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SIGNAGE PERCEPTIONS, EXPERIENCES, AND AESTHETIC JUDGEMENTS

Signage Perceptions, Experiences, and Aesthetic Judgements

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INTRODUCTION

This issue of the *Interdisciplinary Journal of Signage and Wayfinding* presents a range of work truly reflecting both this journal's interdisciplinarity and its attention to both signage and wayfinding research. The title of this issue, Signage Perceptions, Experiences, and Aesthetic Judgements, reflects the range of scholarship included, but also highlights the complex nature of the multiple factors influencing the effectiveness of signage as an essential means of visual communication. As the articles in this issue demonstrate, the interrelated factors of regulation, design, and display context, taken together, will impact viewer perceptions and judgments about the messages on signs, and may lead to different viewer behavior entirely apart from the actual text used. Ultimately, the matters explored in this issue have important implications for commerce and wayfinding, as would be expected of explorations of signage effectiveness, but also connect with the range of related quality of life issues which underscore the importance of signage and wayfinding research in a broader societal context.

Regarding signage perceptions and aesthetic judgements, the Rakestraw, Crawford, and Lee article brings to the forefront the influence of local regulations, and the extent to which designers and non-designers agree or disagree on their perceptions of the results of those regulations with respect to communication effectiveness and perceptions of beauty, interest, and order. These finding are especially important for local elected and appointed officials who make and implement signage regulations and whose understanding of signage research and the potentially far-reaching impacts of their decisions may be very limited. Likewise, design professionals who advise on various aspects of sign regulation, design, construction, and placement may not be

surprised at the results but should be cautioned not to simply dismiss the perceptions of the uninitiated.

The results reported by Hong and Isaac relate to how we perceive and experience signs, and provide an eye-opening challenge to the assumption that billboards have their greatest impact in high-traffic locations. Certainly, those outdoor advertising companies with substantial billboard investments in high-traffic areas where they are able to charge substantial premiums based on potential view counts will want to read this article carefully, as will those advertisers paying the higher rates. While the authors do not claim to directly compare the overall impact of high-traffic sign cluttered locations vs. lower-traffic uncluttered locations, their evidence strongly suggests there is clearly more to billboard effectiveness than just the number of potential viewers at a specific location. Those engaged in signage research will not be surprised. Clearly this study provides the basis for well-designed follow-up studies to better understand the complex mix of signage design, context, and potential views.

Tullio-Pow, Yu, and Strickfaden also address important issues of perception and experience while providing much needed research results to inform public policy and standards for major retailers and shopping malls in serving the shopping needs of those with visual impairments. Their study, grounded in taskscape theory and multiple-method ethnographic perspectives, provides new understanding into how signage and wayfinding impact the shopping experience of those with visual impairments, based on the researchers' characterization of seven essential activities for those with visual impairment. Their findings provide a systems approach that can serve to inform those tasked with designing complex shopping environments for able-bodied people to instill balance and equity without compromise so that those with visual impairments are treated as full citizens with full access to shopping opportunities.

Simpson's work using three-dimensional eye-tracking heat maps adds an important methodological element to the growing collection of research using mobile eye-tracking technology to dynamically assess viewer perceptions and experience over time and space. Clearly, eye-tracking has become an increasingly important tool for expanding our understanding of viewers' response to signage in real-world contexts. Technological advancements have rapidly moved the technique from lab measurement of eye response to static images on a monitor and the predicted response based on photo images using 3M's VAS system, to dynamic measurement of eye movement in real-world environments using wearable mobile eye-trackers. Simpson's work seeks to expand on the representation of viewer gaze using 3D gaze projection heat maps. This is an important advance that deserves the attention of all interested in better understanding the complexities of the communication effectiveness of signage.

This issue ends with a review of a recent book that is very much about perceptions, experience, and aesthetic judgements, and has caught the attention of urban designers and others interested in urban placemaking. As Metsker-Galarza's review shares, the book has more far-reaching relevance for signage researchers with concerns about visual communication. *What the Signs Say: Language, Gentrification, and Place-Making in Brooklyn* is focused on helping readers understand how signs contribute to the creation and transformation of specific places, yet it also is very much about visual communication in a broader context, and the sometimes subtle and not so subtle ways of telling viewers what a business is and is not, and implicitly communicating who is welcome and who is not. As Metsker-Galarza notes, *What the Signs Say* is very much about critically assessing how the text and graphic symbols on a sign can contribute to the transformation of a place, whether signaling investment and inclusion, or displacement and exclusion.

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Perceptions of On-Premise Commercial Sign Regulation Codes for Beauty, Interest, and Order by Designers and Non-Designers

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Abstract /

Regulation has long since guided urban growth, and it is essential for municipalities to construct regulation that is conducive to creating visually stimulating public spaces. Minimal scientific research has been conducted on the impacts of commercial signage and the varying arrangements created by different sign regulations in regard to perception (Jourdan, Hurd, & Hawkins, 2013; Portella, 2014). With the rise of public involvement in planning (Lane, 2005; Sanoff, 2000), it is essential that designers and non-designers coordinate to develop sign controls that contribute to urban growth. This research studies the differences and similarities in perceptions of planning and design professionals and non-designers to aid in the development of future, more positively perceived, signage regulation. By using visual models presented in the form of a survey, findings show both similarities and differences between these groups in their assessment of signscapes regarding communication, perceptions of characteristics like beauty, interest, and order, an overall preference toward highly structured codes, and a difference in harshness of evaluation.

Keywords /

on-premise signage; zoning code; form-based code; perceptions of designers and non-designers

INTRODUCTION

The urban landscape is comprised of many parts, all regulated by a municipal code. One of these parts, signage, is an important element within the urban environment, as both way-finding and commercial signs line modern American streets (Meikle, 2013). Their primary function is communication, and they are regulated by a municipality's code or ordinance to protect the health, safety, and general welfare of the public (Strauss, Jourdan, & Weinstein, 2014; Jourdan, Hurd, & Hawkins, 2013). A signscape, the collection of signs within a streetscape, can have a pronounced effect on the socio-economic productivity of a place (Rexhausen, Hildebrandt, & Auffrey, 2012; Stotmeister, 2013; Taylor, Sarkees, & Bang, 2012; Alford, 2011). A legible and well organized signscape can increase positive perception and economic activity while the opposite can lead to visual pollution and can hinder economic activity.

Regulation development has long been an area of contempt for designers and for whom they design (Pendlebury & Townshend, 1999; Kaplan & Kaplan, 1989). Public involvement in planning has become increasingly prevalent (Lane, 2005; Sanoff, 2000), so now, more important than ever, design professionals and non-designers must successfully create effective regulations collaboratively to advance urban growth and development. It would seem as though the education and training planning and design professionals receive would alter their perception of the urban landscape, but there is conflicting evidence on whether or not this perception varies much from non-designers (Portella, 2014; Yung & Chan, 2013; Gjerde, 2011; Pugalis, 2009; Coeterier, 2002; Kaplan & Kaplan, 1989). If these two groups do not perceive the environment similarly, it can be argued that planning and design professionals would have difficulty providing their clients with products that accurately represent their wants and needs. Understanding how each group thinks and

communicates is a first step in effectively creating a collaborative environment for urban signage development.

Existing research has found the quantity, placement, design, and size of commercial signage can contribute to visual clutter and has the potential to decrease the aesthetic quality of the outdoor environment (Jourdan, Hurd, & Hawkins, 2013; Portella, 2014). Because of the impact that signage can have on the public realm (Crawford, Lee, & Beatty, 2015; Berger, 2014; Portella, 2014; Nasar & Hong, 1999), proper regulation of these structures is key to creating visually stimulating public spaces. In connecting environmental perception and signage, it is apparent that a gap in research exists between how designers and non-designers consider on-premise commercial sign regulation.

The purpose of this interpretive study is to understand how the perceptions of designers and non-designers are similar and differ regarding on-premise commercial sign controls within urban corridors. The area of research is in the greater Lansing, Michigan area, and focuses specifically on a span of Michigan Avenue that extends over two municipalities, the cities of Lansing and East Lansing. By understanding the perceptions of on-premise sign controls by different user groups in this localized policy environment, this study can add to the body of knowledge regarding sign regulation and design.

LITERATURE REVIEW

Designers and Non-Designers

Challenges in public planning can arise from miscommunication between designers and non-designers. The public often has difficulty describing their requests and requirements regarding development, resulting in a fixation on specific details instead of the exploration of broad ideas (Kaplan & Kaplan, 1989). Conversely, designers may overwhelm the public with project's complicated technical aspects (Creighton, 2005). This gap in communication, along with the presence of multiple individual desires and preferences, makes it particularly challenging to cultivate productive conversations concerning planning and development (Kaplan & Kaplan, 1989; Burisch, 1979), but, as Sanoff (2000) notes, individuals can be reasonable and capable of altering their views when presented with new information and a shared vision.

Designers, among others, are responsible for shaping the public realm and guiding the development of signage including theme, regulation, construction, placement, and form. Historically, expert opinion has been used as the primary source for developing city regulations (Portella, 2014; Pugalis, 2009; Parolek, Parolek, & Crawford, 2008). The debate on how heavily to rely on expert opinion is based principally on the idea of the expert's understanding of regulation and how that can truly represent community desires. However, differences in perception exist between designers and non-designers and designers may only have a limited ability to predict public preferences (Kaplan & Kaplan, 1989). Research confirms that facets of the outdoor environment, such as architecture, historic sites, and civic spaces, are evaluated differently by designers and non-designers (Yung & Chan, 2013; Pugalis, 2009; Coeterier, 2002; Kaplan & Kaplan, 1989).

Notable environmental perception studies found differences between designers and non-designers in perception of the outdoor environment (Pugalis, 2009; Coeterier, 2002). The studies had conflicting results of evaluation criteria considered as significant to each group. In Pugalis' (2009) study of urban public space, research found that designers were predominantly concerned with the aesthetics of urban public space while non-designers found social encounters and cultural experiences within the space to be more important. Conversely, in research on the evaluation of historic sites, Coeterier (2002) reported that non-designers were more concerned with physical form or aesthetics while design professionals concentrated on features such as building age, rarity, and completeness. This variability may result from the different subject matter under evaluation; the discrepancies between how designers and non-designers evaluate environments remains.

While there is considerable support for the claim that designers and non-designers perceive environments differently, the degree of these differences is not well defined. Several studies observed similarities, as well as differences, between evaluation criteria of designers

and non-designers (Yung & Chan, 2013; Pugalis, 2009; Coeterier, 2002). Yung and Chan (2013) and Gjerde (2011) indicate that professionals and non-designers evaluate spaces slightly differently and allude to statistically significant differences in perception between the two groups. However the research indicated that these dissimilarities may not be substantial. Studying social, economic, and aesthetic variables, one case found that both designers and non-designers identified architectural merit as significant for evaluating historic buildings. Although this variable was identified as significant by both groups, architectural merit was the most significant criteria to non-designers, while cultural identity was ranked first by built environment professionals (Yung & Chan, 2013).

Gjerde (2011) also found that designers and non-designers perceive urban street scenes similarly. Significant differences were not found in perception, but rather in the greater conviction with which designers voiced their thoughts in contrast to non-designers. While previous research comparing perceptions commonly focused on singular objects or buildings, Gjerde (2011) speculated that by studying the urban environment as a whole, similarities between these two groups may be more apparent.

In her book *Visual Pollution*, Portella (2014) found commonalities across designers and non-designers. These conclusions are consistent with Crawford, et al. (2015), where thirteen stakeholder groups, including planning / design professionals, were compared. While these results vary from some of the literature, both Portella (2014) and Crawford, et al. (2015) measure the perceptions of planning and design professionals in relation to commercial sign controls. These studies also focused on streetscape evaluation; because the outdoor environment is complex, signscapes could be a distinct variable that is evaluated similarly by both designers and non-designers.

On-Premise Signage and Regulation

On-premise commercial signs are signs located on the site of the business for which the sign advertises (Kieffer, 2001). This includes, but is not limited to, building mounted signs, electronic message centers, pole signs, pylons, roof signs, animated signs, ground signs, and window signs. Wayfinding signs direct users to a given destination and include traffic, street, and directional signs (Kieffer, 2001). Because on-premise commercial signs are located on private property, they offer their own sets of challenges regarding traffic and safety. Understanding sign characteristics that provide motorists with clear communication, thereby ensuring safety, is a contributing factor to the regulation of on-premise signs (Garvey & Crawford, 2015; Jourdan et al., 2013).

Misguided regulation of on-premise commercial signage occurs because of a misunderstanding of the impact that signs have on the visual landscape and the economic welfare of a business (Taylor, 2011). Since the early 1900s, sign regulation has been allowed, grounded on the ideas that regulations protect community health, safety, and general welfare (Jourdan et al., 2013). Sign controls are traditionally governed by a municipality's zoning ordinance, however alternative forms of sign controls can be found in other municipal regulations, like form-based codes (Parolek et al., 2008). Zoning regulations rely on a distinct separation of uses and these types of regulations have been criticized for their tendency to hinder business development (Liebermann, 2002; Parolek et al., 2008). For example, signage regulations within zoning codes define specific requirements regarding height, luminosity, sign type, placement, and other aspects (Jourdan et al., 2013). The objective for both a zoning and form-based code is to organize signage in a way that promotes health, safety, and general welfare, but modern sign policies may be overreaching from their original scope, as sign regulation is often based on localized aesthetic preferences and not empirical health, safety, and welfare research (Strauss et al., 2014; Jourdan et al., 2013; Kinoshita & Orlando, 2013; Taylor, 2006).

For the first time since World War II, urban centers in the United States are growing, increasing the demand for high density, multiuse structures and spaces that can be difficult to accommodate with traditional zoning regulation (Cohen et al., 2015; Liebermann, 2002; United States Department of Agriculture, 2015). Form-based codes emerged as an alternative to traditional zoning, forming a regulatory relationship between the built and natural environment to encourage economic growth and combat urban sprawl through sustainable, walkable, and high-quality environments

(Parolek et al., 2008). These ideals are traditional components in streetscape design but have only recently regained broad support from urban planners and designers (Parolek et al., 2008). Form-based codes consist of graphic or typological coding. The rules are described with simple text accompanied by clearly drawn diagrams, definitions, and additional visuals that support the character to be created by each specific code (Form-Based Codes Institute Staff, 2013). This approach makes form-based codes user-friendly and act as guides for designing commercial signage (Form-Based Codes Institute Staff, 2013; Parolek et al., 2008).

Research indicates that urban streetscapes can be improved by reducing sign obtrusiveness (Nasar & Hong, 1999). In this study, respondents preferred less-obtrusive signscapes, finding the signs to be more legible and viewed these places as more interesting and desirable to visit (Nasar & Hong, 1999). Other research (*see* www.signresearch.org) found that signage located in urban downtowns was positively perceived when high resolution digital and backlight signs were present and signscape was diverse (Berger, 2014).

Signage and Communication

An unchanging aspect within the study of signage perception regards the primary function that signs provide—communication. In nearly all of the literature reviewed, a positive correlation between sign communication and legibility exists (Portella, 2014; Berger, 2014; Nasar & Hong, 1999; Vanderbona & Yossayaffra, 1999; Werner & Kaminoff, 1983). In addition to increasing efficiency of directional movement (Bai et al., 2010), clear signage can have a positive impact on perceived crowding and reduce feelings of confusion (Werner & Kaminoff, 1983). This reinforces the justification for controls that regulate sign placement, scale, and organization.

Portella (2014) studied perceptions of commercial signage in historic downtowns across cultures in search of universal or distinct preferences. This research analyzed advertising, signage, and environmental quality and began to define factors of beauty, interest, and order that support an aesthetic signscape. It also found common perceptions of signage across cultures and professions, as well as an increased positive perception for historic city centers with sign regulations in place. Consistent with Portella (2014), Crawford et al. (2015) studied stakeholder perceptions of commercial sign controls, finding common perceptions of signage regulations in non-historic areas. Both Portella (2014) and Crawford et al. (2015) identified connections between user preference and sign controls, providing a foundation for future research.

Research Opportunity

The main themes of the literature review point towards opportunities for research. Signage provides a common function of communication across users of the environment. Many users are non-designers, and there are differences in how designers and non-designers perceive signage. Commercial sign regulations and policies influence signage design and the aesthetic aspects of perceived beauty, interest, and order.

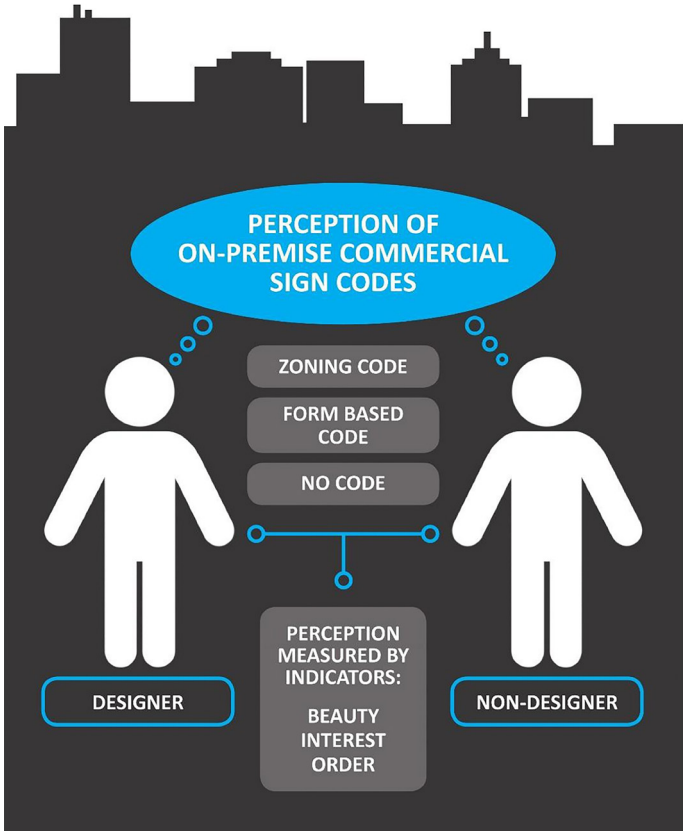

Figure 1 / Conceptual Framework

METHODS

Conceptual Framework

The study considers perception of on-premise com-

mercial sign codes by designers with professional training in the field and non-designers. Three signage code formats were studied: zoning code, form-based code, and no code; beauty, interest, and order are the indicators used to measure user perceptions (*see* Figure 1). The aesthetic indicators are drawn from Portella's (2014) research and measured using a five-point Likert scale. Working definitions for the indicators are:

1. Beauty: Qualities of physical form evoking a positive response or feeling correlated to attractiveness.
2. Interest: A visually stimulating character that activates and engages the senses.
3. Order: The harmonious arrangement of parts in a consistent or rhythmic pattern.

Research Question

The central research question is: Are there differences in perception of on-premise commercial sign regulations between designers and non-designers? A series of associated sub-questions have been developed to supplement the central research question:

RQ_1: Is there a significant difference in perception of beauty, interest, and order in the no code sign models between designers and non-designers?

RQ_2: Is there a significant difference in perception of beauty, interest, and order in the zoning code sign models between designers and non-designers?

RQ_3: Is there a significant difference in perception of beauty, interest, and order in the form- based code sign models between designers and non-designers?

Research Site

The study area is a three-mile section of the Grand River/Michigan Avenue corridor connecting Michigan State University and the Michigan Capitol, with

Figure 2 / Greater Lansing Research Site and Study Nodes

[1] *Details regarding the research site, model development and study node images are cited with permission from Current Urban Studies (see Appendix A) from the 2015 publication, "Aesthetic perception of urban streetscapes and the impact of form-based codes and traditional zoning codes on commercial signage," by Crawford, Lee, and Beatty.*

Figure 3 / Node 1: East Lansing Existing Conditions

Figure 4 / Node 2: Lansing East Michigan Avenue Existing Conditions

Figure 5 / Node 3: Downtown Lansing Existing Conditions

three specified locations identified as the focus (*see* Figure 2)[1]. Graphic images of the current signage code application are represented in Figures 3, 4, and 5. The node images in Figures 3, 4, and 5 were generated to show the signage in the clearest perspective possible are depending on sign size and mounting. The variations of image vantage point are potentially a study limitation.

Research Design

This study uses an in-situ approach to studying the perceptions of designers and non-designers, where the three nodes along Michigan Avenue are modified

from their original state to create new models with altered sign code applications. The research design enables statistical data to be collected through a predefined online survey.

Study Node Model Development

To gauge the perceptions of respondents, the survey used digital models to prompt responses. Participants were asked to rate six streetscape models based on the three aesthetic indicators. Two models were created for each of the three study nodes using the current zoning code, a form-based code, or a no code sign application, producing six images in total. These streetscapes were created using SketchUp, a 3D modeling program, which produced a valid tool to gauge participant environmental perceptions (Partin, 2011). The black-and-white line drawing models follow Partin's (2011) research, which found consistent evaluations by non-designers between the computer-generated drawings and photos of the same site. Color was intentionally eliminated to provide consistency across the sites and remove color bias; this is a study limitation and provides an avenue for future study.

Each streetscape was rated by participants on three, five-point Likert scales that separately measured beauty, interest, and order. The question reads, "Rate the streetscape along each of the following scales" and response options are:

Scale 1: very beautiful, beautiful, neutral, ugly, very ugly

Scale 2: very boring, boring, neutral, interesting, very interesting

Scale 3: very ordered, ordered, neutral, chaotic, very chaotic

The sign code applications used to develop the model images were based on the existing zoning sign code in Lansing and the form-based code of Casper, Wyoming. By using existing streetscapes with existing codes, the study could ensure that when developing the model images codes were accurately applied. Casper's Old Yellowstone District form-based code was chosen to guide the design of the alternative form-based code models because of the city's comparable size to Lansing and the established application of signage code on a downtown streetscape. The no code sign application was developed by using only non-conforming signs under existing sign regulations.

Detailed descriptions of each model development are illustrated below:

Node 1- East Lansing

Signage in Node 1 is governed by East Lansing's zoning code as a "C parcel." Two streetscape models for Node 1 were created: The zoning code sign model, representative of existing conditions, and an alternative no code sign model (*see* Figure 6).

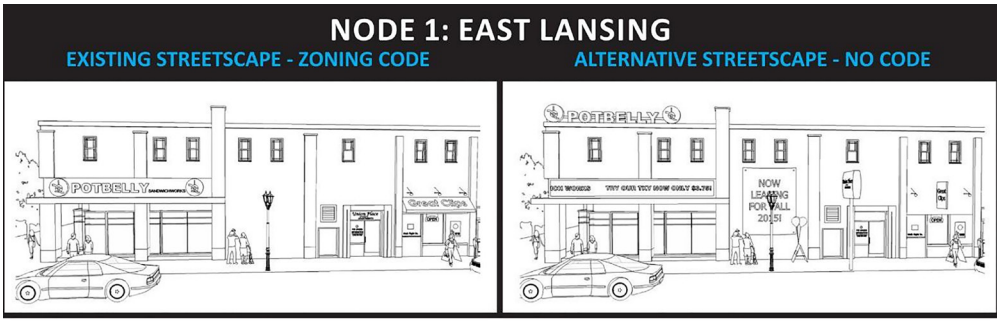

Figure 6 / Node 1: East Lansing Sign Code Models (Adapted from Crawford et al. (2015))

Basis for alternative streetscape model: No Code Sign Application

The sign types added would **not** be permitted under the existing zoning sign code.

- EMC sign was added to the business called Potbelly.
- Roof sign was added to Potbelly.
- Temporary "Now Leasing" banner was placed, visually filling up the space between Potbelly and Union Place, also giving Union Place more of a presence.
- Sandwich board with balloons was added. Temporary, moving or lit objects, like balloons, would not be permitted under the existing sign code.
- Pole and panel sign was added along the street. This increases visibility along Grand River Avenue. The perpendicular orientation of the sign can be seen from a distance down the street. This sign type in combination with the sign's proximity to the building would not be permitted under the existing sign code.
- Great Clips awning was removed and replaced with a projecting sign, increasing visibility for two-way foot and auto traffic.

Node 2- Lansing East Michigan Avenue

The signage in Node 2 is governed by the City of Lansing zoning code as an "F-1 parcel" for commercial use. Two streetscape models for Node 2 were created: A zoning code sign model, representative of the existing conditions, and an alternative form-based code sign model (*see* Figure 7).

Figure 7 / Node 2: Lansing East Michigan Avenue Sign Code Models (Adapted from Crawford et al. (2015)).

Basis for alternative streetscape model: Form-Based Sign Code Application

- Based on Casper's Old Yellowstone District form-based code.
- Awning Signs
  - > Awnings are limited to first and second floor uses and must project over individual windows and door openings.
  - > Backlit, translucent, internally illuminated awnings are prohibited.
  - > Sign or sign lettering shall comprise no more than thirty percent (30%) of the total exterior awning surface. Any graphic logo or text printed on an awning is counted toward the allowable sign area.
- Wall Signs
  - > Wall signs shall not project from the surface upon which they are attached more than twelve (12) inches.
  - > Wall signs and ghost signs painted directly on a structure are appropriate.
  - > The maximum total wall signage per façade shall not exceed two (2) square feet per linear foot of building façade length of the wall on which it is located. In no case shall total wall signage exceed three hundred (300) square feet for any building.
- Window Signs
  - > Window signs shall not cover more than twenty five percent (25%) of the area of each window.

Node 3- Downtown Lansing

The signage in Node 3 is zoned as a "G-1 parcel" for business use (Lansing, 2014). Sign regulations are reflective of a model form-based code, serving to preserve vistas, protect the dignity of the area, and enhance the visual cityscape of the Capitol. Two streetscape models for Node 3 were created: A form-based code sign model, representing existing conditions, and an alternative no code sign model (*see* Figure 8).

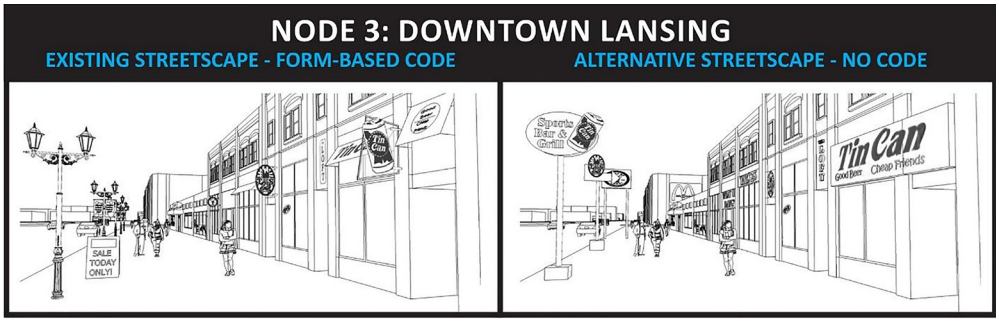

Figure 8 / Node 3: Downtown Lansing Sign Code Models (Adapted from Crawford et al. (2015))

Basis for alternative streetscape model: No Sign Code Application

- Form a generic character, everywhere USA.
- Placement of pole signs along street to attract attention from the heavy

motor traffic in this area. This sign type in combination with the sign's proximity to the sidewalk would not be permitted under existing sign code.
- Large-scale billboard advertisement placed in the distance. This sign type would not be permitted under existing sign code.
- The awning and projecting signs have been replaced with wall mounted signs, 3D lettering and cabinet signs.
- Increase in the scale of the building-mounted signs to attract attention from motor traffic.
- Enlargement of type size for increased visibility. This text scale would not be permitted under existing sign code.
- Removal of sandwich board.

Perception Indicators

Beauty, interest, and order were used as indicators to gauge perceptions of the model streetscapes. Identified in previous research studying perceptions of designers and non-designers (Gjerde, 2011; Coeterier, 2002), the indicators of environmental evaluation (Ewing & Clemente, 2013) and signage perception (Crawford et al., 2015; Portella, 2014; Nasar & Hong, 1999), have been selected as suitable measures to evaluate perceptions of the sign code model images presented in the survey. In a study of non-designer's perception of historic sites, beauty was studied as a secondary design criterion, and results showed that interest enhanced positive perception (Coeterier, 2002). Research regarding urban environmental evaluation used the concepts of interest and order to measure perception (Nasar & Hong, 1999; Gjerde, 2011). Gjerde's (2011) research reports that order and visual interest were the two most important factors.

Data Collection

As a systematic non-experimental design, this study employed the use of an online administered questionnaire, with SurveyMonkey.com as the data collection platform. Because of the low rate of response generally found in online surveys, a snowball effect was used to reach potential participants (Lee, 2014). The survey questionnaire was reviewed and approved by the Michigan State University Institutional Review Board of Human Subject Protection Program (IRB #14-159). E-invitations to the survey were distributed through the Signage Foundation Inc. and Michigan State University Land Policy Institute's organizational listservs. Additionally, an announcement with a link to the survey was posted on the Signage Foundation Inc. and the International Sign Association websites, as well as the American Society of Landscape Architects (ASLA), the ASLA Women in Landscape Architecture Professional Practice Network and the Michigan State University Landscape Architecture Club's LinkedIn and Facebook web pages. Other potential participants were contacted electronically through the Environmental Design Research Association, Michigan Avenue Development Authority, Michigan Avenue Homeowners Associations, Michigan State University Center for Community & Economic Development, and Healthy Home Coalition.

Participants self-identified their user group from a pre-developed list of stakeholder affiliations. Non-designers identified themselves as home, business, or rental property owners, students, developers, institutional and government affiliates, and sign manufacturers. Designers self-identified as professionals in design related fields. Additional demographic identifiers were gathered to determine if the participant group was representative of the general population.

Instruments

The survey was designed as part of a larger research project, partially funded by the Signage Foundation Inc. The sections of the survey used for this article include a portion on perceptions of model streetscapes with different sign code applications and demographics. The Signage Foundation Inc. review board participated in the questionnaire's vetting process and pre-test. The survey included open and closed-ended questions in the form of multiple choice, interval, semantic differential, and opinion based textual questions. The survey first asked respondents to identify their stakeholder affiliation, followed by ratings of the sign code models, and finally demographic questions.

Pairs of SketchUp models, representing the same streetscape with either a form-based, zoning, or no sign code application, were presented to participants. They were instructed to evaluate the models using five-

point semantic differential scales that rate the level of beauty, interest, and order. Additionally, open-ended questions about positive and negative characteristics of the signage allowed respondents to elaborate on their perceptions. The pairs of models were randomly presented in the survey to mitigate ordering effects.

The survey gathered demographic responses using predefined multiple-choice answers on the topics of age, gender, major stakeholder affiliation, and education.

Data Analysis

The data was downloaded from SurveyMonkey in IBM-Statistical Package of SPSS and Microsoft Excel formats. Participant socio-demographic statistics were evaluated through quantitative descriptive statistical analysis. For the five-point semantic differential scales rating perception, a one-way Analysis of Variance (ANOVA) test was used to examine differences in perceptions between designers and non-designers in relation to the indicators beauty, interest, and order. A one-way ANOVA test was used to find differences in perception between designers and non-designers for the form-based, zoning no code sign applications.

RESULTS

A total of 207 individuals participated in the survey, with 43% identifying as designers and 54% as non-designers. Participation across age groups were similar for the designer and non-designer groups with 50% over 45, 30% in the 30-44 range, and 20% between 18 and 29 years old. More women (63%) participated in the survey than men (37%).

All participants had some college experience, with 29% of both the designer and non-designer groups holding a bachelor's degree. The designer group had a higher percentage of participants who held master's (45%) and doctoral degrees (20%).

Table 1 / No Code Application - One-Way ANOVA

No Code Application - One-Way ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.969	1	1.969	6.211	.014
Within Groups	51.984	164	.317		
Total	53.953	165			
	Indicates Significant Difference				

Table 2 / No Code Application Descriptive Statistics - One-Way ANOVA

No Code Application - Descriptive Statistics				
	N	Mean	Std. Deviation	Std. Error
Designers	71	2.6009	.47432	.05629
Non-Designers	95	2.8211	.62088	.06370
Total	166	2.7269	.57183	.04438

Table 3 / Zoning Code Application - One-Way ANOVA

Zoning Code Application - One-Way ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.484	1	.484	2.057	.153
Within Groups	37.861	161	.235		
Total	38.345	162			
	Indicates Significant Difference				

Table 4 / Zoning Code Application Descriptive Statistics - One-Way ANOVA

Zoning Code Application - Descriptive Statistics				
	N	Mean	Std. Deviation	Std. Error
Designers	70	3.2071	.50476	.06033
Non-Designers	93	3.3172	.46952	.04869
Total	163	3.2699	.48652	.03811

Table 5 / Form-Based Code Application - One-Way ANOVA

Form-Based Code Application - One-Way ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.769	1	.769	4.614	.033
Within Groups	24.509	147	.167		
Total	25.279	148			
	Indicates Significant Difference				

Table 6 / Form-Based Code Application Descriptive Statistics - One-Way ANOVA

Form-Based Code Application - Descriptive Statistics				
	N	Mean	Std. Deviation	Std. Error
Designers	64	3.3490	.41010	.05126
Non-Designers	85	3.4941	.40699	.04414
Total	149	3.4318	.41328	.03386

Differences in Code Applications and Designer/Non-designer Perceptions

To assess the perceptions of designers and non-designers, a one-way ANOVA test compared the combined mean scores of the three aesthetic indicators and three signage zoning application models (*see* Tables 1–5). Results showed statistically significant differences between designers and non-designers for the no code ($F(1, 164) = 6.211$, $p = 0.014$) and for the form-based code applications ($F(1, 147) = 4.614$, $p = 0.033$). A significant statistical difference was not found in perceptions regarding the zoning code application ($F(1, 161) = 2.057$, $p = 0.153$). The mean scores displayed in Tables 2, 4, and 6 are on a standard scale, where higher scores indicate more beautiful, more interesting, and more ordered ratings. Lower scores indicate less beautiful, less interesting, and less ordered. Although the mean scores of the designer and non-designer groups were not identical, they were consistent across each code type. For both groups, the form-based code application had the highest aesthetic ranking (Designers $M = 3.35$, Non-designers $M = 3.49$), the zoning code application had the middle ranking (Designers $M = 3.21$, Non-designers $M = 3.32$), and the no code application had

the bottom ranking (Designers $M = 2.60$, Non-designers $M = 2.82$). The mean scores show that non-designers consistently rated all sign code applications with better aesthetic scores than designers.

Code Applications by Indicator

The first sub-question asked if a significant difference in perception of beauty, interest, and order in the no code sign models exists between designers and non-designers (*see* Table 7). Analysis showed statistically significant differences in the perception of beauty ($F(1, 164) = 9.395$, $p = 0.003$) and order ($F(1, 164) = 4.302$, $p = 0.040$) between the study groups. No statistically significant differences were found regarding the perception of interest ($F(1, 164) = 0.679$, $p = 0.411$).

Table 7 / No Code Application and Indicator - One-Way ANOVA

No Code Application and Indicator - One-Way ANOVA						
Code and Indicator		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
No Code Beauty	Between Groups	3.711	1	3.711	9.395	.003
	Within Groups	64.784	164	.395		
	Total	68.495	165			
No Code Interest	Between Groups	.371	1	.371	.679	.411
	Within Groups	89.637	164	.547		
	Total	90.008	165			
No Code Order	Between Groups	2.801	1	2.801	4.302	.040
	Within Groups	106.777	164	.651		
	Total	109.578	165			
	Indicates Significant Difference					

The second sub-question tested for significant differences in perception of beauty, interest, and order in the zoning code sign models between designers and non-designers (*see* Table 8). Statistically significant differences were found in the perception of beauty ($F(1, 161) = 3.336$, $p = 0.070$). There were no statistically significant differences between the study groups for the perception of interest ($F(1, 161) = 0.612$, $p = 0.435$) and order ($F(1, 160) = 0.372$, $p = 0.543$).

Table 8 / Zoning Code Application and Indicator - One-Way ANOVA

Zoning Code Application and Indicator - One-Way ANOVA						
Code and Indicator		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Zoning Code Beauty	Between Groups	1.087	1	1.087	3.336	.070
	Within Groups	52.459	161	.326		
	Total	53.546	162			
Zoning Code Interest	Between Groups	.311	1	.311	.612	.435
	Within Groups	81.879	161	.509		
	Total	82.190	162			
Zoning Code Order	Between Groups	.123	1	.123	.372	.543
	Within Groups	52.779	160	.330		
	Total	52.901	161			
	Indicates Significant Difference					

The third sub-question tested for significant differences in perception of beauty, interest, and order in the form-based code sign models between designers and non-designers (*see* Table 9). Statistically significant differences in the perception of beauty ($F(1, 147) = 6.209$, $p = .014$) and interest ($F(1, 146) = 4.728$, $p = .031$) were found, but there was no statistically significant difference for the perception of order ($F(1, 147) = 0.109$, $p = 0.742$).

Table 9 / Form-Based Code Application and Indicator - One-Way ANOVA

Form-Based Code Application and Indicator - One-Way ANOVA						
Code and Indicator		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Form-Based Code Beauty	Between Groups	1.805	1	1.805	6.209	.014
	Within Groups	42.732	147	.291		
	Total	44.537	148			
Form-Based Code Interest	Between Groups	1.945	1	1.945	4.728	.031
	Within Groups	60.062	146	.411		
	Total	62.007	147			
Form-Based Code Order	Between Groups	.025	1	.025	.109	.742
	Within Groups	34.277	147	.233		
	Total	34.302	148			
	Indicates Significant Difference					

Mean Comparisons

The mean scores displayed in Tables 10, 11, and 12 are on a standard scale, where higher scores indicate more beautiful, more interesting, and more ordered ratings. Designers rated the form-based code application as the most beautiful ($M = 3.20$) and most ordered ($M = 3.77$), and the zoning code application as most interesting (M=3.12). Non-designers rated the form-based code application as the most beautiful ($M = 3.42$), interesting ($M = 3.31$), and ordered ($M = 3.75$). Both groups rated the no code application as the least beautiful (Designers M=2.37, Non-designers $M = 2.67$), least interesting (Designers $M = 2.77$, Non-designers $M = 2.86$), and least ordered (Designers $M = 2.67$, Non-designers $M = 2.93$).

Table 10 / No Code Application & Indicator - Descriptive Statistics for One-Way ANOVA

No Code Application and Indicator - Descriptive Statistics					
Indicator		**N**	**Mean**	**Std. Deviation**	**Std. Error**
Beauty	Designer	71	2.3662	.58528	.06946
	Non-Designer	95	2.6684	.65886	.06760
	Total	166	2.5392	.64430	.05001
Interest	Designer	71	2.7676	.69092	.08200
	Non-Designer	95	2.8632	.77337	.07935
	Total	166	2.8223	.73858	.05732
Order	Designer	71	2.6690	.77434	.09190
	Non-Designer	95	2.9316	.83031	.08519
	Total	166	2.8193	.81493	.06325

Table 11 / Zoning Code Application & Indicator - Descriptive Statistics for One-Way ANOVA

Zoning Code Application and Indicator - Descriptive Statistics					
Indicator		N	Mean	Std. Deviation	Std. Error
Beauty	Designer	70	3.0286	.60724	.07258
	Non-Designer	93	3.1935	.54190	.05619
	Total	163	3.1227	.57492	.04503
Interest	Designer	70	3.1214	.70421	.08417
	Non-Designer	93	3.2097	.71976	.07464
	Total	163	3.1718	.71228	.05579
Order	Designer	69	3.4928	.62716	.07550
	Non-Designer	93	3.5484	.53194	.05516
	Total	162	3.5247	.57322	.04504

Table 12 / Form-Based Code Application & Indicator - Descriptive Statistics for One-Way ANOVA

Form-Based Code Application and Indicator - Descriptive Statistics					
Indicator		N	Mean	Std. Deviation	Std. Error
Beauty	Designer	64	3.1953	.56073	.07009
	Non-Designer	85	3.4176	.52240	.05666
	Total	149	3.3221	.54857	.04494
Interest	Designer	64	3.0781	.63132	.07891
	Non-Designer	84	3.3095	.64893	.07080
	Total	148	3.2095	.64947	.05339
Order	Designer	64	3.7734	.50340	.06292
	Non-Designer	85	3.7471	.46690	.05064
	Total	149	3.7584	.48143	.03944

DISCUSSION

The results show that there are, in fact, perception differences of on-premise commercial sign regulations between designers and non-designers and highlight similarities as well. Significant differences were found in both the no code ($F(1, 164) = 6.211$, $p = 0.014$) and the form-based code applications ($F(1, 147) = 4.614$, $p = 0.033$). The three code types structurally vary the organization of signage. The zoning code application ($F(1, 161) = 2.057$, $p = 0.153$), which was not found to be perceived differently between the study groups, is the median in modern structural signage organization. The no and form-based code applications are on opposite ends of the spectrum, represented by the chaos of having no codes and rigid design structure of form-based codes. Greater differences in perception between designers and non-designers were identified between these two codes. Historically, zoning codes have been the most prevalent type of sign regulation in the United States (Liebermann, 2002), so familiarity with this organizational style could contribute to the common perceptions amongst designers and non-designers around this model.

Similarities between these two groups became apparent when analyzing the mean scores of the form-based, zoning, and no code applications. Although there are statistically significant differences between the study groups, the mean scores show that each of the code applications were ranked in the same order consistently

between designers and non-designers. The no code application for designers (Designers $M = 2.60$, Non-designers $M = 2.82$) had the lowest mean score, meaning that it was perceived as the least beautiful, interesting, and ordered. The zoning code application (Designers $M = 3.21$, Non-designers $M = 3.32$) had the median score, followed by the form-based code application (Designers $M = 3.35$, Non-designers $M = 3.49$), implying that it was perceived as the most beautiful, interesting, and ordered. This indicates that designers and non-designers both perceive similar aesthetics in the sign code models, however participants with design background consistently rated each indicator more harshly than their counterparts.

Beauty, Interest, and Order

The familiar proverb, beauty is in the eye of the beholder, expresses the diverse nature of the perception of beauty. Beauty was the only variable to have a statistically significant difference between designers and non-designers over all the code applications. Order and interest were perceived as significantly different between study groups, indicating that these characteristics are more universally understood or evaluated. These findings relate to previous research, where Gjerde (2011) specifically identified order and interest as the primary factors that influence environmental aesthetic perception. Beauty may be the variable in which professional training in planning and design influences perception.

This study validates that when rating signscapes, measures of interest and order can be useful tools in developing sign controls. Because of their more universal perception, these factors may be more accurately represented in signage codes. Due to significant differences in perceptions between groups, beauty becomes a variable that requires greater attention in early stages of public planning and participation in order to accurately represent the needs and desires of the public.

Perception & Communication

The designer and non-designer groups evaluated the model sign codes in a consistent order, however there were significant differences in the strength of rating given to the indicators in the form-based and no code sign applications. Those with a design background consistently rated each indicator more harshly, indicating that designers' professional and educational backgrounds may provide them with the confidence to make stronger convictions about sign code models.

CONCLUSION

Principal Conclusions

Six conclusions emerged from the survey analysis:

1. There is a significant difference in the perception of on-premise commercial sign regulations between designers and non-designers on signscapes represented by the form-based and no sign code applications, the most and least structurally organized regulations. There are not statistically significant differences regarding the zoning code application, likely because of its median structural organization and prevalence in current American signscapes.

2. There are similarities in perception of on-premise commercial sign regulations between designers and non-designers on which sign code application produced the most beautiful, interesting, and ordered streetscape. The form-based code had the best aesthetic score, while the zoning code had the median aesthetic score, and the no code was least favored. This was consistent between both study groups, regardless of statistically significant differences found in the form-based and no sign code applications.

3. Significant differences were produced from the degree to which designers and non-designers ranked the indicators beauty, interest, and order. Designers tended to give lower scores than non-designers, but the order in which the study groups ranked the model streetscapes was consistent for each code type.

4. Beauty was the only indicator to have a statistically significant difference between the designer and non-designer groups for all of the streetscape models. The indicators order and interest were more similarly rated across the sign models, suggesting that beauty is perceived differently than the indicators of order and interest between designers and non-designers.

5. The mean scores for which signscape was ranked as the least beautiful, interesting, and ordered indicate harsher ratings by designers than non-designers.

6. Because of the consistency of mean scores, the results suggest that designers do not perceive the model sign codes much differently than non-designers, but that they are simply more critical with their evaluations, which led to statistically significant differences in the form-based and no code model streetscapes.

Limitations and Future Research

Studies like this are a starting point for exploring designers and non-designers' perceptions of sign regulation. To accurately represent perceptions of signage over time, this type of research will need to be repeated to keep up with changing perceptions and signage technology. A convenience snowball sampling strategy was used in this study which limits the generalizability of the findings; it should also be noted that participants were shown software generated black and white line-drawings not the actual sign in real-world conditions with varying lighting, color, and other sensory conditions that affect perception. Finally, while this study focused on environmental designers and urbanists, future work should include graphic designers as a stakeholder group, given the role that they play in signage development.

Implications

By understanding differences in communication and evaluation of on-premise commercial sign regulations, designers can more effectively coordinate with the public to create well received sign codes. This research shows both commonalities and differences between designers and non-designers, suggesting that professionals within the planning and design realm cannot assume they entirely understand the wants and needs of the community for whom they are designing. In particular, the perception of beauty is an area where these differences are most apparent. Because this characteristic is not mutually understood, professionals should closely consider the input of the public regarding their perception of beauty when designing sign regulations.

This study shows that designers tend be more critical in their judgment of commercial sign regulation than non-designers, a trait that could hinder collaboration between designers and community partners. In order to improve communication, designers should consider listening to public perceptions and ideas prior to formulating and presenting much of their own thoughts.

Sign codes influence the physical characteristics and placement of commercial signs, impacting the visual quality of a streetscape. This research confirms that people appreciate the structure of a sign code provides, regardless of professional planning or design training. Implications of these findings show that regulation for signage is justified, as it contributes to a more positively viewed and functional streetscapes, which aids in the production of a thriving public realm.

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APPENDICES

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Mar. 7, 2016

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Authors: Pat Crawford, Eunsil Lee, Maleah Beatty

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Appendix A / Permission of Copyright from the Journal of Current Urban Studies

* *note: Maleah Rakestraw's maiden name is Maleah Beatty*

Location, Location, Location: The effect of clutter on the evaluation and aesthetic judgment of off-premise signage

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Abstract /

Academic scholars and practitioners uniformly suggest that off-premise signs such as billboards will be more effective if they are installed in high-traffic areas rather than low-traffic areas. In this research, we question the ubiquity of this claim and illustrate potential advantages of installing off-premise signs in low-traffic areas given that these environments also tend to be less cluttered (i.e., having fewer competing signs). Across two studies, we provide converging evidence that consumers evaluate a billboard more favorably when it is displayed by itself than when it is displayed next to other billboards. We show that the same billboard in a low-clutter (vs. high-clutter) location is judged to be more aesthetic, which in turn improves the overall evaluation of the billboard. We further delineate boundary conditions in which the benefits of a low-clutter environment are attenuated.

Keywords /

off-premise signage; billboard; location; clutter; aesthetics

INTRODUCTION

Many consumers encounter billboards on a daily basis. The International Sign Association (ISA) defines a billboard as a type of off-premise sign that usually displays a brand's name and logo and is located beyond the property of the business it is advertising (ISA, 2020). The ubiquity of billboards may be due to their effectiveness at conveying information about businesses and their offerings. According to a 2015 Nielsen survey, 71% of Americans look at the messages on roadside billboards, and of those, 47% indicated that they remember the messages displayed. Moreover, billboards and other off-premise signs that feature simple and provocative messages, large fonts, and vivid colors are more likely to be noticed and deemed memorable (Donthu et al., 1993).

A critical factor that determines the effectiveness of off-premise signage is its location (Donthu et al., 1993; Franke & Taylor, 2017; Wilson & Till, 2010). Unlike on-premise signs, a billboard can be displayed in a public space (in accordance with local zoning regulations) rather than being restricted to the property of the business it promotes. When it comes to determining ideal location, past research uniformly suggests that billboards should be installed and displayed in high-traffic areas, such as along highways and in metropolitan areas, so they can be seen by the highest number of consumers (Donthu et al., 1993; Franke & Taylor, 2017; Wilson & Till, 2010). The rationale behind this advice is intuitive: the more people who are exposed to billboards, the more who will see and potentially buy the promoted offerings. Accordingly, these high-traffic areas come with a hefty price tag, which is often prohibitive for small businesses.

In our research, we propose that there may be value in displaying a billboard in a low-traffic area, beyond its lower cost. Our proposition hinges on the fact

that high-traffic areas tend to have a high density not only of people but also of various forms of billboards (e.g., Times Square in New York City). Consequently, high-traffic areas typically entail multiple competing billboards (i.e., a high level of clutter) whereas low-traffic areas do not necessarily contain as much advertising clutter or competition. We argue and demonstrate that under certain conditions, consumers evaluate a billboard located in a low-clutter area more favorably than the same billboard in a high-clutter area.

As an example, consider the regionally famous Magikist signs in Chicago. Magikist was a local rug cleaning company that placed 13-foot-long billboards in the shape of its logo—human lips—across the Chicagoland area, typically in low-clutter locations where no other competing billboards were visible (*see* Figure 1). From the 1960s until the early 2000s, when the company went out of business, the Magikist lips were cherished Chicago landmarks that locals and tourists would pose with and photograph. The last remaining Magikist sign was so beloved that after the sign was torn down, a local entrepreneur purchased it for nearly $4,000 (CBS Chicago, 2013).

Figure 1 / Magikist Lips Signage in Chicago, IL

How might we account for the success of signage in low-traffic (and presumably low-clutter) locations given prior research (Donthu et al., 1993; Franke & Taylor, 2017; Wilson & Till, 2010) and common intuition that high-traffic signage will be more effective? We conjecture that consumers will be more likely to perceive a sign in a low-clutter area as a work of art rather than a deliberate marketing tactic. In turn, the premium associated with aesthetics boosts consumers' overall evaluation of the sign.

When investigating the communication effectiveness of signage, there are numerous consumer responses that merit consideration, including attention (Kellaris & Machleit, 2016; Knuth et al., 2020; Wu et al., 2020), affective reaction (Kellaris et al., 2020), and trust (Isaac, 2020). In our research, we focus specifically on consumers' self-reported evaluation of signage, which we operationalize as their liking of the billboard. It has been widely documented that consumers' evaluations or attitudes towards a marketing message is a strong predictor of downstream behavioral responses related to the brand or product promoted in the message (*c.f.,* Mitchell & Olson, 1981). Prior work on signage documents a link between evaluations and behavioral responses such as purchase intentions (Kellaris & Machleit, 2016; Knuth et al., 2020) and compliance intentions (Kellaris et al, 2020). Furthermore, signage research has shown that consumers' evaluations of signs are influenced by their affective state (Kellaris et al., 2020), the ease of signage processing (Wu et al., 2020), and the credibility of the message on the sign (Isaac, 2020). Extending these findings, we delineate a novel process whereby aesthetic judgments can also affect the overall evaluation of a sign.

In the following section, we review the crucial role of aesthetics in consumers' evaluation of marketing signs and other advertisements. We then describe our hypothesis and proposed mechanism based on two streams of research: the signaling effect of white space and the contrast effect of competing objects.

ROLE OF AESTHETICS IN CONSUMER JUDGMENT

According to the Outdoor Advertising Association of America (OAAA), there have been over 350,000 billboards installed each year in the United States since 2015. Given this high number, consumers are likely to encounter billboards of various sizes, colors, fonts, images, and formats (non-digital vs. digital). These different design specifications may differentially impact consumer judgments (Donthu et al., 1993; Shimizu, 2002). According to Donthu et al. (1993), consumers find billboards that use large fonts and black-and-

white colors to be more noticeable and memorable. In contrast, Shimizu (2002) suggests that large and colorful billboards (vs. small and monochromatic billboards) yield a greater return-on-investment. As these examples illustrate, each visual dimension (e.g., size, color, etc.) can uniquely impact one or more aspects of consumer judgment (e.g., recognition, recall). However, little is known as to whether the combination of these visual components holistically affects aesthetic judgments and how such judgments carry over to consumers' overall evaluations of billboards.

To fill this gap, we first conducted a pilot study to examine whether there is sufficient variance in the aesthetic value of different billboards. We used OAAA's OBIE award archive as our stimuli (OAAA, 2020). These billboards were submitted as nominees for 2019's OBIE awards, which honors creative excellence in out-of-home advertising design. Of the collection of 251 billboard images, 100 images that portrayed billboards installed in similar locations (i.e., highways) were selected. In this pilot study, we showed these selected billboards to an online panel of Americans (N = 202; M_{age} = 37.46, SD_{age} = 10.77, 33% female) who were recruited from Amazon Mechanical Turk. Each participant viewed and evaluated the subjective aesthetic rating of 50 randomly-presented billboards by indicating the extent to which he/she found each billboard to be a "work of art" on a scale from 1 (not at all) to 7 (very much). The mean aesthetic value rating was around the scale midpoint (M = 4.50), indicating that participants found the billboards to be moderately aesthetic in general. More importantly, as Figure 2 illustrates, there was a substantial variability in perceived aesthetic value across billboards, ranging from 3 to 6.

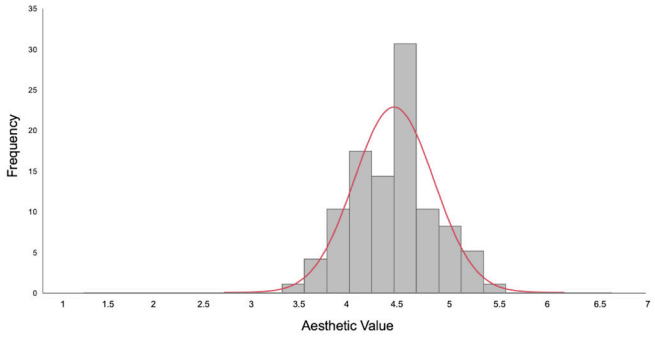

Figure 2 / Distribution of Billboards Based on Perceived Aesthetic Value

Does it matter that some billboards are deemed less aesthetic while other ones seem more aesthetic? Is there any benefit from an evaluative standpoint if a sign is perceived as a work of art? When it comes to answering these questions, research in consumer behavior has provided corroborative evidence that perception of art typically enhances overall evaluation of target objects (Hagtvedt et al., 2008; Hagtvedt & Patrick, 2008; Krishna et al., 2016; Patrick, 2016). According to Hagtvedt and Patrick (2008), the presence of artwork on a commercial object spontaneously evokes perceptions of luxury and high quality; these perceptions positively spill over to general opinion about the object. In one of their experiments, participants evaluated a hand soap considerably more favorably when it had an artistic image on the package than when it had a non-art image. This so-called "art-infusion effect" is not just unique to consumer goods and occurs in other contexts, including advertisements (Estes et al., 2018; Huettle & Gierl, 2012), high-end brands (Lee et al., 2015), and brand extensions (Hagtvedt & Patrick, 2008). Together, these findings imply that, in the context of signage, consumers may favor those that are highly aesthetic, regardless of the actual message.

WHITE SPACE AS A DETERMINANT OF AESTHETIC VALUE

Consumers' perceptions of aesthetic value can be enhanced by numerous visual factors from colors (Homburg et al., 2015; Yan et al., 2014) to size of objects (Puccinelli et al., 2013; Semin & Palma, 2014). Related to the present research is white space (also known as negative space), which is a factor known to boost aesthetic judgments. Despite its name, white space does not need to be white; it refers to any vacant space found between design elements or objects within a visual layout (Pracejus et al., 2006).

Research in consumer behavior documents that the presence of white space in print advertisements (Olsen et al., 2011; Pracejus et al., 2006), shelf space (Sevilla & Townsend, 2016), and logos (Sharma & Varki, 2018) improves aesthetic judgments, which in turn increases consumers' evaluation of brands and products. In one of the studies conducted by Sevilla and Townsend (2016), consumers found moisturizing hand cream to be more aesthetically pleasing when units of hand

cream were more spread out on display shelves (creating white space) than when they were tightly stacked side by side (no white space). As a result, they evaluated the hand cream more favorably when it was presented with white space than when it was not.

Based on these findings, we predict that consumers will find a billboard located in a low-clutter (vs. high-clutter) area more aesthetically pleasing. High-traffic areas tend to have a greater number of co-located billboards and other forms of signage, leaving the viewer to perceive minimal white space. In contrast, low-traffic areas are less likely to be cluttered. In fact, these areas often comprise empty landscapes, which grant more white space when a sign is placed by itself (*see* Figure 3, A–D). According to our theorizing, the presence of white space in a low-clutter environment should boost the perceived aesthetic value of a sign. Accordingly, we hypothesize the following:

H_1: Consumers will evaluate a billboard more favorably when it is displayed by itself (i.e., in a low-clutter area) than when it is displayed along with other signs (i.e., in a high-clutter area).

(3A) Billboards in Time Square, New York City, NY

(3B) Billboards in Downtown Los Angeles, CA

(3C) Cabela's billboard in Green Bay, Wisconsin

(3D) Milano's billboard in Dayton, Ohio

Figure 3 / Examples of Billboards in High-Clutter (Top) and Low-Clutter (Bottom) Locations

CONTRAST EFFECT AS ANOTHER DRIVING FORCE

We do not argue that the increased evaluation of a billboard in a low-clutter area is solely driven by the presence of white space. In fact, we believe that our proposed effect is multiply determined and will depend on the other signs installed in the high-clutter area. This is because consumers are likely to make a judgment about a sign by comparing it against other signs displayed in the same area, resulting in a contrast effect.

Contrast effects are cognitive biases that alter our perception and evaluation of an object because the process of comparing it with other objects amplifies their differences (Kahneman & Miller, 1986; Schwarz & Bless, 1992). For example, the contrast effect can make an item appear lighter than it actually is when it is placed against a dark background. This effect plays a role in a wide variety of situations from price perception (Cunha & Shulman, 2011; Lynch et al., 1991) to art evaluation (Tousignant & Bodner, 2014, 2018; Arielli, 2012). A cheap product appears more expensive when next to cheaper products (Cunha & Shulman, 2011; Lynch et al., 1991). Similarly, consumers judge average-beauty images to have lower aesthetic value when displayed alongside high-beauty images (Tousignant & Bodner, 2014, 2018; Arielli, 2012).

Collectively, prior research suggests that consumers judge a target object less favorably when it is compared to a set of more superior objects, which is consistent with our current hypothesis. However, there are cases in which the target object is compared against inferior objects. In such situations, an expensive product appears cheaper when it is presented next to other, even more expensive products (Cunha & Shulman, 2011; Lynch et al., 1991) and average-beauty images seem to have higher aesthetic value when presented in combination with low-beauty images (Tousignant & Bodner, 2014; 2018; Arielli, 2012).

Based on these findings, we predict that when consumers evaluate a sign high with aesthetic value, it will be evaluated similarly irrespective of whether it is located in a low- or high-clutter area. This null effect is the result of the presence of white space and the contrast effect acting on consumers' evaluations in opposite directions. On one hand, the presence of white space should cause a sign that is high in aesthetic value to seem better if it is in a low-clutter area (vs. a high-clutter area), as there is more white space in the visual layout. However, the contrast effect should cause a sign that is high in aesthetic value to seem better if it is in a high-clutter area versus a low-clutter area because the high-clutter sign benefits from comparison with other nearby signs (that are likely to be less aesthetic). Since the contrast effect tempers the benefit of white space on low-clutter signage, we posit the following:

H_2: The proposed effect will be attenuated when consumers evaluate a billboard that is high in aesthetic value.

Finally, we conjecture that there may be an individual-level difference that moderates the positive effect of a low-clutter (vs. high-clutter) environment on sign evaluation. Specifically, we argue that the effect may be evident among consumers who are less knowledgeable about art, but not among consumers who are more knowledgeable about art. Prior research on consumer expertise indicates that when evaluating a product, consumers with high product knowledge make judgments based on relevant information (e.g., product attributes; Alba & Hutchinson, 1987; Dodds, 1995). In contrast, consumers with low product knowledge tend to incorporate external cues that are often unrelated to the product itself (Alba & Hutchinson, 1987; Dodds, 1995). Hence, in the context of signage, consumers who are highly knowledgeable about art would evaluate a billboard based on its content only and would be less likely to rely on contextual cues such as white space or competing billboards. Not being art experts, consumers with low knowledge in art would instead incorporate all possible contextual cues when evaluating a target sign. Accordingly, our final hypothesis is as follows:

H_3: The proposed effect will be attenuated among consumers who are highly knowledgeable about art.

Over two studies, we examine the effect of display location on evaluation of off-premise signs. In Study 1, we document preliminary evidence for H_1. In Study 2,

we test H_1-H_3 and provide converging evidence for our proposed effect. Experimental stimuli for both studies are provided in the Appendix.

Study 1

In Study 1, we attempt to provide an initial demonstration of our proposed effect. In this study, we use moderately aesthetic billboards as our stimuli. Thus, a moderately aesthetic billboard is presented either by itself in a low-clutter area or with other average billboards in a high-clutter area. We predict that participants will evaluate the target billboard more favorably when it is displayed in low-clutter area than in a high-clutter area. Furthermore, to show that our effect is robust across different visual contexts, we presented these billboards on two different background locations: on the side of a street or a field. We predict that our proposed effect will emerge regardless of the background location.

Method

One hundred and fifty American participants (M_{age} = 41.15, SD_{age} = 12.74, 50% female) from an online panel (Amazon Mechanical Turk) completed this study in exchange for nominal monetary compensation.

This study adopted a 2 (billboard clutter: low vs. high) x 2 (background location: street vs. field) between-subjects design. Participants were randomly assigned to one of the four aforementioned conditions. We manipulated clutter via presence of competing billboards in the given location. In the high-clutter condition, participants were presented with six different billboards, namely those by Magikist, Creation Museum, Snapchat, Coca-Cola, Nivea, and CAT Footwear. In the low-clutter condition, we only showed participants a sign by Magikist. In the street background condition, the billboards were placed on the side of a street, whereas in the field condition, the same set of billboards were placed in the middle of a vacant field (*see* Appendices).

All participants were informed to focus on Magikist's sign: the Magikist lips. We further informed participants that Magikist was a local rug cleaning company. They were then asked to indicate how much they liked the billboard on a scale from 1 (not at all) to 7 (a lot). To assess perceived aesthetic value, we asked participants to report how much they found the billboard to be visually appealing on a scale from 1 (not at all) to 7 (very visually appealing). To examine a potential downstream behavioral consequence, we also measured participants' word-of-mouth (WOM) intention by having them indicate how likely they were to share a photo of the billboard on social media, on a scale from 1 (not at all) to 7 (very likely).

Finally, we measured participants' familiarity with Magikist by having them indicate the extent to which they are familiar with the company from 1 (not familiar at all) to 7 (very familiar). The objectives of including this measure were twofold. First, we sought to rule out the possibility that participants' prior knowledge of the company was the driver of our proposed effect. Second, for explanatory purposes, we aimed to test whether clutter affected perceptions of familiarity in addition to aesthetic value and liking.

Results

A two-way Analysis of Variance (ANOVA) revealed that a significant main effect of billboard traffic ($F(1, 146) = 5.73$, $p = .018$) on the evaluation of the Magikist sign. In general, participant liked the Magikist lips more when it was presented in a low-clutter area where there were no other billboards ($M = 3.86$, $SD = 1.83$) as compared to when it was located in a high-clutter area with five other billboards ($M = 3.15$, $SD = 1.76$). This effect was robust regardless of the background location, as the interaction effect between background location and clutter was not statistically significant ($F(1, 146) = .26$, $p = .61$). We found no evidence for the main effect of background location ($F(1, 146) = .02$, $p = .88$).

Furthermore, participants generally found the Magikist sign to be of moderate aesthetic value. The average of aesthetic ratings hovered around the scale midpoint, 4 out of 7 ($M = 3.94$, $SD = 2.06$; $t(149) = -.36$, $p = .72$). However, as we predicted, participants indeed found the Magikist sign more aesthetically pleasing when it was presented in a low-clutter area ($M = 4.28$, SD = 1.97) than in a high-clutter area ($M = 3.56$, $SD = 2.09$; $F(1, 146) = 4.69$, $p = .032$). We found no evidence of a main effect of background location ($F(1, 146) = 0.08$, $p = .776$), nor an interaction effect between background

location and clutter ($F(1, 146) = .72$, $p = .398$).

We obtained a similar pattern with the WOM behavioral intention measure. Participants were more willing to share the photo of the billboard online when it was located in a low-clutter (vs. high-clutter) environment ($M_{low\text{-}clutter} = 3.19$, $SD = 2.27$ vs. $M_{high\text{-}clutter} = 2.10$, $SD = 1.71$; $F(1, 146) = 10.55$, $p = .001$). Again, both the main effect of background location ($F(1, 146) = 1.54$, $p = .216$) and the interaction effect between background location and clutter were not statistically significant ($F(1, 146) < .001$, $p = .986$). The key results of Study 1 are displayed in Figure 4.

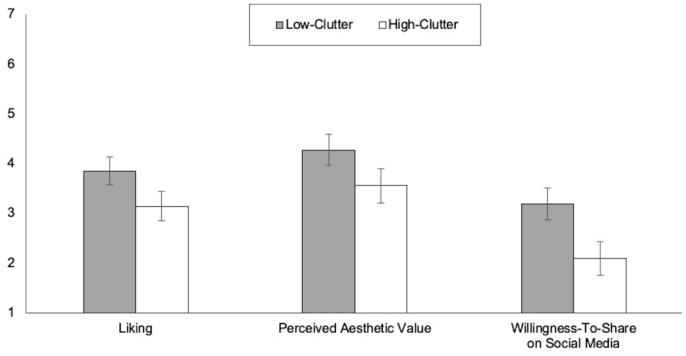

Figure 4 / Results of Study 1: Judgments and Behavioral Intentions as a Function of Billboard Clutter

Finally, we conducted a series of mediation analyses to further examine our theorizing. First, we ran a mediation analysis using the PROCESS macro (Model 4) to test whether perceived aesthetic value mediated the effect of clutter on billboard evaluations (Hayes 2017). This mediation analysis utilized bootstrapping with repeated extraction of 10,000 samples. For this purpose, the high-clutter condition was coded as '0,' and the low-clutter condition was coded as '1,' with liking of billboard as the dependent variable. We included aesthetic value as a potential mediator in the model. Results of the mediation analysis indicated that the indirect effect of clutter through perceived aesthetic value was positive ($B = .54$, $SE = .25$) and statistically different from zero (95% *CI*: .05, 1.06).

We also conducted a serial mediation analysis using the PROCESS macro (Model 6) to see whether liking of billboard mediated by artistic value sequentially mediates the effect of clutter on likelihood to post the billboard image on social media. The bootstrapping and coding criteria were identical as above. In this model, we included aesthetic value and overall billboard evaluation as potential mediators and likelihood to post the billboard image as the dependent variable. We found evidence for serial mediation from clutter to aesthetic value, from aesthetic value to billboard liking, and from billboard liking to likelihood to share on social media ($B = .32$, $SE = .17$; 95% *CI*: .02, .68).

Finally, a two-way ANOVA on brand familiarity (i.e., Magikist) revealed no main effect of billboard clutter ($F(1, 146) = .96$, $p = .33$), no main effect of background location ($F(1, 146) = 2.24$, $p = .14$), and a non-significant interaction between clutter and background location ($F(1, 146) = .36$, $p = .55$). Although billboard clutter significantly influenced consumers' liking, aesthetic judgment, and sharing intentions, it had no impact on the perceived familiarity of the brand promoted on the billboard. Furthermore, we conducted additional two-way Analyses of Covariance (ANCOVA) on the aforementioned key measures—liking, aesthetic judgment, and sharing intention—while including brand familiarity in the model as a covariate. The main effect of billboard clutter was still evident for all three measures (liking: $F(1, 145) = 4.72$, $p = .031$; aesthetic judgment: $F(1, 145) = 3.74$, $p = .05$; sharing intention: $F(1, 145) = 10.47$, $p = .002$), which suggests that the effects were not driven by participants' general familiarity of the brand.

Discussion

The results from Study 1 provide initial evidence for our proposed effect (H_1). Indeed, consumers evaluate a billboard placed in a low-clutter area more favorably than the same sign placed in a high-clutter area. Specifically, when a billboard is displayed in a low-clutter (vs. high-clutter) area with no other billboard, consumers evaluate it more favorably, find it more aesthetically appealing, and are more likely to share an image of the billboard on social media. Moreover, because all the signage stimuli used in Study 1 was moderately aesthetic, we provide evidence for our white space account. That is, our results are consistent with our theorizing that the presence of white space in a low-clutter area makes a sign seem more aesthetic, which in turn enhances the overall evaluation of the sign.

Although the findings of Study 1 are consistent with our white-space explanation, one could argue that they emerged because participants were more involved in the evaluation task and better able to attend to the target sign in the low-clutter condition due to the lack of distraction from multiple competing signs. Although plausible, we note that in all of our experimental conditions, participants were explicitly informed to attend to the target billboard (i.e., the Magikist lips). As such, we can assume that participants' involvement did not vary across the conditions. Nevertheless, research on fluency (*c.f.,* Reber et al., 1998) suggests that the metacognitive difficulty of processing information—known as disfluency—can adversely affect evaluations. According to this alternative account, the presence of multiple competing billboards in the high-clutter condition may have been distracting to viewers and yielded a sense of processing disfluency, thereby lowering evaluations. Although the mediation results of Study 1 suggest that perceived aesthetic value plays a role in driving our observed effect, in the next study we will attempt to more directly rule out a (dis)fluency explanation.

Study 2 also examines whether a contrast effect might influence evaluations of signs in a high-clutter area. Specifically, when a target sign is aesthetically inferior to the competing signs in a high-clutter area, the contrast effect should have a negative effect on evaluations of the target sign. In such a situation, both the contrast effect and the lack of white space should dampen evaluations of the target sign, and thus evaluations in a high-clutter sign area should be lower. The effect observed in Study 1 should be replicated, however, when a target sign is aesthetically superior to the competing signs in a high-clutter area, the contrast effect should have a positive effect on how it is evaluated. Given that the contrast effect and the lack of white space act in opposing directions on evaluations of the target sign, the benefit of placing a sign in a low-clutter area should be attenuated.

Study 2

The objectives of Study 2 are twofold: to replicate the results of Study 1 and to show evidence for the contrast effect as another underlying mechanism. In order to do so, we manipulate the aesthetic value of the target billboard (low vs. high) and examine its moderating role in our proposed effect. Specifically, we predict that we will replicate the findings from Study 1 when participants evaluate billboards that are low in aesthetic value. According to our theorizing (H_2 and H_3), this effect will be attenuated for billboards that are high in aesthetic value and also among participants who are highly knowledgeable in art.

By illustrating the moderating impact of aesthetic value and consumers' knowledge about art, we aim to rule out the (dis)fluency alternative described earlier. Whereas our proposed mechanism—multiply determined by white space and the contrast effect—predicts an interaction between clutter and perceived aesthetic value on the overall evaluation of the target sign, a (dis)fluency account predicts a main effect in which high clutter areas always result in lower evaluations of the target sign.

Method

One hundred and eighty-six respondents (M_{age} = 38.34, SD_{age} = 12.09, 45.7% female) from an American online panel (Amazon Mechanical Turk) participated in this study in exchange for nominal monetary compensation.

We employed a 2 (billboard clutter: low vs. high) x 2 (billboard aesthetic value: low vs. high) between-subjects design. We manipulated the aesthetic value of a target billboard based on the results of the pilot study we mentioned earlier (N = 202). The three billboards that participants found to be most aesthetic included billboards from Flying Biscuit Café, Flying Heart Brewery, and Marvels (M = 5.60). On the other hand, the three billboards that participants found to be least aesthetic were those of ICP Painting, Jerome's Furniture, and Panera Bread (M = 3.40; *see* Appendix for stimuli).

The billboard clutter was manipulated in the same fashion as in Study 1. Unlike Study 1, however, we displayed all the billboards in a field background, as the background location—field versus street—did not impact billboard judgments in the previous study. In the high-clutter condition, each billboard that was high or low in aesthetic value was presented with four other moderately aesthetic billboards (M = 4.50); in

this condition participants were presented with a total of five billboards. When the target billboard was high [low] in aesthetic value, the remaining four billboards were considered aesthetically inferior [superior] to the target billboard. In the low-clutter condition, participants saw a billboard that was either high or low in aesthetic value displayed in a field by itself. In each condition, participants reviewed three different, randomly presented billboards (all high or all low in aesthetic value).

After viewing each billboard, participants were asked to indicate their opinion using five different scales that ranged from negative to positive, unfavorable to favorable, dislike very much to like very much, bad to good, and unpleasant to pleasant. All scales ranged from 1 to 7, with higher numbers representative of more positive evaluations. For our analysis, we created an evaluation index by averaging these highly correlated scales (α = .97).

We then measured participants' subjective knowledge of art by having them indicate the extent to which they are familiar with art and their level of knowledge of art in general on a seven-point scale. We aggregated these two items to create an art knowledge index (α = .88).

Results

A two-way ANOVA revealed that there was a main effect of aesthetic value ($F(1, 182) = 16.01$, $p < .001$) on the evaluation of billboards. Participants evaluated the billboards that were high in aesthetic value ($M = 5.62$, $SD = 1.34$) more favorably than the billboards that were low in aesthetic value ($M = 4.78$, $SD = 1.55$). More importantly, this main effect was qualified by a significant interaction effect between aesthetic value and clutter ($F(1, 182) = 5.96$, $p = .016$). Participants evaluated billboards that were low in aesthetic value more favorably when they were presented in isolation, in a low-clutter location ($M = 5.15$, $SD = 1.30$), compared to when they were presented with other billboards in a high-clutter location ($M = 4.41$, $SD = 1.67$; $F(1, 182) = 6.18$, $p = .014$). This effect, however, was not evident when participants evaluated billboards that were high in aesthetic value ($M_{low\text{-}clutter} = 5.48$, $SD = 1.39$ vs. $M_{high\text{-}clutter} = 5.76$, $SD = 1.28$; $F(1, 182) = .91$, $p = .34$). These results are depicted in Figure 5.

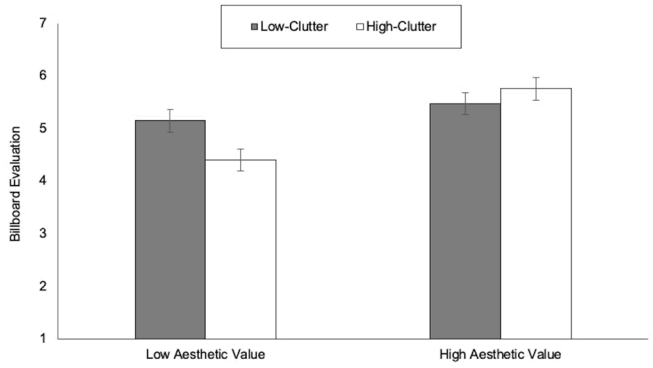

Figure 5 / Results of Study 2: Billboard Evaluation as a Function of Clutter and Aesthetic Value

Furthermore, we tested the moderating effect of participants' knowledge in art. The aesthetic value of the billboard did not interact with art knowledge and was excluded from the subsequent analysis. We ran an Ordinary Least Squares regression on billboard evaluation using billboard clutter, art knowledge, and their interaction term as predictors. There was a significant interaction effect between billboard clutter and art knowledge ($B = .50$, $SE = .15$, $t(182) = 3.30$, $p = .001$). As shown in Figure 6, spotlight analysis revealed that when participants were less knowledgeable about art ($M - 1SD$), they evaluated the billboards displayed in a low-clutter area more favorably than those in a high-clutter area ($B = .95$, $SE = .29$, $t(182) = 3.17$, $p = .002$). When participants were highly knowledgeable about art ($M + 1SD$), this effect did not emerge ($B = -.43$, $SE = .29$, $t(182) = -1.46$, $p = .15$).

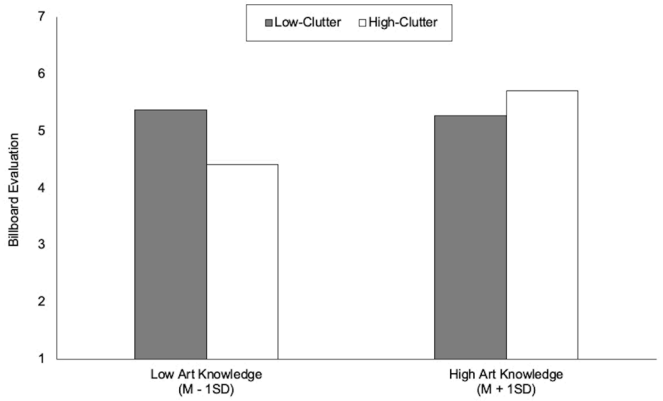

Figure 6 / Results of Study 2: Billboard Evaluation as a Function of Clutter and Knowledge of Art

Discussion

Study 2 delineates boundary conditions in which the advantage of a low-clutter environment on billboard evaluations does not emerge. We replicate the primary finding of Study 1 (i.e., a low-clutter billboard is evaluated more favorably than a high-clutter billboard) when consumers evaluate a billboard that is low in aesthetic value or when consumers have limited knowledge about art. This effect, however, is weaker when consumers evaluate a billboard that is high in aesthetic value or when they are highly knowledgeable about art.

The findings from Study 2 suggest that fluency may not be a primary driver of our effect. First, as previously mentioned, a fluency account would not predict an interaction between signage clutter and aesthetic value on the evaluation of a billboard. Second, the fluency account also cannot explain the observed interaction effect between clutter and participants' general knowledge of art. Metacognitive ease of processing would predict higher evaluations for billboards when they are located in low-clutter areas regardless of consumers' expertise in art. However, the results from Study 2 are consistent with our theorizing. While target signs in low-clutter (vs. high-clutter) areas are evaluated more favorably by consumers with low knowledge of art, this effect is not observed among consumers with high knowledge of art. We reason that this is because less knowledgeable consumers are more likely to rely on contextual cues such as the white space and/or other competing signs in the background to make judgments about a target sign. Highly knowledgeable consumers, however, are confident in their own judgments and have the expertise to evaluate a target sign based solely on the content of the sign.

In addition to ruling out a fluency-based alternative explanation, Study 2 also suggests that the contrast effect acts in concert with white space to influence billboard evaluations. If the presence of white space were the sole driver of our proposed effect, consumers would have exhibited a stronger preference for a highly aesthetic billboard when it was displayed alone in a low-traffic area than when it was displayed with inferior signs in a high-clutter area. Instead, in this study, we found no evidence of such a difference, supporting our proposition that consumers' evaluations are multiply determined by both the presence of white space and a contrast effect.

GENERAL DISCUSSION

Academic scholars and practitioners concur that off-premise signs, such as billboards, will be more effective and yield higher economic returns if they are installed in high-traffic areas rather than low-traffic areas (Donthu et al., 1993; Franke & Taylor, 2017; Wilson & Till, 2010). Indeed, high-traffic areas come with a higher density of consumers, which allows for greater exposure. However, high-traffic areas create competition, which may result in advertising clutter. In this research, we illustrate that placing the same sign in a low-clutter environment can lead to higher consumer evaluations. Across two studies, we provide converging evidence that consumers evaluate a billboard more favorably when it is displayed by itself than when it is displayed with other signs. We further delineate boundary conditions in which the benefits of a low-clutter environment are attenuated. Specifically, the effect disappears when the target sign of interest is highly aesthetic, and when consumers believe they are highly knowledgeable about art.

We show that the positive effect of low-clutter locations occurs because a sign displayed alone is perceived as having higher aesthetic value than when it is placed alongside other signs, thereby increasing its overall evaluation. More importantly, we argue that this effect is multiply determined by the presence of white space and the contrast effect triggered by other competing signs in the visual layout. Building on prior work regarding consumers' aesthetic judgments, our findings indicate that the enhanced white space in low-clutter areas elicits a greater sense of aesthetic value, whereas competing signs in high-clutter areas lead consumers to make judgments about the target sign by comparing it against the others. In Study 1, we provide evidence for our white space account by holding the target and competing signs constant across all conditions. In Study 2, we demonstrate that the effect may also be a manifestation of the contrast effect by directly manipulating the aesthetic value of the target sign.

Previous research has identified a number of elements that affect the evaluation of signs (see Bullough, 2017; Stempler & Polger, 2013; Van Loock et al., 2010). Whereas this work has mainly focused on the message content of signs (e.g., Isaac, 2020; Wu et al. 2020; Sundar et al., 2019), our research examines how an external factor such as the sign's location influences evaluations of billboards. In doing so, we introduce a novel construct, where perceived artistic value is a determinant of off-premise signage evaluation.

In addition to extending prior work on signage, our research also contributes to marketing research on consumers' aesthetic judgments. Prior work in this stream has examined the role of aesthetic value in products (Sevilla & Townsend, 2016), brand logos (Sharma & Varki, 2018), and print and video advertisements (Olsen et al., 2011; Pracejus et al., 2006). To our knowledge, this research is the first to document the role of perceived artistic value and to show how it interacts with sign location to impact consumer evaluations.

As of 2020, the value of the worldwide billboard market is 6.9 billion U.S. dollars (IBIS World, 2020). Whereas common intuition suggests that billboards should always be placed in high-traffic locations, our work suggests that low-traffic locations—which tend to be lower in clutter—may offer certain advantages. Specifically, the increased aesthetic value of a sign in a low-clutter location may result in higher consumer evaluations. Based on our studies, the advantage of being in a low-clutter environment may be greatest when a sign's aesthetic value is intrinsically low or moderate. This work might also be insightful for city planners, zoning boards, and sign regulators. Specifically, our research indicates that co-located signs (i.e., high-clutter areas) are perceived as less aesthetic, whereas a sign displayed by itself is considered to be more aesthetic. To the extent that a governmental agency wants to ensure that a certain neighborhood or geographic area is perceived as historic and less commercial, it may be beneficial to restrict the number of co-located signs.

Of course, practitioners must cautiously weigh the pros and cons of high- versus low-clutter environments to determine the optimal location for off-premise signs. Any benefit that a firm receives in terms of aesthetic appeal from placing a sign in a less costly, low-clutter area may be counteracted by the higher reach of a high-clutter installation, given that high-clutter areas are typically highly trafficked. Additionally, a limitation of our research is that it focused primarily on sign evaluations and not on downstream behaviors, such as product purchase. Furthermore, participants were explicitly asked to focus on a target billboard and provide an evaluation in our studies, so future research is needed to better understand whether the effects we observed will persist in more naturalistic contexts when consumers are not directed to focus on a particular sign and provide a judgment. Finally, we encourage signage researchers to investigate whether the effects obtained in our studies will differ depending on the product or service advertised. For example, consumers may expect billboards for hedonic (i.e., self-expressive) products to be more aesthetic, but may not prefer aesthetic billboards for utilitarian (i.e., functional) products.

Although the present research focused solely on off-premise signage and specifically on billboards, this work could be extended to examine on-premise signage as well. For example, when multiple, co-located on-premise signs are used to advertise different offerings from the same company, it is uncertain whether this clutter will lower perceptions of aesthetic value and sign evaluations in the same way that it affects judgments of off-premise billboards that advertise different companies or brands. An important difference between the two contexts is that viewers of on-premise (vs. off-premise) signs are more likely to have higher levels of involvement and to be more familiar with the advertised offering since they have already decided to visit the business. Although the results of Study 1 suggest that our observed effects occur irrespective of brand familiarity, future research is needed to fully understand whether the effects of clutter manifest in similar ways for both off- and on-premise signage.

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APPENDICES

	Low-Clutter	High-Clutter
Street Background		
Field Background		

Stimuli Used in Study 1

	Low-Clutter	High-Clutter
Low Aesthetic Value Billboards		
		
		

Stimuli in Used in the Low Aesthetic Value in Study 2

	Low-Clutter	High-Clutter
High Aesthetic Value Billboards		
		
		

Stimuli in Used in the High Aesthetic Value in Study 2

Do You See What I See? The shopping experiences of people with visual impairment

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Abstract /

This article reports on the shopping experiences of people with visual impairment (n = 7) and offers an alternative way to understand their needs. Our study adopted taskscape theory and multiple-method ethnographic perspectives to obtain viewpoints of shoppers with visual impairment and examined shopping activities through two lenses (wayfinding and signage) to determine criteria for improved design. We used taskscape theory to gain insights into how this population perceives signage as well as a participatory, human ecological, systems approach to identify the complexity of wayfinding among people with visual impairment. We used observation, notetaking, photography, and interviews to gain insights into personal and social factors affecting participants' experiences when navigating in shopping malls. Our data-driven results include a characterization of seven activities—pre-shopping, traveling to the mall, mall navigation, in-store navigation, merchandise evaluation, checkout, and post-shopping—within the shopping taskscape of shoppers with visual impairments that help assess user needs regarding signage and wayfinding. The shopping taskscape provides a systems approach to advance ideas around designing complex environments for able-bodied people and those with disability.

Keywords /

disability; shopping malls; signage; taskscape; wayfinding

INTRODUCTION

Although the needs of people with disability and designs for barrier-free living are advocated for globally (World Health Organization, 2015) and legislated in Canada (Accessible Canada Act, 2019) and the United States (Americans With Disabilities Act, 1990), legislative compliance does not ensure the needs of people with disability have been met. Designing inclusively to create retail environments with well-designed signage and wayfinding systems is a complex undertaking, especially when considering how people without full visual acuity might navigate such spaces confidently. Our research examined the shopping experiences of people with visual impairment and offers an alternative way to understand their needs. We consider taskscape theory and multiple-method ethnographic perspectives to learn the viewpoints of shoppers with visual impairment by examining shopping activities through two lenses—wayfinding and signage—to determine criteria for improved design.

Shopping is an innately human "leisurely activity" (Bradley et al., 2000, p. 80) that has drawn some scholars' attention (e.g., Miller et al., 1998). Shopping malls are environments where shoppers are "bombarded with stimulation … signage, sounds and crowds" (Dogu & Erkip, 2000, p. 738). A shopping mall in Canada typically comprises an enormous building with few exterior markings, a bus depot, sometimes rail transit, as well as parking lots and multiple entry points on two or more levels. The interior has an extravaganza of lights, color, signage, various types of flooring, crowds of people, escalators, elevators, staircases, a food court, public restrooms, and a mall directory floor plan that lists retailers.

LITERATURE REVIEW

Scant scholarly work brings together the assessment of users' needs in shop-

ping malls and shoppers with visual impairment. As such, this section focuses on shopping, wayfinding, and the use of taskscape theory to better understand shoppers' needs. The shopping practices of people with visual impairment have been examined through research on consumer normalcy (Baker, 2006), dependence and independence (Baker et al., 2001), enhanced accessibility (Baker et al., 2002), grocery shopping (Yuan et al., 2019), and shopping for clothing in brick-and-mortar stores (Bradley et al., 2000; Yu et al., 2015).

Collectively, studies on shopping point to personal factors related to people with visual impairments' confidence and capabilities, challenges of navigating labyrinthine spatial environments, and physical barriers. People with visual impairment struggle with attitudinal barriers, such as negative behavior from salespeople (MacDonald et al., 1994). Bradley et al. (2000) found that people with visual impairment have trouble distinguishing prices and sizes of garments, navigating fitting rooms, and struggle with ambient factors such as lighting, color perception, and signage. Yuan et al. (2019) similarly highlight difficulties with checking out, arranging transportation, parking, and locating mall entrances and restroom facilities.

Dogu and Erkip (2000) define wayfinding as "a set of tools devised to help people reach their destination in an unfamiliar environment" (p. 735). Basic requirements that people need to find their way include information booths, mall maps, visual access and signage, as well as safe and clear spaces that lead to a destination (Dogu & Erkip, 2000, p. 738). Bradley et al. (2000) identify issues with navigating merchandise displays and recommend wider aisles to mitigate difficulties for shoppers in wheelchairs, a solution that may not benefit people with visual impairment as they can become disoriented in overly large spaces.

Many scholars identify that good lighting and signage benefit people and that signage details (e.g., color, typeface size, positioning within spaces, and lighting) contribute to comprehension (Bradley et al., 2000; Dogu & Erkip, 2000; Yu et al., 2015). Architectural features, such as fixtures and fittings, often do not account for the diversity of bodily capabilities (Imrie, 2000). Spatial environments, including entrances, landmarks, and horizontal and vertical circulation are not often discernible within shopping malls (Dogu & Erkip, 2000). The wayfinding route descriptions provided to people with visual impairment by those who have sight are inadequate (Saerberg, 2010), and assistive technologies, such as GPS, are either not desirable or rendered useless in the spaces typical of shopping malls (Maus et al., 2016). Such personal and social factors, combined with challenges around navigating environments, indicate a need to deeply examine the experiences of people with visual impairment in shopping malls.

Taskscape was introduced by Ingold (1993) in his essay titled "The Temporality of the Landscape" and by Kirsh (1996) from the perspective of interactive cognitive science. Ingold's original proposition, that all activities involve a set of dynamic tasks, has since been developed in other ethnographic studies; Vannini (2011), for example, examined passenger performance in catching a ferry. Tullio-Pow (2016) and Tullio-Pow and Strickfaden (2020) tease out taskscape further through explorations into the "clothing taskscape" as a means to assess user needs. Previous research on taskscape theory informs our definition as follows: while activities like shopping ostensibly are similar for everyone, they are different depending on time, place, the relationship between tasks and activities, and an individual's abilities/capabilities. For the purpose of this work, we do not provide a full critical examination of taskscape theory. Rather, we use taskscape to advance our understanding of the needs of people who are visually impaired as related to signage and wayfinding when shopping.

For instance, scholars suggest using access audits of shopping facilities to mediate the needs of people with disability (Bashiti & Rahim, 2016), to examine parking, transit stops, pedestrian walkways, curb cuts, and signage, as well as pathways, doors, stairs and ramps, reception/information counters, and washrooms. Other scholars advise adding tactile warnings (Bradley et al., 2000; Strickfaden & Devlieger, 2011b), accessible graphics and route maps (Strickfaden & Devlieger), Braille, and color contrasts (Bradley et al.). Few can dispute the value of comprehensive design recommendations, however Strickfaden and Devlieger suggest designing with visually impaired people's bodies to work toward more holistic wayfinding "systems" that are "not just

single solutions" (p. 645).

This research team is comprised of investigators with complementary expertise. The first author is an apparel designer who specializes in assessing the needs of people with disability to create inclusive clothing solutions. The second author works in the areas of consumer behavior, shopping, and evaluating retail spaces. The third author is a design anthropologist who focuses inquiry on complicated problem solving for people with disabilities. Approaching the research problem from these diverse perspectives facilitated a more holistic inquiry.

MULTIPLE-METHOD ETHNOGRAPHIC APPROACH

Ethnography is a qualitative approach adopted by design anthropologists (e.g., Clarke, 2016; Gunn et al., 2013) and modified to have an applied focus (Norman, 2013) to investigate user experience. Applied ethnography allows the researcher to become familiar with use-contexts, interfaces between people and objects during activities within environments, and the complicated relationships people have with things (Miller, 2010), all of which enhance understanding and formulation of relevant interview questions.

Walking with people who are visually impaired fosters a heightened awareness of things that otherwise might not have been considered. This approach, walking with a person who is visually impaired, was richly described by Horowitz (2013) in *On Looking: Eleven Walks with Expert Eyes*. Strickfaden and Devlieger (2011a, 2011b; Devlieger & Strickfaden, 2012) used applied ethnographic methods to investigate disability in situ when redesigning the Brussels Metro for people with visual impairment and blindness. This study takes a more holistic view of shoppers with visual impairment within shopping malls, guided by a human ecological "systems" perspective (Ingold, 2011) and Yuan et al.'s (2019) participatory design approach.

We used observation and go-along interviews (Kusenbach, 2003) to accompany participants on their shopping trips to better understand shopping from an inclusive design perspective. This facilitated our observation of activities, environments, and objects encountered to better understand users' needs. Agar (2010) endorses field observation to observe "real moments that involve real people doing real things" (p. 294). The embodied knowledge of the people shopping is considered a kind of techné, or everyday know-how of people doing activities related to day-to day-living (Flyvbjerg, 2001). Observation of such activities allows researchers to learn the nuances of end users by examining their engagement with everyday objects, providing a way to develop empathy (Strickfaden & Devlieger, 2011a).

RECRUITMENT AND PARTICIPANTS

Recruitment was facilitated by an independent consultant from the Greater Toronto Area who was affiliated with a Canadian national advocacy group for people with visual impairment. Eligible participants were over the age of 18 with visual acuity in at least one eye equal to or less than 20/40. We provided information pertaining to the study to those who were interested. People who agreed to participate provided consent and completed the demographic survey, which collected information pertaining to age, gender, household and employment status, education, and income, as well as the cause of vision loss and level of visual acuity.

Participants (n=7) included three women and four men between the ages of 41 and 70. They identified their favorite department store and apparel retailer in a specific shopping mall. Shopping dates were scheduled and two of the researchers met each participant at the mall entrance and accompanied them while they took part in a 75-minute shopping trip. Sixty-minute interviews followed immediately afterwards. A $75 gift card to the shopping mall served as an incentive. See Table 1 for details about our shoppers (identified by a pseudonym), including gender, age at the time of their vision loss, and diagnosis.

DATA COLLECTION

Data collection began by shadowing participants as they shopped (*see* Martin & Hanington, 2012). Participants were encouraged to think out loud while shopping and to physically identify issues of concern with their bodies. The retail environments visited were

Table 1 / Participant Information

Participant*	Gender	Age	No. of years since vision loss	Cause of vision loss
Lewis	M	61-70	>10	Glaucoma
Mari	F	61-70	1–5	Retinal detachment
Bruce	M	61-70	>10	Retinitis pigmentosa
Alan	M	41-50	5–10	Stargardt's
Janice	F	41-50	Born visually impaired	Glaucoma
Dwayne	M	41-50	>10	Glaucoma
Marilyn	F	51-60	>10	Retinitis pigmentosa

*Pseudonym.

familiar to participants and this helped them to articulate the significance of and association to the surroundings, activities, and other people's actions, aiding recall of "mundane details too trivial to think and talk about during more formal research occasions" (Kusenbach, 2003, p. 470). Field notes and photographs were used to document shopping excursions. Interviews took place in a quiet corner in the mall's food court; responses were audio-recorded and transcribed. Questions focused on descriptive, grand tour narratives (Bagnoli, 2004), getting to the shopping mall, logistical barriers, challenges encountered, and suggested solutions.

DATA ANALYSIS

Taskscape theory provides a means to assess user needs in a more holistic way (Tullio-Pow & Strickfaden, 2020). Characterizing a taskscape begins with categorizing environments and activities/tasks. Before starting our detailed analysis, transcripts were verified for accuracy against the audio recordings. We then discussed key definitions for wayfinding and signage. We defined wayfinding as any activity that involved navigating from one place to another. Signage was broadly defined to comprise physical signage but also anything that our participants needed to read, including clothing price and care content tags as well as size labels, the cash register and debit machine display, sales receipts, and employee name tags. Field notes and transcripts were thematically reviewed for aspects related to wayfinding and signage and annotated during multiple readings. Photographs were viewed and matched with information in the transcripts. The data set was then sorted into themes to identify and define activity categories, and this formed the basis of what we call the shopping taskscape. Each member of the research team independently scrutinized the data related to each activity in the shopping taskscape. Discussions to re-examine the data collectively further helped us define themes and subthemes to ensure intercoder reliability.

Creswell (2009) notes that reliability and validity are enhanced through triangulation, rich, thick description, and prolonged time in the field. We shopped with participants for almost 9 hours over 7 days in different shopping malls. We discussed their shopping experiences over more than 6 hours of interviews. Shopping together and talking afterwards offered us multiple ways of knowing, revealing subtle details that may not have been apparent if participants had merely self-reported their experiences via traditional interview.

RESULTS: THE SEVEN ACTIVITIES OF THE SHOPPING TASKSCAPE

The results of this study are characterized around the shopping taskscape, encompassing seven activities that our shoppers engaged in chronologically (*see* Figure 1). The results illustrate factors related to wayfinding and signage that influence the shopping experience of people who are visually impaired. Examining user needs through the activities depicted in the shopping taskscape provides an opportunity to better understand users' needs, values, challenges, and related solutions to establish criteria relevant to the design process.

Activity	Wayfinding	Signage
Pre-shopping	• Website – mall directory • Website – retailer • Transit route/schedule • Mall directory • Construction alert	Website content: • Product information • Stock and price • Construction alert
Travelling to the mall	• Transit route simplicity • Audio announced stops • Transfer from public transit to mall entrance	• Transit signage
Mall navigation	• Information desk • Guided escort • Lighting • Architectural landmarks • Construction • Glass walls with door • Stairs	• Store signage • Lighting
In-store navigation	• Lighting/glare • Floorplan layout • Aisle space/clutter • Merchandise displays • Flooring type • Flooring color • Mirrors/glass	• Name tags • Employee uniforms
Merchandise evaluation	• Fitting room • Salesperson	• Price tags • Size labels • Care instructions • Lighting/glare • Price scanner • Magnifier
Checkout	• Salesperson • Cash register location • Start point of line-up • Flooring	• Cash register display • Debit/credit machine • Touch screen display • Sales receipt font size & contrast • Ceiling signage
Post-shopping		• Food court menu signage • Receipt verification • Online bank statements

Figure 1 / The Shopping Taskscape

Note: Results were characterized by seven activities in the shopping taskscape including: (clockwise from the top) pre-shopping, traveling to the mall, mall navigation, in-store navigation, merchandise evaluation, checkout, post-shopping.

Activity 1 encompassed the pre-shopping activities that our participants engaged in prior to leaving their homes. These include checking internet sites for product information, comparing pricing, studying the online mall directory, and phoning the store to check stock availability. Activity 2 involved the shopper physically traveling to the mall, usually by taking public transit or riding with a friend in their car. When taking public transit, wayfinding transit routes were planned in advance. Activity 3 was about navigation in the mall. This began with a visit to the central information desk to inquire about store locations and public restroom facilities. Shoppers often requested a guided escort (typically a security guard) and were attentive to architectural landmarks as they made their way to their chosen store. Activity 4 encompassed navigation in the store. Upon arrival, our shoppers would assess the retail environment, including an evaluation of physical cues such as store lighting and layout. In addition, wayfinding was scrutinized, specifically how well defined or cluttered the aisles were. Shoppers considered other factors that impacted their successful navigation, including flooring type (tile or carpet), color or surface contrast, merchandise displays, and use of mirrors and glass. Activity 5 involved the shoppers evaluating merchandise, looking at clothing styles and available colors, finding a price scanner, and sometimes using their personal hand-held magnifier to discern pricing, care instructions, and the fiber content of clothing. During this activity shoppers often searched for a salesperson who could provide assistance locating the fitting rooms. Once purchasing decisions were made, participants proceeded to the checkout/point-of-sale area, paying by cash or credit/debit card, which was Activity 6. Activity 7 included post-shopping activities. Our shoppers would often visit the food court before returning home the same way they arrived. Once at home, they verified and scanned receipts, which were saved to their computer for record-keeping. Shoppers then checked their bank or credit card statement online to confirm their purchases.

The following results identify the specific details of each of the seven activities with a focus on issues related to wayfinding and signage through each phase of the shopping taskscape. Participants sometimes suggested solutions for identified problems.

Pre-Shopping

Shoppers used the internet to gather information prior to setting out for the mall. Shopping was typically scheduled with a specific purpose. Retailers' websites were checked to gather pricing and product information; as Lewis indicated: "I'll have something very specific in mind, I don't do window shopping anymore." This sentiment was echoed by Marilyn: "I often use websites. … Pottery Barn has a fabulously accessible website … they have very complete information."

Shoppers would also review the shopping mall directory layout online to determine the locations of specific retailers. Information communicated on the website was crucial, as described by Mari:

> *I use the internet a lot. Even before I came today, I checked to see about the retail outlets to make sure that Lululemon was here and where it was. … Now on the website they didn't say it was under construction because I checked.*

Janice recounted using her phone to confirm product availability before leaving home:

> *My normal routine is doing some pre-shopping at home for the specific item I'm looking for. … I may source it out on the internet … I don't want to make a trip there to realize they don't have it.*

Before even setting foot in the mall, multiple factors influenced shopping success. Shoppers would use the internet to do preliminary wayfinding within the mall directory for the store location. Knowing about unusual situations, such as construction, allowed our shoppers to map out alternate routes or postpone their trip. Besides, being confident about stock availability and pricing details ensured that shopping trips were not carried out in vain. Knowing that these factors are essential to shoppers with visual impairment, and communicating this information effectively, is relevant to website designers, retailers, and mall developers.

Traveling to the Mall

All shoppers reported that mobility was the biggest daily challenge they faced. Unable to drive and dependent on public transportation or getting a ride with a friend,

the range of places they could shop in was limited. Wayfinding and signage impacted their success in getting to the mall; shoppers mentioned transit signage and the directness of the route travelled. Shopping in retail spaces was easier in malls they were familiar with, as Mari described:

> *I often shop at the Eaton Centre even though it's far from where I live. I'm willing to travel that far because it's easy. The ease of transportation, I don't have to do any transfers, so it's a simpler process. And it's always the same, things don't change. I always get off the same place. … I can memorize it. Basically, you want to keep it as simple as possible.*

Dwayne mentioned a different factor—the directness of the route from the transit system drop-off point into the mall: "I use the entrance from the subway, I don't go from the street because I don't like walking through stairs. I get distracted and scared and … I get lost. Near the Gap and Old Navy stores, there are stairs, and they crisscross."

Bruce mentioned the transit schedule and bus signage:

> *I take the bus and subway on the regular routes I travel. I can't see the numbers on the bus, so I have to ask the driver. If it is a new route, I call the TTC [Toronto Transit Commission] ahead of time to find out the schedule. If the bus has an A, B, C, D behind the number, for example, I take the 39 bus, I may jump onto the wrong bus because I can't see the difference. After a couple of stops I know if I'm on the wrong bus. A, B, C, D sometimes may be challenging. On the new buses, the numbers are bigger. One of the amazing things in the last couple of years, they'll read out the stops; that is incredibly helpful.*

The effort required along the transit journey was carefully considered by our shoppers. Wayfinding ease was influenced by the directness of the route and absence of transfer points as well as the simplicity of transition from the transit drop-off point to the mall entrance, notably a lack of stairs. Also highlighted were problems discerning signage that combined alpha and numeric lettering, the size of the lettering, and the advantages of audio-announced destination points. These factors are relevant to transit planners, mall developers, and architects.

Mall Navigation

Navigating the shopping mall highlighted several challenges. The mall's information desk was crucially important to our shoppers and their first stop upon arrival to inquire about store and washroom locations. Dwayne described the problems he encountered and offered a solution:

> *The problem I have is finding the information desk. … [At the Eaton Centre] it is not very accessible. It's not very bright, the lighting there is very poor. I had to find it on my own and it took a long time. I had to ask people and go up stairs. For me they should have more than one information desk. And if there is only one, it should be closer to the*

entrance of the mall rather than … in the middle. Or they should have a phone that you just pick up and ask a question rather than physically finding the information desk. The other problem I have is that I don't know where the washrooms are. … I can't find the washrooms in a hurry there.

Sometimes, shoppers would request a guide to escort them. This too had its challenges, as Alan indicated:

> *I asked [them] to verbalize [landmarks] as we were walking to the store, because I wanted to get to the store on my own in the future. …That's my biggest frustration, that people don't use audible cues; most people point. With customer relations, I often get someone [who] kind of guides me from behind and pulls on me like a dog at the end of a chain as opposed to letting me take their arm or asking.*

When shopping on his own, Bruce mentioned these strategies: "I've had orientation mobility lessons. I practice those. You count your steps literally; those are pretty basic techniques to use." However, this strategy didn't work during mall renovations: "I have a good memory but sometimes you don't get specific directions. If there is construction in the middle of the mall, it's confusing. I don't remember what floor I'm on … and which direction I'm going."

Signage again was mentioned as problematic by Bruce: "I can't always read the signs even if I go close to it. … Sometimes I can't read the sign because there is no contrast, or the light is shining and it's metal." As he stated this, Bruce pointed to the storefront of a hair salon in the mall we were visiting. The sign featured shiny and reflective lettering applied to a metal background. (One of

Figure 2 / Example of Inaccessible Signage

Note: Metallic script lettering on a metallic background creates a sign that is unreadable by people with visual impairment.

the researchers photographed the sign; *see* Figure 2.)

Examining activities while our shoppers navigated through the mall highlighted how the ease of wayfinding was enhanced by the logical placement of the information desk near the main entrance, thoughtful placement of architectural landmarks in the mall to provide cues, and employees who were trained to properly guide people with visual impairment. Our shoppers indicated how optimal lighting and construction renovations in the mall either enhanced or diminished their functional abilities and commented on the problematic reflection caused by glare from certain types of lighting and shiny metal surfaces. These factors are essential to industrial designers, architects, and those who design employee training programs.

In-Store Navigation

Upon arrival, our shoppers assessed the store environment before going inside. Simply finding the entrance was an arduous task, as Lewis explained: "Glass doors, you can't tell whether they're open or closed. I can never find my way into the Gap because I can't tell ... I will wait and follow someone in because I don't want to walk into the wall." After this was discussed with the research team, we became more aware of how many storefronts' entrances are embedded in a glass wall. Figure 3 shows two all-glass storefronts in a mall we visited.

Figure 3 / Concealed Entrances
A) A glass storefront with doors that have handles. B) One with sliding doors.

Mari elaborated her thought process when assessing the store environment:

> *One of the first things I look for in a shop is the physical layout, lighting, and clearly defined aisle spaces with well-displayed merchandise. It makes a huge difference. I don't even bother going into a store where those elements are not in place. For instance, today we went into a large department store that had wide aisles and excellent lighting. They had good wayfinding cues, dark tiles outlining white tiles, which makes it very easy to navigate.*

Our shoppers also suggested that the reflective quality of glass, mirrors, and dark colors presented wayfinding challenges. Janice highlighted the perception of mirrors and wide expanses of dark color:

> *It's difficult to navigate with mirrors because they reflect light. We don't see depth the same way so we can't tell it's a reflection. So, I always walk into mirrors because they're*

used as walls. It is a hazard! Shiny glass and mirrors are really hard. At a small mall near where I live, they've [renovated], replaced it all in shiny black, so not only is it black which is iffy, but it's shiny, shiny, shiny. In retail spaces, big expanses of dark color; we hate those.

Lewis discussed the flooring in relation to navigation problems: "Aisles where you walk are tiled and clothing areas are carpeted. So, you have a tactile cue; it's easier to stay where you want to be and it can help you retrace your steps, which can be a challenge." The tactility of flooring as a means of wayfinding was also mentioned by Alan: "Some parts are tile, and some parts are wood. I can feel the difference, so you know when you're in a different department." Marilyn and Alan mentioned looking for signage in the ceiling to guide wayfinding. Photographs of these factors, as encountered during our shopping trips, are shown in Figure 4.

Figure 4 / Wayfinding Cues
A) Dark tiles to indicate the store entrance. B) Concrete aisles with wood laminate in the merchandise area. C) Ceiling signage to indicate a department.

Merchandise displays served as landmarks. This could be both helpful with wayfinding and problematic. Janice stated, "I like that they have clothes by collection, all casual in one area and all dresses in another; it makes it easier to find what you're looking for. It's unhelpful when they mix it all up together." Mari mentioned, "Today I headed toward clothing that is brightly colored because I notice it. Red, it catches your eye. I will remember that bright piece of clothing in that context [display]; I'll use it as a marker." However, when merchandise was in an aisle it was tricky, as described by Marilyn:

> *I used to be meticulous about reassembling things I knocked over, but now I realize, sometimes that thing shouldn't have been there. If I knock a dress off a hanger, I will always pick it up, but if I knock over a big display that was in an unexpected place I won't. I rarely go to the Shoppers Drug Mart near where I live because they very frequently have displays in the aisle and I'm always knocking things over.*

Lighting glare and layout were mentioned frequently as factors that influenced shoppers' functional abilities. The shopping mall restrooms were an area of concern, as discussed here:

> *I find the lighting very bright in the washroom; for me when it's bright like that, it becomes more difficult to [see] things. The biggest frustration in the washroom is that there isn't soap beside every sink, or the paper towel and dryer is down the hall, and when you're carrying a cane around, you're trying to keep your hands clean and they're wet and everything, it always takes me quite a while to figure out what I'm dealing with. The other thing about washrooms is that you must be careful when you walk, and make sure the floor isn't wet.*

The layout of the interior environment impacted the functional abilities of our shoppers. Wayfinding was improved by flooring choices that contrasted one another in color (dark/light) as well as tactility (hard tile/soft carpet), the placement of merchandise displays to serve as landmarks, use of effective lighting, and signage hung up above. Large expanses of glass, mirrors, and shiny metal surfaces, especially when combined with dark color schemes, hindered shoppers' confidence when wayfinding. The impact of these design choices, generally determined by interior designers, improved or hindered the shopping experience.

Merchandise Evaluation

Evaluating merchandise included multiple activities: examining the price, size label, and care content tags on clothing (often with the aid of a magnifier or price scanner), finding a salesperson, and navigating to the change room.

Salespeople

Salespeople were an integral part of wayfinding. The shoppers in the study had challenges finding salespeople. Typical employee identifiers include uniforms and name tags, but in the absence of these, shoppers worried about approaching a customer in error. Proximity is critical to discern signage and print; our shoppers were conscious of invading others' space to read name tags. Bruce elaborated on his feelings:

> *You have to learn to ask for help; just ask people. You're still a normal person, you're just a normal person who can't see anymore. Another issue is actually finding the person to ask. It's not as easy as it sounds; you don't know which person is the person to ask. When you [are sighted] … you can identify a friendly face but that's not the case with me.*

Janice also discussed this: "In big stores, like Indigo, you can't find salespeople

because they look like everyone else. Sometimes you see the name tag, sometimes you can't." Uniforms were a visual clue that aided the identification of salespeople, as Janice elaborated:

> *A uniform is easier for me to identify ... for example, if they're wearing a red T-shirt. I easily identify the person is working there. Compared to other stores you can't tell, even if they have a name tag on their jacket or shirt; by the time I see the name tag it's too late. I have to get very close to them [to read it] and they question me.*

Finding the fitting room also presented challenges. Salespeople were helpful with wayfinding to the fitting room as Marilyn described:

> *I like it when there are people designated to show you your way to the change room and take your clothing to the change room. The Gap is really good at that I've noticed. The young people will take all your clothes and hang them up for you and walk you back to the change area. I like the unisex part too. That's helpful.*

Price Determination

Challenges with reading labels and tags were prevalent among the shoppers due to small fonts, limited color contrast between the text and background, and location of the label/tag information. Lewis offered these suggestions for improvement and pointed out the price tag shown in Figure 5, indicating it was an excellent example:

> *It helps if the price tags are nice and clear. … Those tags are so small … the numbers are so small … and they're always in amongst the other print too; you can't make them out. Increase the lighting, use large labels.*

Figure 5 / Accessible Hangtags
A) Showing pricing. B) Showing the size.

Using a Price Scanner, Magnifier, or Other Technology

Shoppers could function independently with price scanners, their personal vision aid tools such as magnifiers, or specialty iPhone apps (e.g., Zoomreader); their success depended on lighting levels and the absence of glare. Mari stated, "I think the easiest thing is if there is a scanner, then you can check the price. There has to be good lighting, but if they use an energy saver and shut down the light, then I sometimes have issues." Shoppers were almost always questioned when using their technological tools, sometimes in inappropriate ways, as illustrated by Bruce's experience using a magnifier:

> *People will ask "what's that for" or sometimes if they're more generous, they'll ask if they can help me. Some salespeople think I'm a spy in the store; 75% of the time I get questions ... that's why I try not to use it. Sometimes they think I'm taking a picture of the clothing when you're just using a magnifier to see the price.*

Magnifiers helped our shoppers function independently and overcome the limitations of pricing signage to discern information related to cost and sizing. In the photos below, Bruce showed us how the lack of contrast between the numbers and background on a regular and a red clearance tag (*see* Figures 6 & 7) could be improved by the magnifier. Additionally, the readability of size labelling on a trouser was enhanced by changing the color of the background and text, as shown in Figure 8.

On the evaluation of merchandise, we illustrate factors that influenced wayfinding and reading signage that are directly pertinent to retailers. Uniform colors and name tags were essential to identify salespeople and served as wayfinding cues. Our shoppers appreciated salespeople who led the way to the fitting room. The design of price tag signage, as well as optimal lighting, influenced our shoppers' independence. Red clearance tags and small-size text were difficult to discern but could be viewed with the aid of a personal magnifier to change the contrast.

Figure 6 / Price Tags Shown
A) on the original garment, B) with the magnifier, C) modified for increased contrast with yellow lettering and blue background, and D) modified to show lettering in white on a black background.

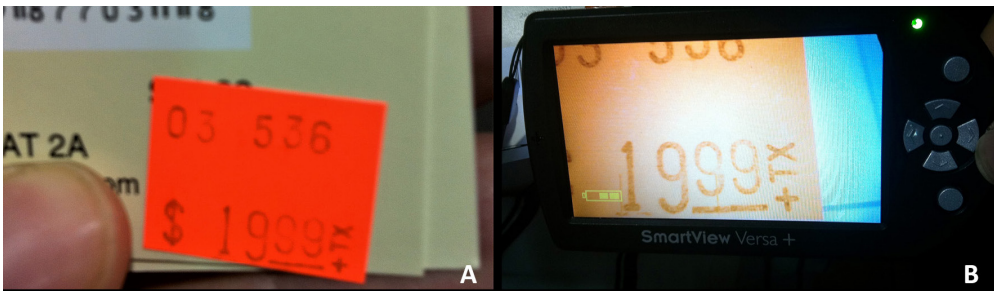

Figure 7 / Red Clearance Price Tag
A) on the original garment and B) with the magnifier.

Figure 8 / Size Label on a Trouser
A) As shown on the original garment. With B) the magnifier converting to a blue background and C) modified to show dark lettering on a white background.

Checkout

Paying for purchases created stress for the shoppers who participated in our study. Issues ranged from finding the checkout, getting in line, handling cash, using credit/debit cards, and being unable to read the cash register display and sales receipt.

Effective signage improved wayfinding to the checkout, as Alan described: "It's typically difficult to find the point-of-sale place, the area where you pay. What I look for is [something] hanging from the ceiling; that makes it distinctive. It helps." Wayfinding to the checkout was aided by flooring choices. Mari recounted a recent change at the mall she frequents:

> *It is difficult when a store makes changes. The mall near me was very easy to get into, straight off the bus stop and right into the mall. The mall is being renovated. I used to go straight into the mall and then into the library; there was a bookcase that I could see on the one wall and I could follow it. It had a format. Now, it is an open space, and I can't navigate around it. [After I complained about it] … they were very understanding and are now working with the mall to get a rug that goes from the front door, right up to the checkout counter.*

Bruce described another wayfinding issue with point-of-sale checkout: "Sometimes I go in front of the line-up, and the cashier tells me I have to join the line, but I don't know where the line-up starts. Some cashiers are helpful; others are rude because they don't have the time and patience."

Purchasing transactions require trust when one is unable to see. People with visual impairment typically fold specific denominations of cash in particular ways to aid identification; however, they feared errors related to how much they were charged, as described by Lewis: "I will look at the price before I go to the cashier and by the time they tell me how much they are charging me, I know it's close to what I have in my mind."

If paying with cash, shoppers were attentive to the change they received because in most cases they were unable to verify if it was correct. Janice said, "I use cash, but for accounting purposes, it's easier to have something I can go back and check." Marilyn emphasized her preference to have the change counted out: "I had no idea what kind of money she gave me. When money isn't close to me, I can't see the denominations on the bill."

Credit/Debit Cards

Alternative forms of payment also presented challenges. Certain types of credit/debit machines were not manageable, as described by Dwayne: "I love using the keypad; I don't have to sign anything anymore. But everybody is doing the touch screen; we can't see the touch screen! The first time I tried the CHIP it was on keypad, which I loved, but the touch screen is inaccessible." Alan elaborated on the challenges he encountered:

> *I had the worst problem the other day at a store. … They had a debit machine with a touch screen. I can't use that. On the Interac machine, okay, I can feel the buttons to punch in my [PIN] code, I can ask the [cashier], "can you just press checking for me?" [With the touch screen machine], I didn't know there was anything on screen. I had to just say no, I had to walk out of the store…*

The described checkout activities highlighted additional information relative to wayfinding and signage. Ceiling-hung signage and distinctive flooring were helpful with wayfinding to the checkout, as was a landmark indicating where the line began. In our analysis, we considered currency as a signage category. Although we cannot change the design of currency, our shoppers made helpful suggestions to mediate their limited ability to discern money by the simple practice of counting back the change. Our shoppers were unable to read or operate machines with a touch screen. Credit/debit cards offered our shoppers confidence to track accuracy through their online statements, as discussed in the following section.

Post-Shopping

The shoppers in our study returned home the way they arrived, either by using public transportation or by getting a ride with a friend. Before heading home,

they often stopped at the food court for a break. When they wanted to eat at the food court, there were added complications. The illuminated menu signage behind the counter (shown in Figure 9) was inaccessible for several reasons, and this was a negative experience, as described by Bruce:

> *[I have issues] in the food court, or even at a McDonald's because you cannot see the menu. You then have to ask questions; the more questions [you have to ask], the more negative you feel. When you have to ask the cashier [these questions], they have to spend more time to help you. That's one of the most negative feelings I have in the mall.*

Figure 9 / Inaccessible Signage - Food Court Menu
An illuminated food court menu creates a sign that is unreadable by people with visual impairment.

Receipt Verification and Storage

We classified the cash register display and sales receipts as signage. Our shoppers described concerns about not being able to see the information on the cash register display and sales receipts. They worried about dealing with incorrect charges (e.g., due to cashier error or a discrepancy between the sale price tag and the actual price at checkout). Being unable to identify an error on the spot was problematic, as traveling back to the store to resolve the issue requires considerable effort. Most shoppers preferred using a credit/debit card, as they can easily track their purchases. Marilyn described her strategies: "I use one credit card. I keep my receipts to the end of the month. I have boxes of receipts. It makes life really easy. ... I always shop in locations where I know I can return my purchases easily." Bruce in turn described his strategy as follows:

> *Usually I use a credit card. I write the card I used on the receipt with a big marker; I make a big logo that I understand; for example, I write TD Visa. When I get home, I file it and check it online to see if it matches. I use software to read out the information on the receipt.*

Various technological tools aided shoppers with this task, as described by Lewis:

> *I use a magnifier at home; and I have a scanning machine that will scan the receipts [into my computer], but it doesn't read everything and it's a real pain in the butt. ... With the magnifier I can still read my bills and check that my Visa statement is correct at the end of the month. It just takes me longer.*

Post-shopping included a visit to the food court, and once home, our shoppers verified their spending by comparing receipts to online banking statements. These activities highlighted issues related to signage. Menus in the food court were illuminated and our shoppers were not able to discern the text and pricing details. It was embarrassing to ask the foodservice person questions and delay other customers. Receipts with faded ink and low contrast between the text and background paper were unreadable and did not scan well, creating difficulty when attempting to verify spending.

DISCUSSION

The presented findings suggest that visual impairment influences how signage is perceived and presents several wayfinding challenges. The shoppers in our study reported techniques for dealing with these challenges, including advance planning, optimizing timing, keeping it simple, using resources, shadowing others, asking for help, and using technological tools. Many of the problems encountered by our shoppers could be mediated by choices made at the beginning of the design process. Nagi (1991) reminds us that disability is not person-specific. Rather, disablement occurs when there are gaps between a person's capability and their environment, a sentiment that is echoed by Imrie (2000). The shopping taskscape enhances awareness

of gaps through an examination of activities and the interactions between people, objects, and their environments, providing a means to better understand users' needs and values.

Retail atmospherics influence shoppers' perceptions and shopping behavior (Baker et al., 2006). This seems to be the case among visually impaired shoppers from our accompanied shopping trips. Objects, object placements, and the spatial layouts of retail environments have the potential to enable or disable. Designing for more embodied experiences requires a shift in thinking beyond sight and incorporating multisensorial experiences into spaces. For instance, interior designers must consider not only aesthetic qualities when making choices about flooring, but also meaningful contrasts between materials, tactile surfaces, and the different acoustic qualities inherent in wood, tile, and carpeting in order to create boundaries between spaces and wayfinding cues to help people get to where they want to be. Our shoppers mentioned ceiling signage was effective and it seems to be an underutilized resource for improved retail wayfinding. Lighting placement must consider glare reduction, hot-spots, and shadowed areas. Vast expanses of glass or mirrors should be eliminated because these reflect light and create confusing illusions of space. Reframing such design decisions would capitalize on what people with visual impairment can still see, thus enhancing their shopping experience.

When considering graphic information required in signage, our shoppers compensated for vision loss and ill-designed price tags and labels by using magnifiers, mobile phones, or other tools. Salespeople often treated these assistive devices as intrusive and suspicious. They would question shoppers or tell them that photos were not allowed. Shoppers offered two key insights around the use of assistive devices and the design of graphic information: (a) salespeople need to be educated on how to provide service to people with visual impairment, and (b) graphic materials need to be redesigned by putting lettering in high contrast (black lettering on a white background), using a sans-serif typeface (e.g., Helvetica), and avoiding italicized lettering.

Our shoppers also recommended streamlining checkout procedures and redesigning cashier areas with a focus on enabling independence. Shoppers mentioned checkout stress related to not knowing if they were charged the correct amount or received accurate change for their purchase and encountered inaccessible credit/debit machines with touch screens. Shoppers suggested sales associates count back currency or provide verbal cues during payment.

Norman (2013) advocates that although people are different, the way they perform activities is similar, suggesting that designers "let the activity define the product and its structure" (p. 231). The human body, in its heterogeneous young and old states, with and without full vision, allows people to confront, connect, and engage with spatial environments. A common expression among most people with visual impairment is perfectly summed up by Mari, one of our shoppers: "[I'm] still a normal person; [I'm] just a normal person who can't see anymore." What is vital is determining what remains the same and what is different.

In the past decade, wayfinding has been increasingly imparted onto consumers through the assumption that they can (and will) use smartphones, signage, and other mediative devices to augment their experience. For people who are visually impaired, this is an unrealistic expectation since "total self-sufficiency is nearly impossible" (Baker et al., 2001, p. 218). For visually impaired shoppers, wayfinding is a social activity that likely requires the help of family, friends, bus drivers, strangers, shopping mall staff, and sales associates at some point during their journey. Yet, our shoppers expressed frustration, embarrassment, and undue disablement through people and designed things. Encounters with other people were particularly challenging, a feeling exemplified by Lewis, who said "the more questions you have to ask, the more negative you feel." Based on our study, acknowledgement is required on wayfinding as a social activity, and frontline staff and sales associates need education on how to interact sensibly with shoppers with visual impairment.

LIMITATIONS AND FUTURE DIRECTIONS

While the shopping taskscape provides a systems approach to examine the complexity of how people

with visual impairment dynamically experience shopping in a mall, our study has limitations. All our participants used a cane, and none had a service dog. Our participants were Baby Boomers, most of whom had age-related vision loss. Future studies might focus on younger people born with visual impairment or blindness. Additionally, working in the field requires a team approach, as using the taskscape generates a sizeable data set that is time-consuming to collect and analyze. The nuanced design criteria we identified may be challenging to prioritize. Segments of the findings would be relevant to different groups—city developers, transit planners, retailers, and a wide range of design practitioners. Lastly, the COVID-19 pandemic has changed brick-and-mortar shopping and the way we pay for purchases. Online shopping has gained popularity as a safe, viable option. Future studies might focus on using the shopping taskscape to examine the online shopping experiences of consumers with visual impairment.

CONCLUSION

As Horowitz (2013) puts it, "'see' has many definitions" (p. 209). Shopping with people who are visually impaired helped us see wayfinding and signage in mall environments differently. It is easy to get caught up in the minutia of the shopping taskscape, however the shopping taskscape provides a systems approach that advances ideas around designing complex environments for able-bodied people and those with disability. Every decision made in the design process either enables or disables. Accessible environments enable functioning and normalcy, and this can't be taken for granted. We encourage researchers to adopt taskscape theory to inform designing.

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Three-Dimensional Gaze Projection Heat-Mapping of Outdoor Mobile Eye-Tracking Data

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Abstract /

The mobilization of eye-tracking for use outside of the laboratory provides new opportunities for the assessment of pedestrian visual engagement with their surroundings. However, the development of data representation techniques that visualize the dynamics of pedestrian gaze distribution upon the environment they are situated within remains limited. The current study addresses this through highlighting how mobile eye-tracking data, which captures where pedestrian gaze is focused upon buildings along urban street edges, can be mapped as three-dimensional gaze projection heat-maps. This data processing and visualization technique is assessed during the current study along with future opportunities and associated challenges discussed.

Keywords /

mobile eye-tracking; heat-map; gaze projection; urban street edge; embodied experience

INTRODUCTION

Advancements in neurological research provide new insights into the way routine urban experience can be considered as embodied (Mallgrave, 2013; 2015; 2018; Jelic et al., 2016; Huskinson, 2018). This builds upon the understanding that the central nervous system (or mind), physical body, and inhabited environment are holistically integrated, with individuals being active perceivers situated within the dynamics of their surroundings (Chiel & Beer, 1997; Gallagher, 2005; Turner, 2017). The detailed analysis of embodied urban experience has recently been made possible through the mobilization of data collection methods for use in outdoor settings (Hein et al., 2008; Spinney, 2015). Such mobilization provides opportunity to track and analyze peoples' movement and activity within urban environments (Birenboim, 2018; Duchowny et al., 2018), as well as capture how they engage cognitively and perceive their surroundings (Gramann et al., 2011; Ladouce et al., 2017). The latter has been achieved through the use of techniques previously used within the laboratory during neuroscientific and cognitive science studies. These span in-the-field application of eye-tracking (Kiefer et al., 2017; Uttley et al., 2018), electroencephalography (EEG) (Mavros et al., 2016), and functional near-infrared spectroscopy (fNIRS) (Ladouce et al., 2017).

This study uses mobile eye-tracking in real-world urban streets. As a method, it provides insight into a person's distribution of gaze while offering an opportunity to infer what aspects of the inhabited environment capture their visual attention at a given point in time (Findlay and Gilchrist, 2003; Rothkopf et al., 2007). It is by no means a new data collection method, especially within controlled laboratory situations (Duchowski, 2017; Holmqvist et al., 2011). Detailed insight into the way people visually engage depictions of various outdoor urban scenes have emerged from lab studies (Emo, 2018; Hollander et al., 2019; Hollander et al., 2020; Noland et al., 2017). However,

the ecological validity of these studies requires careful consideration, especially when seeking to generalize results with how people truly distribute their gaze in urban environments (Ladouce et al., 2017). This is a result of experimental stimuli not fully aligning with the immersive reality of real-world settings and the embodied nature of routine urban experience (Heft, 2019; Sun et al., 2018). Such caution is supported by Uttley et al.'s (2018) critique of eye-tracking methods, as well as Foulsham, Walker and Kingstone's (2011) finding that gaze behavior is significantly different between outdoor mobile situations and indoor laboratory contexts. These limitations have resulted in eye-tracking being used increasingly more during real-world situations (Kiefer et al., 2017; Uttley et al., 2018). Within an urban context, the technique has been used to assess pedestrian gaze behavior with other pedestrians (Fotios et al., 2015), understand how people visually engage with signage and facades of buildings (Tang, 2020), examine how tasks and differing street environments influence peoples' visual engagement with buildings (Simpson et al., 2019a), capture how visual engagement with street edges differs along non-pedestrianized and pedestrianized streets (Simpson et al., 2019b), show how people distribute their gaze when navigating paths and stairs (Marius't Hart & Einhäuser, 2012), and use maps when wayfinding (Kiefer et al., 2014; Koletsis et al., 2017). Each of these studies have sought to situate participants within the shifting complexity of everyday urban settings.

Even though mobile eye-tracking is being used more frequently outdoors, there have been relatively few attempts to explore new ways of articulating the captured data. This is noticeable through the persistent use of data representation techniques that originated when insights were derived from static laboratory experiments (Uttley et al., 2018). The resulting modes of analysis and visualizations created lack responsiveness to the integrated influence of mind, dynamic body, and spatial richness of the built environment; by dint of their construction, they are simply unable to fully make visible peoples' embodied engagement with their surroundings. This investigation seeks to address this by exploring how mobile eye-tracking data capturing pedestrian visual engagement with buildings along urban street edges can be visualized as three-dimensional gaze projection heat-maps.

Heat-mapping is regularly employed as a technique for qualitatively visualizing eye-tracking data (Holmqvist et al., 2011). The approach graphically highlights how an individual or collective distribute their gaze, often upon two-dimensional stimuli. This then enables opportunity to assess where people predominantly focus their visual attention. As a technique, heatmaps "provide quick, very intuitive, and in some cases objective visual representations of eye-tracking data that naïve users and even children can immediately grasp a meaning from" (p. 231). This is important when producing data visualizations that are intended to be interpreted and used by individuals not trained in using eye-tracking. One group of potential users are built environment decision-makers, particularly those seeking to evidence design ideas and align interventions with how users routinely engage urban settings (Billger et al., 2017; Uttley et al., 2018). Building upon the established use of two-dimensional heat-mapping, recent lab-based experiments examined the potential of heat-mapping gaze distribution upon real and virtual three-dimensional objects (Alexiou et al., 2019; Li et al., 2019; Tang, 2020; Wang et al., 2018). These studies provide precedent necessary to explore three-dimensional heat-mapping using outdoor mobile eye-tracking data.

Alongside three-dimensional heat-mapping, there is opportunity to examine the way gaze is directed within three-dimensional space onto objects (i.e., from the eye of the perceiver to an aspect of the surrounding environment). This method has been previously employed during the mapping of gaze vectors to understand the distribution and angle of visual engagement in an indoor airport environment (Müller-Feldmeth et al., 2014; Schwarzkopf et al., 2017). There has been no use, however, of this technique within the dynamic complexity of outdoor urban situations, nor any attempt to combine an understanding of gaze projection in combination with heat-mapping. This investigation seeks to achieve this, and in doing so, aligns with recent developments in urban isovist and visibility analyses. Previous work in this area has started to explore weighted views through the assessment of viewer gaze projection upon a three-dimensional computerized scene and the subsequent influence of the stimuli on

their perception (Fisher-Gewirtzman, 2018). Such research has also taken an embodied turn, with a distinct focus on the eye-level situated perceiver (Emo, 2015; Krukar et al., 2017) and the space–time dynamics and motion of engagement within a real-world environment (Fisher-Gewirtzman et al., 2003). These advancements show a clear desire to more thoroughly understand the combined influence that a dynamically situated perceiver and their surroundings have on real-world visual engagement.

This study builds upon previous mobile eye-tracking and data visualization methods during the production of three-dimensional gaze projection heat-maps. The produced mappings are reviewed in line with current street edge understandings to identify opportunities and challenges associated with such a data processing technique. Also undertaken is an assessment of the method's capacity to offer new knowledge that can inform how urban environments can be manipulated according to how people routinely visually engagement with them.

METHODS

Participants

24 participants took part in the study (n=12 female; n=12 male; mean age=35 years; range=21-61 years). All were recruited via opportunity sampling, using a volunteers list managed by the University of Sheffield. All academic staff were removed from the participation invite and no participants were students from built environment design professions. This was to limit the influences education level and expertise might have upon visual engagement with the street environments. Study participants did not know the aim of the study prior to taking part, had normal to corrected-to-normal vision (through contact lenses), and prior experience walking on the selected study streets.

Apparatus

Mobile Eye-tracking Glasses (Glasses 2.0, SensoMotoric Instruments (SMI), Teltow, Germany) were used. These glasses contain three cameras that record the wearer's eye-movements individually and the environment to the front. The videos were processed in SMI BeGaze, creating a ten frame-per-second video. This consisted of gaze location, represented by a cross-hair, superimposed over a video of the environment being viewed. During data collection each participant wore a peaked cap to limit the impact that sunlight had on eye-tracking data quality, which is consistent with previous outdoor eye-tracking investigations (Kiefer et al., 2014). The lead researcher, wearing a small camera on their chest, followed each participant during data collection to record their location. This method was used due to issues with GPS accuracy identified during pilot studies.

Study Procedure

Before beginning their route, the eye-tracker was calibrated to the wearer with a three-point process; this was repeated until gaze tracking was accurate. Participants' eye-height was also measured. This information was used during the data mapping process.

Once wearing the eye-tracker, each participant walked a short route around six streets in Sheffield, UK. In total, twelve study streets were used across two routes that were walked in the same direction (Streets 1-6 and Streets 7-12). Prior to stepping off along each street, participants were instructed to read a task card detailing a representative activity to undertake while walking. The activities were intended to give the study a greater level of real-world validity and were selected based upon on-site observation of pedestrian behaviors. Six activities were used, categorized by optional actions (breaktime stroll, coffee with a friend, window-shopping) and necessary actions (rushing to work, dropping off an object with a friend, walking to the bus). The use of these categorizations follows previous research (Gehl, 2010) and mobile eye-tracking studies (Simpson et al., 2019a). Such research showed that while optional and necessary activities influence the duration of street edge visual engagement, certain street edges are engaged with for longer periods, no matter the activity category.

The selected activities were dispersed across each of the six streets, meaning that each participant carried out each activity only once along their route. The overall intention was to expose participants to variable, real-world situations. No measures were taken to control any aspect of the environment, beyond the requirement to walk along specified streets in the same direction and undertake defined activities.

Data Processing, Coding, and Visualization

To select the data to be mapped, the eye-tracking videos were manually coded using VideoCoder (Foulsham et al., 2011). This output provided a gaze duration timeline, allowing insight into the amount of time participants visually engaged with buildings and other elements along the street edges of the 12 study streets. A subset of this coded eye-tracking data was then selected for visualization based upon which street edges were visually engaged with the most (Street 1: Chapel Walk and Street 2: Devonshire Street), the least (Street 5: Norfolk Street 1 and Street 6: Norfolk Street 2), and at the dataset's median (Street 3: Westfield Terrace and Street 4: Glossop Road). This subset provide a spectrum of eye-tracking data; Figure 1 highlights the pedestrian eye-level characteristics of the identified streets.

From this six-street data-subset, each participants' eye-tracking video was synchronized with the video from the chest camera worn by the lead researcher; this resulted in a video that highlighted both participant gaze (from the mobile eye-tracker) and body location (from the researcher worn camera). Information from this combined video was then mapped onto three-dimensional models of the study streets. Manual processing was necessarily employed because there is no effective automated system that can accurately interpret the complex three-dimensional dynamics of a pedestrian visually engaging with their surroundings.

The three-dimensional models of the study streets were produced using Trimble SketchUp; this modeling package was selected because of its ease of use and

Most visually engaged street edges 1, Street 1, Chapel Walk

Most visually engaged street edges 2, Street 2, Devonshire Street

Median visually engaged street edges 1, Street 3, Westfield Terrace

Median visually engaged street edges 2, Street 4, Glossop Road

Least visually engaged street edges 1, Street 5, Norfolk Row 1

Least visually engaged street edges 2, Street 6, Norfolk Row 2

Figure 1 / Pedestrian eye-level images of selected streets

effectiveness when analyzing visibility of urban scenes (Lin et al., 2017). To three-dimensionally map the projection of each participant's gaze, from their eye location to the surrounding street edges, SketchUp was used in combination with the point editing plug-in Vertex Tools. Supplementary Figure 1 in Appendix I shows mapping examples for participants walking along Street 3 (Westfield Terrace). Gaze projection data for each participant was then overlaid for each street, producing combined three-dimensional mappings. The imagery for each street, was exported in plan-view and elevation for the left and right street edges. This process was required for the eye-tracking data to be effectively understood at the individual street scale. Supplementary Figure 2 in Appendix I provides example views of a combined three-dimensional mapping that incorporates all data for Street 3 (Westfield Terrace). Finally, the plan and elevation images were processed with Adobe Photoshop's gradient tool to produce the final heat-mappings.

Results and Discussion of Opportunities and Challenges

The visualizations produced through the three-dimensional gaze projection heat-mapping of the mobile eye-tracking data can be seen in Figure 2. Larger scale mappings for each street can be found in the supplementary figures section (*see* Appendix I).

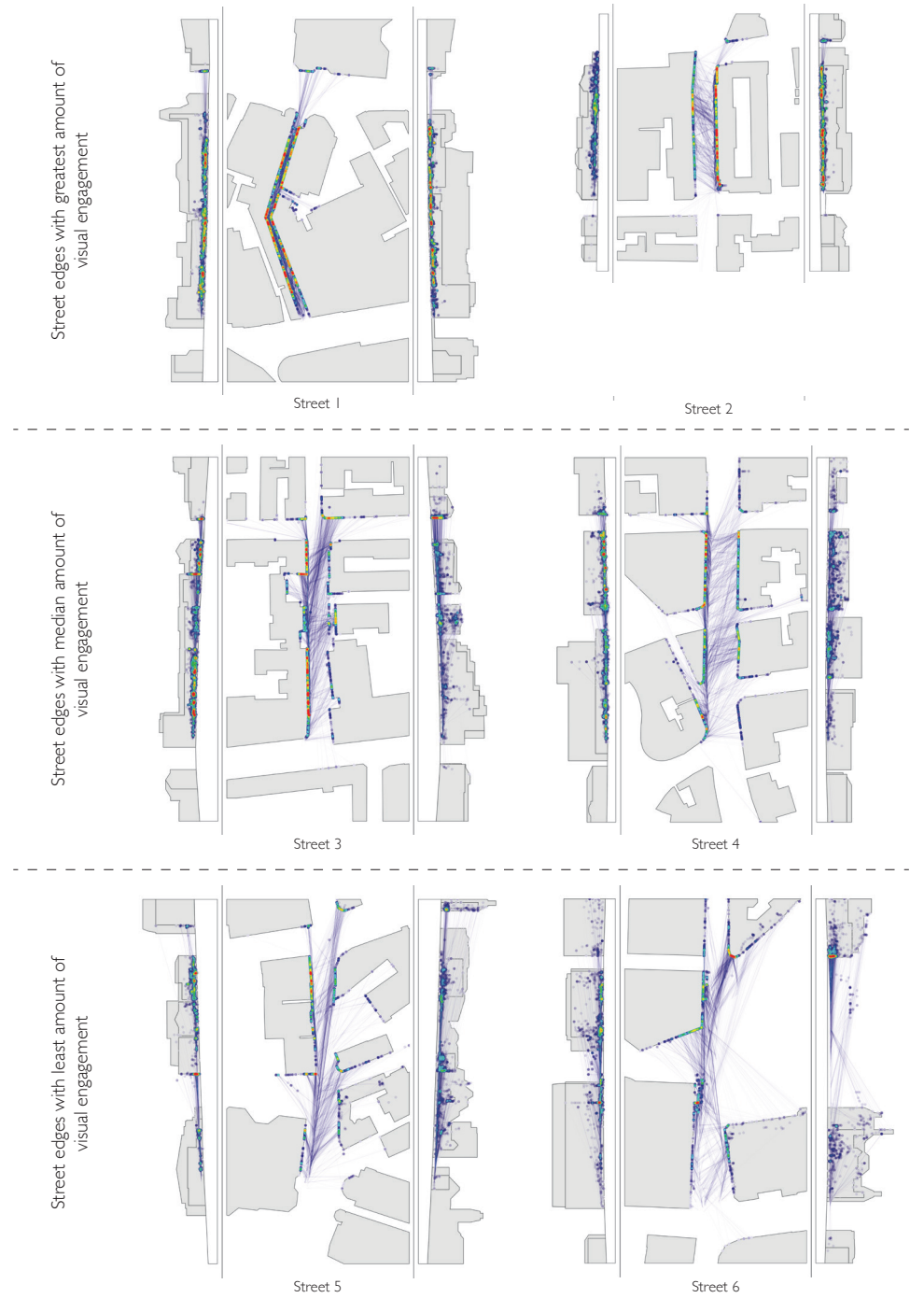

Figure 2 / Three-dimensional gaze projection heat-mapping of pedestrian visual engagement with urban street edges

Figure 2 highlights collective pedestrian visual engagement with different street edges, captured while study participants were situated within the real-world dynamics of urban streets. A broad evaluation of the gaze behaviors, made visible by these mappings, follows. This is in order to better understand and provide a foundation from which to evaluate the effectiveness of the methods employed.

The greatest points of gaze focus were nearly always on the lower portions of the street edges. Even though this visual dominance is common across all the mappings, there is considerable variation between the different study streets. Nonetheless, this observation helps clarify just how disproportionately important building ground floors are at the point of pedestrian experience (Gehl et al., 2006; Karssenberg et al., 2016; Rahman & Mehta, 2020), an aspect of streetscape experience that is often challenging to capture and articulate.

The mappings highlight how the most visually engaged street edges had a greater continuity of high intensity ground floor gaze focus along their length. The edges that were engaged with less had a greater proportion of gaze distributed across their entirety, including upper floors, with only two or three points of noticeably higher ground floor gaze focus. This insight correlates with the understanding that experientially engaging street edges have ground floors that capture and hold pedestrian attention more effectively along their extent, often through a rhythmic linear structure with numerous points of interest (Gehl et al., 2006; Hassan et al., 2019; Thwaites et al., 2020). The effect of this is heightened when pedestrians were actively undertaking the study's optional activities (breaktime stroll, coffee with a friend, window-shopping), as these actions naturally direct gaze towards ground floor shops and businesses (Simpson et al., 2019a). When street edges are structured to accommodate a fine-grain, variable mix of these facilities along their length, (Streets 1 and 2, for example) these optional activities will naturally encourage significantly more ground floor visual engagement, as previously evaluated by Simpson et al. (2019b).

The visuals show how the linearity of streets predominantly directs gaze on the surrounding street edges in a forward direction aligned with the path of travel (study participants walked the streets from bottom to top of the mappings). Of this gaze, there is a dominant focus towards the street edge on the side being walked (see the right side of Street 2 and left side of Streets 3, 4 and 5). Streets 1 and 6 have a more balanced distribution of gaze, likely the result of pedestrianization. Although these observations can be evidenced quantitatively (Simpson et al., 2019b) and described via observations (Gehl et al., 2006), it had not been possible to visualize this phenomenon previously. The mapping processes employed during this study provides tangible, graphic insight into such pedestrian gaze behavior.

The most engaged street edges were along narrower, continuous streets with fewer edge breaks and setbacks. This type of environment seems to effectively contain visual engagement along the street edge, as more open streets had less intense edge engagement (see Streets 5 and 6). Such insight aligns with Thwaites et al. (2020) and Gehl's (2010) arguments that human scaled streets are important to stimulate and intensify pedestrian-environment interactions, particularly with street edges. Likewise, the mappings support the importance of morphological continuity when seeking to establish street edges that encourage active pedestrian engagement (Thwaites et al., 2020).

Interpreting the mappings produced in line with existing street edge knowledge provides insight into the analytical capabilities of the developed techniques. There are, of course, opportunities and challenges associated with the production of three-dimensional gaze projection heat-maps along with the use of mobile eye-tracking outdoors, which require deeper evaluation.

Opportunities and Challenges

Mobile eye-tracking in real-world urban situations provides insights that are more ecologically valid and aligned with realistic visual experiences than those in laboratory contexts (Ladouce et al., 2017; Uttley et al., 2018). This is significant, considering the pressing need for representative empirical insight that can be used to effectively inform design decision-making (Simpson et al., 2019a; Uttley et al., 2018). Many have questioned the knowledge foundations from

which built environment design intervention is based (Cuthbert, 2007; Marshall, 2012; Mehta, 2013). Through mobile eye-tracking there is an opportunity to address this by establishing a rigorous practice around the structure of pedestrian visual experience. The result is new opportunity to guide decision-making and bring design interventions closer to how people routinely engage with urban spaces.

The format of insights and the way in which they are articulated are equally significant. The approach developed seeks to visualize gaze information in a manner that is comprehensible without the need for a detailed understanding of eye-tracking metrics or scientific analyses. The outcome is an innovative communication tool that can readily explain the complexities of pedestrian visual experience and be used to directly inform environmental change approaches. Linked with this is the how the data visualization method developed has the potential to provide generalizable insights. This has been shown through its capacity to complement and evidence, in a visually tangible manner, existing street edge knowledge. There is also, however, an opportunity to provide context and site-specific insights into gaze behavior. For example, along Street 2 there was a noticeable focus of pedestrian gaze towards a specific area of the opposite sided street edge . This was the site of a new shop that clearly grabbed the visual attention of participants, as it was a previously un-experienced aspect of the environment. The heat maps produced showed the experiential influence of this small-scale environmental change that might otherwise have evaded elicitation. This potential for both broad and contextualized, insight from a single tool offers clear opportunities for informing design across different scales. There is opportunity to evidence and guide, through making comprehensible trends in human-environment interactions, how future built environment interventions are approached. Likewise, at a context specific scale, the technique has the potential to highlight areas that require focused design attention to encourage more experientially engaging urban settings.

To date, eye-tracking analysis has been predominantly used to provide insights into the distribution of peoples' gaze upon a given stimulus by categorizing and measuring eye-movements (Duchowski, 2017; Holmqvist et al., 2011). However, the data processing and visualization techniques developed offer the potential to combine an understanding of eye-movements with a broader physiological analysis of how the human body is situated, orientated, and moving within an environment. Previous eye-tracking research has examined the horizontal angle of gaze projection indoors (Müller-Feldmeth et al., 2014; Schwarzkopf et al., 2017) and the way surface complexity influences eye and head angle has been explored (Thomas et al., 2020). This study builds upon such work within a mobile outdoor context and in doing so, there is clear potential for not only comprehending what people predominantly visually engage with (duration) but also the distance over which this engagement is projected and the angle at which it takes place in relation to the space inhabited (i.e., against the dominant forward focused linearity of a street). Constructing such an integrated understanding is significant, as both distance (Hall, 1966; Lynch & Hack, 1984; Morello & Ratti, 2009; Gehl, 2010) and the orientation of the body and eyes (Fisher-Gewirtzman and Wagner, 2003; Gehl et al., 2006; Gibson, 1979; Yang et al., 2007) influence engagement with and perception of urban environments. As a result, this research provides opportunity to integrate eye-tracking with recent developments in the isovist and visibility analysis of urban environments. However, further research is clearly needed in order for such advancements to be realized. Nonetheless, the current investigation has highlighted unrealized opportunities for combined research techniques through encouraging a more embodied and spatially responsive analysis of mobile eye-tracking data that seeks to comprehensively understand the duration, distance, and angle of situated human gaze.

It has been previously highlighted that there is opportunity to link eye-tracking with additional auxiliary data collection techniques (Holmqvist et al., 2011). Recently, researchers have sought to combine EEG (Ladouce et al., 2017), skin-conductance (Uttley et al., 2016), and verbal descriptions (Uttley et al., 2018) with outdoor mobile eye-tracking data, however, further technological developments are needed to effectively link these different data streams (Ladouce et al., 2017;

Mavros et al., 2016). Although this is the present case, there is clear potential for the three-dimensional heat-mapping method to incorporate additional sources of data. This would allow for greater links between gaze distribution and visual attention to be made, which is an ongoing challenge (Uttley et al., 2018). It would also offer opportunity to comprehend the embodied nature of complex urban experiences by linking different information sources that capture how the human mind and body react to the surrounding environment. Such insight could be used to inform evidence-based environmental changes that incorporate multiple, over-laid empirical sources of experiential information.

As described, mobile eye-tracking in real-world situations often provides insights that are more ecologically valid when compared against lab-based studies. When undertaking eye-tracking research in complex outdoor situations, however, it is challenging to control the inherent variability of the stimuli which study participants engage (Uttley et al., 2018). The resulting data is sometimes challenging to make direct comparisons across and draw substantive conclusions from. Further, when people are situated within outdoor settings such as streets, it can be difficult to assess if their attention is actually directed towards what they are looking at within a shifting and multi-sensory environment; these environments heighten the potential for people to be thinking about other aspects of their surroundings or previous experiences rather than what their eyes are directed towards (Hausdorff et al., 2005; Uttley et al., 2018). By layering and heat-mapping the projection of gaze this issue is mitigated through the cumulative aggregation of gaze data. There is future potential for such an issue to be overcome by integrating mobile eye-tracking and wider data collection techniques, as mentioned earlier. This triangulation of data would help establish more representative three-dimensional mappings of visual attention, that is what someone is seeing (cognitively processing) rather than just looking at (gaze). Virtual reality eye-tracking is also a potential technique that could address such issues through its ability to systematically control the stimuli exposed to study participants. Implementing this technique would also eliminate the need for a researcher to follow study participants, which was required for this study and might have influenced their visual behavior. However, the use of virtual reality eye-tracking requires further evaluation, as the immersive research stimuli is still an abstract version of the richness embodied in real-world situations.

This study involved extensive manual data processing. This encompassed categorization coding, using VideoCoder, and creating three-dimensional gaze maps with Trimble SketchUp and the Vertex Tools plug-in. These processes are labor and time intensive and are susceptible to human error, as frame-by-frame interpretation and coding of eye-tracker videos is necessary. There is potential for these processes to be streamlined and automated, particularly as technological advancements are made in machine learning and the categorization of visual stimuli attributes (Badrinarayanan et al., 2017; Middel et al., 2019). Process automation within GIS and MATLAB softwares have been shown to be effective for three-dimensional isovist analyses (Morello and Ratti, 2009; Yang et al., 2007). Similarly, virtual reality could offer opportunities for reducing data collection and coding workloads (Pfeiffer & Memili, 2016; Uttley et al., 2018). Such advancements would reduce the effort and time needed to generate the visualizations while lessening the potential for human error associated with their production.

There are issues with research scale when using mobile eye-tracking outdoors (Uttley et al., 2018). As discussed, data capture, coding, and visualization is time-consuming, therefore limiting the amount of data that can be effectively processed and subsequently restricting widespread application and use. Despite this, there is opportunity to use the insights obtained during this study in combination with and to inform wider analytical approaches. For example, recent advancements in machine learning have allowed the large scale analysis of spatial and material attributes of urban streets that affect visual quality (Ye et al., 2019). Agent-based models have been used to assess human movement and behavior in combination with visual affordance (Turner, 2017; Turner & Penn, 2002). Mobile eye-tracking, alongside three-dimensional mapping, could be used to complement and refine findings derived through these techniques. As a result, there

is potential to scale-up eye-tracking insights to align innovative large-scale analyses with a detailed, embodied understandings of real-world pedestrian visual experiences.

CONCLUSION

The current study advances methods for articulating how people visually engage with urban spaces. The techniques are responsive to the integrated influence of human body, mind, and surrounding environment on peoples' routine experiences. This was achieved through three-dimensionally heat-mapping the projection of pedestrian gaze upon the occupied environment. Such a method advances existing techniques for evaluating outdoor mobile eye-tracking data, which have so far lacked sensitivity to the situated and embodied nature of dynamic visual engagement within urban environments.

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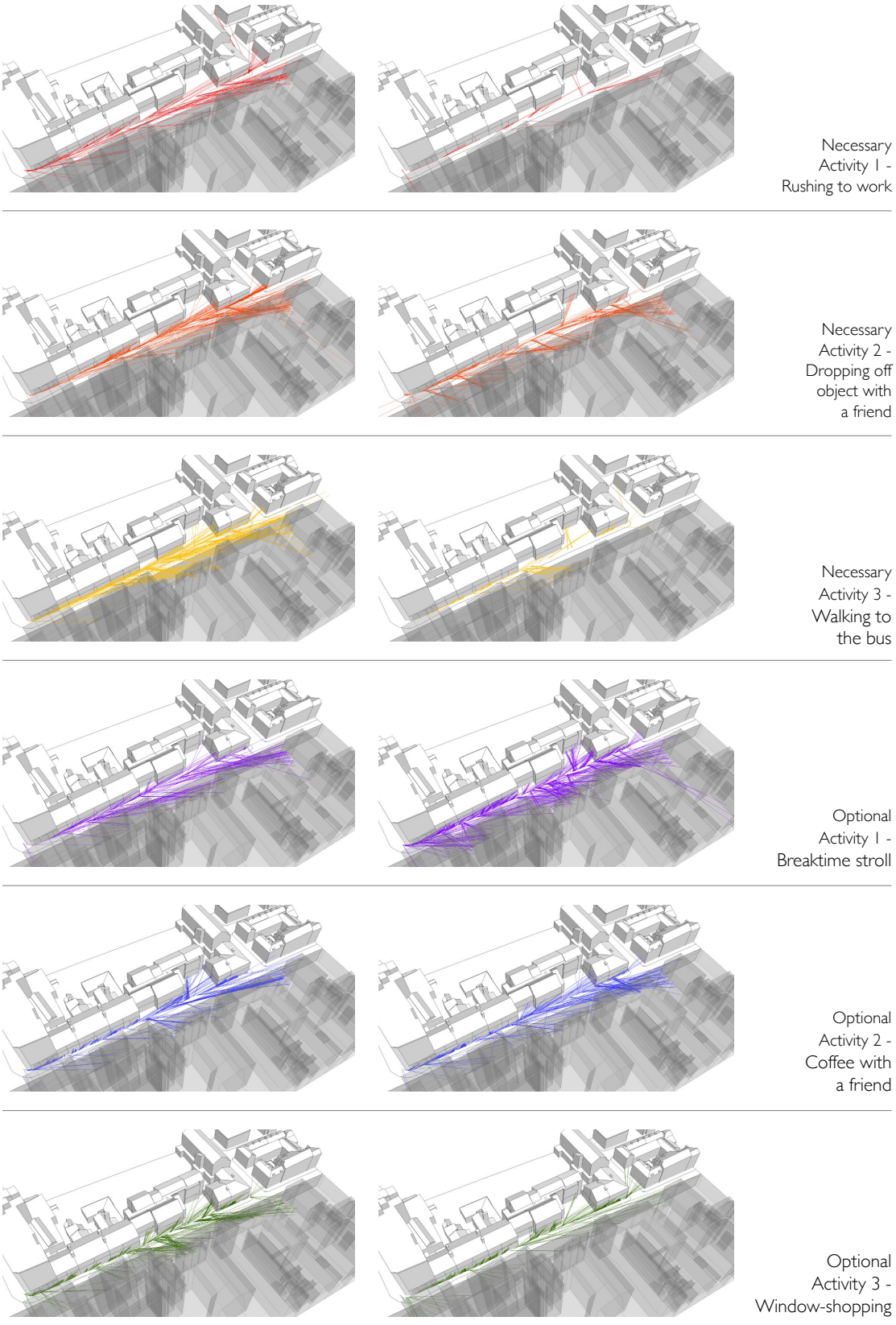
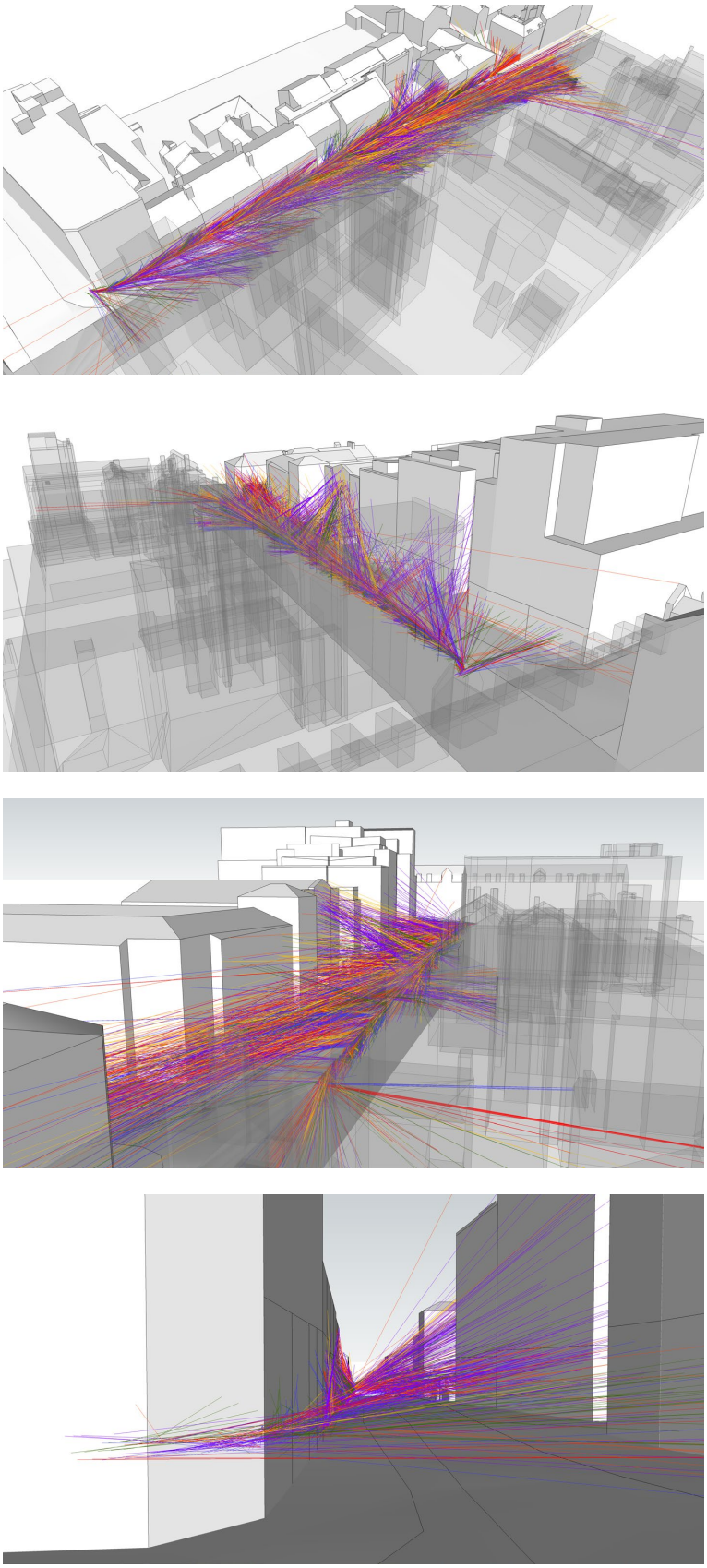
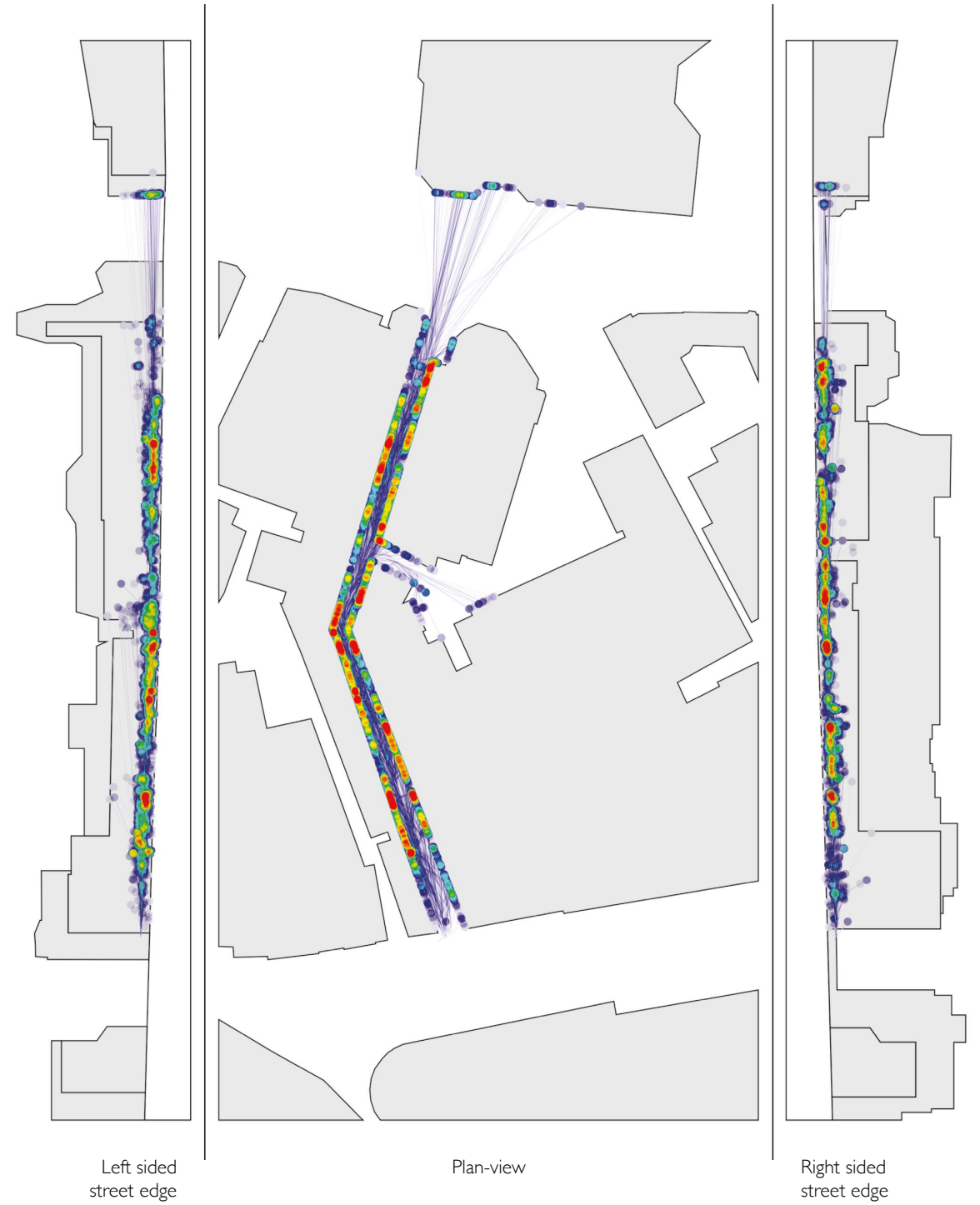
APPENDIX I: SUPPLEMENTARY FIGURES



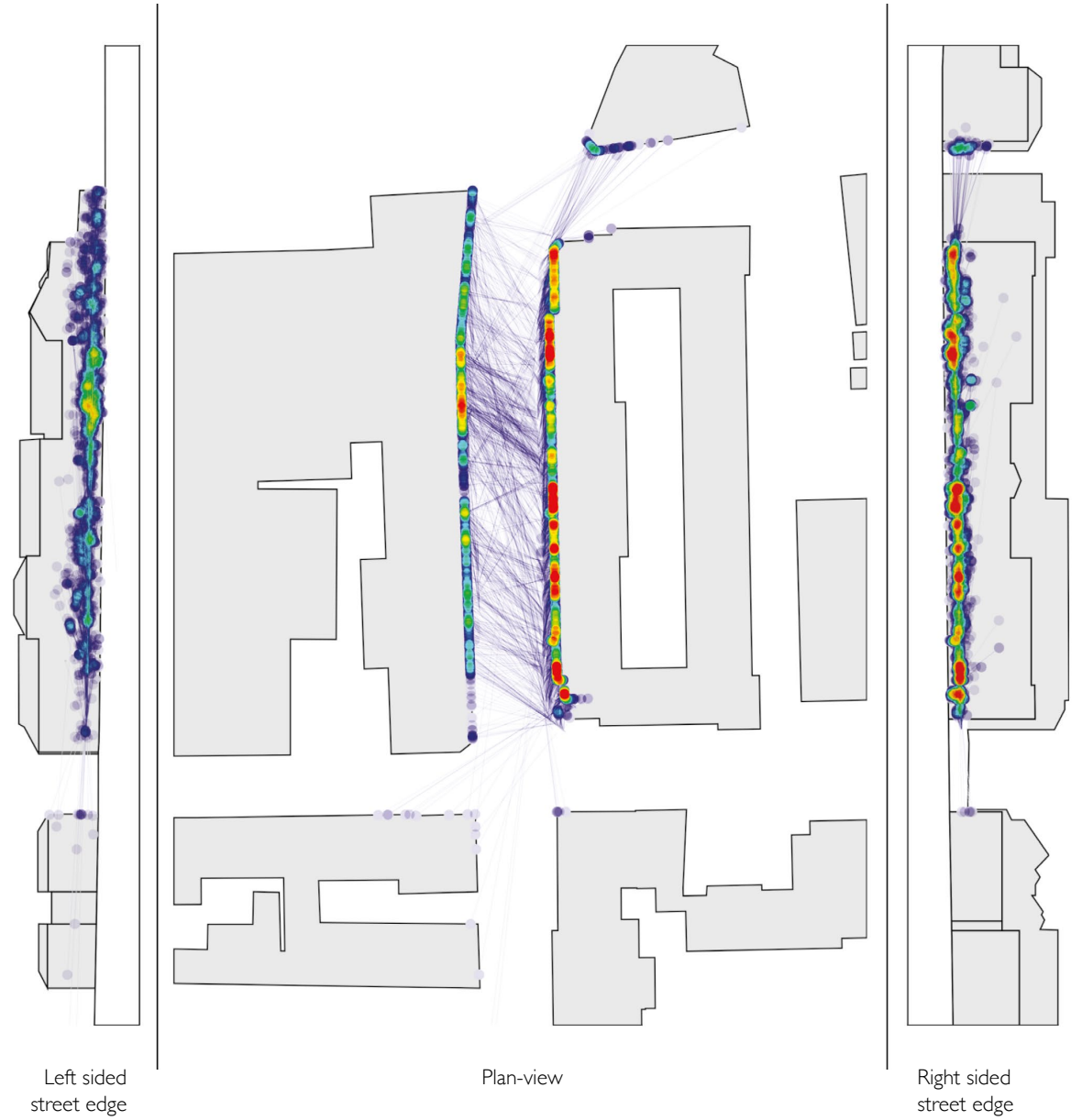
Supplementary Figure 1 / Three-dimensional mapping of individual study participant gaze along Street 3



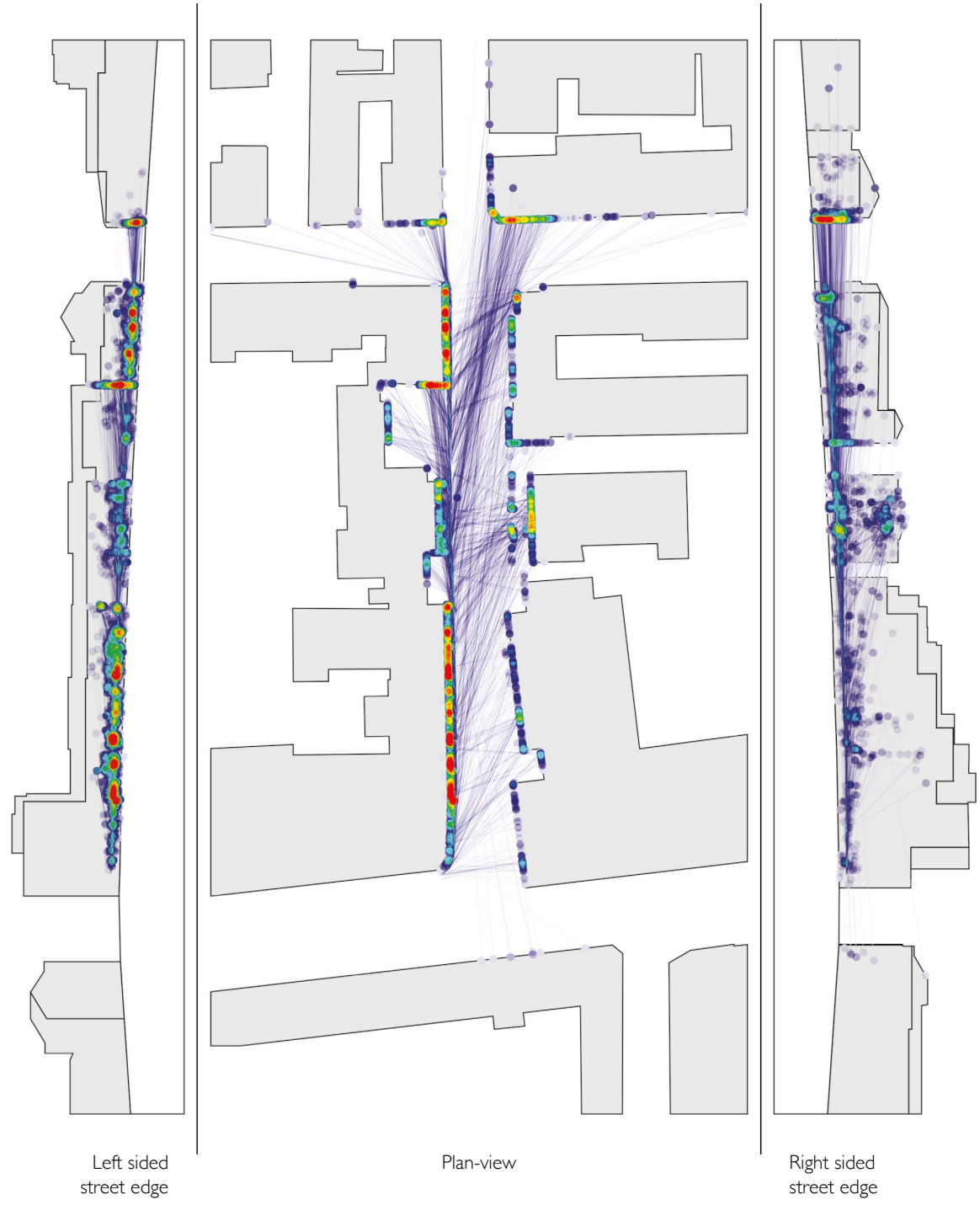
Supplementary Figure 2 / Combined three-dimensional mapping of gaze along Street 3



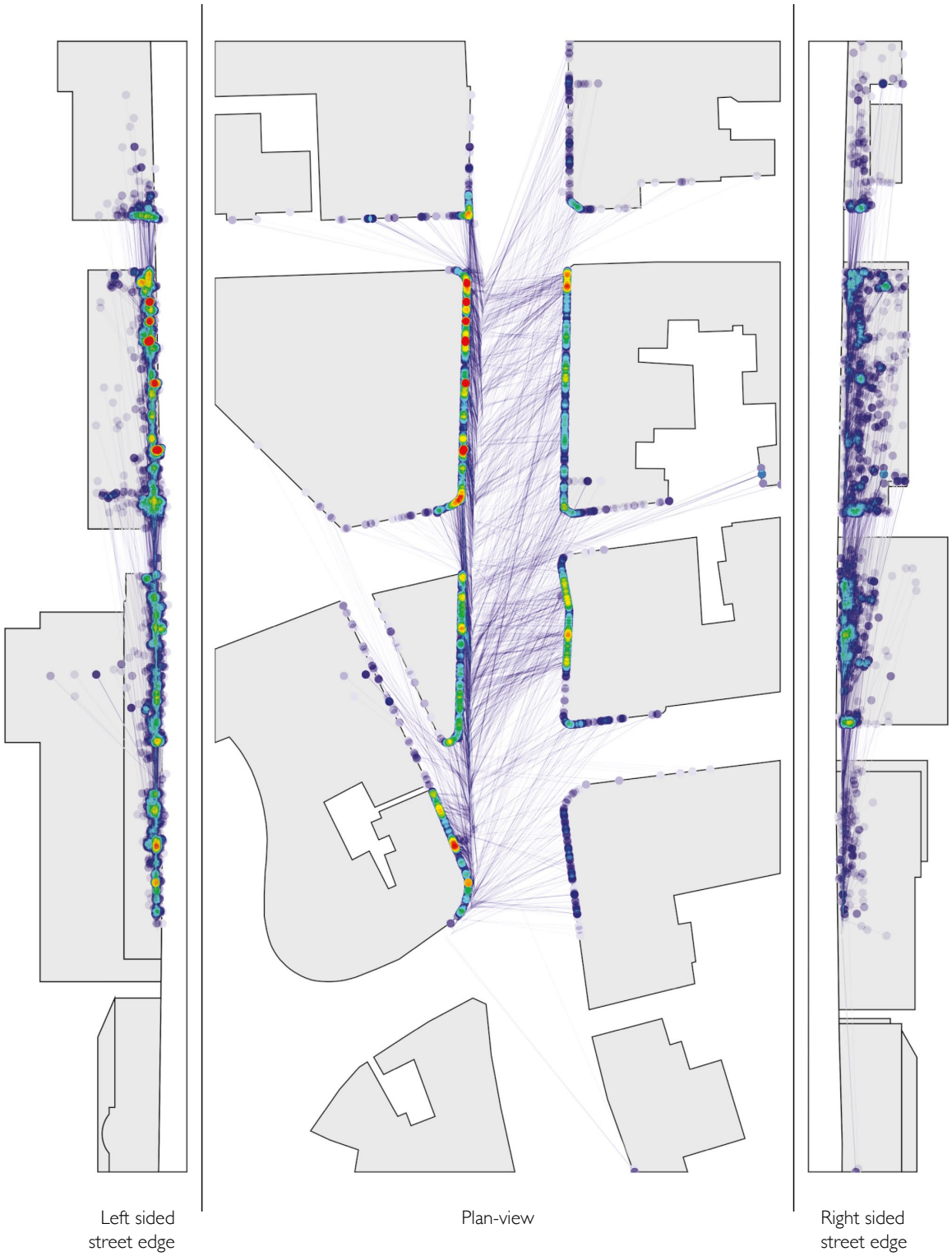
Supplementary Figure 3 / Street 1 mapping



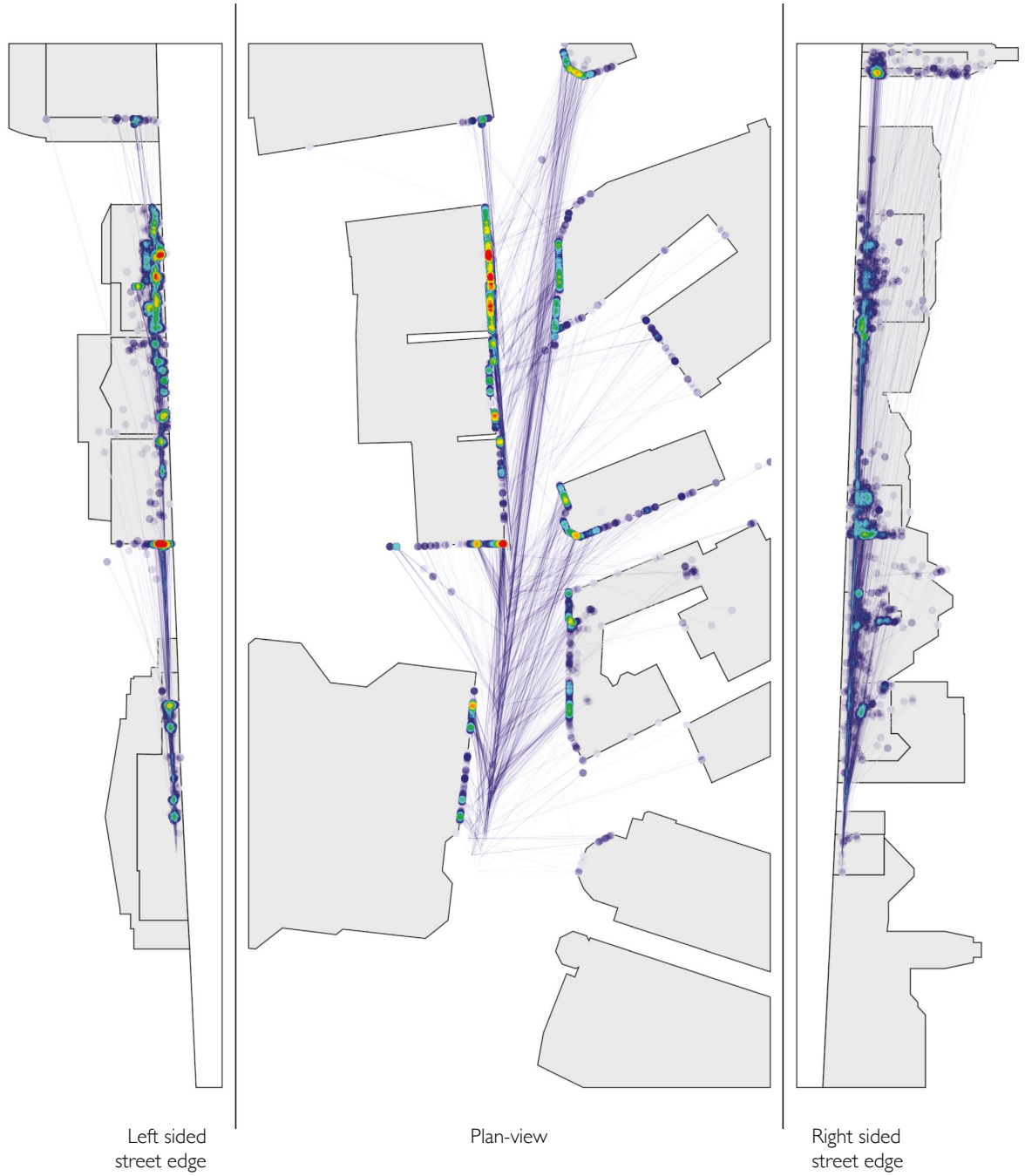
Supplementary Figure 4 / Street 2 mapping



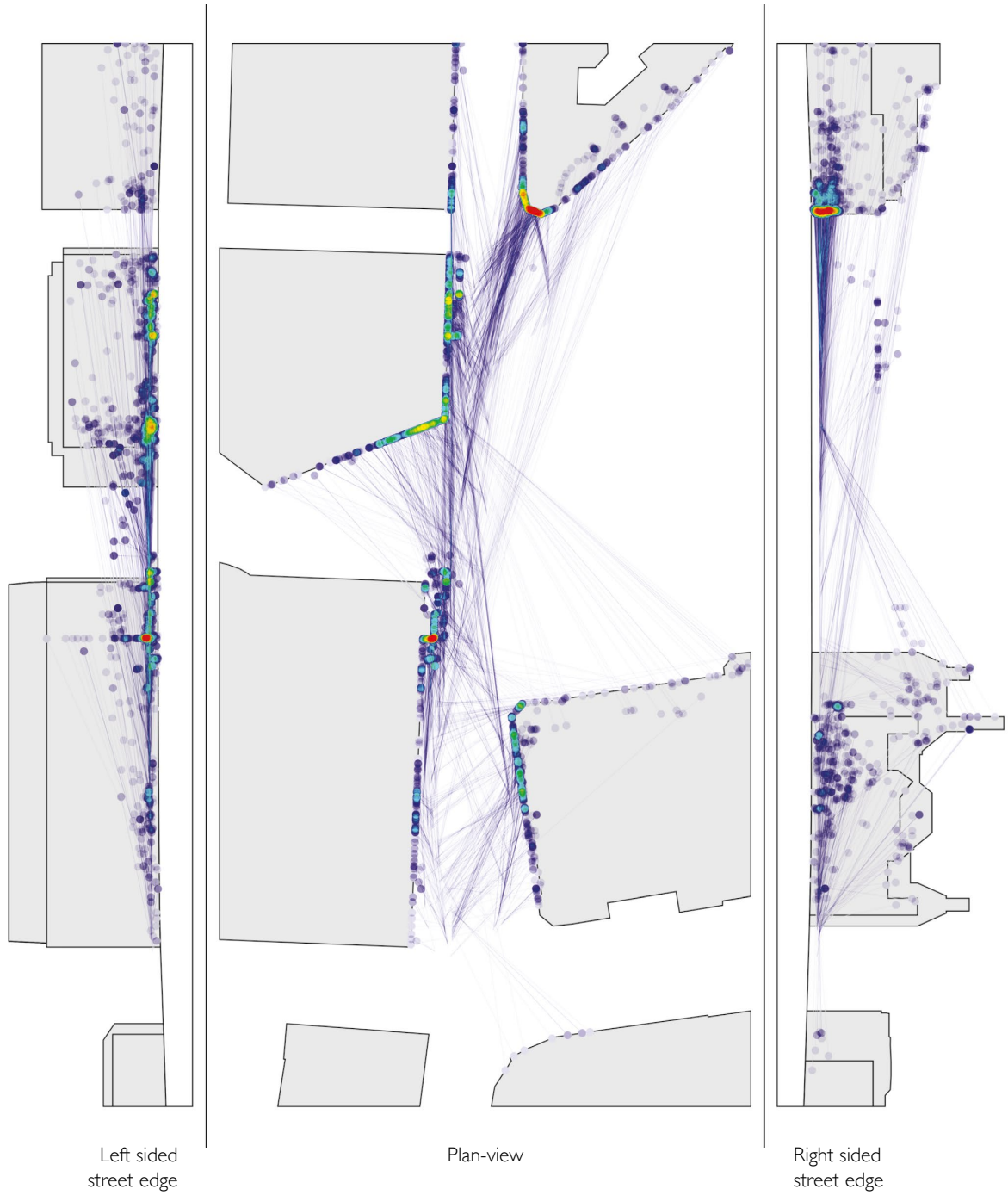
Supplementary Figure 5 / Street 3 mapping



Supplementary Figure 6 / Street 4 mapping



Supplementary Figure 7 / Street 5 mapping



Supplementary Figure 8 / Street 5 mapping

What the Signs Say: Language, Gentrification, and Place-Making in Brooklyn

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Shonna Trinch and Edward Snajdr decipher signage in a way that will prevent you from looking at a sign in the same manner again. Their research is built on a series of site visits, observations, and ethnographic interviews and they posit that signage plays an important role in gentrification. As they explain it, signs effect public space; well designed and interesting signs are important attributes of placemaking, often part of a strategy for cities to reclaim their appeal.

Trinch and Snajdr note that the "meaning of public space, even on the seemingly smallish scale of a storefront sign, can actually play a significant role in the contemporary contest over public space" (p. 3). They support this claim through rich imagery and case studies. The latter allows the reader to understand signage's role within in a community and provides examples of what can go wrong when a sign contains language and symbology that is inconsiderate and offensive to the community where the business resides.

The research is set in Brooklyn, a rapidly changing and well-documented New York City borough. Brooklyn, once a place that people would simply pass through, has become a destination location for "upper-middle-class home buyers, younger hipster renters, Manhattanites looking for new and interesting things, and tourists" (p. 18). As clearly stated by the authors, the aim of the book is to understand the role "commercial language on small-scale shops has played in marking and making gentrified space" (p. 21). The book opens with the authors describing how the site was chosen and, more interestingly, their process of collecting the data by living it through field work. Specifically, the authors conducted their field research through "interviews with residents, developers, activists, and other stakeholders, digital ethnography of websites and blogs, commentary, archival research,

Book Review /

WHAT THE SIGNS SAY

Authors:
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and various types of mapping of Fort Greene and Prospect Heights" (p. 22). In an effort to triangulate their findings, the authors surveyed borough residents, community organizers, college students, and government officials.

Unlike traditional ethnographic research, where researchers can travel great distances, Trinch and Snajdr lived in their field site for fifteen years which, "created a situation in which we are always working, collecting data, talking to people, confirming our ideas of what is happening, and having our ideas challenged by new data from the ever-evolving human happenings and sense-making that is constantly taking place around us" (p. 24). The authors, as ethnographers and language analysts, understand the impact their residency has on the neighborhood and their research. The authors recognize they "fit the common intersectional profile of a gentrifier." While they are proud of and celebrate their heritage, they acknowledge their cultural background "does not orient toward any of the well-defined ethnic communities in Brooklyn" (p. 26). In effect, they remain somewhat outside of and detached from the neighborhood, giving them the ability to dissect and engage with both groups of Brooklyn residents—the gentrifying and the gentrified. Through this lens, the authors describe the complexity of the gentrification process and the role language has in creating a landscape that makes a community more desirable.

The book builds on each chapter by first understanding what makes Brooklyn a distinctive place. The first chapter includes texts and pictures, which highlight differences between the "non-corporate and local store fronts in Brooklyn's retail landscape," thereby allowing the reader to better comprehend the neighborhood's spatial contexts (p. 29). The authors introduce the idea of textual density, referring to text rich signs and signs with large font size. In their introductory analysis, the authors include signs that incorporate non-English languages. All of these examples provide a landscape that allows the reader to understand the visual diversity that exists in Brooklyn. Furthermore, this chapter introduces readers to the rules and norms of sign makers and explains the difference between old and new signage.

The authors refer to "capitalism without distinction" throughout the book, defined as "tolerance and inclusivity despite differences in people's identities, bank accounts, educational levels, and religious beliefs," (p. 60). This concept does not necessarily point to what the business sells, but rather to the clientele it attracts. This is important because often, especially in the case of new signage, what is on the sign can be different than what is behind it. New signage can be characterized by brevity, requiring the consumer to investigate what the store sells by either walking in or looking online beforehand. No matter the method, vague illusions on signage can cause the consumer to research the business, become informed, and potentially share that with their peer group. In a changing neighborhood, these new stores may not be "for" current residents. Connecting back to their primary thesis of signs and gentrification, capitalism without distinction highlights and compounds the "complicated and contentious relationships among different ethnic and racial groups who share and vie for control of a

Brooklyn neighborhood's urban space" (p. 61). As signage advertises a business, it may also advertise a burgeoning trend toward gentrification.

The second chapter dives into modern and historic sign practices and types and analyzes the significance of signage in space and its role in the community. Signage has both positive and negative effects on the communities where these small commercial spaces are located. Trinch and Snajdr note,

> *The language of some shop signs functions in not so obvious ways to make distinctive places for the benefit and use of one (more or less) homogeneous group while in turn serving to gate, to close off, or perhaps even to offend other groups. These processes, we argue, are not so explicitly apparent and perhaps not intentional, yet they conspire with cultural notions of choice and other neoliberal logics to make gentrification seem organic, "normal", and inevitable." (p. 21)*

The last two chapters discuss the impact of chain stores on community landscapes and how their ubiquitous branding threatens the unique visual clues of local business districts; the authors warn of placelessness that results when national chains (and their signs) replace local businesses (and their signs). While there is an ongoing debate around how governments implement signage regulation and the role signage plays in contextualizing a community, it is certain that longstanding small businesses need support from local business districts and governments to ensure that they are able to stay in areas that are gentrifying. Addressing the "high-rent blight" impacting businesses is one-way business districts and local governments can invest in their communities. Without this investment, gentrification will continue, leading to super-gentrifiers and corporate investment that threatens the sense of place.

The authors conclude with a deep dive into "intention, impact privilege, and power in people's struggle to claim space and right to define it" (p. 30). This phenomenon is not just about national businesses gentrifying historically local commercial districts, but about power between a business and the community it resides. Trinch and Snajdr provide an example of this in their discussion of Summerhill, a restaurant in rapidly gentrifying Crown Heights. As they describe it, the business owner, a former corporate tax attorney, constructed a narrative about "preserving" bullet holes in original interior walls for aesthetic purposes—to create a "visually engaging experience"—and to attract business (p. 186). The community organized to communicate their dissatisfaction with the marketing strategy, after a press release by the business owner and several published articles which focused on the inconsiderate irony of this self-mythologizing boozy sandwich shop selling "$12 cocktails" and with "cheekily wall-papered bathrooms," (p. 185). The owner was clearly out of touch with the community's legitimate pain and feelings associated with suffering and loss brought on by foregrounding fake bullet holes. This is a prime example of a disconnected marketing gimmick introduced by a white business owner that wholly fails to recognize the historic trauma of urban communities of color. While the community seemingly preferred supporting Brooklyn-based busi-

nesses, contempt continued to grow due to the lack of sincerity, awareness, and humility for Summerhill; ultimately contributing to the restaurant's downfall.

What the Signs Say is a narrative meant to help readers understand the role signs and visual cues have in creating space. Story driven and image laden, this work is appropriate for an academic audience, including students and researchers who have an interest in visual communications across a variety of disciplines. The book challenges readers to think intentionally about how signs and their texts, can create a sense of place. As business owners think through how they want to appeal to their primary consumer base, they must consider their environment and how certain words, art, or visuals may be perceived by everyone. Communities serve diverse populations, which include residents and tourists, and business owners' connection to the place they inhabit and their intentionality will determine their failure or success.

While the book presents case studies of how unwelcoming space impacts the surrounding community, it lacks guidance for businesses as to how they can develop signage that creates universally welcoming messaging. However, neighborhood groups, business districts, and local governments can learn how placelessness displaces small business and residents. Furthermore, while the book provides examples of how corporate investment can lead to placelessness, it would have been beneficial to learn more about investment strategies being implemented across Brooklyn to retain small business that are struggling with high-rent blight. Overall, this book allows the reader to critically engage with the role of language in signage, and whether an expert or not, this book leaves the reader thinking about signage in a critical way and challenges one to ask, "what *does* the sign say?"