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Wayfinding Zuidoostflank

A research that explores the possibilities of
a wayfinding system for (future) cyclists in
Amsterdam Zuidoost



Colophon

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Preface

Before you lies the result of my research in collaboration with the Municipality of Amsterdam. I conducted this research as part of the Master program Metropolitan, Analysis, Design and Engineering, a double degree from Delft University of Technology and Wageningen University and Research.

The journey started with my personal interest in the topic of wayfinding. Ever since I started my Bachelor of Architecture I have been intrigued to by the movement of people through space. Coincidentally, I met Sigrid Jörissen and she saw an opportunity for me to work on wayfinding in Amsterdam Zuidoost. I want to thank Sigrid for connecting me to the Municipality of Amsterdam and for enabling the possibility for this collaboration.

Furthermore, I want to thank Annoesjka Nienhuis and Chantal Inia for the supervision throughout my research process. Your insights during our discussions helped to guide my research and made me understand the context of Zuidoost much better.

Also, I want to thank the interviewees who took the time to give me an insight in their bicycle experience in Zuidoost. It was knowledgeable and great fun to talk to such enthusiastic people.

Lastly, I want to thank my friends and family. It means the world to have such a loving group of people around me who are always there to either discuss topics related to this research or to get my mind of it when I needed it. This kept me in balance which made the process of conducting my research and writing this report easier.

I hope you enjoy reading this report and that it gives you a new insight and new perspective on the topic wayfinding for cyclists in Amsterdam Zuidoost and beyond.

Amsterdam, 20th August, 2021

Julia Vermaas

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Introduction

Every time we move around in the environment, we engage in wayfinding. Wayfinding refers to the cognitive process of absorbing cues from the environment and with those, create a path to a certain destination. Those cues can be anything that is physical and recognizable, for example, a sign with directions or something that stands out in the environment: a landmark. The absence of one or both aspects could result in unsuccessful wayfinding. In other words: we get lost, which can result in stress, panic and/or a feeling of discomfort (Bell, Greene, Fisher, & Baum, 1996). That is why wayfinding problems continue to attract the attention as it is known that this can have a negative effect on human physiological and psychological states (Jamshidi & Pati, 2020).

This research dives into the wayfinding of cyclists in Amsterdam Zuidoost, to generate recommendations for the Municipality of Amsterdam for a new or adjusted wayfinding system. The need for this research follows from the trend of growing number of inhabitants in the city of Amsterdam and because of this, the necessity to encourage the use of more sustainable modes of transport. A recent publication by the Municipality of Amsterdam explains that by 2040 the number of workplaces will have increase with 51.000 and the number of inhabitants will have doubled from 100.000 to 200.000. This will lead to an 46% increase of movements (Gemeente Amsterdam, 2021). As the car is now the most popular mode of transport in Zuidoost (56% of all daily movements) and the bicycle the least popular (16% of all daily movements), change in travel behavior is needed for the future and current inhabitants. The Municipality of Amsterdam aims to change this behavior with a two fold strategy: 1) make the alternative modes of transport (e.g. bicycle, public transportation) more attractive and 2) discourage the use of the car (Gemeente Amsterdam, 2021). This strategy is operationalized into 92 measures of which, one (of the 25 measures for the bicycle) includes a wayfinding program (see Figure 1).

Fiets	
F1	N-Z fietsroute, deel station Duivendrecht-Passage
F2	Fietsverbinding station station Duivendrecht-Buitensingel
F3	Fietsverbinding Gaasperdam-Weesp
F4	Fietsverbinding Geerdinkhofpad - S113
F5	Afsluiten tunnel Overzichtsweg
F6	Fietsoversteek Mr.Treublaan (kortetermijnoplossing-no regret)
F7	Ongelijkvloerse fietsoversteek nieuwe entree A2
F8	Kwaliteitsverbetering fietspad Zuid-Zuidoost
F9	Kwaliteitsverbetering fietspad Ikea-Pasheuvelweg
F10	Aanleg tweerichtingsfietspad en VR1's westzijde Spaklerweg
F11	Opwaarderen Stationsweg Duivendrecht (noord-zuidroute)
F12	Verbetering fietsverbindingen Oost-westverbindingen station DVD
F13	Verbetering fietsverbinding Joan Muyskenweg-Van de Madeweg
F14	Programma verbetering overige routes
F15-F18	Verbetering sociale veiligheid vier routes
F19	Programma verbetering onderdoorgangen
F20	Programma wayfinding
F21	Nieuwe fietsenstalling Bijlmer Arena
F22	Fietsenstallingen metrostations Spaklerweg-Holendrecht en Overamstel
F23	Fietsenstallingen overige metrostations
F24	Deelfietsprogramma stations
F25	Fietsenstalling evenementen (ArenaPoort-west)

Figure 1. Measures Bicycle

As wayfinding leads to behavior (Arthur & Passini, 1992), a better wayfinding system could encourage the usage of bicycles. To be able to formulate recommendations it is necessary to understand the effect of wayfinding on the bicycle experience. Therefore, this research is guided by the following two research questions:

How does wayfinding affect the bicycle experience in Amsterdam Zuidoost?

How can the wayfinding in Amsterdam Zuidoost be improved?

To generate an answer to these questions this research combines theories based on literature and data retrieved from interviews. Chapter two discussed the theoretical framework. The definition of wayfinding is outlined and the relationship between wayfinding and bicycle behavior is explained.

Introduction

It provides a better understanding for the complex character of bicycle behavior and concludes that wayfinding does affect this, however, it is not the only factor. In chapter three the applied methods for this research are outlined. In this research qualitative data collection, in the form of interviews and bike along interviews is used. The next chapter showcases the results of the interviews which show that the process of wayfinding in Zuidoost does lead to frustration for some interviewees. Also, it creates an overview of the bottleneck areas, which indicate where to improve the wayfinding system. Furthermore, it lists the most mentioned landmarks which are used as points of recognition and could therefore be used for the future wayfinding system. Lastly, chapter five summarizes the findings of the literature and interviews to generate a final answer for the research questions. It summarizes where and what could be changed regarding the wayfinding in Amsterdam Zuidoost. This chapter ends with a suggestion for a new type of wayfinding system: using “route signs”, that visually connect landmarks and destinations into a route. This system would make it easier for (future) cyclists to move around in Amsterdam Zuidoost and beyond.

Theoretical framework

2.1 Wayfinding

2.1.1. The origin of wayfinding

Kevin Lynch was the first to use the term “way-finding” in his book “The Image of The City”. Lynch (1960, p. 3) describes wayfinding as “a consistent use and organization of definite sensory cues from the external environment”. He explains that during the process of wayfinding an individual will use his/her mental image (also referred to as “mental model”, “mental map” or “cognitive map”) “to interpret information and to guide action” (p. 5). Thus, the process of wayfinding is guided by the mental map which is the result from the appearance from the environment itself, interpreted by the individual who moves through it. Wayfinding is therefore a continuous interaction between a person and its environment.

More than two decades later, Passini (1984a, p. 154) defines wayfinding, in his publication “Spatial representations, a wayfinding perspective”, as the ability to solve spatial problems: “a person’s ability, both cognitive and behavioral, to reach spatial destinations”. Passini’s first work on wayfinding: “Wayfinding in Architecture” (1984b) and second, in collaboration with graphic designer Paul Arthur, “Wayfinding, People, Signs and Architecture” (1992) were the first two works which provided a comprehensive explanation of the cognitive and behavior processes that are related to spatial orientation and purposeful mobility. Building on the work of Lynch, Passini (1996, p. 322) states that “wayfinding does not limit itself to the person’s representation of space (mental map) but includes all the mental processes which are involved in purposeful mobility”. He explains that every decision made regarding traveling is based on “information which can be directly perceived within the environment or which can be obtained from memories of previous experience, including cognitive maps” (Passini, 1996, p. 322). This process of decision making then leads to behavior. Passini also explains that this cognitive process can be divided into three steps: “decision making”, “decision execution” and “information processing” (Passini, 1996, p. 322), which will be explained further in Chapter 2.3

Golledge (1999, p. 6), like Passini, argues that during the process of wayfinding, prior to the action, a travel plan is made that “defines the sequence of segments and turns angles to comprise the path to be followed”. During one’s travel some investigation, search and exploration is needed to create and adjust that path and reach the destination. Often objects like maps and signs are used to guide themselves (Golledge, 1999), also referred to as “wayfinding devices” by Lynch (1960, p. 5).

Thus, it can be concluded that, based on the pioneering work of Lynch, Passini, Arthur and Golledge, wayfinding can be described as the cognitive process of spatial problem solving during which the individual follows a path to a destination by using information from the direct environment and/or memory of it. This definition highlights the interdisciplinary character of wayfinding, which finds its roots in a number of disciplines, including architecture and urban design, psychology and geography (Clayton, 2012; Emo, Al-Sayed, & Varoudis, 2016).

Theoretical framework

2.1.2. Wayfinding in the 21th century

Nowadays, the academic world still uses the definitions for wayfinding set by Passini (1984b), Passini & Arthur (1992) and Golledge (1999) (Jamshidi & Pati, 2020; Kuliga et al., 2019; Meurer, Stein, Randall, & Wulf, 2018). Jamshidi and Pati (2020, p. 1) describe wayfinding as “a goal directed spatial problem-solving process (Arthur & Passini, 1992) under uncertainty in which one finds a route to a particular target and recognizes the target when approaching it ; this process depends on perception, information, and decision execution”. However, with the emergence of technology and Global Positioning System (GPS), the terms wayfinding and navigation grew closer to each other (Ishikawa, Fujiwara, Imai, & Okabe, 2008). Ishikawa et al. (2008) explain that the process of wayfinding and navigation both include three stages: (1) define your current location, (2) establish your destination and (3) plot a route to where the destination is located. When executing all these steps people will “access stored knowledge about the surrounding space (internal representations), or refer to navigational aids such as maps (external representations), or do both” (Ishikawa et al., 2008, p. 74). Also, a survey conducted by the map company Zenrin (2017), shows that the use of GPS grew enormously which results in smartphones and in-car navigation systems besides paper maps, being two of the three major navigation tools used by people. This means that wayfinding in the 21st century is unavoidably linked with technology and navigation tools. Ishikawa (2019) points out the potential problems this trend could bring to our cognition and behavior in the environment. “In fact, the two major navigation tools of mobile pedestrian navigation systems and in-car navigation systems have been studied in regard to their cognitive and behavioral consequences and shown to deteriorate the user’s wayfinding and spatial learning” (Ishikawa, 2019). Also Schwering, Krukar, Li, Anacta and Fuest (2017) question the effects of the state-of-the-art wayfinding tools. Even though these new innovations, which are also referred to as turn-by-turn navigation, support the wayfinding tasks in unfamiliar environments and help the user to reach their destination in the best (e.g., fastest, simplest, easiest, safest) way, it also limits the users overview of the route. This restricts the user’s ability to build a memory of the unfamiliar environment, and therefore weaken their sense of orientation of the environment (Schwering et al., 2017). Schwering et al. (2017, p. 274) explains why turn-to-turn navigation does not support the nature of human beings: “Humans do not execute instructions separately, one after another, but integrate their information, spontaneously learn the spatial configuration during wayfinding, and build up cognitive maps to orient themselves in their environments”. Research has shown that by taking into account familiar features of the environment: intuitive landmark information (Michon & Denis, 2001) and simpler decision points (Hansen, Richter, & Klippel, 2006), navigating becomes easier.

2.2. Spatial legibility; landmarks and nodes

In the previous paragraph it is explained that even though state-of-the-art navigation tool made it possible for people to find their way in unfamiliar environments, it does not fully resonate with the way people orient themselves, namely: building cognitive maps by observing and memorizing features of the environment. In this paragraph it is explained, based on theory and studies, what environment elements play an important role for wayfinding and how this influences the behavior of people.

Theoretical framework

In the first paragraph it is explained that people create and use a mental map when finding their way in the environment. Lynch (1960, p. 5) defines the mental map as a “generalized mental picture of the exterior physical world that is held by an individual” and states that the ability to form a mental map depends on the legibility of the environment. “Legibility means the possibility of organizing an environment within an imageable and coherent pattern” (Koseoglu & Onder, 2011, p. 1191). This asks for the ability to obtain spatial information which in its own depend on two variables: the characteristics of (1) the environment and of (1) the way finder (Koseoglu & Onder, 2011). The characteristics and influence of the latter will be discussed further in Chapter 2.3 which dives deeper into the relationship between wayfinding and travel behavior.

Lynch (1960) concluded from his experiments with mental maps, that people organize the environment and thus orient themselves using urban features which he divided into five elements: paths, edges, districts, nodes, and landmarks (see Figure 2).



Figure 2. Five elements of Lynch

Brunyé, Gardony, Holmes and Taylor (2018) explain that in most wayfinding research, a strong emphasis lies on two environmental elements: landmarks and intersections (nodes). It therefore does not come as a surprise that legibility is measured by “the complexity of spatial layout and the saliency of landmarks” (Koseoglu & Onder, 2011, p. 1191). Where, according to Yoo (1993) spatial layout depends on the typological connection in decision points: “a point where a person has to choose among more than one direction, for example nodes in urban space” (Koseoglu & Onder, 2011, p. 1193).

2.2.1. Landmarks and nodes

Landmarks are often physical objects that are easily seen and recognizable and therefore resolve locational ambiguity (Brunyé et al., 2018). They give a sense of orientation and, according to a study of Michon and Denis (2001), are therefore often used for reorientation on the route. One of their findings showed that people had a difficult time finding the way when there were none or only a few landmarks present. Studies show that often people focus on landmarks that are located close to an intersection, where they are used for recognition and therefore can motivate an action (Brunyé et al., 2015; Golledge, 1999; Janzen, 2006; Klippel, 2003). Therefore nodes or intersections are often seen as decision points as they motive travel behavior during wayfinding (Brunyé et al., 2018).

Theoretical framework

2.3 Wayfinding and bicycle behavior

As mentioned before, wayfinding can be seen as a process of problem-solving by making route-choices based on features of the environment. Arthur & Passini (1992) distinguish three steps of this wayfinding process; (1) decision making, during which an individual will make an action plan for their travel, (2) decision executing, during which “people will look for information in order to create a mental model of the route and layout of the site” (Miller & Lewis, 1999, p. 14) and entails “transforming decision plans into behavior” (Passini, 1996, p. 322) and last (3) information processing, during which the features from the environment are processed and utilized in its context. The usage of good (i.e. understandable, visible and readable) spatial objects helps, mainly during the decision executing phase, to make the process of problem-solving easier by making the environment more legible. Lynch (1960) refers to signage (but also maps and street numbers) as spatial object that can help the process of wayfinding. However, as mentioned in the previous paragraph, landmarks play a role as well. These objects can make a person more familiar with the space and thus influence their mental model. Bovy and Stern (2012) conclude that one’s mental picture of a place directly influences the (spatial) choices people make and thus also their behavior.

However, as mentioned before, to create a mental map and thus obtain spatial information, there are two main factors that should be taken into account: the person and the environment. Also Lynch (1960, p. 7) confirms this and explains that the creation of this mental model is “a two-way process between the observer and his environment”. He states that: “This image is the product both of immediate sensation and of the memory of past experience” (p. 5) and that the observer “selects, organizes, and endows with meaning what he sees” (p. 7). Mental models are therefore personal and thus differ per person. Likewise, Bovy and Stern (2012, p. 33) conclude that travel behavior consists out of the following two givens: “the traveler, with his subjective need, experiences, preferences, perceptions, etc.” and the physical environment.

Therefore, it is necessary to understand what the traveler, in this case the cyclist in Amsterdam Zuidoost seeks and experiences regarding wayfinding, and then find out what could be changed in the physical environment to make or keep this experience pleasant. Hunt & Abraham (2007) identified 33 factors that can influence bicycle behavior, of which nine are environmental characteristics of which wayfinding is one, so it is likely that the results from the date collection phase will not only be influenced by the wayfinding system. This is taken into account throughout the research.

Methodology

This chapter will outline the methodology that was used to generate an answer to the research questions.

3.1 Semi-structured interviews

For the first data collection phase, semi-structured interviews are used to identify the bicycle experience in Amsterdam Zuidoost. This method allows to address specific dimensions of the research question as well as leaving space for participants to offer new meanings to the topic (Galletta, 2013). In this research this means that some questions were guided towards the role of wayfinding and their experience, but also that there was room for the interviewees to identify and unravel other factors that might influence their bicycle experience.

Describing one's experience is rather challenging, therefore the method of semi-structured interviews is useful as there is room to set a scene by asking various questions. Also, the setting of these kind of interviews are casual which helps the interviewee to relax and feel more comfortable during the interview.

3.1.1. Participants

Due to the corona virus, it was important to approach potential interviewees in a safe and responsible manner. Therefore, people were reached through social media channels and by flyering form door to door. First, the community centers of Amsterdam Zuidoost: BuurtHuizen Zuidoost posted the flyer, that was created for this research, on their Facebook and Instagram platform. Two residents replied to this post. To reach more people, flyers were spread from door to door in the following neighborhoods: D-buurt, E-buurt, G-buurt, Venserpolder, Amstel III and Holendrecht. 280 Flyers (In Dutch and English) were distributed and ten people responded. The flyering process was divided into three days spread over three weeks. During those three weeks interviews were also conducted. At some point the data of the interviews did not produce new thematic patterns as the same statements were repeated. So a point of saturation was reached, as described by Galletta (2013) and Boddy (2016). In total fourteen residents of Amsterdam Zuidoost were interviewed. The remaining two interviewees responded through snowball effect. This type of participants sampling is identified as purposeful sampling (Palinkas et al., 2015). This technique was chosen to reach information-rich participants due to limited resources.

Almost all participants are residents of Amsterdam Zuidoost and cycle either daily or weekly in Zuidoost. One of the fourteen does not live in Zuidoost and thus only cycles there between two and four times a month. However, this participant has been cycling in Zuidoost for years and is therefore familiar with the environment. Also, the other thirteen residents are acquainted with the neighborhoods, as they have been living there between 1,5 and 40 years. Eight of them are male and the other six female. Their age varies between 19 and 69.

Methodology

3.1.2 Interview process

After receiving the flyer, the participants filled out their contact information in a google form which was created for this research. They were able to do so, by scanning the QR code on the flyer or using the URL link. Participants were contacted either one or two days after filling out the form to schedule an online interview or an interview over the phone. Online interviews were preferred as this resembles the feeling of a sit down interview the most, and therefore can lead to a more natural conversation. However, telephonic interviews were chosen when the participant was not in favor of using an online communication platform. In the end ten interviews were conducted via Zoom and four interviews over the phone.

The interviews were conducted from October to November 2020. On average, the interviews lasted approximately 25 minutes. The shortest lasting about 15 minutes and the longest about 50 minutes. To ensure accuracy, all interviews were recorded with consent of the interviewees.

As it were semi-structured interview, the interview was not guided with a specific set of questions. However, to address certain topics a list of questions was prepared which corresponded with the topics. Some of these questions were used during the interview. Some examples are listed below.

Bicycle experience

- How often do you cycle?
- Where do you cycle?
- Is there a route that you cycle most often?
- Can you describe the first couple of things that pop into your head when thinking about your bicycle experience in Zuidoost?
- Are there bottlenecks during your route? If so, where and could you explain why you experience them as a bottleneck?
- Are there other factors that influence your bicycle experience which we have not covered yet?

Wayfinding

- Do you get lost while cycling in Zuidoost?
- If you would describe your most often used route to me, what would be the set of directions you would give me?
- Are there parts of the route that are unclear where I could get lost easily? Why is that?
- Are there parts of the route that are very clear? Why is that?
- Can you recollect the first time you cycled in Zuidoost? How did you navigate?
- How do you navigate now?
- Do you use landmarks while navigating?

Methodology

3.1.3. Data collection

The interviews were transcribed by using Amber Script. Then, statements of the interviewees were grouped according to the following topics:

- Cyclist experience,
- Wayfinding – learning to find your way
- Bottlenecks/nodes/decision points
- Wayfinding elements – signage
- Wayfinding elements – landmark
- Art project – painted viaducts
- Extra.

The topics were chose based on the predefined research topics and literature research as well as the themes that emerged from the interviewee's responses.

3.2 Bike along interviews

For the second date collection phase, one bike long interview was conducted. This method is chosen so that people can share real time feedback and opinions about a specific route. In this research the bike along interview is used to validate the findings of the interviews of phase one.

During the bike along interview the researcher and interviewee cycle from point A to point B (length of the route +/- 10 minutes). There are two different ways to cycle from A to B: route one and route two. The bike along interview starts with the first route. The interviewee follows the researcher. The participant is asked to pay attention to the route and share their opinion once arrived at point B. There the interviewee is asked to repeat the route in order to identify the points of recognition (landmarks) and describe the overall bicycle experience. The findings are written down by the researcher.

Then the participant is asked to cycle back to point A (following route number one) without using any resources like paper or online maps. The researcher follows the participant and only intervenes when the interviewee takes a wrong turn. When arrived back at point A, the researcher and interviewee again discuss the points of recognition and the bicycle experience.

After that, the interviewee and researcher will do the same as describe above, cycling from A to B and back, but this time they will take route number two. Again, the findings are written down.

Methodology

3.2.1 Identifying the route

The route will be chosen based on overlapping the following two factors:

1. Bottleneck areas which are identified by the interviews during phase 1.
2. The new proposed routes of the municipality (see Figure 3). The municipality has identified four routes which will serve as the main bicycle paths in the future.

By overlapping these two elements on a map, the route which falls in a bottleneck area will be identified.

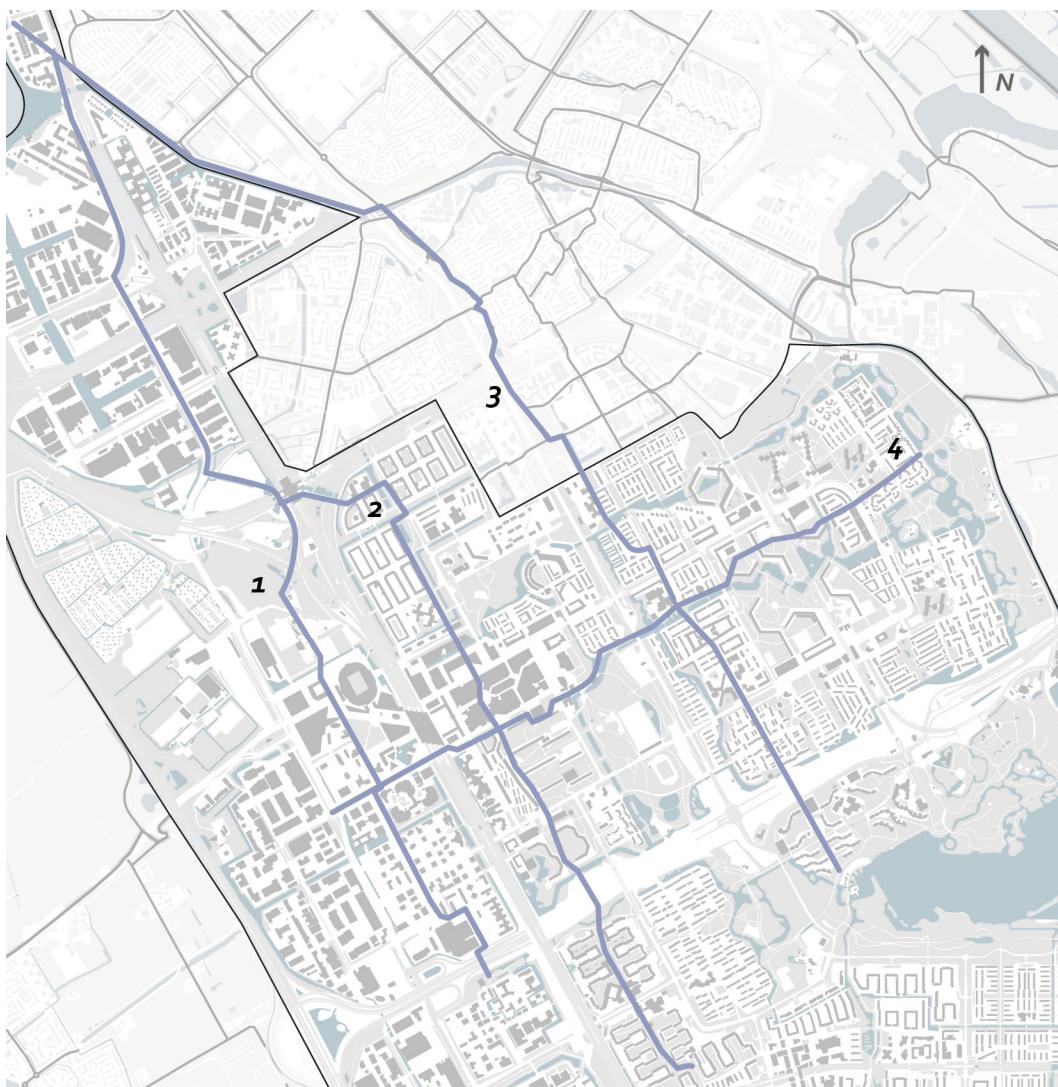


Figure 3. Proposed routes

Results

The citations of the interviewees are translated from Dutch to English by the author.

In this chapter the results of both phases: the semi-structured interviews and the bike along interviews are summarized and explained.

Phase 1: Semi-structures interviews

4.1 Bicycle experience

To get a feeling for the experience of the cyclists in Zuidoost, the words that the interviewees used to describe their experience are listed and grouped below. Because the sample size of the interviewees was small, this list does not represent the bicycle experience for all cyclists in Zuidoost. Also, as described in Chapter 2 Theory, there are many factors that influence bicycle experience of which one, wayfinding, is addressed in this research. Therefore, it is not possible to measure the direct impact of wayfinding on the experience. However, in this chapter the findings that follow from the interviews that mention (an aspect of) wayfinding are summarized and patterns amongst the answers of the interviewees are discussed.

The interviewees use the following words to describe their bicycle experience:

- Safe (3/14). Big and wide bicycle lanes which are separated from the car lanes.
- Unsafe (4/14). “When you have to cross the lanes. Between the city center and Zuidoost, lonely and unclear” (Interviewee J, October 19, 2020).
- Pleasant (8/14). Good surface, not that many traffic lights, a lot of space, greenery.
- Unpleasant (1/14).
- Nice (3/14).
- Complicated/chaotic (6/14).

4.2 Bicycle experience and wayfinding

Multiple interviewees (Interviewee A, October 10, 2020, Interviewee B, October 28, 2020, Interviewee E, October 20, 2020) mentioned that the natural way to find their way is, among other options, to refer to the main car road in the neighborhood. However, in Zuidoost the car lanes and bicycle paths are mainly separated from each other which makes it more difficult to navigate. This results in people needing to learn and remember the bicycle paths, which is done by simply cycling through the neighborhood (experience). Once they know how to find their way, the separation becomes a positive factor which was pointed out by Interviewees D (October 22, 2020), E (October 20, 2020), F (October 21, 2020), K (October 22, 2020). “And the bicycle paths are of course very comfortable, you can almost always cycle there without encountering any cars” (Interviewee D, October 22, 2020). Interviewee D (October 22, 2020) also explains that she prefers taking the bicycle paths that are separated from the car lanes over roads like the Holterbergweg (a “straight line” bicycle path besides the car lane), where you cycle “among the exhaust fumes”. Also, interviewee H (October 24, 2020) mentions the Holterbergweg which he finds “very boring”: “it feels like you cycle for hours on hours”. He therefore tries to avoid that

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road. From this we can conclude that it is likely that people will make the effort to learn a route, if that route feels safe, looks attractive and is “clean” compared to taking the route that is easy to follow but has a more negative effect on the bicycle experience (bad smell, unattractive surroundings, etc.).

For some learning the way comes more naturally than others. Interviewee B (October 28, 2020) explains that the process of finding his way in Zuidoost was enjoyable and also not challenging because of his sense of direction. However, others, like Interviewee L, never reached the point of fully understanding the routes, which influences their bicycle experience in a negative manner. “It keeps away the feeling of having fun whilst cycling. I feel a bit like a fool” (Interviewee L, November 11, 2020). Interviewee L (November 11, 2020), unlike others, also prefer taking the ‘straight’ road to the city center of Amsterdam: “that [route] is just better [than the zig zag bicycle paths]. It is logical and there are no odd detours”. To conclude, everyone bicycle experience is different and therefore also their preferences. Zuidoost is unique because it can accommodate the different needs (quiet park like route vs. clear straight-line route). However, there is still room for improvement so that people, like interviewee L, do not choose to rather boring route only because the alternative is confusing. The next paragraphs explore the role that wayfinding signs and landmarks could play to clarify the bicycle routes in and around Zuidoost.

4.3 Wayfinding signs

Interviewees A (October 10, 2020), B (October 28, 2020), E (October 20, 2020) and L (November 11, 2020) explain that when they first moved to Zuidoost they used the wayfinding signs as a tool to learn the route and find their destination. However, they also mention that in certain areas, which I will list below, there is a lack of these type of signs. As the prospect is that the amount of inhabitants will double in 2040 (Gemeente Amsterdam, 2021), it is key to make sure that the first experience of cycling in Zuidoost will be positive so that cycling in Zuidoost and to the rest of Amsterdam will become a habit. Adding a clear and consistent wayfinding sign network to the bicycle path will help to enable and foster this positive experience. Interviewee B (October 28, 2020) pointed out that the process of figuring out the bicycle network, and “making it your own”, was actually a positive experience for him which created a kind of connection with his neighborhood: “Here is my neighborhood, so to say” (Interviewee B, October 28, 2020). Also, Interviewee I (October 24, 2020) identifies a positive aspect of learning the bicycle network on the go. He explains that getting lost makes him discover new places, which he enjoys. However, Interviewee I (October 24, 2020) mentions that when he has friends over, and they travel to Zuidoost by bicycle, they often get lost. This again proves that new visitors or inhabitant could use more points of recognition to make their first journeys through Zuidoost clear and enjoyable.

Based on the finding of the interviews the focus area of improving the wayfinding signs along the bicycle path should be located at the connection between Zuidoost and Amsterdam. The two main bottlenecks are the following bicycle paths:

- **Venserpolder.** Interviewee A (October 10, 2020) mentioned Venserpolder as a slightly confusing area when he wants to cycle from the E-buurt to the Amstelkwartier area and beyond. “You have to cycle through Venserpolder, and sneakily cross the metro station and all of sudden you reach the AreaA. This could be clearer” (Interviewee A, October 10, 2020).
- **Duivendrecht and Diemen.** The connection with the rest of the city of Amsterdam is confusing.

Results

Interviewee A (October 10, 2020) explains that the moment he crosses the underpass to Diemen, the bicycle lane changes: the quality of the pavement is different, and the wayfinding signs are slightly different. He mentions that the communication of how to get to certain places could be clearer. Also, interviewee J (October 19, 2020) says that the area between Amsterdam and Zuidoost is “unclear”. Furthermore, more interviewees commented on this area: responded H (October 24, 2020) mentions the poor quality of the pavement and interviewee L (November 11, 2020) mentions that the difficulty she encounters in finding the way to the shopping area in Diemen.

These results show something that Interviewee L (November 11, 2020) also mentioned, namely, the main paths are clear but it are the sub paths that need some clarification, like the bicycle path in Venserpolder. Besides that, there should be a partnership between the municipality of Amsterdam and Diemen to connect the bicycle paths not only spatially but also through wayfinding signs to improve the flow to the city. For example, Interviewee L (November 11, 2020) mentions that a sign to the supermarket in Diemen would be really helpful. But also signs to guide cyclist towards the rest of Amsterdam. Interviewee N (October 19, 2020) suggests that the signs would point towards a clear route, for example, “Centuurbaan via Diemen Campus”. These are good starting points; however, the question remains what should be on those signs to make it clear for everyone. Interviewee J (October 19, 2020) points out the difficulties you encounter when answering this question: “There are signs, but you do not always know if you need to be in that area. You must know the area to understand the sign. If you do not know what the Westertoren is, you do not know if you need to cycle in that direction”. In Paragraph 5.4 Wayfinding Landmarks the visual point of recognition are identified which could be used for future wayfinding signs. But firstly, more bottlenecks are identified in the next paragraph.

4.3.1. Bottleneck areas

Besides the unclear or non-existing wayfinding signs along (parts of) the bicycle lanes, interviewees A (October 10, 2020), B (October 28, 2020), D (October 22, 2020), E (October 20, 2020), G (November 2, 2020), H (October 24, 2020), J (October 19, 2020) and N (October 19, 2020) also mention that some neighborhoods are in general confusing. This is caused by two things: (1) the building blocks which look similar, and (2) the meandering layout of the bicycle paths. Both factors make it difficult for the cyclist to orient themselves in space. Many of the interviewees identified **the K-buurt and G-buurt, also referred to as the “old Bijlmer” with the honeycomb flats**, as the most confusing area to cycle through (Interviewee A, October 10, 2020, Interviewee B October 28, 2020, Interviewee E October 20, 2020, Interviewee H, October 24, 2020, Interviewee I, October 24, 2020). Because the building blocks are difficult to distinguish from each other and the bicycle path consist out of many corners and turns it is challenging to keep a general sense of direction. Interviewee L (November 11, 2020) mentions that the meandering of the bicycle paths makes cycling very inefficient: “Sometimes I want to go straight but the path goes left. I have to wait till the path makes a turn again and then I have to cycle back”. Interviewee H (October 24, 2020) confirms this inefficiency about the K-buurt and G-buurt. He also explains the difficulties he experiences when cycling through this neighborhood:

Results

"You are in a green area, but you also have no idea where you are. There are no points of recognition, so definitely in the beginning, when I just moved here, I got lost a few times. You can cycle at a nice pace because the quality of the bicycle path is good. However, then you realize you have made a big detour, because there is nothing in the area you can refer to" (Interviewee H, October 24, 2020).

Furthermore, **the lanes** (e.g. Bijlmerdreef) are identified as confusing (Interviewee D, October 22, 2020, Interviewee L, November 11, 2020):

"I am always confused because of the lanes. We have been living here for over four years and therefore I also have been cycling here for four years, and still, I find that everything looks alike. Often, I do not know how to get to a certain place. I do use Google Maps for this. But you do not really learn it [the bicycle paths] very well because of this" (Interviewee I, October 24, 2020).

Interviewee H (October 24, 2020) confirms this feeling of being confused as well. He does not mention the lanes but mostly the overall network of the bicycle paths. He states that it seems that the designers of the bicycle infrastructure did not think of creating logical routes from one destination to another. He mentions bicycle paths that abruptly end with no connection to another path, desire paths (*olifantenpaatjes*) and residential areas which have no designated bicycle path. Also, Interviewee L communicated her frustration with very "unlogic" bicycle network: "It [the bicycle paths] does not have to be completely straight but a little bit "normal" would be nice. (...) It is fine to follow the flow of the curves, but I do not want to be sent back before I can connect to the next bicycle path" (November 11, 2020). Also, Interviewee N points out that is does not feel logic: "You don't know where you are and you can not orient yourself. (...). "De Hollander" does not want the zig zag paths. He wants to go from A to B" (October 19, 2020). To summarize, there is a need for clarification and structure to create a continuous flow throughout Zuidoost. And even though Google Maps might be a tool that could solve this, there is also a need for a more natural way of navigating.

It should be noted that the layout of Zuidoost also has good aspects: the park-like bicycle paths, in combination with the greenery and water bodies, are identified as a positive factor influencing bicycle experience (Interviewee C, October 26, 2020). Interviewee K (October 22, 2020) states that he really appreciates the architecture of the honeycomb flats, even though his might be an unpopular opinion. Therefore, the focus should lie on taking away the confusion and the feeling of inefficiency. Also, here is would be beneficial to add more wayfinding signs and perhaps other object of recognition. The latter is discussed in the next paragraph.

4.4 Wayfinding landmarks

As explained in the Chapter 2 Theory, there are objects, also referred to as landmarks, which people use to find their way through space. The interviewees were asked which areas and/or objects they use as landmark to make cycling through Zuidoost easier, in terms of finding their way. As mentioned before, these areas and/or objects can be used future wayfinding signs. The following list shows which items were mentioned as landmarks and by how many interviewees.

Results

- Arena (B, A, K, I)
- Metro/train stations (Amstel, Bijlmer Arena, Diemen Zuid, Strandvliet, Holendrecht) (B, D, E, G, K, M, N)
- Diemen Campus (A, M, N)
- Amsterdamse poort (D, E, I, J, K, L, O)
- Nelson Mandela park (B, C, G, J, O)
- Soccer field with outdoor gym (D, M)
- Painted underpasses (A, D, F, G, M)
- Art (B)
- OSB (Open Scholengemeenschap Bijlmer) and School De Rozenmarn (G, I)

Suggestions for wayfinding signs will be showcased and discussed in Chapter 5 Conclusion.

The list consists out of mainly big (infrastructural) object as well as areas like the park and De Amsterdamse Poort. What stands out is the fact that the relatively smaller art objects are also mentioned. Interviewee B (October 28, 2020) has a special interest in art objects and hence this is what stand out to him the most. He mentioned how exploring art in de Bijlmer is for him an activity he enjoys plus it functions as a reference point (landmark) for him. He does mention that art objects, like the “peeing men” underneath the bridge do not stand out directly. This is probably the reason why other interviewees (Interviewee A, October 10, 2020, Interviewee D, October 22, 2020, Interviewee F, October 21, 2020, Interviewee G, November 2, 2020, Interviewee M, November 11, 2020), who are not specifically a fan of art, only mentioned the underpasses that are painted, like the floral paintings at the Dolingadreef underpass. Because the art is very visible, they observe it and therefore it becomes a reference point. They also appreciated the appearance: it looks more ascetically pleasing which has a positive influence on their bicycle experience. Interviewee D (October 22, 2020) mentioned the underpasses beneath the lanes (e.g. Bijlmerdreef) all look alike, so this could be an opportunity to also make these stand out with adding art. Lastly Interviewee J (October 19, 2020) explains that sometimes she experiences a lack of “checkpoints” because there is too much distance between them. She explains that adding more of them so that there is less space between the landmarks, would make navigating through Zuidoost easier.

Results

Phase two: bike along interview or focus group

4.5 Bike along interview

As explained in Chapter 3 Methodology, the bike along interview consisted out of cycling two routes, referred to in this chapter as the blue route (route one) and purple route (route two). These routes were chosen by overlapping the “proposed routes map” over the “bottleneck area map” so that one of the four proposed routes would be filtered out. The route chosen for the bike along interview is route three as it covers a bottle neck area (K-buurt and G-buurt, and two lanes) and it is a route that also connects to the rest of the city of Amsterdam (see Figure 4).

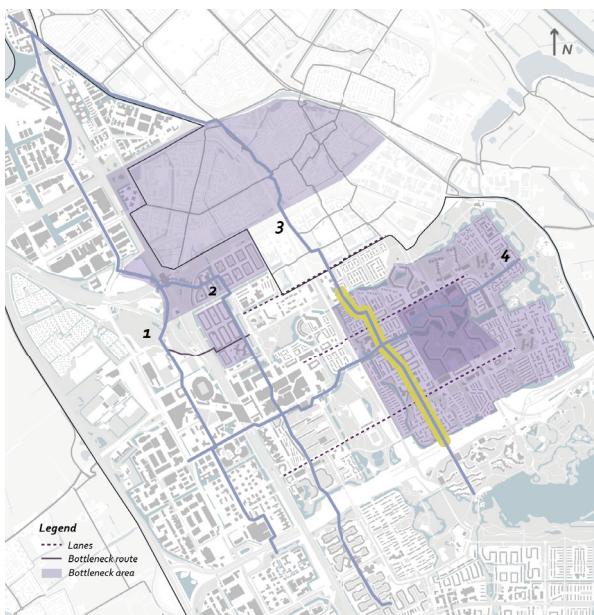


Figure 4. Bike along interview route

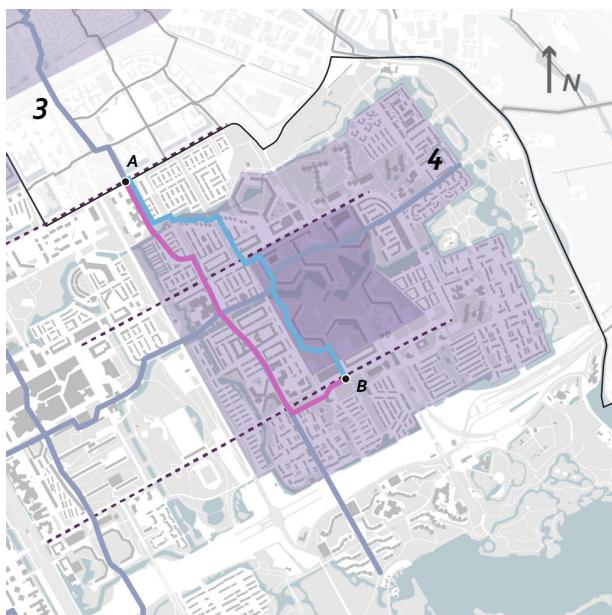


Figure 5. Blue and Pink route

The blue route crosses the neighborhood in a more meandering manner and the pink route follows the exact proposed route by the Municipality (see Figure 5). The latter is a rather straight route.

4.2.1 Interview Notes Blue Route

From A to B

- It is a lot of “kruip door sluip door”
- I must cycle on the sidewalk, instead of on a bicycle path
- Meandering route
- It is a nice route
- Has variation
- “Slingerende” paths

Results

From B to A

During the self navigating route from B to A, the Interviewee took two wrong turns which are indicated on Figure 6 with a red dot. In both instances the interviewee followed the paved bicycle path instead of taking a turn to go on the sidewalk (intended route). This indicates that following the flow of the pavement feels more instinctive. Also, that having to cycle on the sidewalk feels unnaturally.

The interviewee indicated, like concluded from the Interview results of phase one, that the art that she passed did not really stand out. She noticed some on her way to point B, but when she cycled back to point A they did not function as a point of recognition. This validates the finding that art for cyclists should be located either close or on the bicycle path and very visible to be noticed and used as a landmark.

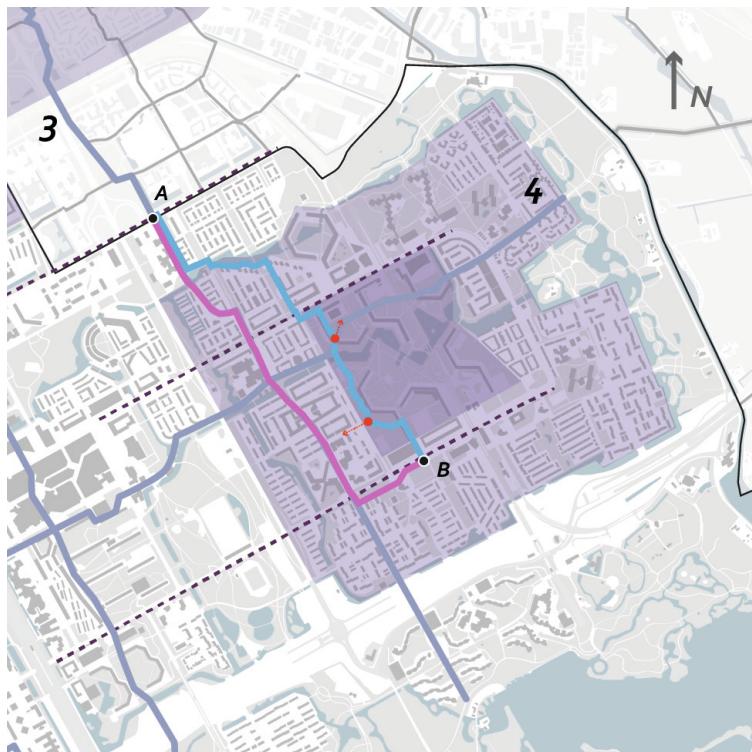


Figure 6. Wrong turns

4.2.2 Interview Notes Pink Route

The Interviewee explains that it is a nice feeling to be able to cycle straight to the destination. Especially in comparison to the zig zag route (blue route) where mistakes are easily made. She therefore also prefers this route over the other one. However, she also mentions that it is a boring route, and she experienced a lot of headwind.

To summarize, seen that there was only one Interviewee for this experiment it is not possible to draw any conclusions. However, it is interesting that, like other Interviewees mentioned during the interviews of phase one, the meandering is experienced as something nice, because there is variation, but it is also the route that is most confusing. The “straight” route however is very clear but boring. This bike along interview therefore validates the conclusions drawn in the previous paragraphs regarding wayfinding.

Conclusion

During this research the aim was to seek an answer to the following two research questions:

How does wayfinding affect the bicycle experience in Amsterdam Zuidoost?

How can the wayfinding in Amsterdam Zuidoost be improved?

The literature research taught us that bicycle experience exists out of many more element than only wayfinding, so in order to understand the effect of wayfinding on someone's overall bicycle experience one should apply a holistic approach. This means that all 33 factors that influence bicycle experience which were identified by Hunt & Abraham (2007) should be investigated. This is beyond the scope of this research and thus is a recommendation for further research. Also, as concluded before, everyone is different and so are their experiences and behavior, as concluded by Lynch (1960) and Bovey & Stern (2012). To create an all-encompassing overview of experiences, a bigger group of cyclists should be interviewed. Therefore, a clear answer to the first research questions can not be formulated. However, the results of the interviews did give an impression of the overall bicycle experience in Amsterdam Zuidoost. Interviewees explained that there were instances where the process of wayfinding did directly lead to, for example, frustration (e.g. because of the meandering bicycle paths) and/or a feeling of identity (e.g. learning the routes and making it your own). In general, cyclists in Zuidoost, and perhaps in any neighborhood, will try to find a route that feels comfortable and safe, and which looks attractive if the process of finding their way is easy. They invest time and effort into learning a route, but only till a certain extend. It is therefore key that the very first experience of cycling through Zuidoost is positive which means that their destination should be easy to find. This brings us to the second research question.

To improve the wayfinding, findings of the literature research and the findings of the interviews are combined. Literature taught us that every wayfinding decision, which includes the decision for the modes of transport and routes, is based on previous experiences or the information we directly perceive (Passini, 1996). For example, if it rains outside, some might decide to travel by public transportation or car instead of by bicycle, but also if we remember that once we cycled through a neighborhood at night which felt unsafe, it is unlikely that we will take that route again. In Amsterdam Zuidoost the Municipality of Amsterdam wants to, among other aims, encourage (future) inhabitants to use sustainable transportation modes (e.g. the public transportation and bicycle) as their main mode of transportation (Gemeente Amsterdam, 2021). Based on the results of this research it is key to therefore make the bicycle paths as inviting and comfortable as possible. This means, for the wayfinding system, that there are: 1) clear signs that can lead cyclists to their desired destination and 2) landmarks which make it easy for people to orient themselves. The following recommendations include what this kind of wayfinding system could look like and where it should be implemented.

Where?

The bottlenecks of Zuidoost are the areas that connect Zuidoost to the rest of the city of Amsterdam (Venserpolder, Duivendrecht and Diemen), the K-buurt and the G-buurt and especially the area around the honeycomb flats (see Figure 7). Therefore, changes should be made there first before other areas of Amsterdam Zuidoost.

Conclusion

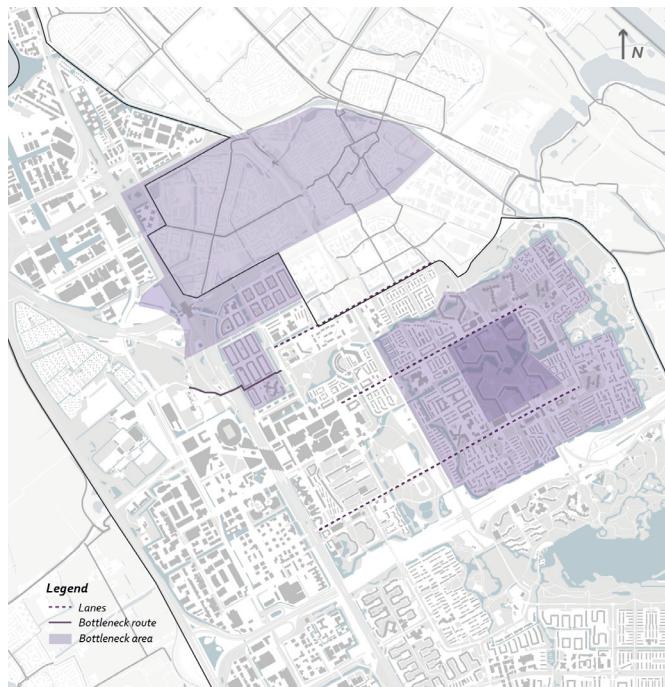


Figure 7. Bottleneck areas

What?

In these areas but also in between them, a new type of wayfinding signs system, referred to as route signs, could be implemented. This type of sign connects multiple destination so that a “route” is created which guides cyclists to their destinations. This step-by-step wayfinding system would make it easier for cyclists to break down their route in multiple smaller pieces.

The route signs use visual communication language as well as words. The destinations can either be: 1) facilities (e.g. supermarket, shopping center, park, etc.), and/or 2) landmarks, like the train and metro stations, the Amsterdamse Poort and the Arena (all other landmarks are listed at 4.1 Wayfinding Landmarks). Figure 8, 9 and 10 show examples of such signs and how they would look like in the build environment.

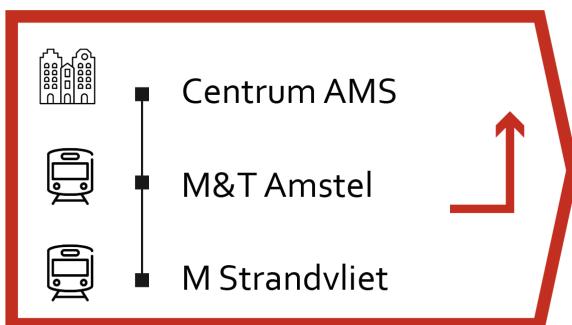


Figure 8. Mock up route sign 1

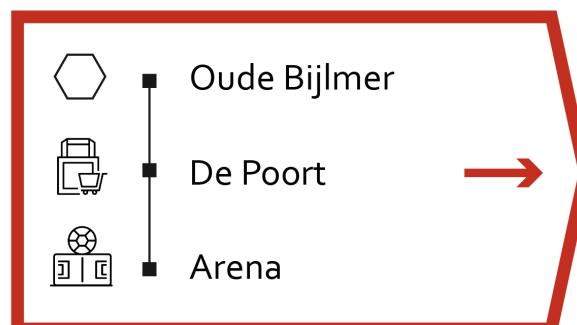


Figure 9. Mock up route sign 2

Conclusion



Figure 10. Impression of route sign at Dolingadreef

Landmarks

As shown above, the landmarks that already exist in Amsterdam Zuidoost lend themselves to be used for the wayfinding signs system, as they are points of recognition for cyclists. The landmarks that were recognized by the interviewees were either “big” well known buildings or infrastructure, like the Amsterdamse Poort, or smaller objects like the painted underpasses. Based on the results of the interviews, making the underpasses at the bottleneck areas like the lanes (e.g. Bijlmerdreef) and at the Old Bijlmer buildings more recognizable, would distinguish them from each other. An attractive colored design like the underpass at the Dolingadreef is preferred, as it stands out and has a positive effect on the bicycle experience.

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