (2020).

How participants used their smartphones depended on their individual need. For many it provided a spatial locator which helped them navigate through unknown environments. For example, many participants utilized the GPS maps and compass apps on their device, or accessed navigational apps, such as: Google Maps, and Apple Maps, or alternative navigational map apps, like Maps.me, and Citymapper. For others, local transit authority apps, including the MVG Transit App, MVV Transit App, and the DB Transit App provided participants with a temporal strategy through both timetables, delays, and real-time transit arrivals. The usage of the app type varied between participants according to their needs, as each app provided participants with different navigational tools for different aspects of their journeys. The preferred app by participants in the three wayfinding process practices was by far Google. Apps such as the local transit authorities (MVG, MVV, and DB), were mentioned as useful by participants, but when put into practice were not used as much as Google. The reasoning behind this may be due to Google's dynamic platform (both static and real-time data) which allows a user to plan their route through both spatial and temporal functions which leads to increased flexibility and a wider scope of route options for the user. The local authority apps provide a more limited approach, which typically only allows users to plan for routes through a temporal lens of wayfinding. In contrast, alternative app choices, such as Maps.Me, provide more spatial and location focused services, often leaving out temporal transit information. This shows that multi-functionality of the smartphone in terms of *time-space coordination*, and the ability to personalize wayfinding and aid in decision making, was a positive benefit for participants through the DTI. Smartphones have become vital for many individuals in terms of their time-space-coordination and increased ability to personalize one's public transit experience (see also Line et al. (2011); Kaplan et al. (2017); Narimoto et al. (2018); Melumad & Pham, (2020); and Bian et al. (2021).

Overall Infiltration of the Smartphone into Everyday Wayfinding

How participants navigated in public transit also reflected a high degree of infiltration of smartphone culture into everyday life or even a dependence on the smartphone. The language used by all participants, regardless of active smartphone usage, continuously held reference to the smartphone. Overall, participants gave verbal indication of their smartphones 195 times during the DTI, ranging from 7 times (Marek), to 36 times (Serena). When mentioning their smartphones, participants would refer to it as an information guide, such as: *"I'll ask for an update,"* or referring to the smartphone as an assessment of their own wayfinding behavior, e.g. *"If I look at my phone, it'll tell me I'm wrong,"* or as a type of foreshadowing, *"I feel like Google probably wouldn't do it this way."* Additionally, the smartphone played both positive and negative emotional roles in participants' experiences. Positively, it was able to offer a sense of reliability to a participant and contributed to an increase in a participants' positive emotions by providing navigational solutions. In contrast, when there was no data or WIFI available, or when the smartphone battery was low, this contributed to negative emotional experiences for several participants which resulted in increased negative emotions throughout their DTI journeys. This type of language and user behavior further demonstrates a shift in navigational and wayfinding culture, and emphasizes the ubiquity and reliance of mobile technologies in public transit as also reported by Line et al. (2011), Brakewood et al. (2014), Kaplan et al. (2017), and Narimoto et al. (2018), and further reported by Melumad & Pham (2020) as a general phenomenon in society.

Spatio-temporal Strategies of Smartphone Usage in the Wayfinding Process

Spatio-temporal strategies involving the smartphone during the DTI were found in the three wayfinding practices, *Preparation, Confirmation, and Adjustment.*

(a) Preparation

Preparation is the strategy-building, or "ground work", participants have done on their smartphone immediately *before* they commence their journey (Denis,

1997; Timpf, 2006; Padgitt & Hund, 2012). This particular phase of wayfinding is an important one, as it sets the tone for the remainder of the journey by lining the participant up with route landmarks and milestones – helping the participant to create a cognitive map of their route and increasing the legibility of their surroundings (Lynch, 1960). The smartphone is beneficial in this case, as it provides an easily accessible, handheld plan based on a familiar platform for the individual.

During the DTI, 10 of the 12 participants used their smartphone for preparing their route to both P2 and P3 (participants Amy and Felix did not find the need to use preparation as they both were very familiar with the chosen route) [Figure 5].

Participants who were less familiar with the area chose to use spatial guidance features (like a GPS map) to help them navigate towards the destination. In contrast participants who were more familiar with the area often chose a temporal guidance feature (like a transit schedule) to get them to the destination, as they could mentally visualize the route, and used the temporal guidance to gauge the distance and speed of walking. Overall, participants preferred a macro-overview of their journey in order to prepare mainly using Google. This was due to its ability to combine both spatial and temporal factors into a single visualization. Having both spatial and temporal features of a journey highlighted allowed the participants to feel greater autonomy to personalize their route choices, and the ability to factor in any personal preference in mobility. The importance of user preference in smartphone personalization during navigation was previously discussed by Shaheen et al. (2016), Kaplan et al. (2017); and Narimoto et al. (2018).

Participant	Preparation	App Choice During DTI
Lita	2	Google→Google
Samuel	1	Google
Marek	1	Google
Tobias	1	Google
Amy	0	0
William	1	Google
Trevor	2	Google→Google
Felix	0	0
Mina	2	Google→Google
Serena	2	Google→Google
Raye	1	Maps.me
Simon	2	Google→Google

Figure 5 /

Number of times participant used Preparation during the DTI, and their choice of app for each event

Serena, a DTI participant, explained her process: *"So, this is a route I'm not very familiar with. The first thing I would do is use Google Maps and look for every step I have to take to get to my destination."* Without using her previous knowledge of the public transit system, Serena immediately looked at her smartphone for guidance.

Participants were more inclined to take the route and mode suggested by their smartphone app – regardless if they had previously indicated they were somewhat familiar with the route or uncomfortable with a certain mode. Similarly, Lita, another DTI participant, explained that when she prepares for her journey, she relies on her smartphone. She incorporates the idea of *Preparation* into her routine so that she has a sense of awareness of her surroundings later on. When asked if there are any modes of transit she typically avoids, Lita responded with the S-Bahn, *"I used the S-Bahn less frequently just because I find it less convenient."* However, when given a choice, Lita used the S-Bahn during her DTI. When asked why she chose the S-Bahn, Lita responded that she used her smartphone to prepare for the journey, and she implied that Google had given her the directions and the suggested modes of transit and therefore she contradicted her own mode preferences and followed the suggestions of the smartphone. This shows the high impact of mobile technologies on decision-making in wayfinding as virtual instructions are given priority to the detriment of the user's learned spatial knowledge. The smartphone's ability to provide a user with a detailed route overview gives it a semblance of authority. A user may view the advice given by the smartphone and compare it to their existing spatial knowledge and may discover that there are more efficient or quicker routes to reach a destination than they previously knew. This creates a positive reinforcement between the user and the smartphone; the more the user turns to the smartphone

to solve a navigational problem, the less they are inclined to use their own spatial knowledge, and therefore form a user-smartphone dependency. The discussion surrounding smartphone dependency and influence on user behavior has been previously found by Münzer et al. (2006); Münzer et al. (2012); Richter et al. (2010); and Waters & Winter, (2011).

(b) Confirmation

Confirmation refers to the way in which people utilize their smartphone to help them navigate a journey. This is ultimately tied with preparation, as one attempts to follow the path provided at the beginning of the journey (Dennis, 1997; Allen, 2000; Schwering et al., 2017). When orienting with a smartphone during the journey, participants have two options: they can confirm and continue on their path, or they can correct and redirect themselves. *Confirmation* focuses on the former – confirming and continuing. Often, participants required a reminder, to double-check, or confirm, that they were heading in the right direction. The key element to this strategy is that, when looking at their smartphone, participants are reminding themselves of their initial path to reach their end destination.

Participants used smartphones during *Confirmation* more (39 times) than *Preparation* (15 times) and *Adjustment* (19 times), and would confirm with their smartphones during both highly active moments, as well as during lulls in their journey. Typically, a participant would use the smartphone for timing of scheduled departure and dead-reckoning to situate themselves in the physical environment and to help point out landmarks along their chosen path to their destination. The number of times a participant needed to confirm their navigational choices [Figure 6] ultimately depended on their familiarity of the mode choice and chosen route, personal characteristics, such as their ability to memorize route data, or a general confidence in their own navigational abilities.

In the DTI, three participants did not use their smartphone for *Confirmation*, this was due to their familiarity of the environment, as well as their ability to use their physical surroundings to orient themselves within the transit system. During *Confirmation*, a participant is either searching for spatial information, temporal information, or

Participant	Confirmation	App Choice During DTI
Lita	5	MVG→Google→Google→Google→Google
Samuel	1	Google
Marek	0	0
Tobias	0	0
Amy	0	0
William	3	Google→Google→Google
Trevor	4	Google→Google→Google→Google
Felix	1	Google
Mina	6	Google→Google→Google→MVV→MVV→MVV
Serena	11	Google→Google→Google→Google→Google→Google→Google→ Google→Google→Google→Google
Raye	7	Maps.me→Maps.me→Maps.me→MVG→MVG→MVG→MVG
Simon	1	Google

Figure 6 /

Number of times participant used Confirmation during the DTI and their choice of app for each event

a combination of both to help guide them through a situation of uncertainty. The smartphone is able to provide this information to a user through one or sometimes two apps, depending on their needs. Google, again, proved to be the most popular choice among participants. The dynamic combination of spatio-temporal information allowed for quick confirmation and reduced user uncertainty in stressful situations, as well as allowed the user to preemptively avoid stressful situations by following the route guidance provided by the smartphone.

For example, Serena, while sitting on the U-Bahn to P2, stated that when she is uncertain of a route, she primarily focuses on spatial factors of navigation. She would continuously follow the path given to her by her smartphone app, *"I checked my phone because…it's not a route I use every day."* The route provided by the app gave her a general step-by-step overview of the path. This shows that an individual's need for locational reassurance during *Confirmation* is important. The need for an individual to verify direction during orientation was also found by Schwiering et al. (2017) who stressed 'Wayfinding Through Orientation', a concept that navigational systems should support users through orientation, spatial learning, and cognitive mapping.

Raye, another DTI participant, was relatively familiar with the transit system, but she mentioned her need to confirm and reconfirm her path during her DTI to check the timing. Following the exact instructions from the app allowed her to slip in and out of both virtual and physical worlds. In doing this, Raye's attention for physical cues became less important, as the need to orient herself was emphasized by the time pressure she experienced. This shows that temporal aspects in an individual's navigation are also valuable in the wayfinding process. Since Raye did not use Google, but Maps.me (primarily spatial), and the MVG app (primarily temporal), her need to check between apps and double-check the information provided by the apps underscores the advantage of the Google app in *Confirmation* situations. User desirability and positive response for app customization has been found by Shaheen et al. (2016) too, however, the comparison of app customizability of spatio-temporal features has not yet been thoroughly researched.

(c) Adjustment

Adjustment requires a situation to occur that forces the participant to reorient themselves from the initial route (Fontaine & Dennis, 1999; Narimoto et al., 2018). For example, when a participant found signage or station design unreadable and difficult to navigate, it led them to feeling lost or confused and required them to change their initial route plans and redirect themselves. During the DTI, several participants found themselves in situations where they indicated they felt "lost" or turned around, or they found themselves in situations where they simply misread a navigational cue along the way. William, for example, often deferred to the smartphone when he made a wrong turn, or missed a connection: *"I have to take bus... which I just missed. I'll ask for an update."* William implemented an adjustment to his original plan and the smartphone provided him with subsequent alternatives to taking the bus. If participants realized they were no longer following their original plan, most of the times they would adjust their route with their smartphone. Even though Google was still a popular choice for participants, app choice varied more during the Adjustment stage compared to *Confirmation*. Here, problem-moments that participants found themselves in often only involved either a spatial or a temporal issue, which reduced the necessity to use an app that integrates spatio-temporal information, such as Google. [Figure 7].

The results also show that the ability of the smartphone to give navigational guidance does not guarantee a successful result by the participant. After exiting the S-Bahn on her way to P3, Serena was looking for a bus station, but was unable to physically locate its position. She felt the signage was difficult to find and the design of the station confusing: *"I found the sign, but it's not on the street … but it should be here because it says so and my Google Maps says so as well."* At that particular moment, she realized she had been led astray (whether by her own doing or the app's instruction is not clear); regardless, due to the discrepancies in information on her phone and at the station, she missed her connection. Serena ended up getting on the wrong bus and travelling in the wrong direction, only noticing it was wrong by comparing the smartphone to her surroundings.

Participant	Adjustment	App Choice During DTI
Lita	3	MVG→Google→Google
Samuel	1	Google
Marek	0	0
Tobias	1	Google
Amy	0	0
William	2	Google→Google
Trevor	1	Google
Felix	1	Google
Mina	3	MVV→MVV→MVV
Serena	5	Google→Google→Google→Google→Google
Raye	2	MVG→MVG
Simon	0	0

Figure 7 /

Number of times participant used Adjustment during the DTI and their choice of app for each event

Avoiding the Smartphone

The smartphone was prominent in personal navigation for participants of the DTI and its big role in transit navigation has been discussed in detail so far. However, looking at how and when smartphones are not used also can help to better understand human-smartphone behaviors and wayfinding needs of users. Some participants refused to use their smartphones for more personal reasons. Simon, for example, referred to his sense of safety when navigating with a smartphone, *"I don't really like to use my cell phone when I am walking … I feel like I will bump into people, or sometimes I might run into a car or a tramway if I don't pay attention to the … environment."* Simon saw the smartphone as a distraction from the surrounding environment, something that could end up unintentionally harming him. He also spoke about his detachment from smartphone as a sense of freedom (and was the only participant to do so), *"I don't like to be controlled by the cell phone. Sometimes I also believe in … getting lost in the city."* This idea of deciding his own path gives him a sense of responsibility and control which is an appealing factor to him as it helps to increase his sense of discovery. This indicates that not all users view the smartphone as positive addition to their navigational experiences. The smartphone can also be seen as an unsafe distraction as the user must navigate the physical world through virtual instruction, which can also take away the user's sense of autonomy. This contradicts the findings by Brakewood et al. (2014), where it was found that smartphones increased a sense of perceived safety in transit systems.

CONCLUSION

The smartphone has become a preferred and convenient navigational tool not only for motorized traffic, but also for public transport. No longer are people restricted to static physical information such as schedules, maps, and signage in order to aid in their wayfinding tasks but they now have a conduit to an instantaneous data

stream of navigational information that influences their wayfinding process in many ways. Most importantly, the dynamic spatial and temporal information is provided in a single hand-held device which allows users to easily access immediate directional recall to understand their spatio-temporal positioning and, in turn, helps to personalize their route (Golledge et al., 2000).

The goal of the explorative study presented in this paper was to better understand smartphone usage in terms of wayfinding experience and performance. It clearly shows that throughout the DTI, smartphone usage strongly influenced all stages of participants' wayfinding processes: *Preparation*, *Confirmation*, and *Adjustment*. However, smartphones are most often used for confirmation issues which points to deficits in signage and readability of the transit environment and the integration of the digital and the physical environment. The study also reveals that in the Preparation and Confirmation phase, apps which provide integrated spatio-temporal informational guidance, such as Google, are clearly preferred whereas users tend to use apps with a clear spatial or time focus (e.g. apps created by public transit authorities) when Adjustment is needed.

In general, using the smartphone helped participants to appease navigational stress. However, smartphones did not always facilitate wayfinding, but sometimes also became a distraction for participants. The more they relied on the smartphone, the more they had to balance between virtual and physical worlds. This brings along new design challenges to understanding how individuals behave in public transit settings and how to synchronize smartphone information with information cues from the physical environment including the wayfinding system.

As technological improvements are made to the smartphone and access to the technology reaches larger numbers of individuals, a better understanding of the integration of smartphone usage and user behaviors in wayfinding is paramount to effective public transit design. As an exploratory study, this provides a good starting point for future research in smartphone-to-user interactions in public transit wayfinding settings.

Further studies with a larger number of participants including elderly people and/or other social groups not covered in this study, will allow for greater validity. Moreover, future studies in different transit environments with different signage systems and travel modes can help to broaden our understanding of smartphone assisted wayfinding in transit environments as well as help to better grasp smartphone reliability and users' reliance on them. The DTI provides a sound method to investigate transit user behavior and to learn more about smartphone assisted wayfinding performance. This will lead to a better understanding of the functionality of our designed transit spaces in times of smartphone use.

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Understanding the Effects of Urban Form and Navigational Aids on Wayfinding Behaviour and Spatial Cognition

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Abstract /

In an age in which navigators can simply follow the represented route on their smartphone to get to their desired destination, is there any need for signage and urban legibility? This study aims to explore the effects of urban form and different navigational aids on visitors' spatial cognition and wayfinding behavior. Thirty-eight participants were placed in one of three groups: i) a paper map only; ii) smartphones with the Google Maps app; and, iii) no navigational aids (local signage only). Participants were asked to find six pre-determined tourist destinations in central Brisbane, Australia, while they were thinking aloud. Post-task tests showed that participants in the group without personal navigational aids were more successful in landmark recognition than map users. Those who used paper maps performed best in route accuracy and street-naming tests. However, across all the spatial recognition tests, the GPS group was systematically neither the best nor the worst in terms of acquired spatial knowledge. The findings have the potential to assist urban designers and navigational mapping producers to design more legible urban spaces and more effective wayfinding tools.

Keywords /

wayfinding; spatial cognition; navigational aids; urban legibility; think-aloud technique

INTRODUCTION

The term wayfinding describes a person's ability, both cognitive and behavioral, to travel from an origin to an out-of-sight destination by following the paths and routes between them (Garling et al., 1984; Golledge, 1992). Successful wayfinding helps travelers gain a sense of safety and well-being (Lu, 2016). So, different disciplines, such as transport planning (Dutriaux & Gyselinck, 2016), psychology (Gras et al., 2012), architecture (Passini, 1984), and urban design and planning (Lynch, 1960), have sought to understand how people make sense of their surrounding environment when navigating.

In cognitive studies, different researchers use the two terms 'cognition' and 'perception' to describe a human's ability to acquire knowledge of the physical environment surrounding them (Yadav, 1987). The term cognition has a much broader meaning than simply describing perception. Regarding the spatial cognition process, first, environmental information is encoded by the human mind (perception) and then the information is processed using different cognitive resources (conception), stored in the long-term memory, and eventually retrieved and applied for a particular purpose such as wayfinding (Vandenberg, 2016).

However, the use of navigational aids, such as directional signage or maps, has made the wayfinding process much easier for urban navigators. This study aims to explore the effects of three different navigational aids, such as paper maps, GPS, and directional signages, on individuals' spatial cognition and wayfinding behavior.

Lynch (1960) argued that observation of environmental cues while navigating in an urban environment creates a mental image in an indivi-

dual's mind which he called a "cognitive urban image." During wayfinding activities, the spatial visualization ability of navigators assists them to use their stored spatial information through a decision-making process (Li, 2007). This ability varies among individuals (Hegarty & Waller, 2005), and people might have different perceptions about the same environment depending on their personal characteristics, such as age (Techentin et al., 2014), brain size (Rushton & Ankney, 1996), and sex (Goede, 2009).

In spite of individual differences in spatial cognition processes, Lynch (1960) suggested that one's mental image of an urban environment can be understood as consisting of five key elements: landmarks, paths, nodes, edges, and districts. Landmarks are distinctive features that by their uniqueness make them memorable in urban users' minds. If they are observable from near and far, they play the role of reference points during navigation through an urban environment (Lindberg, 1984; Lynch, 1960). 'Paths', including sidewalks and streets, provide directional movement through urban environments for navigators. 'Edges' are certain boundaries surrounding a particular district with a continuous, certain form, such as rivers or highways. The junction of paths forms 'nodes' that tend to be more identifiable if they have sharp and closed boundaries and can be used as public spaces. "Districts" are large areas that have homogeneous characteristics, including physical characteristics such as color, texture, façades of buildings, materials and patterns of pavement, that consciously can be observed in one district area (Lynch, 1960). A legible (or imageable) city has these elements grouped into a somewhat coherent overall pattern.

Following Lynch's ideas, Siegel and White (1975) defined three types of spatial knowledge that humans use to create cognitive maps: *landmark knowledge* – using point-like elements of the environment; *route knowledge* – using line-like elements; and *survey knowledge*, which encodes the metric information about the layout of space (Golledge, 1987). For example, when a woman arrives in an unfamiliar city she may decide to have dinner in a restaurant on her way from the airport to the hotel. In order to recall the location of this restaurant, she would memorize the fact that it was after the park and around the corner from a particular statue. After using this method several times to search for and find the restaurant, she will begin to use route knowledge (Dillon & Vaughan, 1997). Route knowledge refers to the spatial knowledge that is acquired by traveling from an origin to a destination, using existing paths that connect the landmarks. It is based on the knowledge acquired by traveling from A to B through paths that connect landmarks and places (Siegel et al., 1978; Thorndyke & Hayes-Roth, 1982), and consequently developing a path network. The most often used path segment is represented by lines in cognitive maps (Golledge, 1978). Now, our abovementioned woman begins to make sense of the location of her hotel. She knows that the hotel is near the corner and up that particular road. After visiting her chosen restaurant several times, she will begin to make sense of existing environmental features — in two or three-dimensional layouts — on her way from the restaurant to the hotel. In other words, she begins using her previously observed/survey knowledge to generate a mental map of that environment (Golledge, 1999). Survey knowledge is based on coordinating different routes between landmarks and the estimation of the Euclidean distance between them, while creating a cognitive map (Siegel et al., 1978; Thorndyke & Hayes-Roth, 1982). Wayfinding performance could be affected by using each of these forms of knowledge (Meneghetti et al., 2021); for example, 'go straight on (route) until you see the city tower (landmark) and then turn left. Better understanding of how navigators make sense of their surrounding environment could be used by urban designers and navigational aids designers to improve the legibility of urban environments as well as the effectiveness of wayfinding systems.

The advent of technology and the use of GPS-based mobile navigation systems have brought forth new forms of interaction between individuals and the surrounding environment, whether they drive a vehicle or walk (Grison & Gyselinck, 2019). Several previous studies have compared the use of different navigational tools with acquired spatial knowledge, whether in indoor space (Hölscher et al., 2007; Thorndyke & Hayes-Roth, 1982), outdoor space (Chang, 2015; Ishikawa et al., 2008; Münzer et al., 2006) or virtual environments (Ruginski et al., 2019).

Ishikawa et al. (2008) examined the effectiveness of a Global Positioning System (GPS)-based mobile naviga-

tion system when compared to paper maps and direct experience of routes by focusing on the user's wayfinding behavior and acquired spatial knowledge. They found that the distance travelled and the number of stops for the GPS group were significantly larger than map users and direct-experience participants. In addition, the GPS users walked more slowly, made more directional mistakes, and drew less accurate sketch maps in terms of topological accuracy, than the direct-experience group. Later, Chang (2015) conducted a similar study, comparing the wayfinding efficiency and behaviour of international tourists when using a mobile navigation aid or a paper map and local directional signs. Her study found that sketch maps drawn by participants who used the local signs for wayfinding provided more detailed information/landmarks, and their drawn walking routes were more accurate than those of map users and GPS users. But GPS users remembered more information regarding transportation and route/road items, such as road names and the entire travel route.

RESEARCH OBJECTIVES

This study aims to confirm the findings of previous studies (Chang, 2015; Ishikawa et al., 2008) in terms of the difference in acquired spatial knowledge that occurs from the use of three different navigational aids, such as those used in our study, in an outdoor setting, and to understand why these differences occur. In addition, it seeks to gain better understanding of how key features of the urban environment contribute to urban legibility/imageability. Two basic hypotheses are measured in this study:

H1: Spatial knowledge acquisition, when navigating the same urban environment, varies based on the type of navigational aid used.

H2: That looking at a GPS-based navigational device would decrease navigators' engagement with their surrounding environment.

Better understanding of the role of navigational aids and how real-world navigators acquire spatial knowledge when using them may assist urban designers and wayfinding practitioners to develop better wayfinding signage approaches and systems and could also assist app-developers to produce improved navigational aids, particularly for GPS-based devices.

RESEARCH DESIGN

Participants

Thirty-eight students from Griffith University's Gold Coast Campus, 15 men and 23 women, were recruited through emails and posters on campus, based on the following criteria: a) be over 17 years old, b) be unfamiliar

with the Brisbane CBD, c) speak English well. They ranged in age from 18 to 56 years old, with a mean of 26.8 years, and a standard deviation of 8.5. All were unfamiliar with the study area and travelled at least 70km from the Gold Coast to central Brisbane by train and met the experimenter at Roma Street Station to undertake the wayfinding tasks. The travel costs from the Gold Coast to Brisbane were reimbursed; in addition, they received $50 incentive payment.

To minimize the impact of potential confounding variables, the socio-demographic characteristics of the groups, such as gender, age, degree and nationality, were controlled using statistical ANOVA testing (Table 1). There was no significant difference in terms of demographic features among the three groups of participants. Participants' sense of direction was assessed using a Santa Barbara Sense of Direction (SBSOD) scale, and no significant differences were identified.

Table 1 / Summary of personal characteristics across the independent groups

Socio-economic Characteristics		**Navigational Aid Type**			
		Signage (N=14)	Map (N=12)	GPS (N=12)	P Value
Gender	Male	5	5	5	0.29
	Female	9	7	7	
Age	Range (Min-Max)	18-34	18-56	18-46	NA
	Mean	24.2	28	28.9	0.39
Degree	High School Diploma	6	4	3	0.57
	Bachelor	5	3	5	
	Master	2	5	4	
Country of origin	Australian	5	4	4	0.98
	Non-Australian	9	8	8	

To control membership of the sampled groups, partly taking into consideration their own preferences, the participants were assigned to one of three groups: i) a group using *Google Maps* (n=12); ii) a group using a conventional 2D paper map (n=12); and iii) a group with no aids other than the local signage that is already in place in the built environment (n=14). A briefing session was held prior to the experiment day, at which all participants were informed of the aims, procedures, and requirements of the research, particularly the parts related to the think-aloud and sketch mapping techniques. Without referring to the urban elements identified by Lynch, they were informed that after the test they would need to draw their mental image of the observed environment, and some samples of sketch maps were shown. Participants' sense of direction was assessed using a Santa Barbara Sense of Direction (SBSOD) scale, and they were asked which group they preferred to be in. If membership in their first preference was not possible, they were assigned to their second preference. All participants

were assigned to their first or second preference group. On the experiment day, participants were informed about the destinations.

Study Area

The Brisbane central business district (CBD) and the South Bank precinct, being the two most popular sightseeing areas in Brisbane, were chosen as the study area (see Figure 1). The participants were asked to individually find six pre-determined destinations in the study area, in any order, these being: the Brisbane City Hall, the Queen Street Mall, St. Stephen's Cathedral, South Bank Beach, South Bank Railway Station, and the COWCH Café Bar in South Bank. The list of destinations was written on a piece of paper and given to them.

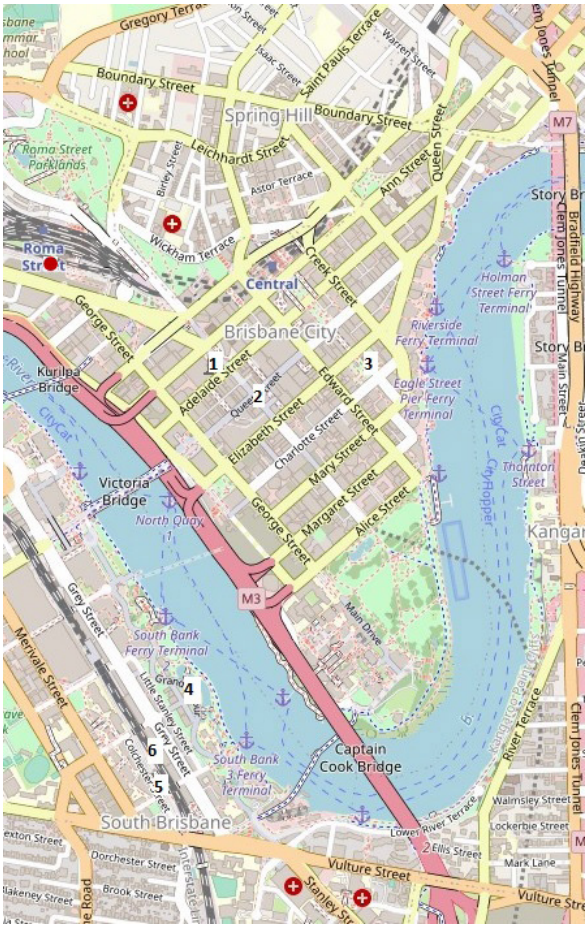

Figure 1 /

The map of the study area

DATA COLLECTION PROCEDURE

Wayfinding Task

The starting point was the Roma Street Station, where the participants' train arrived. The final meeting point was at COWCH café, where post-test tasks occurred.

A Samsung Galaxy J5 Mobile phone equipped with 3G service and the *Google Maps* app was given to the GPS group. The map of the surrounding area was shown on a screen size of 14cm x 7cm. The app showed the location of the user on the screen, and dynamically updated as they moved in the area. Participants were asked not to use the voice navigation option.

Participants in the paper map and local-signage only groups were also given smartphones, but only to record audio of their speech and to capture GPS tracks of their movement, and they were instructed not to use them as a navigational aid. The route tracker application *Geotracker* was installed on the same smartphone and recorded the length of time taken by all participants, as well as the route travelled. Participants in the paper map group were given an A4-size tourist map of Brisbane, as provided by tourist information centres in the city. There was no suggested route or other annotation on the map and they had to find the destinations and plan their preferred routes by themselves.

All groups were instructed to only ask other people for help if they were unable to navigate via their navigational aid, or the built evironment, without assistance. All groups were asked to think aloud and verbalize their thoughts, in English, about the wayfinding process, the buildings, streets, the signs, the maps, their feelings, and whatever else they saw or that came to their minds.

Think-aloud

The think-aloud method (Ericsson & Simon, 1980) was employed to help identify differences in wayfinding behavior across the three groups of participants who used different navigational aids. Participants were asked to vocalize their thoughts continuously while solving the wayfinding task. This provided rich verbal data about individuals' reasoning, what they saw and how they felt during wayfinding. The think-aloud method is

well-used in wayfinding research (Hölscher et al., 2009; Hölscher et al., 2006; Kato & Takeuchi, 2003; Passini, 1984; Schnitzler & Hölscher, 2015; Vaez et al., 2019). All recordings were transcribed by a research assistant. After transcription, the participants' statements were segmented, with one segment of utterance defined as the continuous statement which occurs between two pauses (Kato & Takeuchi, 2003). Two rounds of coding were then conducted by a single researcher with a time interval of two weeks (Yu & Gero, 2015). Participants' reasons for choosing a street segment, or any side of the street, during navigation were extracted from the think-aloud protocols, as well as the names of landmarks perceived by them. Krippendorff's α (alpha) statistics suggested that the two rounds of coding had a good agreement ($\alpha \geq 0.8$).

Sketch mapping and recognition test

Using Lynch's (1960) approach, the participants were asked to draw and write down as much information as they could remember, such as streets, buildings, landmarks, parks, transport stations, etc., solely from memory and without referring to any other paper or digital map. To overcome the problem of individuals' lack of drawing ability, a spatial recognition test (Piaget & Inhelder, 1967) was also taken after collecting participants' sketch maps. For the test, the participants were shown photos of five buildings and landmarks in the study area, and they were asked to write down the number of photos that they could clearly identify.

Sketch mapping follow-up interview

To gain more insight into how visitors developed a mental image of space and the role of navigational aids in that process, participants were asked to write their answers to the following questions, which were written and read to them:

- Why did you remember and draw certain streets on the sketch map (i.e. what were the features that made them memorable)?
- Why did you remember and draw certain land marks on the sketch map (i.e. what were the features that made them memorable)?
- How did your way-showing tool (digital map, paper map, signage only) influence the cognitive map you drew?

Distance estimation task

To assess participants' survey knowledge — estimated Euclidean distance between landmarks, the participants were given multiple pairs of landmarks that were all on the list of those they had to find. The Euclidean distance was described to them as "the straight-line distance between the two landmarks." They were asked to score the Euclidean distance between each pair from 0 to 9, where 0 meant next to each other (no distance) and 9 meant the longest distance. The participants received a unit of measure, which was the distance between South Bank Station and COWCH (which they had all just been to), as equal to 1.

RESULTS

Destination decision making

Participants' utterances showed there were two main approaches to initial destination decision making in the wayfinding task. 36 participants decided to begin by walking to the closest destination, for example, "I first go to the City Hall because it is the nearest one." Two participants (one in the GPS group; one in the paper map group) decided to follow a clockwise route, for example, "I prefer to start from left and see the cathedral and go towards the other destination in the right" There was no significant association between group and participants' destination decision making.

Wayfinding performance

The average distance travelled to find all destinations helps indicate the effectiveness of the navigation aid on performance. Table 2 lists the average travel time, the average distance travelled, and the average walking speeds across each group of navigators. Average travel time is a less reliable indicator of performance, due to variability in breaks taken by the navigators. A one-way, between-subjects ANOVA was conducted which showed that the difference in the average travel times across the

groups was not statistically significant at the 95% confidence level. But the average distance traveled was significantly different between groups as was their average walking speed ($F(2, 35) = 3.5$, $p < 0.05$).

Table 2 / Wayfinding performance of the three groups

Groups	Average distance travelled (km)	Average travel time (h)	Average walking speed (km/h)
GPS	5.47	1:46	3.1
Paper map	6.03	1:47	3.3
Local signage only	6.47	1:52	3.4

Post-hoc paired comparisons showed that the average distance travelled, as well as the walking speed of the local-signage-only group, were significantly greater than those of the GPS group ($p < 0.05$). However, statistically there were no significant differences in the average distance travelled and walking speed between the paper map group and the two other groups.

Participants' utterances showed that six participants in the paper map group and eight participants in the local-signage-only group asked for directions; no one in the GPS group asked for directions.

Sketch maps

All 38 sketch maps drawn by the participants were collected and analysed based on Lynch's five urban image elements (Lynch,1960). Thirty-two of the cognitive maps were drawn from a top-down view (see Figure 2a); only two of them were drawn from a side perspective (see Figure 2b). Four maps used a combination of both views (see Figure 2c). One participant's sketch map was too simple to be analysable as a cognitive map, so it was excluded from the cognitive map analysis.

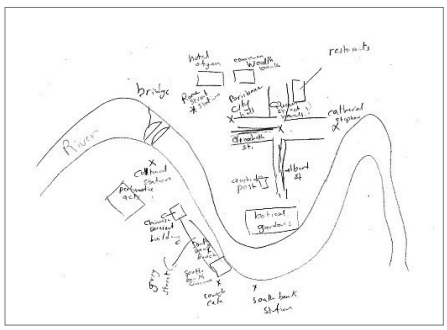

Figure 2a:

Top-down view

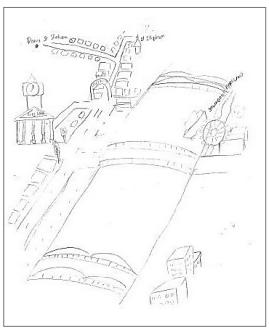

Figure 2b:

Side perspective

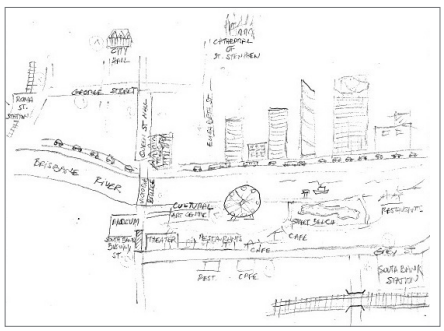

Figure 2c: /

A combination of top-down and side view

Analysis of landmark knowledge by group

The number of remembered landmarks, such as transport stations, cafes, restaurants, shops, and banks, was considered a measure of landmark knowledge, point-like elements of the environment, across the groups (see Table 3, first row). A one-way, between-subjects ANOVA was conducted to compare the effect of each navigation aid on the landmark knowledge acquisition of participants. There was a significant difference in the number of remembered landmarks across the groups [F (2, 34) = 6.50, p < 0.01]. Post-hoc paired comparisons showed that participants in the local-signage-only group remembered a significantly larger number of landmarks compared with the two other groups (p < 0.05). However, there was no significant difference between the numbers of landmarks mentioned by participants across the two other groups.

Table 3 / Mean (and standard deviation) for each variable by participants in the three groups

Variable	GPS Group (n=12)	Paper map Group (n=12)	Local-signage-only Group (n=14)
Landmark Knowledge	7.4 (3.5)	8.6 (3.4)	10.1 (7.9)
Distance Estimation	2.0(1.4)	2.5(0.7)	2.8(1.3)
Street Name	2.7 (1.5)	4.5 (2.1)	2.1 (2.2)

Analysis of route knowledge by group

Route knowledge refers to the information participants gained about the paths they had taken, in terms of turns and directions, and the landmarks that existed along those routes (Werner et al., 1997). To assess the route knowledge gained by participants, we adapted Billinghurst and Weghorst's (1995) method, which suggests scoring the sketch maps based on three criteria: map goodness; object classes; and relative object positioning. All sketch maps were rated by two independent 'raters' who were familiar with the study area but unaware of the participants' identities and the type of navigational aids they used. They first rated the map goodness by using the question, "how good are the drawn routes in helping you navigate toward the destinations?" (Beime, 2007; Billinghurst & Weghorst, 1995; Lukas et al., 2014). As we were particularly interested in route knowledge, we used route accuracy as the second rating criterion to represent object classes (Lukas et al., 2014). Route accuracy refers to any route in terms of "correct relations of the routes drawn in the sketch maps, turns and directions" (Lukas et al., 2014, p. 34). Relative object positioning was determined by the positioning of any landmarks on the drawn routes (Lukas et al., 2014; Parente, 2016). The inter-rater-reliability, Kendall's Tao, for rating of map goodness, route accuracy, and relative object positioning, was 0.70, 0.65, and 0.72, respectively, suggesting good inter-rater agreement/reliability. The scores given to the maps were of ordinal value, so the Kruskal-Wallis H test was used. There was a difference in the ranking of map goodness drawn by each group that was approaching, but not quite reaching, statistical significance [H(2) = 5.42, p<0.1]. The results of Mann-Whitney U-tests (Table 4, first row) showed that the map goodness of routes drawn by the paper map group was significantly higher than the GPS group, but there was no significant difference between the local-signage-only group and the two other groups.

There was a significant difference among the three groups in the case of route accuracy [H(2) = 7.37, p<0.05]. The results of the Mann-Whitney U-test showed that the paper map group significantly outperformed the two other groups, while there was no significant difference between the local-signage-only and GPS groups (Table 4, second row).

There was a difference approaching significance between groups in terms of relative object positioning [H(2) = 5.17, p<0.1]. According to the Mann-Whitney U-tests, the local-signage-only group performed significantly better than the GPS group, while there was no significant difference between the paper map group and two other groups (Table 4, third row).

Table 4 / The results of the Mann-Whitney U-test for the analysis of route knowledge between groups

Category	Groups	Mean ranks	Mann-Whitney U Test	P value
Map goodness	GPS, paper map	9.29, 15.71	33.5	.02
	GPS, local signage only	10.58, 15.23	49	.1
	Paper map, local signage only	14, 12	66	.5
Route accuracy	GPS, paper map	7.92, 17.08	17	.001
	GPS, local signage only	11.33, 14.54	58	.2
	Paper map, local signage only	16.79, 9.50	32	.006
Relative object positioning	GPS, paper map	10.88, 14.13	52.5	.2
	GPS, local signage only	9.21,16.5	32.5	.01
	Paper map, local signage only	12.38, 13.58	70.5	.6

Analysis of distance estimation (survey knowledge) by group

The survey knowledge in this paper is assessed by the capability of participants to estimate the Euclidean distances between pairs of destinations (Siegel et al., 1978; Thorndyke & Hayes-Roth, 1982). As noted earlier, all participants were asked to score the Euclidean distance between some pairs of destinations using a score between 0 to 9. The mean number of correct distance estimations for participants was slightly higher in the local-signage-only group and lowest in the GPS group (Table 2, second row). But the result of an ANOVA test did not show a statistically significant difference among the three groups of participants (p>0.1).

Results of the sketch mapping follow-up interview

- Why are some paths more memorable?

Each group of participants was asked why some streets were memorable in their mental maps and drawn in their sketch maps, with results shown in Chart 1.

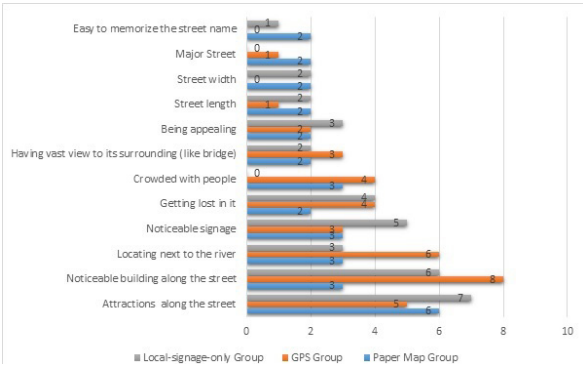

Chart 1 / Frequency of reasons for remembering paths by participants in the three groups

The most frequently mentioned reason for streets to be memorable for paper map and local-signage-only groups were attractions along the street (for example, the existence of shops, cafes and bars along Queen Street and Grey Street), and for the GPS group it was noticeable buildings along the street. This result shows the importance of landmarks and buildings in making a memorable path for navigators.

- Why are some buildings/landmarks more memorable?

Each group of participants was asked why some landmarks were memorable, with the results shown in Chart 2. The most frequently mentioned reason for a landmark to be memorable for all groups was because it was an eye-catching building in terms of color, building height or mass.

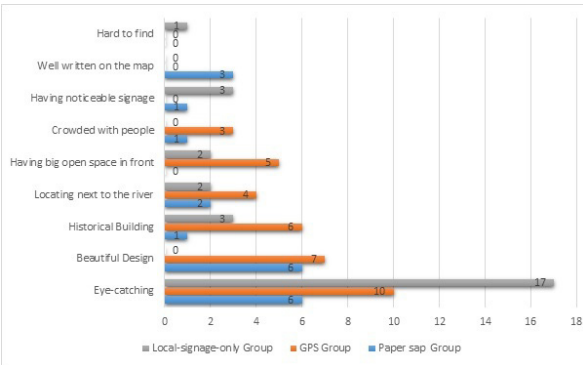

Chart 2 / Frequency of reasons for remembering landmarks in landmark knowledge task by participants in the three groups

- How did your way-showing tool influence the cognitive map you drew?

Chart 3 shows how different navigational aids helped participants create a mental map. For the paper map group, the most frequently mentioned influence was the map's role in helping them realize the overall shape of the city center as a peninsula, followed by locating the position of streets in relation to the river. For the local-signage-only group, being without a proper map was more confusing, preventing them from creating an accurate mental image. Compared with the paper map group, participants in the GPS group found their wayfinding tool more confusing and less helpful for creating a cognitive map; however, a few of them found it influential in estimating distance and remembering street names (not in line with the post-wayfinding tests results).

Analysis of the think-aloud data

Analysis of think-aloud utterances, used to understand how people interact with space during a wayfinding task while using different navigational aids, can provide new understanding of the reasons behind the poor spatial knowledge acquisition of GPS users.

Using environmental cues in wayfinding performance

All groups were asked to think aloud and verbalize their thoughts about the wayfinding process, the buildings, streets, the signs, the maps, their feelings and whatever else came to their minds. To get more insight into the influence of environmental features on wayfinding behaviour, participants' reasons for choosing a street segment or any side of the street during the navigation task were extracted from the think-aloud protocols.

Table 5 shows the participants' preferences for taking a street segment, or even a side of the street, based on their utterances. Diverse route selection criteria were mentioned by the three groups of participants, including:

a) Physical characteristics of the road, such as being straight, short, a highway or a major road. For example, "I take this street because it is wide" (Group: local-signage-only); "I take North Quay because I see it directly goes to the city hall" (Group: paper map); "I think this way is the shortest one" (Group: paper map).

b) Being comfortable for pedestrians due to having shade or pedestrian roads. For example, "I will go on the left side because it is shady" (Group: GPS); "I stay in this side because it has wide pedestrian road" (Group: local-signage-only).

c) Type of space along the street, such as green areas, a river, shops and cafes, or any attraction. For example, "I take the right one because I think I can pass through the parkland as well" (Group: GPS); "I am going to the right side because of those stores and cafes" (Group: Paper map); "I choose the left because it looks nice" (Group: local-signage-only).

d) The number of cars, for example, "There is busy with cars, so I go there" (Group: local-signage-only); "I think I can get through this, the street on the right one has no car" (Group: paper map).

e) The crowd on the street, for example, "I will continue here because here is less people" (Group: GPS); "I am fine with the left side of the street because I see a lot of people" (Group: paper map).

f) Green light, for example, "I prefer to turn right, the light is green; it is better than waiting for front cross" (Group: paper map).

The results of a Kruskal-Wallis H test showed that the three groups differed significantly in using environmental cues during navigation [$H(2) = 6.69, p = 0.035$].

Table 5 / The participants' environmental preferences for taking a street. The percentage within condition are shown in parentheses

Environmental Cue / Group	GPS n(=12)	Paper map (n=12)	Local signage only (n=14)
Shade	14 (1.20)	14 (0.98)	8 (0.49)
River	3 (0.21)	4 (0.28)	7 (0.42)
Avoiding the crowd	6 (0.42)	0	0
Following people	2 (0.14)	21 (1.47)	31 (1.90)
Attractions	5 (0.35)	10 (0.70)	15 (0.91)
Major roads	0	1 (0.07)	3 (0.18)
Pedestrian roads	1 (0.07)	0	5 (0.30)
Straight routes	0	4 (0.28)	1 (0.06)
Green light	0	0	4 (0.24)
Green area	8 (0.56)	6 (0.42)	4 (0.24)
More cars	0	1 (0.07)	1 (0.06)
Less cars	1 (0.07)	2 (0.14)	0
Shortest path	0	5 (0.35)	0
Highway	0	0	3 (0.06)
Total	40 (2.83)	68 (4.78)	80 (4.9)

A Mann-Whitney U-test (see Table 6) shows the GPS group used the environmental cues significantly less than the local-signage-only group (p=0.01), and there was a difference approaching significance between the GPS and paper map groups (p=0.05), while there was no significant difference between the paper map and local-signage-only groups (p=0.5).

Comparing the participants' reasons for remembering streets with those for choosing a route segment reveals some similarities, such as attractions and locations next to the river.

On the other hand, some influential factors in route choice behaviour were not mentioned as reasons in the mental image generation, such as major roads and crowds for the local-signage-only group. On the contrary, some reasons were only mentioned for mental image generation but not for route choice behaviour, such as

Table 6 / The results of the Mann-Whitney U-test for the analysis of total environmental cues mentioned by participants for choosing a street segment

Category	Groups	Mean rank	Mann-Whitney Test	P value
Total environmental cues	GPS, Paper-map	9.83,15.17	40	.05
	GPS, Local-signage-only	9.54,16.89	36	.01
	Paper map, Local -signage-only	12.54,14.32	72	.5

major roads for the GPS group. Although the GPS group followed the crowd while navigating considerably less than the two other groups, the crowded streets that they passed through remained in their minds.

Perceived landmarks

From the think-aloud recordings, a count of the names of landmarks was extracted from transcripts for each group, for example, "I see a big wheel." There proved to be no significant difference in the number of landmarks mentioned across the groups [$F(2) = 1.21$, $p = 0.3$].

DISCUSSION

The results confirmed the outcomes from similar previous studies (Chang, 2015; Ishikawa, 2012; Ahmadpoor & Heath, 2018) which found that navigational aids would significantly impact people's wayfinding behavior and acquired spatial knowledge.

The first hypothesis of this study was supported. The acquired spatial knowledge significantly differed among the three groups. Regarding landmark recognition, the local-signage-only group performed significantly better than the two other groups. While surrounding spatial knowledge, including the local signage system, was the main source of wayfinding information for this group, the navigational assistance provided to the two other groups reduced their dependence on landmark knowledge when navigating. The paper map group performed better in terms of route accuracy than the two other groups, and the local-signage-only group more accurately located landmarks on drawn routes than the GPS group. The type of navigational aid had no significant impact on distance estimation performance, but the paper map group was more likely to remember the names of streets than the two other groups, presumably as the paper map users needed to look for the names on the map to locate themselves in the actual environment, and needed to see and understand the street names to know where to turn. This is cognitively more demanding. This result differed from that of Chang (2015); within which GPS users were more successful in street naming than the paper map users and the signage users; one possible reason could be the difference in methods used in

the two studies. In our study, we separately defined a street naming task by asking participants to name the street names on the plain maps of the study area. But in Chang's study, street naming performance was assessed by counting the road names provided in drawn sketch maps.

The second hypothesis was partially supported as well. The think-aloud data showed that the GPS group used the environmental information in their surroundings, such as attractions or the river, significantly less than the two other groups. They only followed the turn-by-turn navigational instruction on the device (Bakdash et al., 2008; Burnett & Lee, 2005; Farrell et al., 2003; Gaunet et al., 2001; Parush et al., 2007; Péruch et al., 1995). In addition, think-aloud utterances showed that the GPS group chose to avoid the crowd in order to interact with their device undisturbed, while following the crowd was used as a wayfinding strategy by the two other groups.

However, according to the think-aloud utterances, the GPS and Paper-map groups still observed landmarks. There was no significant difference in the number of landmarks mentioned (perceived) across the three groups. But the local-signage-only group had to rely on this landmark knowledge more and inscribed it in their spatial memory. In other words, the GPS and paper map groups were more often only observing and perceiving the urban environment, instead of exploring and conceiving it. This result showed that the reason behind the strong landmark knowledge acquisition when using no map is that in this method of wayfinding navigators have to rely on the existing landmarks in their surrounding environment to find their way. However, navigation by maps frees people from reliance on those urban elements, and they just perceive but do not conceive. For example, although the GPS users look at their surroundings and see the existing urban elements (as evidenced by perceived landmark data), they cannot remember them after the wayfinding task because they do not need to use them to navigate (as evidenced by analysis of the think-aloud data). Consequently, they gain poor spatial knowledge of their surroundings (as evidenced by sketch mapping and recognition tests). The combination of the cognitive mapping technique and the think-aloud method has revealed a new psycho-cognitive aspect, beyond that of previous studies, of the effects of navigational aids on wayfinding behaviour and spatial cognition

The importance of attractions and buildings in path and landmark recognition demonstrated in this study confirmed previous work (Long, 2008). This outcome suggests that map designers, whether digital or paper, should pay more attention to showing tourist attractions in an accurate way in order to catch the attention of navigators and make these sites more memorable. Firms like Google are developing mapping tools with increasing sophistication in terms of displaying building and landmark information. Furthermore, with 3D models of cities now commonplace, more information could be provided to the wayfinder. Augmented reality may offer significant advantages here, if systems are carefully designed to maximize not just immediate navigation needs but also spatial learning. Overall, the findings of this study suggest new ideas to improve the functionality of the navigational aids in terms of spatial knowledge acquisition. For example, putting an emphasis on the representation of noticeable buildings and urban attractions in maps can enhance the memorability of paths and improve the acquired spatial knowledge. Other implications include showing the location of urban signage on maps. Thus, instead of following the recommended route on the Google map, navigators would have an option to walk toward the urban signage and use this during navigation as well, offering an opportunity to use spatial knowledge while exploring the city. Figure 3 shows an example.

On the other hand, while navigational aids can help people to find their way, it is important that architects, urban designers and urban planners work together to design legible urban environments. Chart 2 provides helpful information regarding enhancing urban legibility and creating more memorable landmarks, such as using notable signage for the names of buildings or designing large open spaces in front of buildings.

There are several limitations of our research. As in similar studies, and due to a lack of budget, we were unable to continually observe participants and trust that participants followed the instructions provided to them throughout their wayfinding task. However, the voice

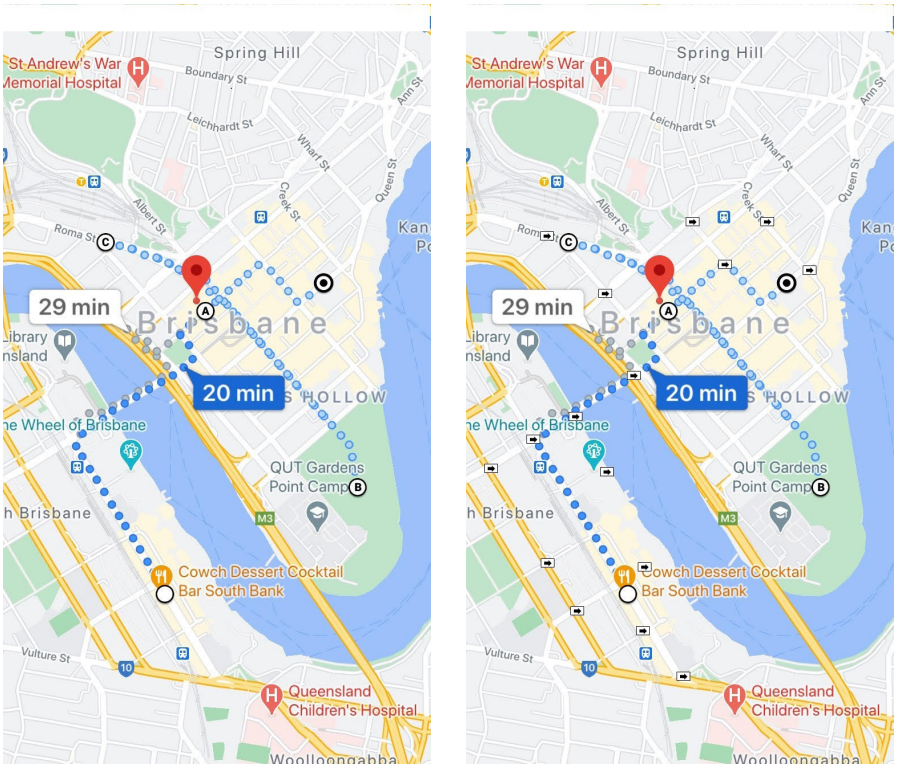

Figure 3 /

Google Maps app before (left) and after representing the urban signage (right)

recordings give us confidence that they did so. The quality of the sketch maps can be influenced by the drawing ability of participants. In addition, we used even numbers of raters for rating the sketch maps, although the agreement between raters was so high it suggests that using odd numbers of raters can strengthen the certainty of the result.

Methodologically, the study showed the value of including the think-aloud model in such research designs. It provided useful insights into landmark knowledge and route knowledge formation. In addition, to answer the research question we used slightly improved cognitive mapping methods compared with previous studies, such as distance estimation and street naming tasks. As GPS-based smartphone apps and similar technology improve, we need to continue to develop methods that help us observe behavior, capture acquired spatial memory, and understand how and why such memories are created.

Some issues remain unresolved. There are many options for spatial memory testing, but, as we found, respondent burden and costs are high if one includes most of them. If one had to reduce the set of tests conducted, it would be difficult to discern which tests would "best" help researchers understand particular issues of wayfinding effectiveness, spatial cognition, and memory.

For practitioners, there remains a need to continue to improve

urban wayfinding systems, regardless of the increasing use of digital navigation. Practitioners may wish to explore ways in which the wayfinding systems that cities are installing in the built environment can better interact with digital wayfinding. They may also wish to disrupt GPS navigators and encourage them to make other route choices. How these outcomes might best be achieved has been little explored as yet.

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Intersection: Road Signs and Public Art

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INTRODUCTION

I live in Albuquerque, a city that grew around a crossing of north/south and east/west paths of commerce and conquest. The Camino Real de Tierra Adentro, (Royal Road of the Interior Land) a trade route linking Mexico City to San Juan Pueblo (Ohkay Owingeh) in northern New Mexico intersected the westerly colonial wagon trails that usurped Native American trading footpaths. The contemporary city tolerates, at its heart, a perpetually humming intersection of interstate highways I-25 and I-40. Known locally as the Big I, the interchange is a colossal stack of curving concrete chutes that channels thousands of motorists a day in near alignment with the cardinal directions. This crossroad of major highways is shifted slightly north and east of the original central intersection of the former Route 66 (now Central Ave.) and the BNSF railroad tracks. This latter intersection continues to officially disperse city addresses into directional quadrants. Mail without the designated quadrant added to an address risks delivery to a house with the same number and street name in an opposite, distressingly faraway corner of this now sprawling city.

Albuquerque is somewhat west of the halfway point between Chicago and Los Angeles, and historically offered an appealing resting/refueling destination for the road-weary traveling along Route 66. Vestiges of a mid-century proliferation of motels and their exuberant signage are still visible along much of Central Avenue, and although dwindling and decaying, the abundance of these artifacts still make up one of the better-preserved stretches of the mother road.

Some readers will remember how a tunneling Bugs Bunny lost his way in Albuquerque, missing a crossroads, erupting to the surface all over

The Crossroads Motel is at the intersection of Central Avenue and I-25, and is now visited not only because of its just-off-the-ramp convenience for highway travelers, but because of its importance on a recent layer added to the map — the site of a memorable Breaking Bad Scene.

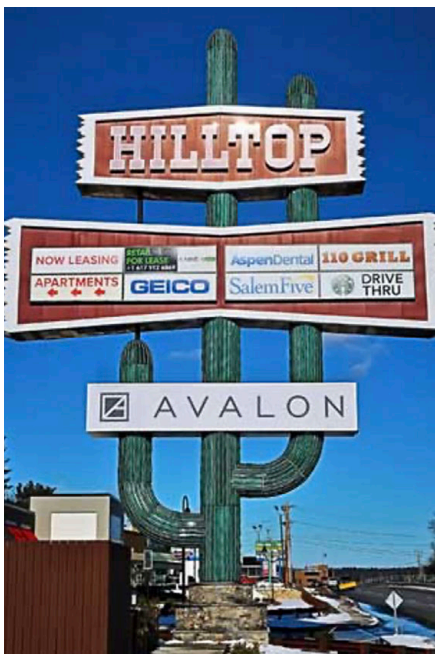
the globe but never managing to make the "right" left turn at an important crossroad (https://www.youtube.com/watch?v=e8TUwHTfOOU).

Tunneling under a place, in unfamiliar territory, without visible landmarks or a GPS system to rely on, you can't tell where you are, and like a disoriented subway traveler, Bugs comes to the surface, repeatedly to attempt to see where he is. I propose that a tunneling/popping up spatial metaphor can be productively imagined as temporal—the past can be allowed to erupt, to be brought to the surface to remain on it for some time, and to be made clearly visible, in order to better orient

The former Zia Motor lodge sign in 2021, still looming on a vacant lot on Central Avenue, exists in a kind of limbo of survival. Representative of a kind of phantom infrastructure deemed not quite worthy of preservation, but apparently too sturdy, large and iconic to take down, this roosting/nesting spot for pigeons is widely photographed by passersby.

ourselves to current challenges and opportunities, and to consider long term consequences of both historic preservation and public art decision making.

It is not a surprise that static, solidified and hardened representations of past events become a contested issue in the realm of public art—monuments have recently been toppled, and violently fought over because they stamp out, refuse, or suppress the stories of those who were not the victors. In contrast to bronze and granite of typical monuments, road signs are both hard and soft, impervious and



The beloved Hilltop cactus sign, Route 1, Saugus, MA, then and now. Public art programs can learn from the strategies of the business community to simultaneously preserve and renovate iconic road signs. Public artworks can be envisioned as sites of change that also maintain continuity, that become opportunities for grounding narratives of remembering and change in shared space. Sustaining the sign's function as advertising for current businesses parallels maintaining the relevance and communicative potential of artworks in changing cultural contexts.

fragile, with extremely sturdy steel and concrete support structures that elevate and frame softer, more pliable interiors of lexan, vinyl and composite materials—an acknowledgement of the both the aspirations (permanence) and realities (possible failure) of owning a business and a reflection of the differing time scales of individual entrepreneurship and urban planning. Road signs are now commonly understood as re-usable, but many mid-century road signs were not made for re-use, their cabinet designs were irregular and highly specific, and the hand craftsmanship involved in their production more specialized and extensive. The materials that comprise mid-century signs are often valued more highly than those used in current sign production, and many of mostly intact vintage signs are deemed worthy of historically accurate preservation, especially if they are able to be removed from their original location and advertising function into more sheltered environments. Those that remain in their original locations, still widely visible and accessible, offer unique opportunities as sites for public art because of their combination of changing and unchanging features.

ROAD SIGNS AS SITES FOR PUBLIC ART

Old road signs, especially larger, sturdier ones whose support structures are still intact but whose vintage lettering and neon are either too decayed or too problematically specific to preserve, offer public art programs an opportunity to rethink three-dimensional public artworks as sites more akin to galleries than stand alone, immutable works of genius. Valued artworks are still assumed to be the product of

Reviver, 2012-2019. Friends of the Orphan Signs (FOS), a small non-profit arts organization, worked with the City of Albuquerque Public Art program to revitalize this sign with artwork created in collaboration with local high school students. The sign was removed and stored when the lot was finally developed in 2019, the city is storing the artwork for eventual display in a planned Route 66 visitor center. Reviver's seven year existence in situ satisfied time requirements for publicly funded semi-permanent artwork, and garnered the artwork enough fans to bolster the decision to save it.

The Sundowner Lion's Whisper project, in development. FOS worked with the City of Albuquerque Public Art program and members of New Life Homes, a residential community that supports people transitioning from difficult situations including incarceration and rehab, in order to develop the imagery for this sign at the site of a motel on former Route 66. The lower cabinet will include reader board tracks for changeable letters displaying messages collected from the residential community. The tree nearby, although it partially obscures the sign, is very highly valued for its shade in this sun drenched city. The lion and the text will be visible seasonally and to those walking nearby, "whispering" to the observant and to those who know where to look.

unique , individual perspectives, and detractors of public art often consider the genre a lesser form because it necessarily involves legal limitations, institutional approval and revision processes, and thus multiple or communal perspectives that "dilute" the artwork. Empty road signs as sites for public art provide a unique opportunity to model an inclusive public art approach that also values historic continuity, a palimpsest of sorts that leaves traces of the past as well as room for new eruptions.

The already spatially and temporally contextualized sites of road signs as places for public art offer a model that is not-neutral because most viewers assume that a sign is meant to directly communicate to a broad, moving public, and that the content is likely to be about wayfinding, products and services, or public service messaging. Art in a sign is not detaching itself from everyday activities, it elbows itself into an often crowded field of text and images in an adamantly not-white-cube, non-elite space. A sign that offers revolving temporary exhibitions of art works can be an accessible plein air gallery that takes advantage of the sturdiness and inherently super-visible nature of road signs.

Among the artists FOS engaged to reach broad audiences via road signs were the well-known local muralist Nani Chacon and poet Sara Rivera. These established artists tended to align their ongoing interests with the opportunities signs afforded them—Nani extended her interest in developing portraiture and an iconography of indigenous leadership by working with teens to imagine the patron saint of travelers, St. Christopher, as an elder who would be familiar to them.

Sara Rivera brought her involvement in language and translation to the FOS Donut Mart project. This unfunded project utilized the few letters remaining on the business sign's readerboard after the business had closed as a starting point for messages to the public. Sara ran an algorithm that listed all of the words that could be formed form the few remaining letters, in both Spanish and English, and since the sign was within easy reach from the ground a team of artists changed messages regularly. The modest project received outsized recognition due to its location at a busy intersection with lengthy stop lights. A local critic writing about public art in Albuquerque featured the project as her favorite artwork in the city, and one of Sara's Donut Mart messages, photographed and posted on Twitter by a passerby who titled it "American Gothic", went viral on Twitter, with thousands of retweets in 2018.

St. Christopher, by Nani Chacon, working with Highland High art students, 2014.

Integral to the mission of FOS is artistic collaboration explored as a range of possible structures. In established educational settings, FOS artists worked with teens from local public high schools as part of the regular art class curriculum, and formed after-school art clubs specifically to work on sign designs. Lindsey Fromm directed the Elevation project, working with children at a preschool, collaging photos of the children, their drawings and selected quotes for a series of artworks installed in a sign near the school.

Other models of engagement employed by FOS include inviting teams of artists to work together with members of an existing community group living near an orphan sign

not found

in order to generate images and texts for that sign. The Casa Barelas project paired the bilingual artist Cristine Posner with a neighborhood association with a primarily Spanish speaking membership. Cristine asked participants to bring snapshots and important artifacts from their household collections to digitally scan as part of the initial stages of the image making process.

Themes explored by community groups were not pre-determined by FOS—but emerged from conversations with participants. Often these groups eventually focused

The Wild is Always Breathing On You, Lindsey Fromm working with preschool children, 2021.

The Casa Barelas sign during installation, 2016. The image on the sign features a photo of one of the participant's husband in his military uniform flanked by scanned images of his medals.

on public memory discussing the ways in which images of a past event displayed in relic infrastructure can become an important symbol for a community. Even if displayed only temporarily, these images can strengthen a shared sense of identity and history. When the planned life of a sign image is measured in terms of weeks and months rather than years, artists can respond to the specifics of the sign's site as well as its history, knowing that they are potentially reaching a very broad audience while consciously inserting their work into a succession of images. Vintage road signs have a particular appeal to long-time residents of a place because they are effective memory prompts that are shared by a community and are not usually or commonly associated with traumatic or controversial events. Seeing these familiar signs continually revitalized with vibrant new imagery can reassure communities that connections to the past can be maintained at the same time that new perspectives are considered.

Although FOS does not systematically collect information about how are projects are received by the community, we do compile anecdotal evidence of public interest in these projects. Images of our projects show up often in social media and comment threads attest to enthusiastic support. We were excited to find that a lingering video shot of The Reviver sign was featured on Anthony Bourdain's Albuquerque episode of Parts Unknown. FOS artists are continually approached by for information about our projects by journalists and art writers, and are often about invited to participate in art exhibitions. FOS projects are regularly funded by an array of governmental and private sources, and since there continues to be no shortage of empty and orphaned signs in Albuquerque—we look forward to continuing this work throughout the city and proposing it as a public art model for other cities with a surplus of empty signs.

The Revision project. FOS, digital print on vinyl, 2020. During the pandemic FOS artist/educators worked with the Albuquerque museum photo archives to select and edit images that were sent to local poets. The poets created text inspired by the image this artwork pairs an image selected and edited by Sara Rivera and a text written by Beca Aldrete Baca, the mood of the artwork recalls the earlier one installed in the same site.

The Casa Barelas sign during installation, 2016. The image on the sign features a photo of one of the participant's husband in his military uniform flanked by scanned images of his medals.

Exploring Vernacular Signage Along America's Legacy Roadscapes: A Field Report of Ongoing Research

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Abstract /

The context in which a sign is displayed and viewed, reflecting the surrounding natural, built and socio-cultural environments in which it is placed, is essential for how well a sign is able to perform its intended visual communication function to orient, inform, persuade, and/or regulate. To this end, signage research must give appropriate attention to contextual factors, especially along highways where natural, built, and socio-cultural environments may continually change. This field report describes efforts to document and assess vernacular signage found along America's legacy highways. Vernacular signs include a range of contextually designed and placed displays, usually connect to unique local businesses. The focus here is on how vernacular signs respond to contextual factors and often control their own contexts, and as such provide insight to the design, placement, and regulation of contemporary signs of all types.

Keywords /

vernacular signage; contextual factors; legacy highways

INTRODUCTION AND OVERVIEW

In 2004, John Jakle, a professor of geography and landscape architecture at the University of Illinois at Urbana-Champaign and Keith Sculle, the head of research and education for the Illinois Historic Preservation Agency published *Signs in America's Auto Age: Signatures of Landscape and Place* (Jackle & Sculle, 2004). As the authors note, signs "orient, inform, persuade, and regulate" (xvii), and as such, "give meaning to our natural and human-built environment, to landscape and place" (xvii). For those interested in how the design, placement, and context of on-premise signs both affect the visual communication effectiveness of the signs (Auffrey & Hildebrandt, 2017), and the signs' impact on creating a sense of place (Rahman & Mehta, 2020), the book offers an expansive examination of "how we take meaning" from signs and assign meaning to their locations (xx). As such, this work is foundational in its depiction of how signs contribute "meaning to our surroundings—the ways we 'read' landscape" (xvii). Yet even more, for contemporary signage researchers, Jakle and Sculle's work provides a useful historical perspective for understanding how on-premise signs have evolved in response to changing social and environmental contexts as they are used to orient, inform, and persuade. Indeed, it is the basis of our ongoing work that this historical perspective provides important lessons for understanding and informing the design, placement, and regulation of contemporary on-premise signage.

PREVIOUS RESEARCH

It was in this context that signage researchers from the University of Cincinnati with backgrounds in community development and urban and regional planning, and architecture and design set out in 2012, to document the design, placement, and context of on-premise signs along some of America's most venerable legacy roadscapes: US 50 from Ocean City, MD to Sacramento, CA; US 61 from New Orleans to the Minnesota Canadian border; and historic US Route 66, from Chicago to the Santa Monica pier. Other trips were made to places recovering from natural disasters to observe signage replacement (post-tornado recovery in Joplin, MO and Greenfield, KS), and those experiencing expanded use of signs associated with very different types of rapid economic expansion (Williston, ND and Branson, MO). Over the past nine years, the researchers have driven more than 12,000 miles and collected over 20,000 photos, taught three graduate seminars focused on signage research using visual attention and eye-tracking technology, presented and published numerous academic papers, and curated a university gallery exhibit. Currently a book manuscript based on this work is under preparation.

FUTURE RESEARCH

This field report describes on-going efforts to explore the use and impact of America's on-premise signage from a contextual perspective rooted in historical sociocultural understandings. This research has focused on "vernacular signage" along "legacy highways." Vernacular signage has been defined in various ways by numerous researchers and is often associated with vernacular architecture (VAF, 2021) and even vernacular landscapes (Jackson, 1986). This work has adapted a definition by designer Angela Voulangas who considers vernacular signage to be "local, site-specific, handmade or hand-crafted messages" (Voulangas, 2010). For our purposes the definition has been expanded to go beyond "one offs" to include a broad range of contextually designed and placed displays intended to reflect unique local establishments or organiztions. For signage research, what is important is how the study of vernacular signs provides insights to the de-sign, placement, and regulation of contemporary signs. This insight is particularly important for understanding how past, present, and future signs orient, inform, persuade, and regulate.

The positioning of this research along America's legacy "roadscapes" is considered equally important to its focus on vernacular signs. The term "legacy" as used here refers to those older two-lane US highways, many built in the 1920s, 30s, and 40s, and that are not part of the Interstate highway system. Interstate highways are highly regulated spaces that have been designed and located to facilitate the rapid movement of large numbers of vehicles and volumes of cargo between and within major metropolitan areas. Given the different role Inter-

Figure 1 /

Donut Shop, along US 61, Natchez, MS, 2013.

Figure 2 /

Bo-Mac's along US 50, Shoals, IN, 2012.

state highways, research related to the design, placement, and regulation of signs along Interstate highways raises somewhat different questions whose answers may have limited implications for signage in different contexts. Conversely, the many existing segments of the "United States Numbered Highway System"—often called US Routes or US Highways—continue to provide links between major cities. Sometimes these highways are re-routed and rebuilt as multi-lane freeways, but frequently they continue to serve as main streets through the business and government centers of the many small and medium-size cities, towns and villages that dot the American landscape (Weingroff 2019). The term "roadscape"

Figure 3 /

Yard Dog and Maya off US 290, Austin, TX, 2013

Figure 4 /

Ocean Gallery off US 50, Ocean City, MD, 2013.

reflects the combination of roadways and landscapes and is intentionally used here in a specific way: encompassing all the visible features that are part of the natural and built environments of an area along a roadway including animate and inanimate objects. Like landscapes, roadscapes are often experientially interpreted in terms of both their functional and aesthetic appeal based on sign viewers socio-cultural conditioning (Jackson, 1984).

With respect to signage research, it is understood that the signs along a particular roadscape, like language and literature, take on meaning based on the physical and socio-cultural character in which they are experienced (Sinha 2015). In the case of highway signs, it is the physical and socio-cultural character of the surrounding roadscape that affect how the message, design, and placement of signs are able to orient, inform, persuade, and regulate.

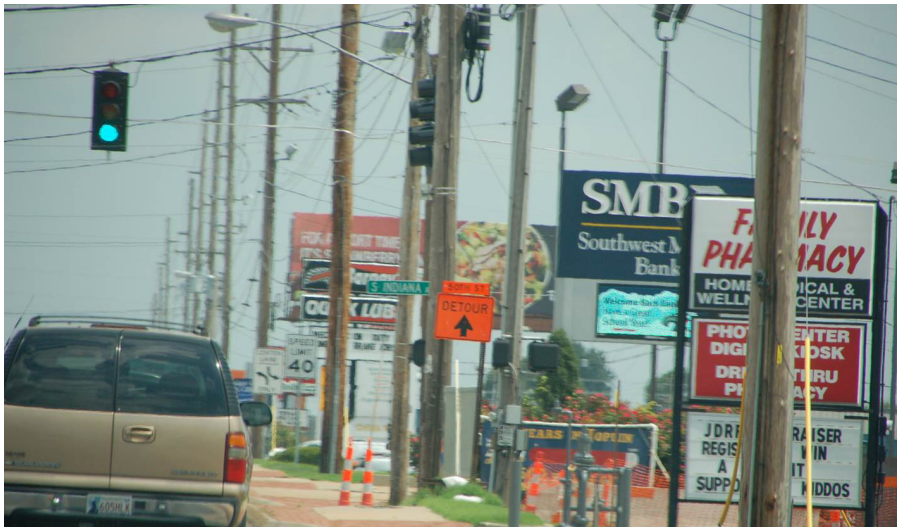

Figure 5 /

Visual Clutter Context, along US Route 66, Joplin, MO, 2014.

Figure 6 /

Flavors Drive Thru, along US 50, Aurora, IN, 2012.

Figure 7 /

Days Inn and Mobil, along I-40, Arizona, 2018.

Based on extensive highway signage research and travel over the past eight years, there is clear evidence that the roadscapes along legacy US highways generally offer greater variety of both physical and socio-cultural context and vernacular signage than do the roadscapes along the Interstate highway system, or state highways or local roads.

RESEARCH METHODS

This ongoing collection of images of vernacular signs along America's legacy highways is both a continuation and expansion of a long-term signage research agenda and seeks to build on the success of previous highway signage research. Indeed, a significant part of this current research is to design an enhanced research methodology so as to more broadly assess the communication effectiveness of on-premise road signs so the resultant understandings might better inform sign design, placement, and regulation. The researchers' previous work had focused on understanding how signs garner visual attention by means of analyzing photos of "in situ" on-premise road signs using both static image analysis (3M, 2017) and dynamic eye-tracking technologies (Tobii, 2019). Fundamental to this research was an effort to understand how the visibility, conspicuity and legibility of road signs are impacted by real-world contextual features of surrounding landscapes (i.e. natural and built environment features) in fulfilling the basic functions of signs to orient, inform, persuade, and regulate (Bullough, 2017; Jackle & Sculle, 2004).

As an expansion of that prior research design, new and existing methodologies can and should be adapted to facilitate a more advanced assessment of the other known and yet to be identified unknown factors influencing how signs orient, inform, persuade, and regulate. Visual attention analysis software has been useful for assessing

Figure 8 /

Example of Visual Attention Software Analysis, 2016

how sign design and placement capture viewer attention within a single perspective or viewshed as captured by a camera in a discreet moment in time (3M, 2017). When used appropriately, and the results interpreted within the limitations of the visual field captured in an analyzed image, such software can be a useful, easy to use, and inexpensive signage research tool (Auffrey & Hildebrandt, 2017). However, its major limitation is that it may miss important contextual elements that are visible to real-world sign viewers but have been excluded from the analyzed images. This may be especially problematic for highway signage research given how the valid sign images must necessarily be collected from a moving vehicle in a highway travel lane. Partially in response to the limitation of visual analysis software, recent wayfinding research has used more advanced eye-tracking technology to dynamically assess how subjects' visual attention is captured by directional signage as they move through signage environments (Tang, 2018). Other research has adapted eye-tracking technology for assessing pedestrians experience of on-premise signs in shopping districts (Knuth, Behe & Huddleston, 2020). Current research at the University of Cincinnati is focused on adapting the eye-tracking technology for highway sign research (Hildebrandt & Auffrey, 2020).

Other research methods for highway sign research may include tools such as visual preference surveys (VPS) for obtaining viewer feedback on signage design alternatives based on photos with full context (Nelessen, 2021). VPS have been used in urban and regional planning research to assess impacts of zoning changes and preferences for development alternatives, and conceptually the methods have promise for signage research as well (Ewing, 2019). Specifically, VPS methods may allow more rigorous assessment of how signs with different designs and contextual placements orient, inform, persuade, and regulate different groups of viewers. Further, VPS methods might be adapted to identify if and when vernacular signage, either separate from or in combination with vernacular architecture, provides an advantage for certain types of visual communication messages.

Finally, any discussion of the development of advanced research methods for the assessment of on-premise highway signs must address the need for a signage image source with consistent, valid and reliable data. In this regard, it is hoped that an outcome of the current highway signage research, and perhaps more realistically an aspirational component of a future research process will be the creation of just such a permanent, searchable digital archive of still and video images of on-premise signage. Such an archive would be made available to researchers throughout the world via the internet, and made searchable by date, type, technology, location, context, purpose, size, and other yet undetermined characteristics. Technical issues of format, perspective, and quality will need to be standardized and classified. Given its open-source nature, care will be needed for the determination and maintenance of accurate authorship and other sourcing information. Of course, appropriate digital security will be required to avoid loss or corruption of images (Gosal & Ziv, 2020).

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Visualizing and Communicating Neighborhood Identities

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Abstract /

Place quality, sense of place, and authenticity are sensory, psychological, and social constructs that are perceptible in forms, activities, and meanings of places. Much of this is visible in the material culture of places—in the architecture, art, public spaces, show windows, signage, artifacts in public spaces, as well as those that are in private space but visible to the public, and more. In this project we aim to capture and communicate the sense of place and distinct quality of each neighborhood in Cincinnati, OH. Using a range of qualitative and quantitative methods, we generate a set of consistent elements to create a single postcard to represent each neighborhood. The 52 cards, one for each neighborhood comparatively present the individual identities of each neighborhood along with a collective identity for the city.

Keywords /

neighborhood; sense of place; identity; authenticity; neighborhood postcards

INTRODUCTION

Cities are often advertised as places made up of many unique and authentic neighborhoods. They are promoted as places that offer a choice of neighborhoods that are distinct spatial and social areas with diverse communities. Yet, as cities evolve and are revitalized, often under immense development pressure, many become victims to standardized planning and design strategies that disregard much diversity that the neighborhoods may possess. These processes erode the unique sense of place and authenticity of distinct neighborhoods, as well as the diversity within cities, resulting in homogenized and ageographic urban space. This is an area of concern for urban designers, architects, planners, geographers, historians, and several others who are interested in authenticity, place quality, and sense of place. Scholars and professionals in these fields have a host of means and methods to capture and map material and social elements and phenomena to represent the characteristics that distinguish neighborhoods from each other. These methods range from tangible and quantitative aspects of demographics and other characteristics available in census data to the various qualitative information available in the built environment, social media, individual stories, soundscapes, and many more that represent the *genius loci* or sense of place of neighborhoods. In this study, we synthesized and visualized qualitative and quantitative data and information to represent the character of each of the 52 neighborhoods in Cincinnati, Ohio. We generated a set of consistent elements to create a single postcard to represent each neighborhood. By doing so, we are able to comparatively present the individual identities of each neighborhood along with a collective identity for the city.

AUTHENTICITY AND SENSE OF PLACE

A sensory, emotional as well as a social construct, authenticity can be quite simply understood in Zukin's (2010) words as "the *look* and the *feel* of a place as well as the social connectedness that place inspires" (p. 220). Although authenticity is subjective, it is made visible in buildings, objects, spaces, and other real things. In the spatial context, authenticity has several overlaps with the idea of sense of place. Harrison and Dourish (1996), capture the notion of place as the result of space that is overlaid with meaning by humans. Similar to Zukin's (2010) notion of authenticity, Canter (1991) suggests that our understanding of a setting, in essence, depends on what we *do* in places and how we *feel* about them.

Authenticity and sense of place are key concepts in urban design. Authentic places are understood as the confluence of relevant forms, activities and meanings (Montgomery, 1998; Punter, 1991) and urban designers interested in creating memorable places strive to create forms and spaces that emerge from rooted culture and local settings. In doing so, urban designers must understand the value of the context in which they operate to uncover and emphasize the intrinsic qualities that make places distinctive and authentic. The material culture of places has much to offer, as it represents the forms and activities of places. In the context of neighborhoods, there is a variety of material culture—architecture, art, public spaces, show windows, signage, artifacts in public spaces, as well as those that are in private space but visible to the public, and more—that serves as the source of understanding the authentic and unique sense of place. In this project, we aim to map and convey the sense of place of each neighborhood in Cincinnati, Ohio by mapping the most representative elements of material culture from each neighborhood.

SETTING

Cincinnati, Ohio is one of the cities in North America that has many distinct neighborhoods with strong identities. A city located along the Ohio river with multiple hills provides a unique geography for the neighborhoods that are are built on hillsides, hilltops, and in valleys. Abundant open space, ranging from small parks to forests as well as other water bodies within the city, also provide distinct landscapes for several neighborhoods. Cincinnati is one of those cities where the majority of neighborhoods, due to their age, history, and unique character have a pattern that permits them to be distinguishable physical places. It is a place of distinct spatial geographic areas with a robust structure, a history, and a community attached to place that makes many of its neighborhoods truly unique. In addition, of the 52 neighborhoods in the city, 32 have designated business districts, ranging from a handful of shops to several city blocks, that provide a wide range of services and amenities and also lend a sense of place and centeredness to each neighborhood.

Since the racially charged civil unrest of 2001, the last two decades in Cincinnati has been a time of immense energy and newfound trust in the city that has led to the

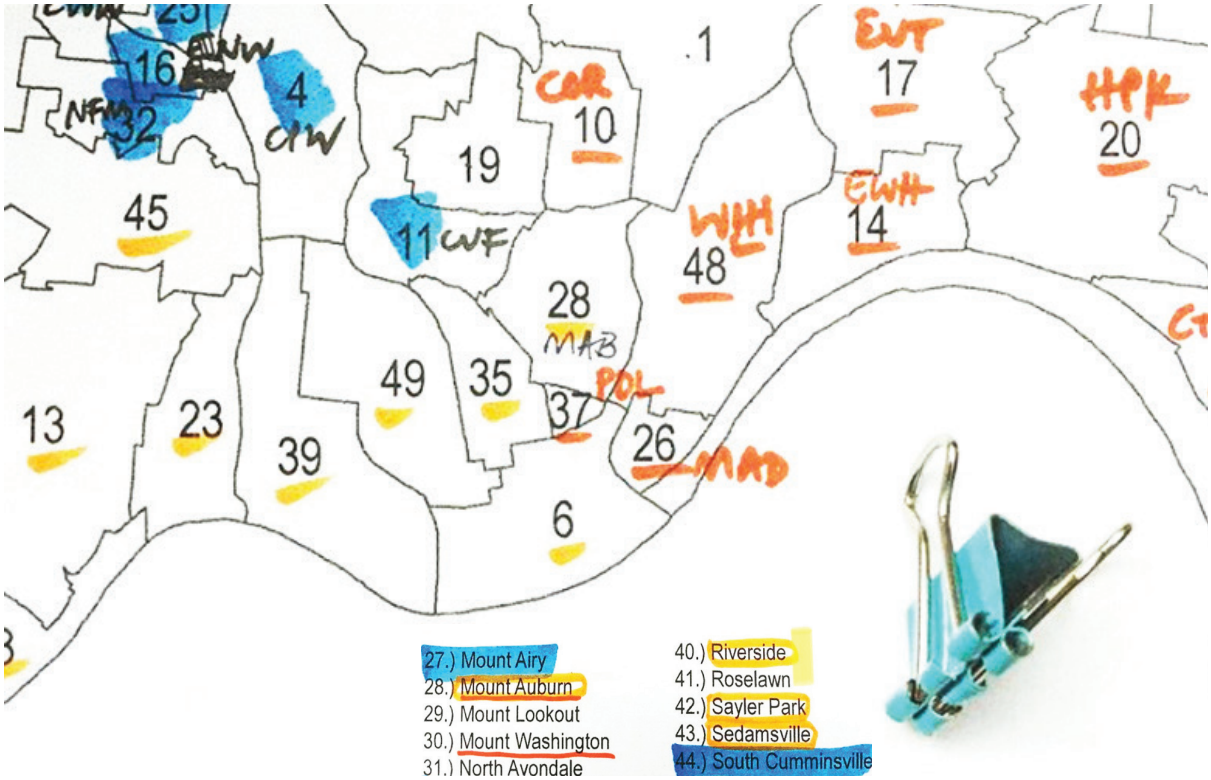

Figure 1 /

Partial map of the 52 neighborhoods of Cincinnati, Ohio

revitalization of several neighborhoods. Once again there is the desire and promise to make the city a place to live, work, learn, play, and grow. Existing institutions are being revived and new ones established to build and strengthen community. At the same time, this transformation also results in loss of meaningful landscapes and elements of material culture that provide a sense of continuity, ownership and meaning to people, and thus attachment to their neighborhoods.

MAPPING NEIGHBORHOOD IDENTITIES

This project aims to visualize and strengthen the sense of community and neighborhood identity in the neighborhoods of Cincinnati. Our goal is to capture and communicate the sense of place and distinct quality of each neighborhood in the city. Creating a visual and tactile set of postcards makes it easy to communicate the neighborhood's uniqueness, individual character, and distinct sense of place not only to other residents of the city but also to the residents of the neighborhood itself to help them understand the uniqueness of where they live (Figure 1).

Each postcard is a synthesis of qualitative and quantitative data and information that represent the character of each neighborhood in Cincinnati. This information is distilled into a set of consistent elements that consist of a photograph, data, and a narrative. One face of the postcard is a photograph that represents a unique but representative image of the neighborhood. This photograph may be a beloved business, a mural, a historic building, a marker, or a street scene. On the other side are four text elements that represent the neighborhood. These include a three-letter abbreviation of the neigh-

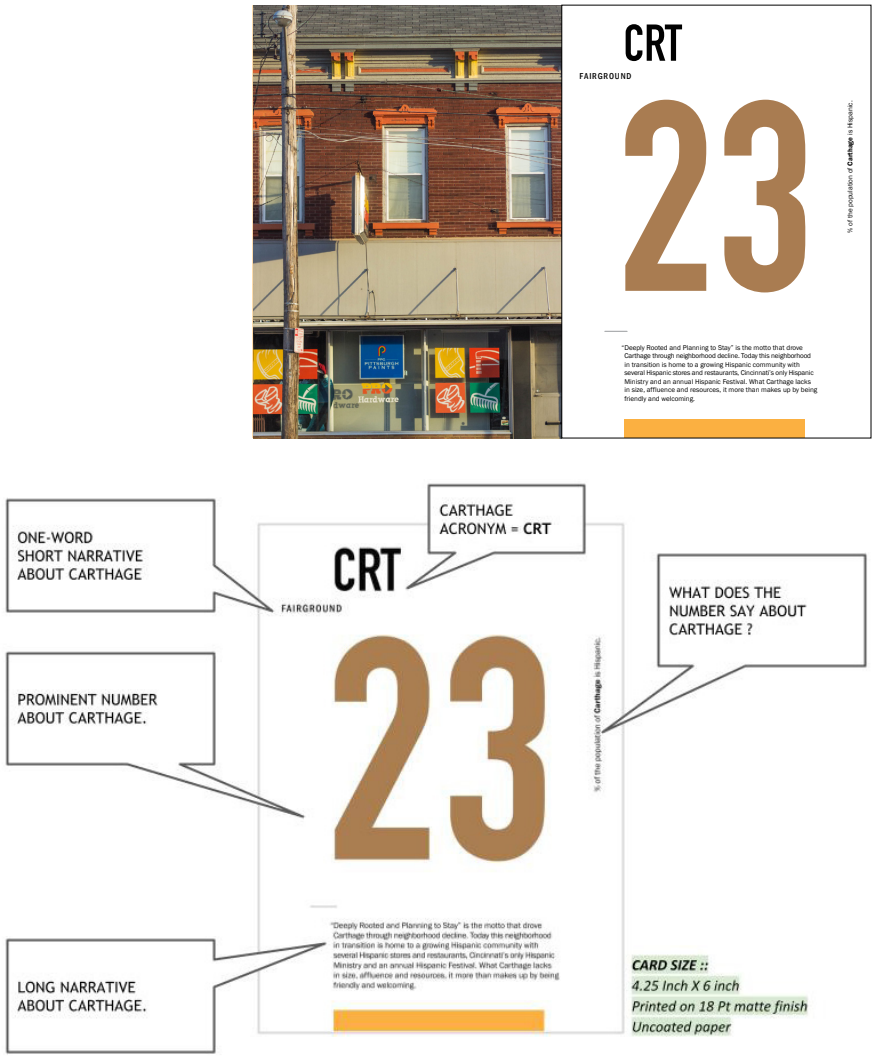

Figure 2 /

The design and components of the neighborhood card

borhood name, one word that represents the neighborhood to many people (crowd-sourced from students at the University of Cincinnati), a short paragraph discussing a unique historic or demographic aspect of the neighborhood, one prominent number that represents the neighborhood and an explanation of that number (Figure 2).

The photographs of material artifacts were taken by the two authors and another member of the project team. The data and information on neighborhoods were obtained from the City of Cincinnati, 2010 US census data, ESRI Forecast 2017, ACS Estimate 2011–15, Cincinnati Area GIS (CAGIS), Neighborhood Community Councils websites, Zillow, Trulia, Downtown Cincinnati Inc., Walkscore.com, and websites of specific organizations, such as the Cincinnati Observatory and Spring Grove cemetery.

Figure 3 /

A wide range of visual material culture of the neighborhoods make up the neighborhood cards.

Figure 4 /

The fronts and backs of all the 52 neighborhood cards

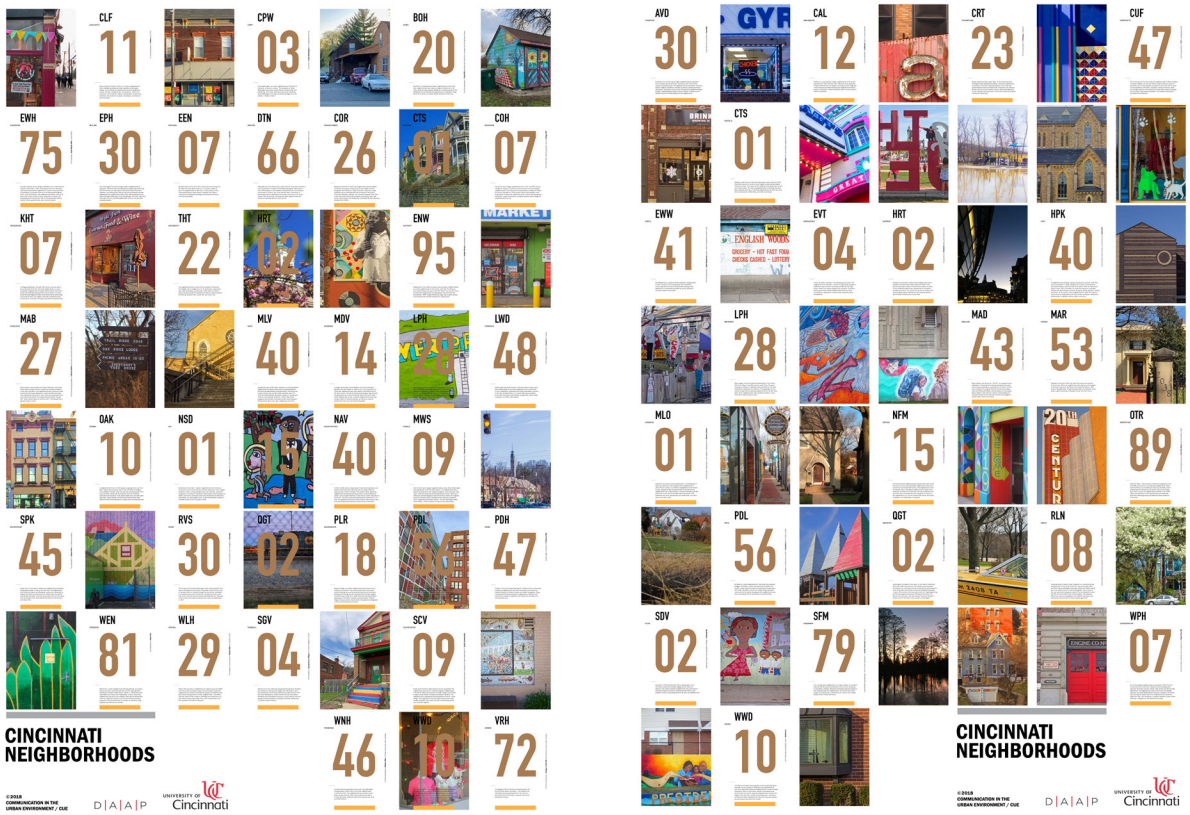

Figure 5 /

Posters displaying the 52 neighborhood cards

Figure 3 showcases the wide range of visual material culture that represents the 52 neighborhoods and Figure 4 and 5 display both sides of the cards showing the range of characteristics and circumstances that distinguish the 52 neighborhoods. The collection of postcards comparatively presents the individual identities of each neighborhood and also a collective identity of the city.

We began this project on neighborhood identities by asking "how can we create an artifact to visualize and communicate neighborhood identity?" As we visited each neighborhood, developed a sense of place for each, collected data and information we learned about the unique places in the city, as might be expected. But we also learned about the vast disparities, sometimes in neighborhoods adjacent to each other. As we conceptualized and finalized the postcards, we also started to experiment with the possibility of creating a new set of postcards that explore the interactions to create a dialogue between residents of neighborhoods that are starkly different from each other often within the same part of the city (Figure 6). We expect to use these as artifacts as learning tools for residents of the city.

Figure 6 /

Creating a dialogue between neighborhoods by overlapping neighborhood characteristics in one card

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Book Review: Art and Design in 1960s New York

by Amanda Gluibizzi

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In *Art and Design in 1960s New York*, Amanda Gluibizzi, explores the intersectionality of art, design, advertising, and signage during the period of great social unrest. The 1960s were a challenging time for New York. High poverty, widespread crime, and economic decline culminated in New York City defaulting on its credit in 1975. This social turmoil coincided with the flourishing of art and design in New York, as both fields responded to an urban environment in flux. It is within this context, a city in crisis, that Gluibizzi examines the ways in which artists began to incorporate elements of the city, its design, its civic and commercial signage, into their art. Fundamental to this analysis is how the fields of art and design responded to each other during that time, and how the lines between the two fields became increasingly blurred as artists and designers pushed the boundaries of their respective fields.

Instead of using artists and designers as counterpoints to each other, the author explores their works in tandem. In this way, a dialogue is built around signage and wayfinding themes of New York at the time, explored from both artistic and design perspectives, and with the philosophical works of Ludwig Wittgenstein providing the backbone for much of the dialogue and analysis.

When writing about design, Gluibizzi includes everything from print advertising – such as that found in magazines and on billboards – to civic and street signage, as well as wayfinding strategies such as those employed for the Noorda and Vignelli map of the New York Subway. The Combines of artist Robert Rauschenberg help to inform our understanding of the controversy over billboards (chapter 3), and Vito Acconci's wayfinding-focused *Following Piece* provides for a more sinister interpretation of the

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efforts at developing a new signage system for the New York Subway (chapter 4). Finally, solutions to the social and economic crises are called for in back-to-back design and art exhibitions in 1972 (chapter 5).

The sources employed throughout the book are diverse, spanning from the art pieces and design products of the time to the personal and published writings and interviews of artists, designers, and urban thinkers, as well as current published literature. The extensive use of primary source materials, especially those written or recorded by the artists and designers themselves, provides sound supporting evidence of the interaction of the two fields and the influence of the urban environment on their work. Of the book's five chapters, this review focuses on chapters 3-5 since those chapters pertain primarily to issues of signage and wayfinding at that time. Chapters 1 and 2 are informative as well, and those interested in pop art and print advertising are encouraged to read these.

In chapter 3, *Navigating the Vernacular Glance: Billboards, Signs, and the Urban Combine*, Gluibizzi explores how artists, such as Robert Rauschenberg, exploited the "explosion of grammatical rules" (p. 82) brought about by the proliferation of billboards. While Rauschenberg seemed receptive to the insertion of billboards into the urban landscape by incorporating the style and syntax into his Combines, his acceptance contrasted with the vocal opposition of designers, planners, urban thinkers, and suburban homemakers who saw billboards as unsafe eyesores, leading to an uncontrolled "linguistic chaos" (p. 79).

The conflict over billboards centered around aesthetics and safety, with the likes of Robert Moses arguing that billboards would spoil the "scenic areas and fine architecture," or they would "endanger the safety of motorists" (p. 77). The visual confusion of the New York urban environment, thought to be exacerbated by billboards, led some artists such as Rauschenberg to examine the implications of these concepts in their work. Using arrows, civic signage, and traffic lights, Gluibizzi effectively argues that Rauschenberg's Combines guide "the viewer's eye through and around the aspects of the works that might act as billboards would to prevent straightforward progress through the composition" (p. 83). The viewer is required to make sense of the competing signage of the Combines, much as they are forced to make sense of an increasingly illegible urban streetscape. The nexus of art, design, and the response of both fields to street signage, comes to the fore in this chapter.

In Chapter 4, the analysis turns to wayfinding, where Gluibizzi compares the Unimark design plan and methodology for an overhaul of the New York Subway System signage, with Vito Acconci's performance art titled *Following Piece*. The subway at the time was in poor condition and was considered an "undesigned misery" by Mayor John Lindsay's own Task Force on Urban Design. Consultants for Unimark, Massimo Vignelli and Bob Noorda, were contracted by the Metropolitan Transit Authority to attempt an effective redesign of the signage, and to perform passenger flow studies. These passenger flow studies, in which the passengers were "followed" (p. 117) by Noorda, and points of decision or mistakes were marked on a map of the subway, allowed for the creation of "a plan for the installation of signage at needed points along the paths through the stations" (p. 117).

Acconci explores this wayfinding technique in *Following Piece*, in which Acconci chooses "a person at random, in the street… following him wherever he goes, however long or far he travels" (p. 119). Gluibizzi shows how both artist and designer followed a similar process. Both plotted their targets' movements; both produced maps; likewise, both showed an awareness of the imposition of their actions on unsuspecting subjects.

With the focus centered on subway signage, the author explores typology, and the way in which typeface, font, serif or sans serif, can influence how signage is designed and passenger perceptions of the signage in the New York Subway. Gluibizzi writes that "by its nature, signage must navigate between the geographic, the pictographic, and the typographic" (p. 127). Unimark's recommendation to replace the "amateurish" and "folksy" (pp. 114, 119) hand-painted subway signage with a clean Helvetica was an effort to improve readability but also appeared to assert a level of control over a chaotic wayfinding system. The choice of typeface such as Helvetica and other sans serif fonts allowed for, as Gluibizzi writes,

more "dictatorial undertones," (p. 128) leaving the traveler with less flexibility to question their path.

At times, the analysis appears stretched, and the dialogue between the work of the artists and that of designers could sometimes be difficult to follow. Yet this historical perspective, looking at the "undesigned misery" (p. 113) of the New York subway, is a thoughtful study of how artists and designers employed wayfinding techniques in their work.

In Chapter 5, *What's the Matter with the Megalopolis*, the setting is a New York City in decay. Congested streets, pollution, and aging public transit led the city to host two exhibitions, one for artists and one for designers, with the goal of responding to the many challenges facing the city in the 1960s and 1970s.

The 1972 design exhibition, titled "Making New York Understandable" explored the fundamental problem of the "illegibility" of New York, and how designers struggled with an "un-understandable city" (p. 144). Indeed, the invitation to contribute to the "Making New York Understandable" design exhibition stated the challenge clearly: "We make posters to sell products on highways, then get lost going home on those same highways. We make public service ads but we can't read the public subway map in our own city" (p. 144).

Designers, according to Gluibizzi, traced the illegibility of New York back to the cognitive mapping concept proposed by Kevin Lynch. Unlike centrally designed cities such as Paris, New York, Gluibizzi writes, appeared to have been built ad-hoc. An incoherent street grid, larger than life architecture, and a disorienting subway system all served to undermine a traveler's ability to wayfind by locating known landmarks and monuments.

Following the design exhibition, artists provided a response with an exhibition of their own, titled "Making the Megalopolis Matter: The Artists Answer." Gluibizzi approaches both exhibitions with a critical eye, comparing works from each, and parsing the major themes to which both designers and artists were responding. It is in this vein of comparison that Gluibizzi returns to the Unimark and its design efforts for the subway. The 1972 subway map, the product of Unimark's subway analysis created by Massimo Vignelli, is contrasted with the art piece *Walls Paper*, by Gordon Matta-Clark, which appeared in the "Megalopolis" exhibition. Far from presenting a solution, Matta-Clark's piece, depicting houses on the verge of being torn down, touched on the fears of designers that their "fixes" to the signage problems of New York would be vain and superficial, and would fail to resolve the city's many challenges. Here Gluibizzi returns to the Vignelli map, for "in print and in public, the subway map was called out for making the city, once again, un-understandable" (p. 177). Seen as a solution to a decades-old problem, the new subway map had failed, and was scrapped in 1978.

Art and Design in 1960s New York is art-heavy and challenging for the non-artist to decipher at times. The reader is also left wondering how this method of analysis could be applied to modern signage and wayfinding challenges. Concluding remarks outlining new areas of research would have been helpful for this. However, the book is well-organized, and the author has carefully interwoven layers of history, art, design,

and the urban landscape into a complex narrative of a city in flux. Indeed, the examination of how art and design employed civic and commercial signage and wayfinding strategies provides a fascinating interpretation of how both fields responded to the city's urban challenges. *Art and Design in 1960s New York* is an insightful contribution to wayfinding and signage research, blending art and design perspectives in a historical context that researchers from disciplines spanning art, design, signage, and wayfinding will find valuable.