IMPROVING THE WAYFINDING TO THE COMMERCIAL SERVICES AT SCHIPHOL

supporting passengers to explore the surroundings of the airport autonomously

Master Thesis
Design for Interaction
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Schiphol

Zou hij verdwaald zijn? Dacht de walrus.
Hij zwom een smalle zijarm van de rivier in.
Hij wilde zelf niets liever dan verdwalen.
Maar er was overal altijd wel iemand die de weg wist en hem die wees.
“Maar ik wil de weg niet weten!” riep hij dan. “Ik wil hem kwijtraken!”
De ander haalde zijn schouders op en zei:
“Ik kan er ook niks aan doen dat ik hem weet, walrus.”

- Toon Tellegen

Could he be lost? The walrus thought.
He swam into a narrow arm of the river.
He wanted nothing more than to get lost.
But there was always someone everywhere who knew the way and who showed him.
“But I don’t want to know the way!” he cried. “I want to lose it!”
The other shrugged and said:
“I can’t help it that I know, walrus.”

- Toon Tellegen

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Executive summary

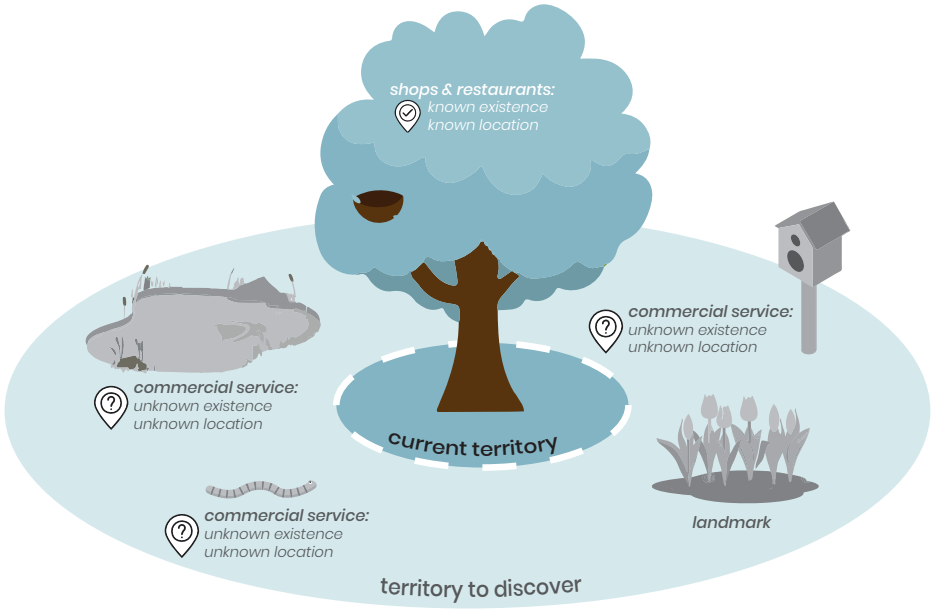
Airport Audio Tour

supporting passengers to explore the surroundings of the airport autonomously

Problem: **The commercial services at Schiphol are poorly found by passengers**

Which results in passengers mainly visiting **known places** (e.g. shops and restaurants).

While Schiphol has many **other facilities** to offer that tap into the **needs of passengers** during their waiting time, which the passengers are currently **unaware** of. (Airport Library, Rijksmuseum, NEMO, Baby Care Lounge)



Solution: **The audio tour expands passenger's recreational territory at Schiphol**

The audio tour improves:

the awareness of the commercial services
by taking the passengers by the hand, pointing out the *existence* of the commercial services
"I'll go to the museum, yes, and to the library. I'm going to rummage around again!" (P2)

the wayfinding ability of passengers
by introducing the *location* of the commercial services and relevant landmarks
"I know where everything is now. Because I walked down the whole airport, I feel more kind of orientated." (P6)

the quality of the waiting time at the airport
by providing a recreational wayfinding activity
"I think it is really nice to have a distraction that is not only about being on your phone, but like seeing other things." (P4)

making passengers feel more relaxed
"I feel more relaxed now! I feel more calm even. Because I think I now know my surroundings better. Because just before that, I was a little overwhelmed because there is so much..." (P1)

Why audio?

There is a lot of **visual competition** in the lounges of the airport (advertisement, other passengers, primairy wayfinding information). It has been decided to not compete with these visual stimuli and to stimulate the passenger via **other senses**. Touch, smell and taste were considered **less practical** to provide wayfinding information, compared with audio. Providing wayfinding instructions via audio has been considered valuable, **highlighting aspects** of the airport in an innovative way (for example by ambient sound).

Contents

This thesis explores how the commercial wayfinding at Schiphol could be improved.

Chapter 1 introduces the context and assignment of this project.

Chapter 2 describes the discover phase in which the current situation is researched and needs for the desired situation are identified. In chapter 2.1 the approach for this project is explained. In chapter 2.2 an overview of general information & wayfinding principles is given as a foundation for this thesis. Then, in chapter 2.3 an external analysis is executed to investigate how commercial wayfinding is arranged at other locations (shopping malls, other buildings in the transport domain and other airports). Chapter 2.4, the internal analysis, describes the current (commercial) wayfinding system at Schiphol and the different stakeholders involved. Chapter 2.5 entails the passenger analysis, including passenger segmentation and passenger (recreational and information & wayfinding) needs.

In chapter 3 the results of chapter 2 are synthesized into the design brief, in which goals and requirements for the design are set. The design brief is used as a starting point for the next phase.

In chapter 4 the design vision is introduced. Next it describes the process of ideation and prototyping, which leads to a final concept.

Chapter 5 entails the validation of the final wayfinding concept. It also includes the validation for the concept to create awareness for the wayfinding concept. Lastly, the wayfinding concept is validated against and compared with wayfinding literature.

Chapter 6 comprises the discussion, conclusion and recommendations of the project. It also includes a personal evaluation, references used in the project and the appendices.

Glossary & abbrevations

Airside	Area outside the terminal walls, at the side of the aircraft. Including: aircraft stands, taxiways, platforms, and airside roads. See: Landside.
F&B	Food & beverages (horeca)
O/D	Original/Destination. Passengers starting or ending their journey at Schiphol
I&W	Information & Wayfinding
Landside	Area outside the terminal, at the side of the airport access roads, parking, and local and regional transport. See: Airside.
NPS	Net promotor score, indicating customer satisfaction
NS	Nederlandse Spoorwegen: Dutch railway company
Rise/fall point	Assembly point for escalators, elevators and stairs
ROE	Return on Equity - measure of financial performance
SSU	Self Service Unit
TRF	Transfer (flight)

Section 1
INTRODUCTION

This chapter includes:

1.1 Context

Schiphol aspires to bring the world closer. Schiphol is the third-busiest airport in Europe in terms of passenger volume and the busiest in Europe in terms of aircraft movements (Feiten en cijfers 2019, Schiphol). Image 1 shows the passenger numbers for 2019. That year, 36 million passengers departed from Schiphol (Customer Insights - Factsheet, 2020). Daily, almost 200.000 passengers from all over the world travel via Schiphol, all having different needs, goals and experiences.

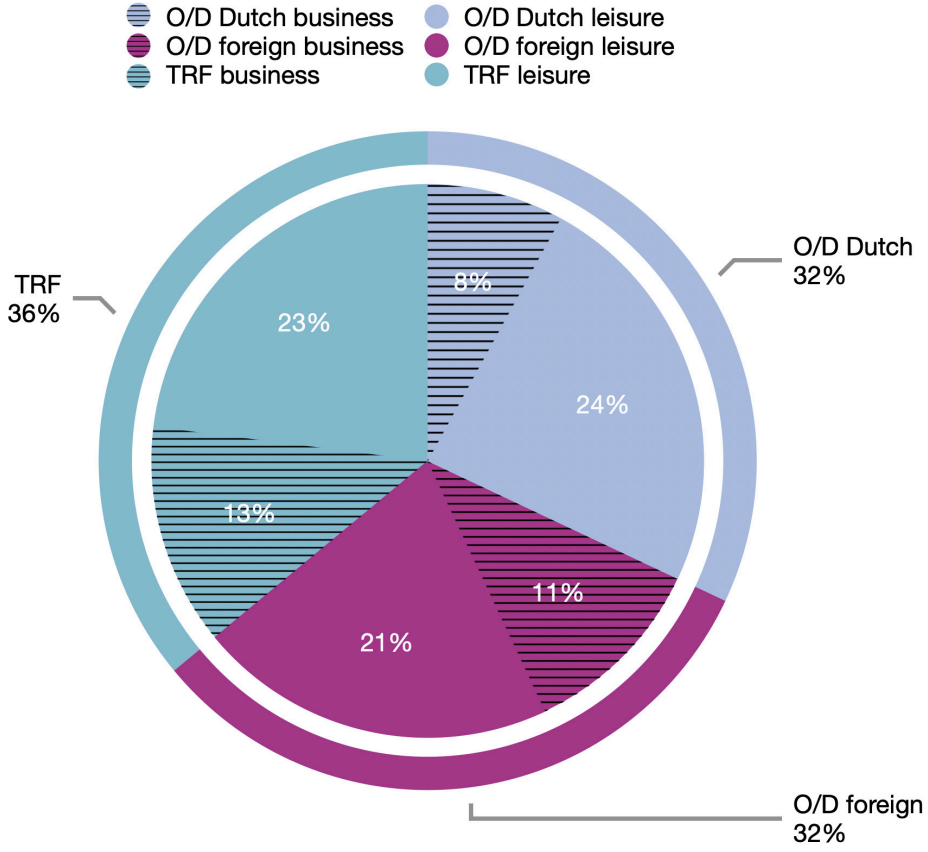


Image 1: Departing passengers from Schiphol, per target group

To reach Schiphol's goal of becoming Europe's preferred airport: the best airport in Europe for Transfer and to be among the best two for O/D (Mijksenaar, 2015), this assignment touches upon the aspect of wayfinding, one of the ten most important aspects on which airports are rated.

Already for some time, the processes at an airport do not only revolve around the functional travel process anymore. Non-aeronautical activities (such as recreational activities) have become increasingly important; for the passenger, but also for the airport itself and its profitability. In this fast-changing world, airports need to keep up with mobility and digital developments to stay relevant.

1.2 Assignment

Schiphol wants to improve the information & wayfinding system for the commercial functions (shops, restaurants, services) on the airport. The current wayfinding system for commercial functions consists of blue boards, together with digital references, such as the Schiphol app. This wayfinding is separated from the functional wayfinding (for the primary airport process, indicating gates etc.), which is indicated with the famous yellow Mijksenaar boards.

The current commercial wayfinding solutions do not deliver the desired result: Many commercial functions, especially the commercial services (see chapter 2.4.3), are not found by the passengers. This may be caused on the one hand by the limited amount of references to the services and on the other hand by the little awareness of the services among passengers. (Luif & Stephanus, 2017). This leads to a mismatch between the offer of Schiphol and the use of the offer by the passengers.

The main stakeholders for this project are Schiphol, the passenger and the commercial facilities at Schiphol. Within Schiphol, many different departments exist, each having their own interests in (a part of) the passenger journey. For this commercial wayfinding project, the Commercial department and the Operational department (product owner of the functional wayfinding) are the most important stakeholders.

Due to the crisis caused by COVID-19, Schiphol has recently gone through 'Project Reset', in which the organization has been reorganized. The Commercial department, on behalf of whom this assignment is carried out, is merged from the Consumers department and the Real Estate department. The vision of Consumers is "making time valuable", which is highly relevant for this thesis.

Research questions

The main research question for this thesis is:

How can the commercial wayfinding system at Schiphol be improved so that the commercial facilities are better found by passengers?

The following research sub-questions enable to answer the main research question:

A How does human wayfinding work? What cognitive processes and spatial elements are involved? *(chapter 2.2.1: wayfinding processes)*

B How does commercial/recreational wayfinding work? *(chapter 2.2.2: commercial wayfinding)*

C How is natural wayfinding, physical wayfinding, and digital wayfinding arranged at other locations? *(chapter 2.3: external analysis)*

D How is the current (commercial) wayfinding arranged at Schiphol? *(chapter 2.4: internal analysis)*

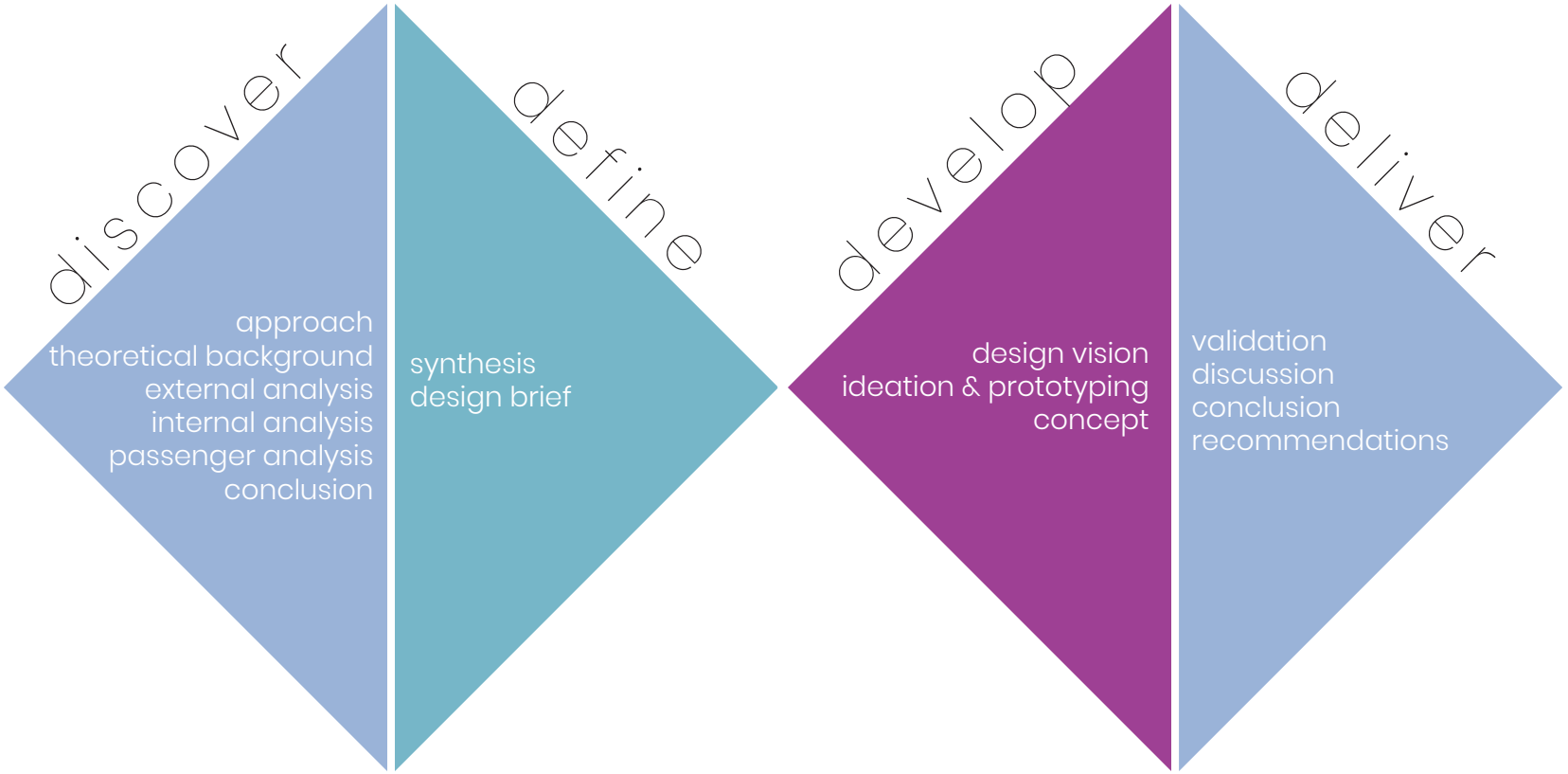
E How can passengers be segmented? What is their wayfinding behavior? *(chapter 2.5.1: passenger segmentation)*

F What are the passenger's recreational and information & wayfinding needs? *(chapter 2.5.2: passenger needs)*

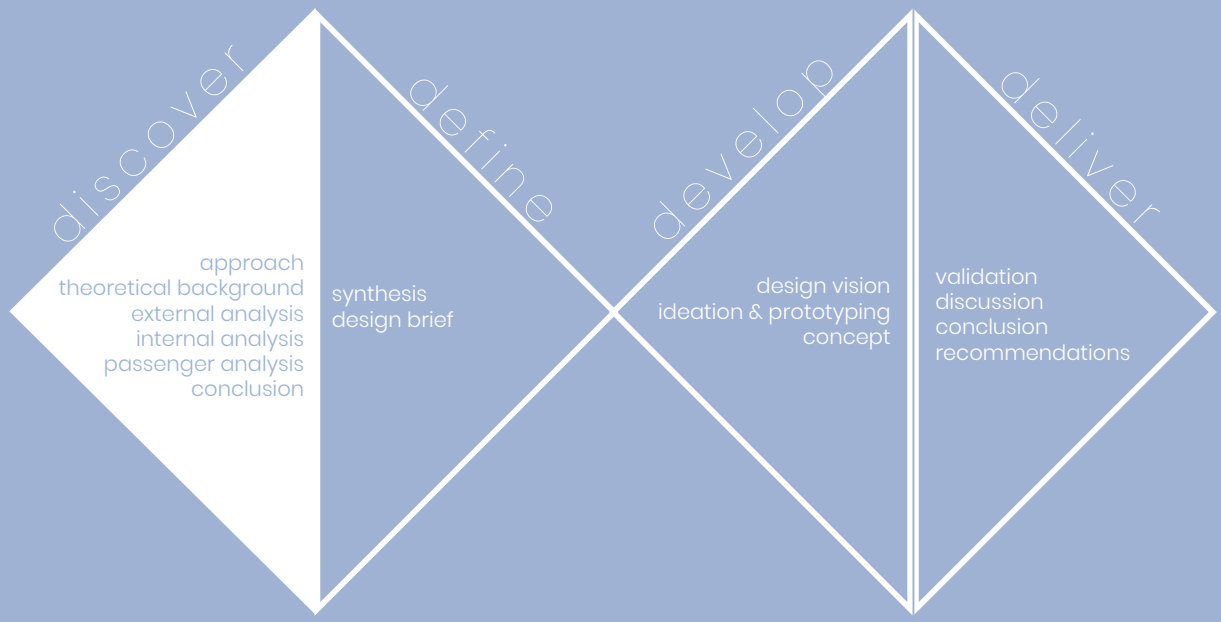
G How can the insights gathered from the research questions above be translated into a design for a (commercial) wayfinding concept? *(chapter 3: define)*

Project layout
The project layout is based on the Double Diamond model, which is described by the British Design Council. This model is widely used by designers and forms the baseline for the education at Industrial Design Engineering at the TU Delft. By diverging and converging, the Double Diamond model helps to convert research insights into a design.

The visual on this page shows the different stages in the project in four phases: discover, define, develop and deliver.



Section 2
DISCOVER



2.1
Approach

This chapter explains and substantiates the different methods used during this project.

2.1 Approach

This chapter explains and substantiates the different methods used during this project.

2.2 Theoretical background

There are some basic principles underlying human wayfinding that are applicable to (almost) every wayfinding situation. These principles have already been researched and described in literature. To improve a wayfinding system, it is crucial to understand these principles in order to get an idea of how the cognitive processes of wayfinding work.

This chapter describes those basic principles of wayfinding and gives answer to the questions: What is 'commercial' wayfinding and (how) is it different from other types of wayfinding? How does the environment people navigate in influence the wayfinding abilities? What are other factors that influence the wayfinding behavior of people?

2.3 External analysis

A lot can be learned from existing wayfinding situations. A benchmark study is executed to look at best case and worst case information & wayfinding examples. This gives insights into recurring common problems and challenges regarding indoor wayfinding and in do's and don'ts for the rest of this project. The benchmark study looks at buildings in other domains, buildings in the transport domain and other airports.

2.4 Internal analysis

The context of this assignment is the airport of Schiphol. To design a wayfinding concept that is relevant, applicable and efficient for Schiphol, it is key to be familiair with the current situation and wayfinding system at Schiphol. To do so, observations in the context are done and interviews with experts are executed.

2.5 Passenger analysis

In the end, passengers who travel via Schiphol will be the main users of the wayfinding system. To design a wayfinding system that is relevant for them and matches their needs and wishes, passenger analysis is executed.
First, different sources from Schiphol (e.g. Customer Insights) are consulted to get insight in the passenger research that has already been executed by the airport. Based on this information and the information that is still missing regarding passenger needs, primary research is executed:
People have different levels of knowledge (explicit, observable, tacit and latent), which they express in different ways (say/think, do/use, know/feel/dream) (Sanders, E, Stappers, P.J., 2020). Different methods can be used to get to the different types of knowledge. Image 2 shows the methods used to find out about passengers needs regarding the commercial wayfinding.

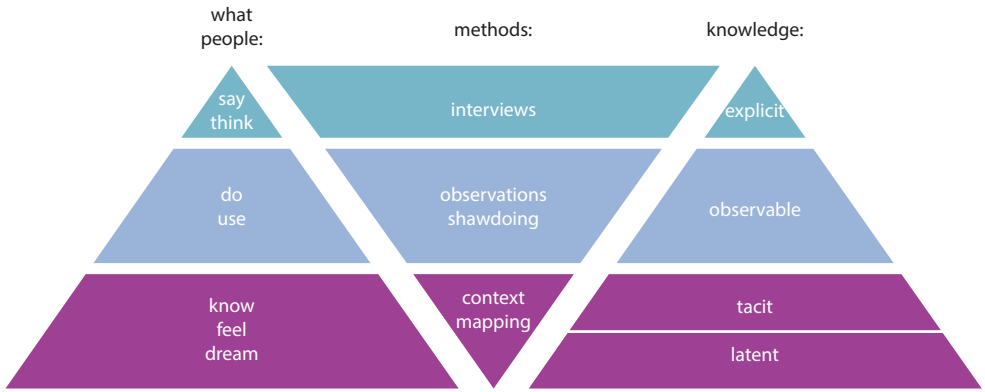


Image 2: Methods used to find out about passengers needs

2.2
Theoretical background: Information & Wayfinding

This chapter desribes the theoretical background for information & wayfinding principles.

2.2 Theoretical background

Wayfinding is an important aspect while visiting an airport.
Aspects related to the ease with which passengers move through the airport to their destination play an important role in the scores that airports achieve on the annual ASQ ratings (Airport Service Quality). ASQ is a global benchmarking program, measuring passenger's satisfaction while traveling through an airport.

'Ease of finding your way' is one aspect in the ASQ top 10, based on priority indicated by passengers. On this aspect, Schiphol is rated as 4th (for transfer flights). To reach the goal of becoming Europe's preferred airport, Schiphol needs to improve its wayfinding system (as Zurich and Munich are on the 1st and 2nd place respectively).

Wayfinding at an airport is based on multiple aspects (image 3).
Natural wayfinding is based on solely the design of the airport. This is what remains if you remove all signage, maps, apps and other wayfinding solutions from the building. According to Hans Bouchier, wayfinding expert at Schiphol, the optimal goal would be to have such a good natural wayfinding of the building that all the other wayfinding solutions become unnecessary. But in the current situation, also digital information and physical signage is needed to enable intuitive wayfinding.

The current commercial wayfinding information at Schiphol mainly builds upon signage and some personal information.

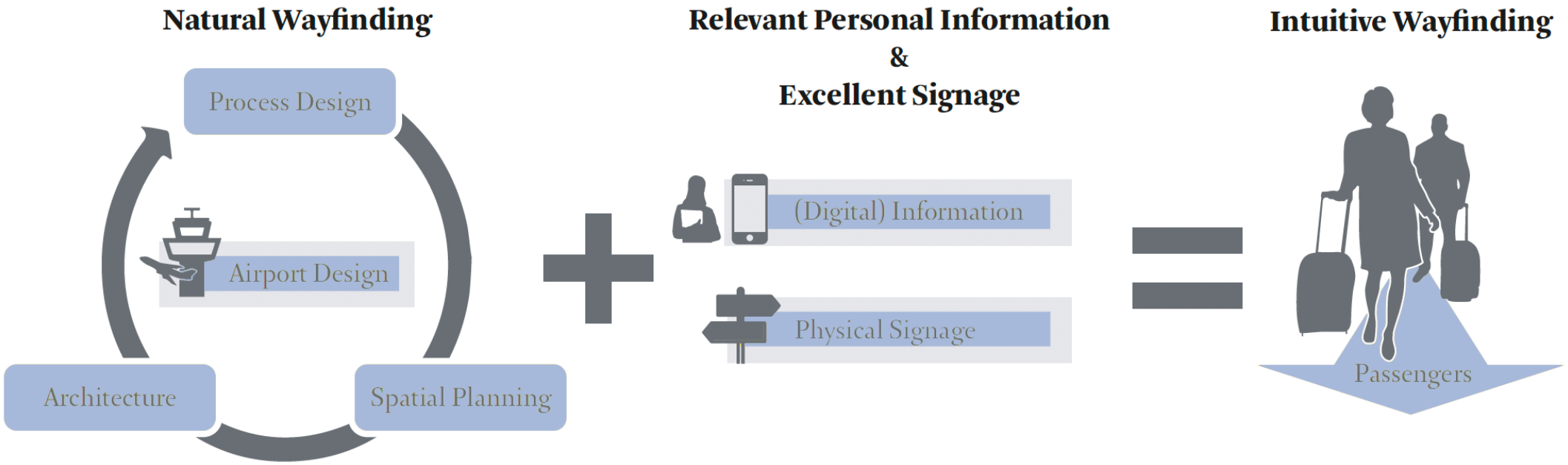


Image 3: Intuitive wayfinding vision of Schiphol Group (Informatie en Wayfinding: visie en implementatie strategie, 2016)

2.2.1 Wayfinding processes

Wayfinding comprises the process or activity of ascertaining one's position and planning, following and adjusting the route while navigating. Already from the 1960s onward, much fundamental wayfinding research has been published. This research is still relevant, as the principle of wayfinding has not changed over time, which is covered in this chapter.

Wayfinding tasks

People can have different types of locations to navigate to: They can navigate to a known location, to a destination with an unknown location and to explore a new environment (Allen, 1999).

The first and most prevailing task is *commute* (see image 4). Which is described as traveling between two familiar places, with a known route. An example might be traveling from home to work. The intention of the commuting is focused on efficiency and is often routine-based. Routinized behavior builds on automatic processes, which ask little attention and effort. However, commuting often not only builds upon one single route, but alternative routes can be used if needed. In this selection process, higher level decision making takes place.

The second task is called *quest* and occurs if people are searching for and navigating to a destination they have not visited before, which causes the specific location to be unknown. This task involves the most cognitive effort, as information should be retrieved and processed, for example from maps, signs or verbal descriptions. Furthermore, there is often uncertainty about the current location in relation to the location of the final destination.

Lastly, people *explore* the environment with the goal to discover new places. This exploration is often started from and ended at a known location. During the exploration, the goal is to link new locations and routes to the familiar point of reference. While exploring the surroundings, it is unknown what the usefulness of the trip will be, as it is a surprise what will be encountered. This task is based on some automatic processes as well as intentional or even strategic cognitive processes.

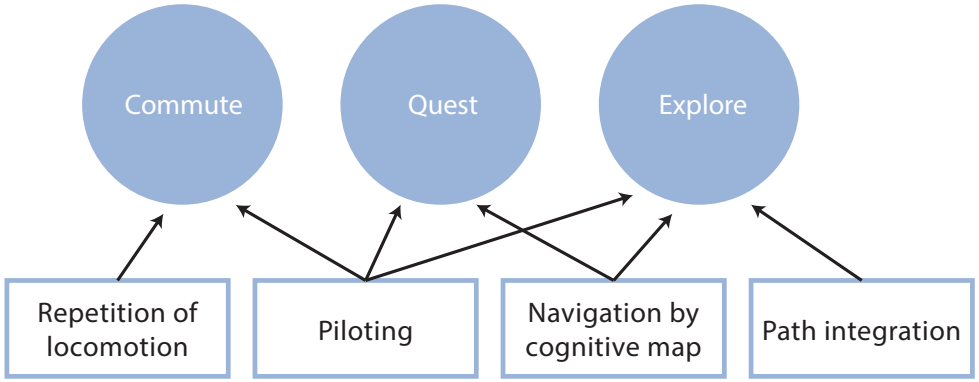


Image 4: Wayfinding tasks and their strategies. Adapted from: Allen, 1999

Fewings (2001) describes this explorative wayfinding task as recreational wayfinding, in which the individual finds satisfaction and enjoyment from the wayfinding activity itself. Already from the prehistoric times, people have spent time on jigsaw puzzles, labyrinths and mazes for entertainment.

Wayfinding strategies

Allen (1999) describes different wayfinding strategies for different wayfinding tasks:

Repetition of locomotion is a routine based action, following along a route. This habitual task asks for little attention.

When applying *piloting* strategies, landmarks are used as reference points. To keep track of the progress along the route, the sequence of landmarks is checked between the point of origin and destination. The focus is always on finding the next landmark in the sequence. Piloting is used in both familiar and new surroundings.

A *cognitive map* is an internal representation of different places that are systematically related (image 5). People develop cognitive maps over the course of multiple visits at the location. Progress is assessed based on familiar landmarks and estimating the time-space between these landmarks. Cognitive maps are very useful for keeping orientation during explores. During quests, they can be helpful to reach one's destination. And for commutes, they can be applied to come up with detours.

A cognitive map does not resemble cartographic maps: it can be distorted and incomplete, which however does not have to negatively impact the wayfinding performance (Ishikawa & Montello, 2006; Passini, 1984). Lynch already referred to this principal in 1960, under the heading of 'environmental image' (Lynch, 1960).

Finally, *path integration* comprises updating one's location, compared to the point of origin. Therefore, path integration is especially useful for finding one's way back. Progress can be measured with an indication of a distance or time limit regarding the location of the destination.

Route and survey cognitive map
There are two types of cognitive maps: route and survey maps (Arthur & Passini, 1992; Lawton, 1994). Image 5 shows at the top the actual map of a commercial center in Montreal. The bottom left drawing shows a route-based information strategy and the bottom right drawing a survey-based information strategy.

Route strategies build upon a sequential order of directions (for example left/right directions) and the use of landmarks (Hund et al., 2008). With this local focus on the next step, this strategy (as applied with the locomotor repetition strategy) is inflexible and the route cannot be easily adjusted if needed.

Survey strategies (or orientation strategies) are based on cognitive maps representing relations and distances between places. This global approach is independent of directions and orientations, such as cardinal directions (North, East, South, West) (Hund et al., 2008), which makes this strategy more flexible for changes (Prestopnik & Roskos–Ewoldsen, 2000).

People unfamiliar with the environment tend to use route-based information and landmarks more (Ishikawa & Montello, 2006), whereas once they get more familiar with the environment they shift towards survey-based strategies (Haq & Zimring, 2003).
However, the two strategies are not completely separated, as they are both used and preference differs per individual (Ishikawa and Montello, 2006).

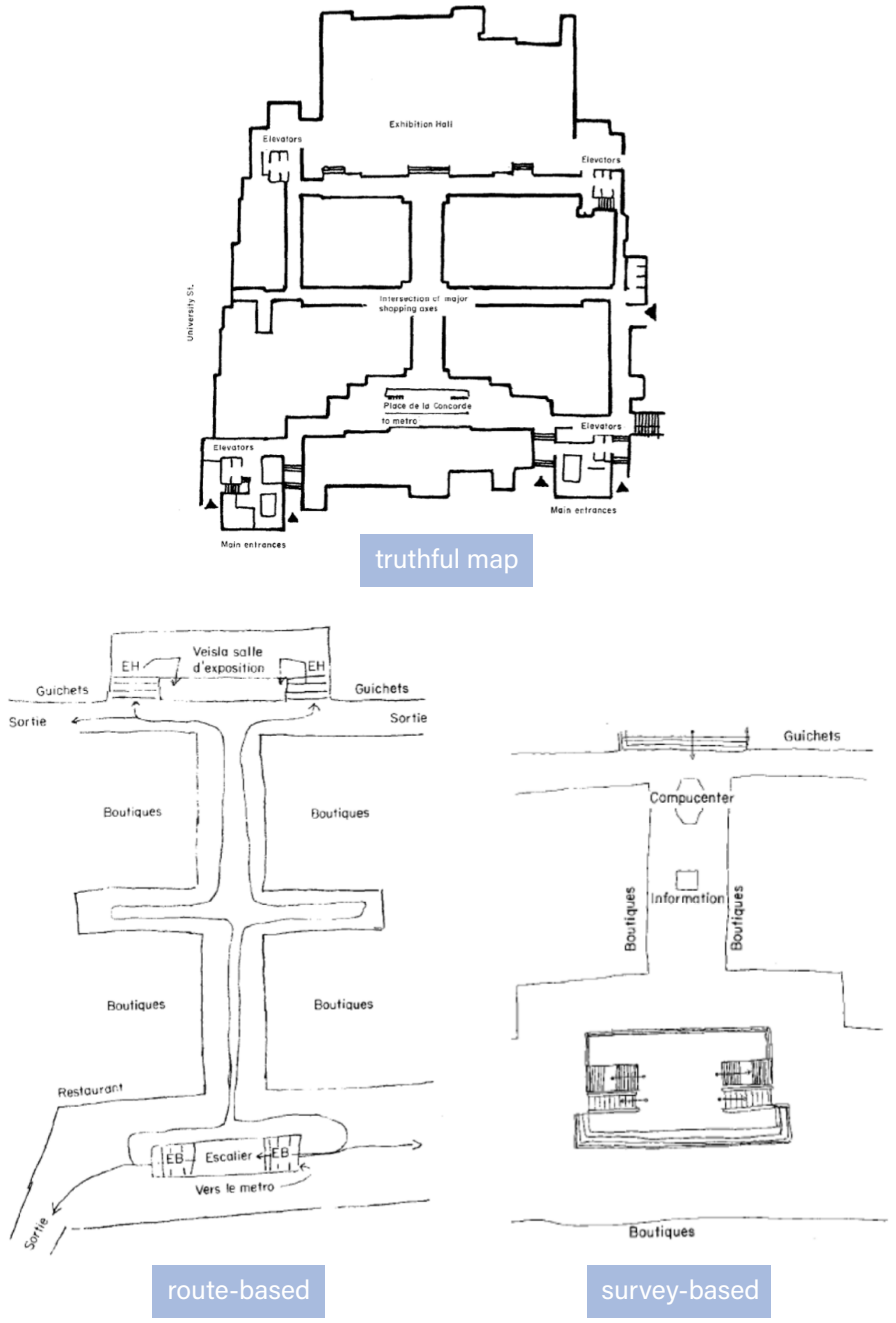


Image 5: Cognitive maps (top: truthful map, bottom left: route-based cognitive map, bottom right: survey-based cognitive map) (Romedi Passini, 1984)

Landmarks
A landmark is an object or feature in an environment that is easily seen and recognized from a distance, especially one that enables individuals to establish their location. As Soh (2003) stated: "Having an exact map to represent the terrain alone is not enough to ensure effective wayfinding; one needs to relate the map to the environment."

When applying different wayfinding tasks, landmarks fulfill different purposes. In the case of commuting, landmarks serve as an indication of where the person is along the route in time-space. In the situation of a quest, landmarks are often provided as route description, leading from one landmark to the next. While exploring, landmarks are used as reference to familiar areas. (Allen, 1999)

2.2.2 Commercial wayfinding

This thesis is focused on commercial wayfinding, which is in essence more explorative than functional wayfinding and therefore different wayfinding strategies apply (image 6). Passenger interviews conducted for this project also proved that passengers, while searching for commercial functions (tertiary wayfinding), most of the time do not have a specific destination in mind (see Passenger Analysis: chapter 2.5.2).

A good (commercial) wayfinding practice is important for commercial facilities as this has a positive marketing benefit (Arthur & Passini, 1992). This subchapter explores the underlying wayfinding principles for commercial wayfinding.

Explore strategies
When people explore unfamiliar environments, they use piloting strategies, cognitive maps and path integration. People start their exploration from a familiar point, which they use as a landmark. They explore new routes and locations and try to link those to familiar territory. To return to the original starting point, path integration is used.

According to O'Neill and Jasper (1992), shopping patterns are initially restricted to areas on which information is available to the consumer. As they explore the environment, their 'shopping territory' expands.

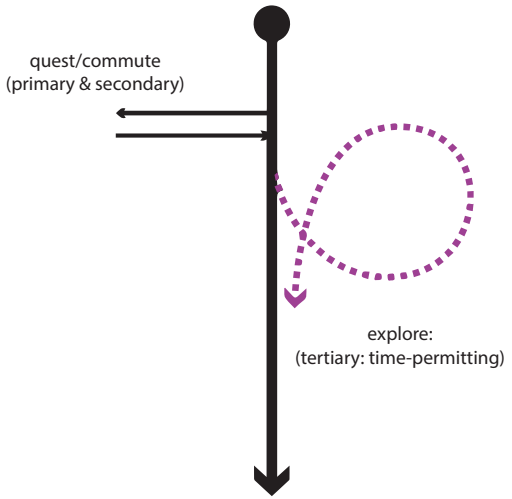


Image 6: Wayfinding strategies at an airport (Glastra-van Loon, 2017)

Shopping motivations and wayfinding strategies
Arthur & Passini (1992) describe how for all different shopping motivations and movements through shopping malls decisions need to be made that will guide and determine the navigation through the building. Often, those decisions are made subconsciously (see Influential factors: chapter 2.2.3). Furthermore, Passini (1984) demonstrates that some people in complex commercial buildings base their navigation on spatial properties of the building, whereas others rely on signage.

Babin et al. (1994) suggest that wayfinding processes reflect shopping values (for an explanation of different shopping values, see Passenger Analysis: chapter 2.5.1).

Utilitarian shoppers use wayfinding strategies different from those of hedonist shoppers (Titus and Everett, 1995): Utilitarian shoppers focus mainly on completing the task of finding items in a rational and efficient way, which is like a quest. They strive to solve the wayfinding problem efficiently and base the wayfinding process on landmarks and/or other persons. Hedonist shoppers seek to enhance enjoyment through experiencing and exploring the shopping space and sensorial excitement (see image 7).

Commuting tasks, which entails traveling between two familiar places with a known route, almost never occur while traveling through an airport, possibly only highly experienced and frequent travelers experience traveling via an airport part as commuting. Passengers do apply the wayfinding tasks quest and explore while traveling via an airport.

For more information about the relation between wayfinding strategy selection and search task, the consumer retail search process (CRSP) model is described in appendix 1.

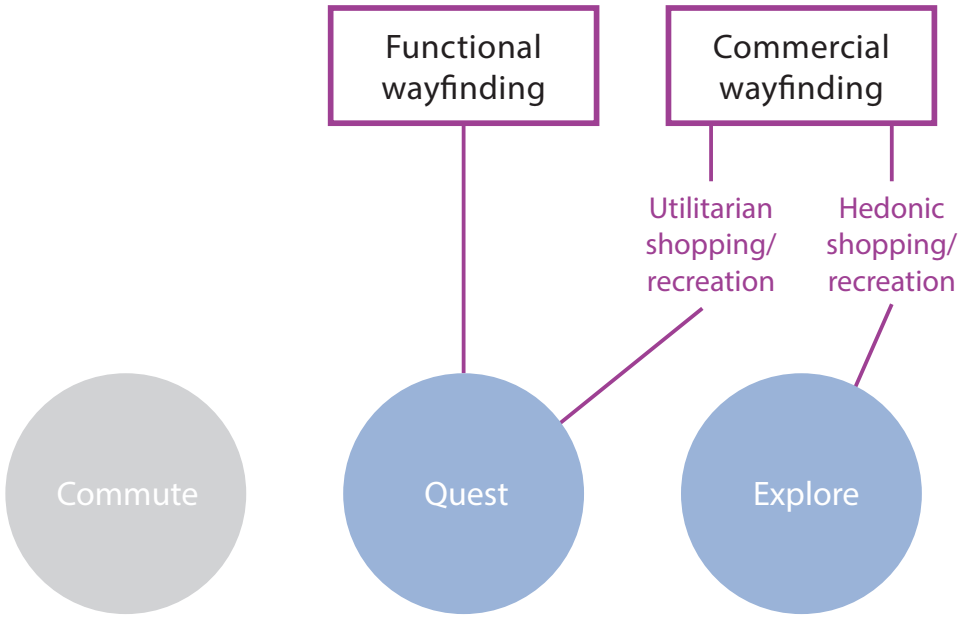


Image 7: Functional and commercial wayfinding tasks

2.2.3 Influential factors

While looking at wayfinding at an airport extra factors are at play, such as limited time, which can cause stress amongst passengers. Furthermore, sense of time and sense of place can be distorted because of long-haul flights.

This subchapter describes how information overload and stress influence the cognition and wayfinding abilities. Other internal factors, such as cultural differences, familiarity with a location and sense of direction, are described under the chapter 'Passenger Analysis' (chapter 2.5).

Information overload

Passengers at an airport may experience information overload while making their way through the airport. However, the implications of information overload for the cognitive processes is less familiair to designers (Passini, 1996). When an individual experiences the mental state of information overload, the perception and treatment of input information is restrained. Since people know how to ignore information that they do not need, the amount of stimulation is not what causes information overload: It is rather the necessity to check the environment for relevant information. If people know what to look for and where, the need to constantly scan the environment is reduced, thereby also reducing the chance of information overload (Passini, 1996).

Strong contrasting colors attract the eye and make the perception and differentiation of objects easier. However, too many eye-catchers can again create a situation of information overload and confusion (Dogu & Erkip, 2000).

Information overload makes people less susceptible for unexpected information, as they are only looking for the specific information they need. Therefore, information overload reduces the chances of explorative wayfinding behavior.

This shows the importance of presenting wayfinding information consistently. Several researches propose the exclusive application of public wayfinding signs in buildings via reserved communication channels (Passini, 1992) and for wayfinding and traffic regulation signs in cities (Carr, 1973). Also Hans Bouchier, wayfinding expert at Schiphol, looked into the possibility of creating a universal wayfinding system applicable for all airports around the world (Bouchier, 2021).

Stress

Little research has been done about the impact of stress on the wayfinding abilities, and most of it is focussed on emergency wayfinding (Ozel, 2001). However, Evans et al. (1984) confirmed the results of Mackingtosh et al. (1975) that stress reduces the ability to create and draw cognitive maps.

When looking at broader research and the influence of stress on cognition, Sandi (2013) concludes the following: In the case of simple tasks that involve implicit memory (information that you unconsciously and effortlessly remember), mild stress can improve cognitive functions. However, high or very high stress impairs the cognitive functions, especially in situations were explicit memory is needed. This is the case if cognitive effort is needed to retrieve information, for example in the situation of finding one's way in an unfamiliar environment (e.g. an airport).

Person-place cues

An interesting aspect in wayfinding that leads people (unconsciously) to certain locations is the notion of 'person-place cues.' This notion holds that the location of people in an environment suggests the popularity of that specific place (Dalton et al., 2019). A place that people estimate to be popular, as people are willing to visit it, will attract more visitors. The popularity could be caused by a temporary event (a street art performance) or a permanent activity (such as a shop). Dalton et al. state that this phenomenon is more likely to take place during explorative (wayfinding) behavior, when deciding what (unfamiliar) place to visit. People also apply this strategy when selecting a restaurant.

Conclusions

- Wayfinding strategies differ based on the wayfinding task (commute/quest/explore).
- Functional (primary and secondary) wayfinding has a step-by-step nature, whereas commercial (tertiary) wayfinding is more explorative.
- Explore strategies build on piloting, navigation by cognitive map and path integration.
- Route strategies are used in unfamiliar environments and build upon a sequential order of directions and the use of landmarks.
- Recreational/commercial wayfinding is facilitated by landmarks and organizing facilities into different zones.
- To reduce information overload, people only focus on the specific information they need to complete their wayfinding task.

2.3
External analysis

This chapter includes a benchmark study at:

2.3 External analysis

This chapter entails a benchmark study at other locations with the goal to reveal 'worst case' examples and 'best case' examples of indoor wayfinding information in practice.

Benchmarking: a process basis for teaching design, 1997

Method: benchmarking

Benchmarking is a way of discovering 'best practices' and 'worst practices' - whether in a particular company, by a competitor or by an entirely different industry. The goal of benchmarking is to see where improvement can be made in the current situation, so that competitive advantage is sustained.

Site visits were executed at the following locations:

Buildings in other domains (appendix 2A):
- Markthal Rotterdam
- The Mall of the Netherlands
- Supermarket Albert Heijn
- Efteling theme park (maps)

Other buildings in the transport domain (appendix 2B):
- Rotterdam Central Station (NS)

Other airports (appendix 2C + 2D) (no visits have been made)

The main conclusions are described on the next page, see the appendices for the complete analysis.

Conclusions

- Landmarks are a powerful tool for orientation and navigation and can be indicated on wayfinding information to support the wayfinding tasks.
- Digital elements can provide extra and personal information about the location of, and navigation to specific locations.
- Similarly as at Schiphol, other buildings in the transport domain (e.g. the NS train stations) apply different ‘zones’, with varying focus on the primary process (or commercial activities).
- Finding a balance between functional wayfinding and commercial wayfinding is a challenge for buildings in the transport domain (airports and train stations).
- For locations that have a primary focus on recreational activities (such as shopping malls), there is more space for commercial wayfinding information than for locations that have a focus on operational processes.

2.4
Internal analysis

This chapter describes the internal analysis that took place at Schiphol. It describes the current (commercial) wayfinding system at Schiphol and the stakeholders involved in the wayfinding system.

Covered in this chapter:

2.4.1 Wayfinding system Schiphol

This chapter describes the current wayfinding system at Schiphol.
In this report a distinction is made between functional and commercial wayfinding. Functional wayfinding covers primary and secondary wayfinding, whereas commercial wayfinding involves tertiary wayfinding (ACRP, 2011).

This hierarchy in wayfinding information at airports is also found in the color coding of the signage at Schiphol, designed by Mijksenaar (image 8).

Primary wayfinding (yellow) gives information about passenger activities directly related to the airport process. For example:
- Ticketing/Check-in;
- Baggage Claim;
- Gates;
- Ground Transportation.

Secondary wayfinding (grey) gives information about activities not directly related to the process, but necessary for the journey. For example:
- Elevators;
- Parking;
- Restrooms;
- Currency exchange.

Tertiary wayfinding (blue) gives information about activities unrelated to the traveling process. For example:
- Shopping;
- Eating/drinking;
- Relaxing.

This color coding visually prioritizes the primary wayfinding over the secondary and tertiary wayfinding, by applying different color contrasts, where the colors yellow and black have the greatest contrast.

The table on the next page shows an overview of the current functional wayfinding and commercial wayfinding side by side.

Image 8: Color coding hierarchy on Mijksenaar signage

	Functional wayfinding	Commercial wayfinding
Image		
Channels	Digital, physical, personal	Digital, physical, personal
Signage	Yellow and grey boards	Blue boards
Wayfinding hierarchy	Primary and secondary wayfinding	Tertiary wayfinding
Subject	Required steps of traveling process	Activities unrelated to traveling process
Messages	Gates, bagge hall, elevators, restrooms, parking	Commercial functions (retail, horeca and services)
Wayfinding task (currently)	Quest (linear)	Explore, sometimes quest
Goal	Efficiency (legibility)	Recreation (stimulation)

2.4.2 Current commercial wayfinding

This subchapter looks at how the commercial wayfinding information at Schiphol is currently organized. To acquire the information, field research (observations, (expert) interviews and an Airport Assistant shift) is done.

Commercial wayfinding information is only placed at locations where the airport process does not have to be the main focus for the passenger. At Schiphol Plaza (peripheral), the lounges and the Holland Boulevard, the passenger can allow himself to spend some time on recreation.

Commercial wayfinding information is not placed at:
- Plaza central;
- Check in;
- Security check;
- Passport check;
- Gates;
- Baggage claim.

At image 9 it can be seen how visual expressions are minimized at the passport check, so that the passenger can focus on the primary process of catching a plane.

Image 9: Minimizing visual expressions at passport check

Commercial wayfinding mediums

At locations where commercial wayfinding is placed, passengers can retrieve commercial wayfinding information via different mediums:
- Blue signs;
- Self Service Units (at information zones);
- Static maps;
- Banners;
- Staff;
- Schiphol app and website.

Appendix 3A, 3B and 3C give an overview of the different wayfinding mediums and where they are located at Schiphol.

Points of attention current commercial wayfinding information
This subchapter explains which aspects of the current commercial wayfinding information might complicate the location of and navigation to the commercial functions for the passenger. Information has been gathered during a service safari and passenger interviews. Below an overview of the issues with the current commercial wayfinding is given; see appendix 10 for a more detailed description.

Issues with the current commercial wayfinding

- Only present to a small extent
- Not used consistently
- Not (always) up to date
- Not (always) complete
- Digital wayfinding solutions are user-unfriendly
  (e.g. routeplanning not possible)

It should also be noted that the commercial wayfinding information might not be the only problem why commercial facilities are not found. Many commercial services are not located in direct sight, decreasing the chance and ability for natural wayfinding.

In the example of the Rijksmuseum (image 10), the location is actually placed in sight: The green walls are part of the museum. However, passengers do not note or recognize the green color as the museum. This problem might be amplified by the fact that the entrance of the museum is on the other side of the main walkway. Another problem here is that the museum is located next to automatic walkways. If passengers note the museum once they are on the automatic walkway, they should consciously decide to turn around and get back to the museum, where they still need to find the entrance.

Image 10: Location Rijksmuseum (on the left)

2.4.3 Commercial facilities

This subchapter gives an overview of the current commercial functions at Schiphol. Schiphol offers retail, food & beverages (horeca) and commercial services (RHS).

The Commercial department divided the commercial services over five categories (entertainment, storytelling, well-being, airport convenience, financial services), see image 11. The services that are located on the left side of the image mainly contribute to the satisfaction of the passenger (NPS), whereas the services on the right side mainly ensure greater revenue (ROE). With the commercial services, Schiphol wants to give the passengers an 'experience', rather than just the basics (Luif & Stephanus, 2017).

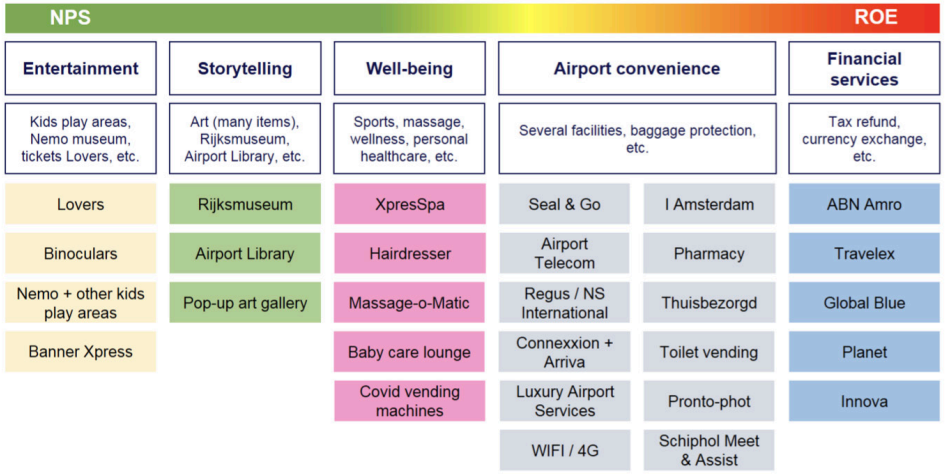


Image 11: Categorization current commercial services at Schiphol (Schiphol Group, 2021)

As stated in the assignment description at the beginning of this thesis, there is a mismatch between the passenger and Schiphol: Passengers desire to use certain commercial services at Schiphol, but the problem is that they do not know that these services actually exist (image 12). This leads to passengers not using the facilities, even though the demand from the passengers is there.

In a conversation with Judith van den Bos, working at the Customer Insights department of Schiphol, she explained:

"There is a gap between the needs of passengers regarding the facilities at Schiphol, and what they know about the (current) facilities at Schiphol."

As different people from the Commercial department indicated, this mismatch is mainly the case for the commercial services. These locations can also be referred to as 'hidden gems': something that is extremely outstanding and not many people may know about.

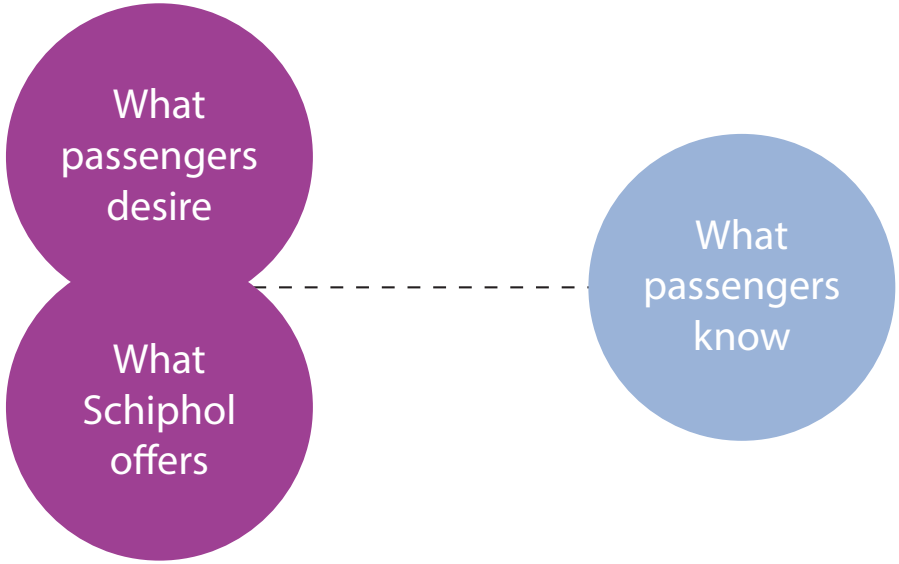


Image 12: Mismatch between Schiphol and the passenger regarding the commercial services

2.4.4 Internal stakeholders

This subchapter describes the internal stakeholders of Schiphol that are involved in the organization of the (commercial) wayfinding system.

The responsibilities for the functional and commercial wayfinding information are divided over two departments within Schiphol:

- Functional wayfinding: Operations department
- Commercial wayfinding: Commercial department

As both departments have different concerns, there is found to be a discrepancy between (the goal of) the commercial and the functional wayfinding. Since there is a lot going on at an airport, 'noise' in the context (for example renovation work or noise from other passengers) can also trouble the communication.

Based on the 'Sender - Receiver model' (image 13), this situation is illustrated (image 14).

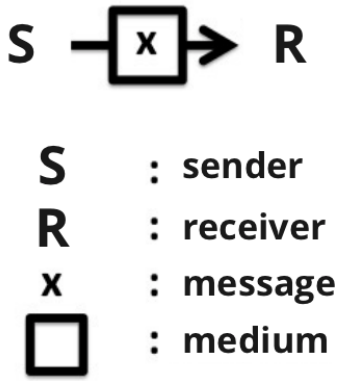


Image 13: 'Sender - Receiver model'

Not only physical space on Schiphol is scarce (either making space for passenger flows, or placing shops), also the visual space and attention of the passenger is limited.
Both Operations and Commercial want to have the attention of the passenger: They are competing with visual expressions to get the attention of the passenger. This can result in passengers struggling with an information overload (see chapter 2.2.3: Influential factors).

See appendix 3D for a more detailed description of the relation between the two departments.

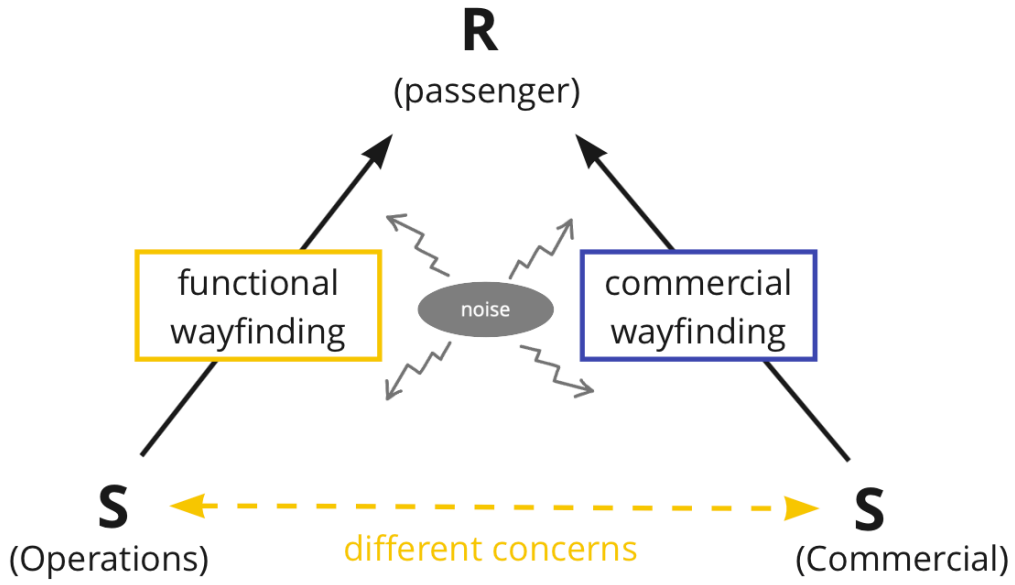


Image 14: Different concerns regarding the wayfinding information

Conclusions

- There are several issues with the current commercial wayfinding at Schiphol which makes the passengers unable to find the commercial services.
- There is a gap between what passengers desire and what passengers know about the current commercial services at Schiphol: The passenger is unaware of Schiphol's current offer. The unknown but desired facilities can be referred to as 'hidden gems.'
- For certain commercial services at Schiphol, natural wayfinding is limited because of a lack of differentiation and blocked sight lines.
- Passengers use little information sources before arriving at Schiphol; they do not plan their stay at the airport.
- Due to a focus on the primary process by Schiphol, there is limited space for commercial wayfinding.

2.5
Passenger analysis

This chapter gives an overview of the research done to get more insight in the needs of passengers regarding wayfinding and information at an airport.

Covered in this chapter:

2.5.1 Passenger segmentation (secondary research)
2.5.2 Passenger needs (primary research)
- Recreational needs
- Information & wayfinding needs

2.5.1 Passenger segmentation

Passengers can be categorized based on different characteristics. This paragraph describes the segmentation which is most relevant for this project: based on the travel process of the passenger. Three groups of passengers can be defined based on their travel process:
- Arriving (O/D)
- Departing (O/D)
- Transfer (TRF)

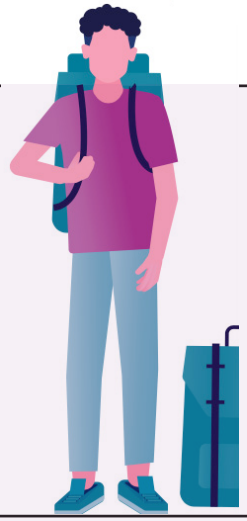
This segmentation is selected as the travel process defines what passengers are looking for: their information & wayfinding needs. Segmentation based on passenger flows also forms the basis for passenger journeys. Appendix 5 gives an overview of other ways to segment passengers.

For the Commercial department, only departing passengers (O/D and TRF) are relevant. Arriving passengers often leave the airport as soon as they reclaimed their luggage and want to go to their final destination as quick as possible.

The next page shows an overview of the departing passengers and their needs, based on information required from the Customer Insights department.

It can be seen that:
- The Net Promotor Score (NPS) of TRF passengers is higher than the NPS of O/D passengers.
- TRF passengers spend least money on airside.
- Passengers spend a large part of their waiting time at the gates (which is not in line with Commercial's vision of "Making time valuable").
- The wayfinding & Information needs are the same for O/D and TRF passengers (see appendix 6).
- Recreational needs differ per passenger group and per individual.

Departing passengers	O/D passenger	Tranfer passenger
Number of passengers (2019)	23 million	12,9 million
	NPS +38 (2021) (+1)	NPS +43 (2021) (=)
Expenses airside per passenger (2019)	€15,20 leisure; €12,40 business	€10,30
Average waiting time airside (2014)	2 hours	3,5 hours
Average time at gate (2013)	1 hour 13 min	1 hour 26 min
Average time in lounge (2013)	44 min	1 hour 42 min
Impact improved waiting time (# of passengers x average waiting time)	46	45,15
Wayfinding needs	Getting on time from current location to the gate, spending spare time valuable.	
Recreational needs	Leisure: Enhance feeling of starting holidays Business: Take a rest or work	Leisure: Refresh, relax, pass the time Business: Take a rest or work
Information needs	Wants to know about inspiring and surprising locations to pass the time and to enhance the feeling of adventure and exploration (leisure)	



2.5.2 Passenger needs

This paragraph describes the needs of passengers while traveling via an airport, which vary per person and per moment in the journey through the airport.

A distinction can be made between Information & Wayfinding (I&W) needs and recreational needs (R). Image 15 below is based on information from Verhagen and Stephanus (2015).

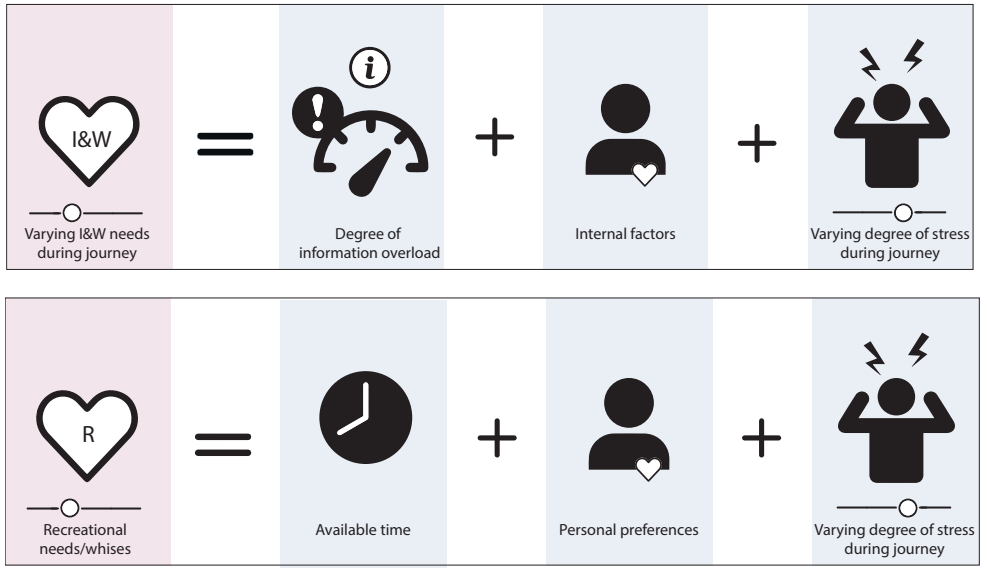


Image 15: Information & Wayfinding (I&W) needs and recreational (R) needs

Information & wayfinding needs

Information & wayfinding needs vary during the journey of the passenger through the airport, as they are depending on the amount of information (overload), internal factors and the degree of stress (see chapter 2.2.3 Influential factors). Appendix 7 gives a more detailed description of the different factors at play.

Engelshove (2015) and Aerts (2015) identified four information needs for passengers at an airport: process, time, facilities and disruption information, see image 16. All departing passengers (transfer and O/D) should have access to this information, to give them the feeling of being in control.

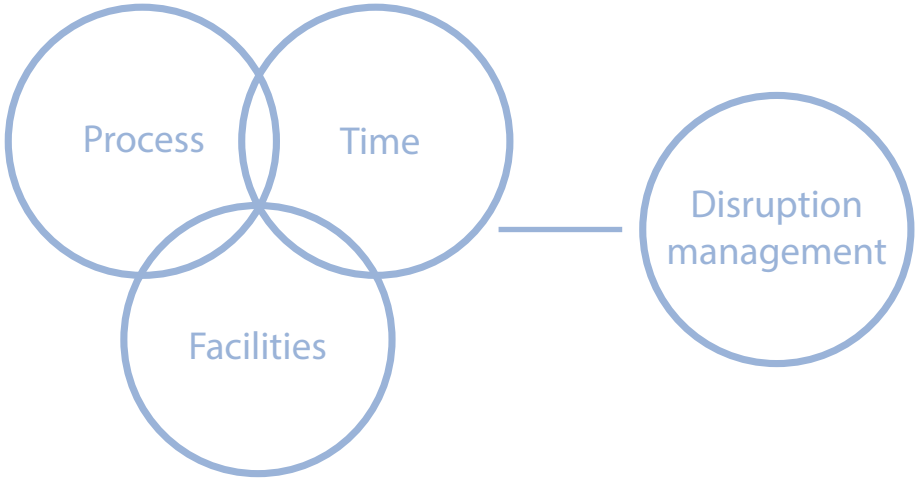


Image 16: Passenger information needs (Aerts, 2015 and Engelshove, 2015)

Recreational wishes/needs

The recreational wishes and needs highly depend on the (perceived) available time for the passenger. If a passenger is in a hurry to catch his flight, he will not spend time even thinking about shopping or other recreational activities.

The preference for a type of recreation (for example active/relaxing) is based on personal preferences of the passenger.

The varying degree of stress during the journey is dependent on the location in the journey and the type of passenger (see appendix 7).

Conclusions secondary research

Paragraph 2.5.1 and 2.5.2 give an overview of secondary research about passenger needs at an airport. It can be concluded that:

- Both information & wayfinding needs and recreational needs are relevant for designing a commercial wayfinding system.
- Arriving passengers are not an interesting target group for commercial activities: They want to leave the airport as soon as possible.
- The information & wayfinding (I&W) needs of passengers depend on the degree of information overload, internal factors and the degree of stress.
- All departing passengers (TRF and O/D) have the same information and wayfinding needs.
- Recreational (R) needs are dependent on the (perceived) available time, individual preferences of passengers and the degree of stress.
- To improve the wayfinding abilities of passengers the level of stress and amount of information overload could be minimized.
- The stress passengers experience varies during their journey through the airport. In the lounges, the stress level is the lowest, and the level of anticipation and excitement the highest. Therefore, it is mainly interesting to investigate the phenomenon of stress in a functional wayfinding situation.

Now what?

To get a better insight in the information & wayfinding needs and the recreational needs of passengers at Schiphol, further passenger research is done, which is described on the following pages.

Recreational needs

This subchapter describes the recreational needs of passengers at an airport. Passengers at airports have different recreational needs, based on personal preferences, but also the amount of waiting time and goal of the trip are relevant. Customer Insights describes the recreational needs for different passenger segments as follows (Luif & Stephanus, 2017):

- O/D leisure: Time at the airport should support the feeling of holidays.
- Transfer: Relax, refresh and pastime (sometimes: luxurious shopping).
- Business: Work and relax quietly.
- Families: If the children are happy, we are happy.

Goal

To get a more profound understanding in the tacit and latent recreational needs of passengers. A second goal of the sessions was to get insight in the familiarity of passengers with the commercial facilities at Schiphol.

Delft Design Guide, 2020

Method: contextmapping

To find get a deeper insight into the (latent and tacit) recreational needs and wishes of passengers during their waiting time, contextmapping sessions were conducted. Contextmapping is a generative method to reveal latent and tacit needs among participants (image 17). This method is especially useful in the pre-concept design stage, when there is much space for finding new design opportunities.

A downside to this method is that it can be very time consuming. The sessions need extensive preparation and analysis (especially when using transcripts) is a tedious process.

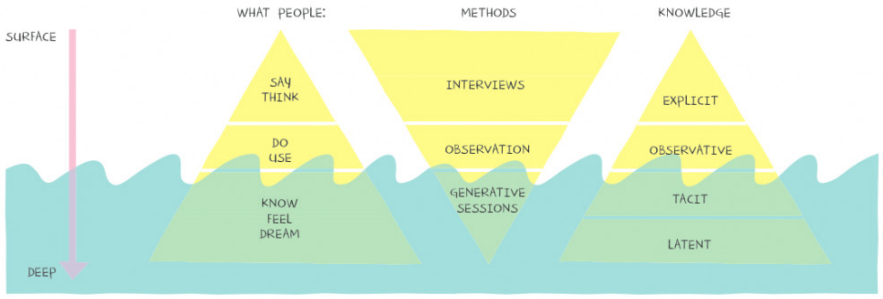


Image 17: Generative sessions reveal latent needs (Sanders & Stappers, 2020)

Hypothesis

Below, the main hypotheses of this research are stated. Appendix 8A describes the hypotheses per section.

#1: Passengers who are waiting before their flight departs would like to do some activities to fill the waiting time.
#2: Passengers currently find facilities at the airport by walking around (explore), they do not actively search for specific locations.
#3: Passengers are not aware of the wide variety of commercial services that Schiphol has to offer.

Approach

Contextmapping sessions have a standard layout: First, the present situation and past experiences are taken into account. Then by building upon insights from the present and past, dreams of the participants can be projected into the future to create an idea of what matters to them. This ideal scenario (of how to spend the waiting time at an airport) can serve as useful input for the pre-concept design stage.

All eight sessions were conducted at the participant's homes, as it was regarded that the sessions would take too long (1-1,5 hour) to conduct with passengers at the airport. The sessions were set-up with advice from Froukje Sleeswijk Visser, teacher at the faculty of Industrial Design Engineering (TU Delft) and also referred to as the 'context queen.'

Participants

It was chosen to select participants from my own acquaintances, since it was considered that these people would be more willing to spend their time on the session. Before the session, the participants were not aware of the topic of this graduation, with the goal not to influence their answers and the results of the session.

From my acquaintances, it was attempted to create an as varied group of participants as possible (gender, age, origin).
1. Woman, Dutch, leisure 23
2. Woman, Dutch, leisure, 26
3. Woman, Indian, leisure, 28
4. Woman (mother), Dutch, leisure, 37
5. Man, Dutch, business, 65
6. Man, Indonesian/Dutch, leisure, 65
7. Woman, Dutch, leisure, 30
8. Man, Chilean, leisure, 30

Planning & materials

A few days before the session the participants received a card deck of the commercial facilities at Schiphol (image 18 and 19). This card deck served as:
- sensitizer (Sanders & Stappers, 2020);
- conversation starter;
- a way to assess the awareness of the commercial facilities at Schiphol.

Image 18: Card deck of the commercial functions

The card deck has four different colors, indicating the different categories:
1. Purple: relax & do
2. Orange: shops
3. Old purple: food & beverages
4. Black: primary functions

During the session, the audio was recorded so that transcripts could be made. Appendix 8A describes the set up of the sessions in more detail.

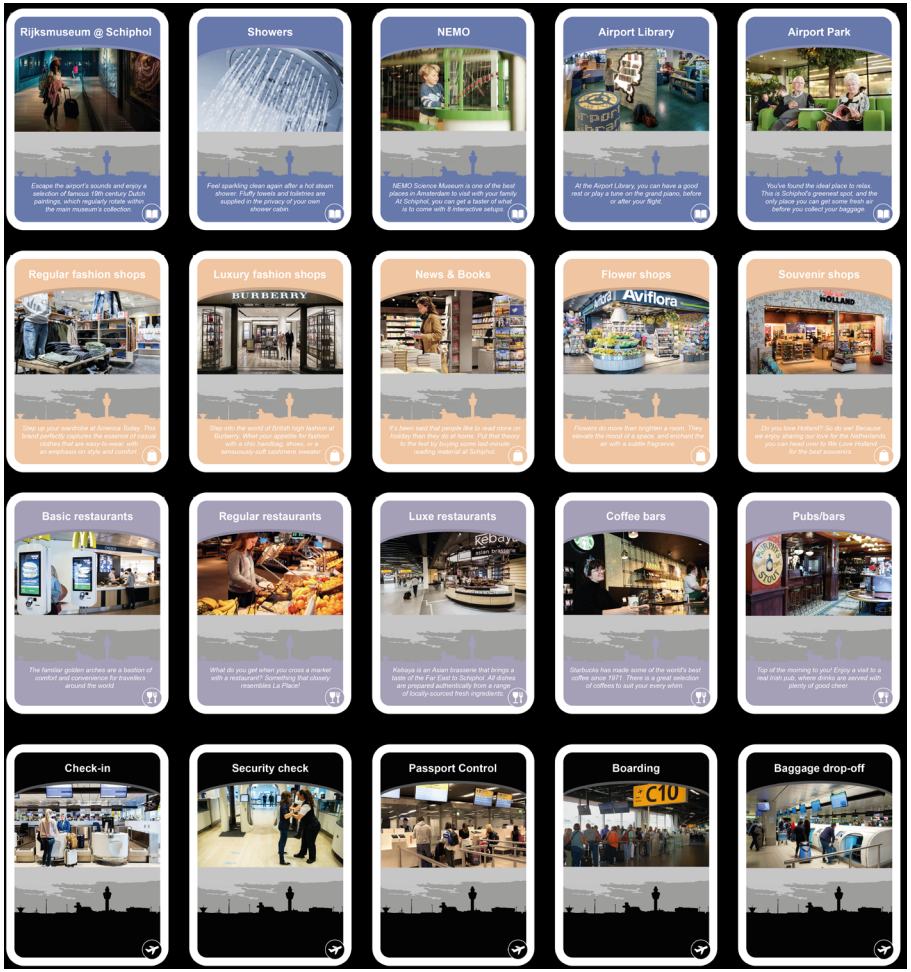


Image 19: Categorization of the card deck

Results contextmapping
The main insights of the contextmapping that are relevant to the design brief are described in this subchapter*. For an overview of all insights, see appendix 8C.

Insight 1:
Passengers seek pastime to fill their waiting time before their flight departs.
As the average waiting time in the lounges is more than two hours (Customer Insights, 2020), passengers want to have something to do.

Rianne: *"But it is more... curiosity and interest and a bit of pastime ... And then just stimulate myself a bit and get inspiration... Rather then really looking for offers or cheaper products or..."*

Insight 2:
Passengers mostly visit known and obvious places at the airport.
Currently, most passengers visit locations they are familiar with, such as shops and restaurants.

Demi: *"Yes, well, that's usually... you just arrive there. So that's the first thing you see too. And then I am not very much the person who, if I am not sure if, say, on the other side, there is something really nice, to go and find out. Because then I'm like, Okay here is food. So here I get food."*

Insight 3:
Passengers visit shops just for the sake of pastime.
Different types of activities might suffice to pass the time. Currently, many passengers visit shops without any buying intention, but just for the sake of pastime. However, people would prefer to participate in an activity.

Rob: "*When we show shopping behavior, it is out of boredom. Then we will walk around, but relatively little is bought."*

Insight 4:
Schiphol has many (free) services to offer, which most passengers are not aware of.
Crystel: *"That there really are a lot of things that I thought, "Does that exist?" (...) And I am also familiar with Schiphol, but XspresSpa... no, I had really never seen all of that. "*

Insight 5:
The existence of the commercial services surprises the passengers and they would like to be notified about their existence and location.
Demi: *"Well, I would have liked to encounter that one. Nemo and Rijksmuseum, showers never seen. Seriously there is a whole spa? Okay... Meditation center... Baby care lounge."*

Insight 6:
Passengers do like to explore the surroundings of the airport, but want to stay connected to their flight.
Preeti: *"No I think I would want to keep... otherwise I get distracted really easily. And if it's complete different distraction that I'm like, in a different world, like, whatever I need, I will miss my flight. So I need the reminder that I'm still at an airport or I still like... somewhere tell me that."*

Insight 7:
Passengers want to have insight in how much time they have left for recreational activities
Rob*: "Or you should already know it and if you can conclude that: you still have ten minutes walking time; Oh I still have an hour, so I can spend another 50 minutes on this. Because that, that, I find that funny about those airports just to discover: So what is it like, what else is going to happen outside?"*

*The quotes are translated from Dutch to English.
See for the original transcript appendix 8B.

Insight 8:
Passengers find locations at the airport by wandering around (explore strategy) and do not plan their visits.
Frank: *"And then you did indeed, if I already went upstairs at the departure hall two, walked past the restaurants, then I walked straight to the lounge and then you also passed the Rijksmuseum. (…) So it was. It was more intuitive, impulsive, like: let's walk in! instead of us targeted walking in."*

Insight 9:
Passengers prefer to have the personal and location-based information digitally (on a mobile phone), so that they can take the information with them.
Demi: *"I think digital is easier because then you just always have it with you, but if it is, for example, a map that is located at several locations, so that you can quickly reach a map, then that is also nice. But yes, I think because the airport is of course quite large that it does not make much sense to put 80 of those floor plans everywhere. In every hallway… So I would say digital."*

Insight 10:
Passengers won't download an app.
Ronja: *"I wouldn't download an app. My phone is already full. I only download apps that I use every day. And for Schiphol, which I then use once a year or so: I'm not going to download an app for that. This might be a bit more convenient for the business traveler."*

Conclusions

It can be concluded that the three main hypotheses can be accepted:

- #1: Passengers who are waiting before their flight departs would like to do some activities to fill the waiting time. (However, passengers do not plan how they will spend their waiting time.)
- #2: Passengers currently find facilities at the airport by walking around (explore), they do not actively search for specific locations.
- #3: Passengers are not aware of the wide variety of commercial services that Schiphol has to offer. (However, they would like to be informed about these facilities.)

All in all, this research shows that Schiphol can distinguish itself from other airports and get a higher passenger satisfaction by tapping into the needs of departing passengers during their waiting time. An important aspect here is to raise more awareness among passengers about the (free) commercial services available at the airport.

Limitations

There are some limitations to this research. First of all, this research was conducted among only ten participants. Although it was attempted to create a diverse group of participants, it is difficult to state whether this is representative for the big number and variety of passengers that visit Schiphol. It should also be taken into account that all participants currently live in The Netherlands. Most of them live here permanently, some temporary. This may influence the perception of the airport of Schiphol and may result in a biased opinion, which may only represent inhabitants of The Netherlands. A final limitation to this research is that the sessions took place at the homes of the participants. On the one hand this could ensure a safe environment to share one's experiences and opinions, but on the other hand this might create a feeling of distance towards the situation of the airport. It might be difficult to emphatize with a situation and location of Schiphol that the participant is currently not in. It has been tried to reduce these effects as much as possible by providing the card deck beforehand, to sensitize the participants.

Information & wayfinding needs

This subchapter describes the research that was executed to find out about information & wayfinding needs among passengers. Sixteen departing passengers were interviewed and observed.

Goal

The goal of this research was to get insight in how passengers find their way to the commercial facilities at Schiphol and to see whether there are weak points in the current wayfinding system. This research focusses specifically on the ability of passengers to find their way to the Rijksmuseum.

Delft Design Guide, 2020

Method: passenger interviews and observations

Interviews are combined with observations to get insight in what passengers say and do regarding commercial wayfinding at Schiphol.

Interviews provide a more in-depth understanding of peoples thoughts, needs and beliefs. However, interviewees can only tell what they consciously know: Tacit and latent knowledge should be retrieved via contextmapping sessions.

Observations are used to find out about unintended or unexpected scenarios. A limitation of this method is that people might behave differently if they know they are being observed.

Hypothesis

#1: Passengers do not plan how they will spend their waiting time.
#2: Passengers are not aware of the existence of the Rijksmuseum at Schiphol.
#3: Passengers experience difficulty finding the Rijksmuseum at Schiphol.

Approach
Passengers waiting in the lounge for their flight to depart were interviewed about how they were currently spending their waiting time. Afterwards, the passengers were asked if they were aware of the fact that there is a museum at Schiphol and whether they would like to find their way to the museum. The passengers themselves could decide which strategy they would use to find the museum. During the search, the passengers were observed and shadowed (on 2 meters distance). Passengers were asked to think out loud. Afterwards, an evaluation was done with the passenger. See appendix 9A for the specific questions that were asked during the interview.

Participants
The research was conducted among sixteen departing passengers who were waiting in lounge 1 and 2 at Schiphol. Passengers were selected that seemed not to be busy (e.g. catching their flight, calling on their phone, eating). No selection on age, gender, origin, passenger type (O/D or TRF) or destination was made. When starting the interview, the passengers were first asked if they were willing to participate and answer a few questions. When starting the quest for the Rijksmuseum, the passenger again had the option to stop the interview.

Planning & materials
The research took place on the 25th March (14.30-19.00) and the 1st of April (8.30-12.00). A tablet with a digital questionnaire was used to ask the questions to the passengers. Notes were taken on the tablet.

Results
From sixteen participants, eleven passengers agreed to search for the Rijksmuseum. Reasons why passengers were not willing to search for the museum were that they were too tired, or that they were waiting on other people to return.

From the eleven participants, four succeeded to find their way to the museum. The successful wayfinding strategies were: using Google maps (2x), following the signs to the museum and asking personnel. See appendix 9B and 10 for the detailed results.

Conclusions

- Passengers seek pastime to fill their waiting time before their flight departs, especially for waiting times longer than 1 hour. However, passengers do not want to spend a lot of effort in finding specific facilities: passengers should rather be guided and find the facilities intuitively.
- Currently, the commercial services (specifically the Rijksmuseum) are not intuitively found, as people do not know that they exist. But even when actually searching for the Rijksmuseum, the current wayfinding does not suffice and does not easily guide the passenger to the services.
- The digital wayfinding solutions are user unfriendly, as not all facilities are included, routeplanning is not possible and filtering options are limited.

The hypotheses can be accepted. Image 20 gives an overview of the conclusions.

Now what?

A wayfinding solution should be developed that improves both the awareness of and the wayfinding to the commercial services.

Limitations

It should be noted that this research took place during the COVID pandemic and that only 10% of the normal passenger numbers was reached. Most of the shops were closed, which caused some passengers to think that the Rijksmuseum (and other facilities) were also closed.

Many passengers had a longer waiting time due to the reduced number of flights. The reduced passenger numbers can on the one side improve the wayfinding, as there is less noise in the environment, on the other side there are less passengers that could be followed, so track behavior is reduced.

While shadowing the participants during their search, some indicated that they would have given up as they were not able to find the Rijksmuseum easily. However, they now kept searching because I was with them and they knew that the location was in reach. It should be considered that currently passengers who are interested in visiting the museum might resign as they experience the museum is too hard to find. Lastly, this research was conducted among only sixteen passengers, which reduces the reliability of the results.

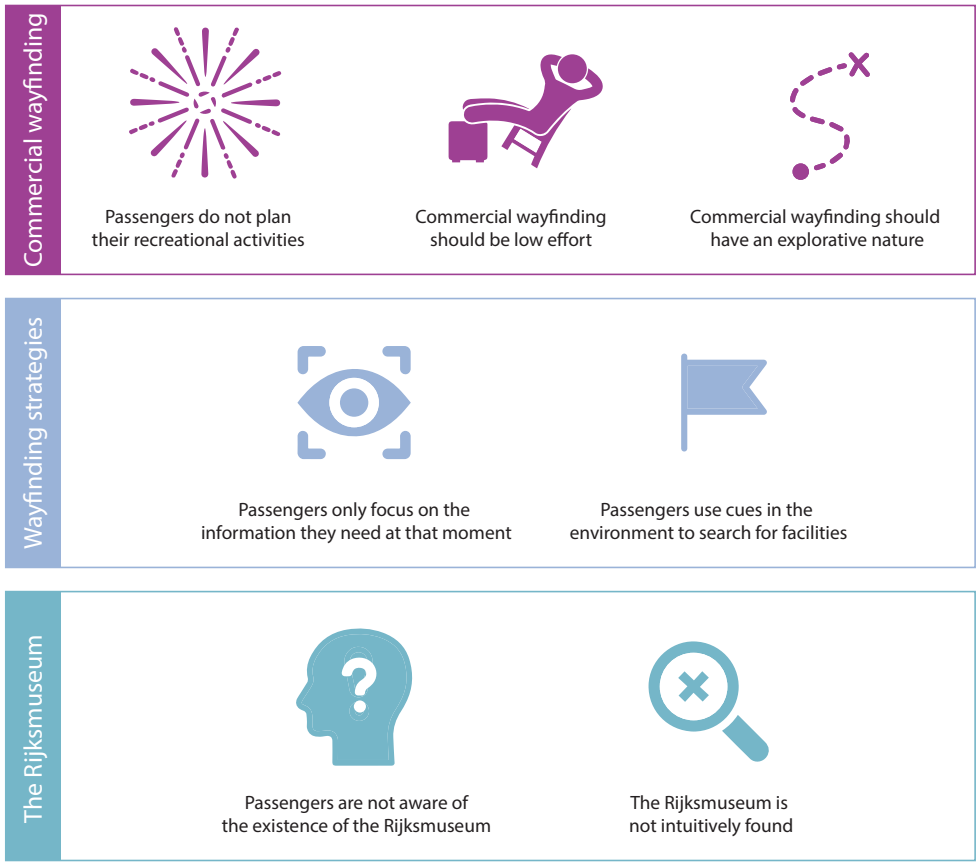


Image 20: Conclusions from passenger interviews and observations

2.6
Conclusion

This subchapter gives an overview of the most important conclusions from the discover phase and highlights the ensuing implications for the design (brief) of the wayfinding concept.

2.6 Conclusion

This subchapter gives an overview of the most important conclusions of each paragraph from the discover phase and highlights the ensuing implications for the design (brief) of the wayfinding concept.

2.2 Individuals in unfamiliar environments often apply route strategies, which have a focus on the next step (e.g. finding the next location or landmark).
The commercial wayfinding solution should provide passengers (often unfamiliar with the airport) with route-based wayfinding information.

2.3 Finding a balance between functional wayfinding and commercial wayfinding is a challenge for buildings in the transport domain (airports and train stations).
The commercial wayfinding solution should be well considered in order not to hinder the current functional wayfinding system of Schiphol.

Landmarks included on wayfinding information enable individuals to more easily relate the provided wayfinding information to the environment in which they navigate, improving the ease of wayfinding.

Digital elements can provide extra and personal information about the location of, and navigation to specific locations.
The commercial wayfinding solution should include landmarks and digital elements to provide relevant wayfinding information to passengers at Schiphol.

2.4 Unlike retail and food & beverage facilities, the commercial services are not found (by natural wayfinding) by passengers, since their locations are often hidden. This in combination with the current commercial wayfinding system having several issues results in passengers being unable to find the commercial services (intuitively).
The commercial wayfinding solution should guide passengers towards the commercial services (retail and food & beverages facilities do not have to be included in the wayfinding solution).

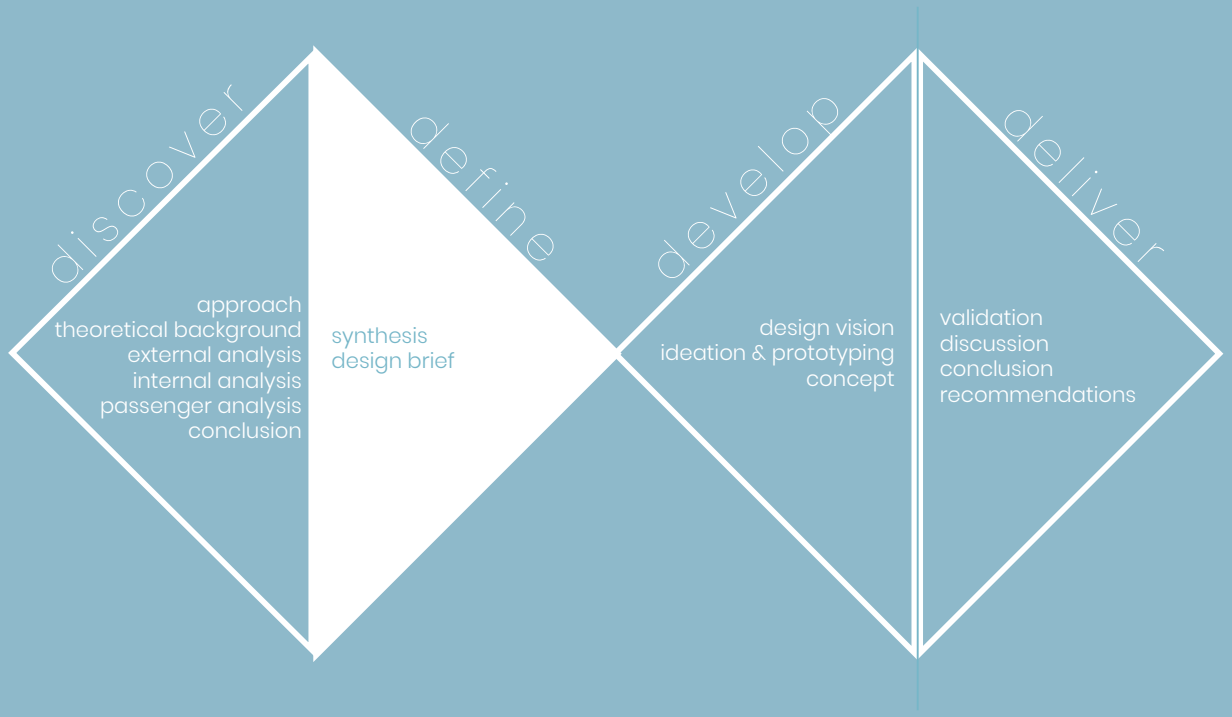
2.5 Departing passengers at Schiphol would like to do activities to fill their waiting time in a pleasant way. However, they need to have enough time before their flight departs to feel comfortable enough to explore the airport beyond the area that they are already familiar with.
The commercial wayfinding solution should be targeted at departing passengers having a longer waiting time than 1,5 hours.

Passengers are unaware of Schiphol's current offer of commercial services. The unknown but desired facilities can be referred to as 'hidden gems.'
The commercial wayfinding solution should make the passengers aware of the existence of the commercial services.

Passengers do not plan their waiting time.
Awareness for the commercial wayfinding solution should be raised in the context of the airport.

In the next chapter (define), the results from the research of the discover phase are synthesized into the design brief.

Section 3
DEFINE



3.1 Synthesis

This chapter synthesizes the results from the research of the discover phase. Based on the synthesis, a design brief is formulated for the remainder of the project.

Passengers at Schiphol seek pastime to fill their waiting time before their flight departs. They are looking for activities to do in the lounges, but mostly visit known locations such as shops and restaurants. Many passengers just visit the shops only to have something to do and to counteract the boredom, without the intention to buy anything.

However, Schiphol has many other (free) services to offer, which most of the passengers are not aware of (hidden gems). The existence of the commercial services (e.g. Rijksmuseum, Airport Library, Nemo, spa) surprises the passengers and they would like to be notified about their existence and location, so that they can visit them.

Currently, the commercial services are not intuitively found, as passengers do not know that they exist. But even when actually searching for the services, the current wayfinding does not suffice and does not easily guide the passenger to the services. The digital wayfinding solutions are user unfriendly, as not all facilities are included, routeplanning is not possible and filtering options are limited.

Passenger analysis also showed that passengers do not want to spend a lot of effort in finding specific facilities: passengers should rather be guided and find the facilities intuitively. Passengers do like to explore the surroundings of the airport, but want to feel guided so that they minimize the risk of getting lost.

Passengers find it hard to estimate how much time they have left for recreational activities, and prefer not to take risks so they arrive early at the gate. To ensure passengers use their waiting time in a more valuable way, the intervention should give insight in the process: How much time does the passenger have for recreational activities? What is the walking time from the facility to the gate? What is the boarding time? These information needs are the same for all departing passengers (TRF and O/D).

Also, passengers do not want to walk too far for specific facilities. They would rather visit locations that are on the route to their gate, or are located close to the gate. Therefore, the offer of facilities should be based on the location of the passenger, in combination with the location of the gate.

Passengers have personal preferences on how to spend their waiting time (and different shopping motivations). Therefore, passengers should be able to filter and select the facilities that they want to visit.

Most passengers do not plan their waiting time at the airport and find locations by wandering around and exploring the environment. Therefore, it is important that the intervention that leads the passengers to the commercial services happens in the context of the airport lounges.

Passengers prefer to have the personal and location-based information digitally (on a mobile phone), so that they can take the information with them. However, it is expected that they won't download an app.

There should be a cue in the physical environment that leads to the digital intervention. These cues can also serve as landmarks, which in turn facilitate the wayfinding abilities of passengers. Currently, there is no such connection between the 'physical Schiphol' and the 'digital Schiphol' (which might explain why the Schiphol app is rarely used).

Image 21 and 22 give a visual overview of the current and desired situation. Appendix 11 gives a structured overview of the insights and conclusions and how they are built up.

3.2 Design brief

In this paragraph the design brief is described in which goals for the design of the commercial wayfinding concept are set.

What is the problem?

The problem with the current commercial wayfinding is twofold: First, the passengers are unaware of the existence of the commercial services. Secondly, the wayfinding to the commercial services is not intuitive and (often) does not lead the passenger to their intended destination.

Assignment

"Design a personal and location-based wayfinding concept that leads passengers in their waiting time to the commercial services of their preference at Schiphol."

The scope of the assignment has been narrowed down to only the commercial services: Retail and horeca (food & beverages) are excluded from the design brief as these locations are well found by passengers.

Target audience

Departing passengers (O/D and TRF) that have a waiting time longer than 1,5 hours.

Objectives

Objective 1:

Through **cues** in the environment, the passenger should be made **aware** of the commercial services.

Objective 2:

The cues in the environment should **connect** the 'physical Schiphol' to the 'digital Schiphol.'

Objective 3:

The digital solution should **guide** the passenger to the commercial services. The wayfinding information should be **route-based** and based on **landmarks** in the environment.

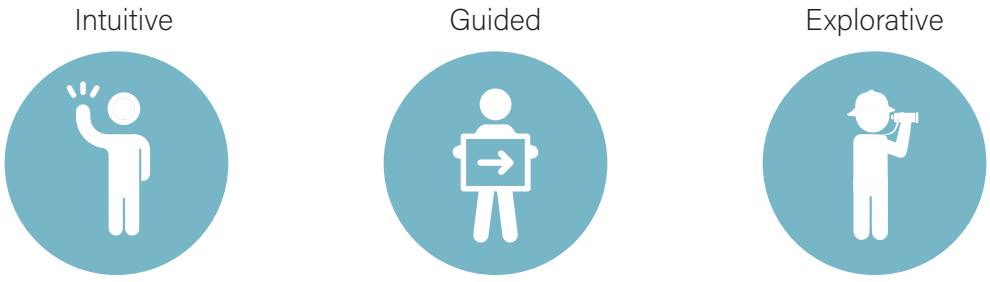
Objective 4:

The digital solution should work **location based** and should give the passenger insight in the **travel process** and **available time**.

Objective 5:

The passenger should feel invited to **explore** the surroundings of Schiphol, while having the feeling of being **guided**, minimizing the risk of getting lost. The wayfinding should be **intuitive**, making it accessible.

To make the interaction vision more concrete, it is described how the three elements are interpreted in the case of this project.



Current situation

Unintentional Uninformed Limited

Passengers spend a long time waiting at the gate

"But Michael is always a bit stressed... He always gets a bit nervous... He is quite focused on the time slot... and he prefers to be on time..."

Commercial services are not intuitively found

"While they also have that indoor playground, next to the restaurant. A lot of people don't know that either..."

GATE

Passengers primarily focus on relevant flight information (tunnelvisie)

"And I always, somehow, have gate D88 or something. So I am always at the very end in a corner somewhere and I don't see anything else.

Passengers are not aware of the commercial services, however they are interested in visiting them

"Well, I would have liked to encounter that one. Nemo and Rijksmuseum, showers never seen. Seriously there is a whole spa? Okay... Meditation center... Baby care lounge."

NEMO

Airplane

RIJKS MUSEUM

Airport Library

Often passengers only visit familiar and easy findable places

"No, I do not go through all corners of Schiphol before I go to my gate. No, I am not making a hike like: Well what do we have on this side?"

Passengers seek entertainment during the waiting time

"Yes, we are bored so we went into every store and we are slowly going to look at everything. Just to entertain your eyes ... they could have put a big TV there too, probably."

LOUNGE

territory to discover

current territory

territory to discover

Passengers do not plan their journey and waiting time at Schiphol

"I wouldn't search at home: What can you see at Schiphol now?"

Image 21: Current situation. (The quotes are translated from Dutch to English. See for the original transcript appendix 8B.)

Desired situation

Intuitive Guided Explorative

Passengers seek pastime, but want to stay connected to the flight (information)

"I would want to keep... otherwise I get distracted really easily. And if it's complete different distraction that I'm like, in a different world, like, whatever I need, I will miss my flight."

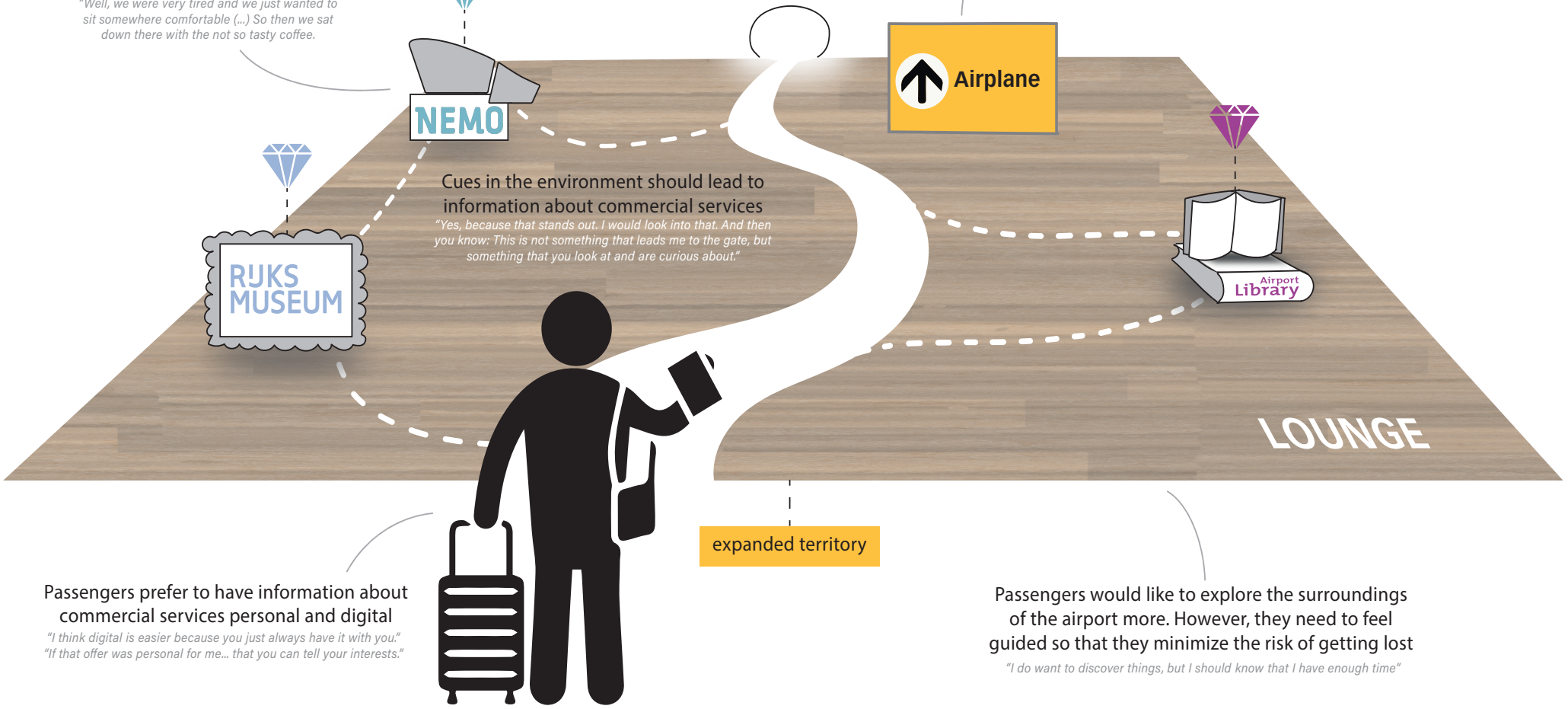
GATE

Passengers want to have insight in the process and available time for recreational activities

"This is an option, but I must know if it fits. How much time does it take to walk? That you can see: you still have ten minutes to walk; Oh I still have an hour, so I can spend another 50 minutes on this."

Passengers do not want to spend a lot of effort in finding specific locations

"Well, we were very tired and we just wanted to sit somewhere comfortable (...) So then we sat down there with the not so tasty coffee.



Cues in the environment should lead to information about commercial services

"Yes, because that stands out. I would look into that. And then you know: This is not something that leads me to the gate, but something that you look at and are curious about."

Passengers prefer to have information about commercial services personal and digital

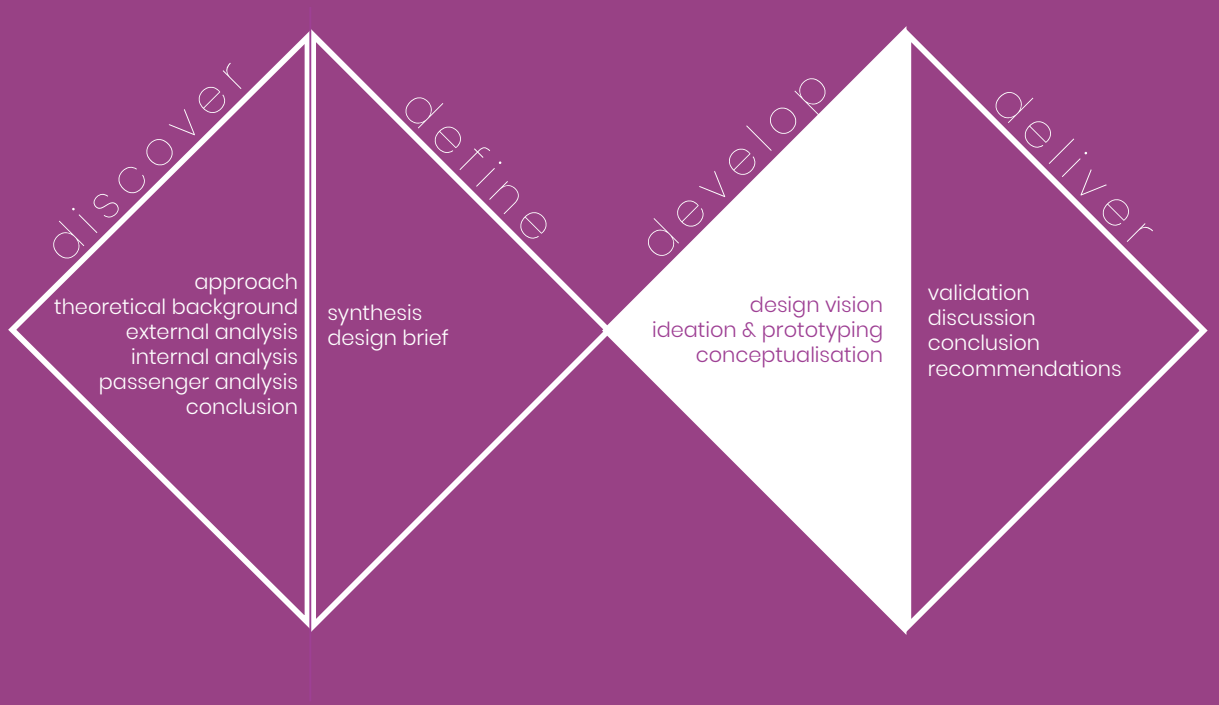
"I think digital is easier because you just always have it with you."
"If that offer was personal for me... that you can tell your interests."

Passengers would like to explore the surroundings of the airport more. However, they need to feel guided so that they minimize the risk of getting lost

"I do want to discover things, but I should know that I have enough time"

Image 22: Desired situation. (The quotes are translated from Dutch to English. See for the original transcript appendix 8B.)

Section 4
DEVELOP



4.1
Design vision

4.1 Design vision

In this subchapter, the design vision for the wayfinding concept is presented.

Commercial wayfinding is different from functional wayfinding in the fact that individuals can find satisfaction and enjoyment from the (commercial) wayfinding activity itself (Fewings, 2001). This wayfinding activity can also be called recreational wayfinding and can serve as a way to release stress (see chapter 2.5.2). To take this idea of 'wayfinding as entertainment' further, it has been decided to exclude traditional wayfinding solutions (signs, maps, arrows, GPS routing) from the design vision.

Another aspect that is taken into account is that the current wayfinding at Schiphol (and often at other locations) is based on sight. At every location at Schiphol, multiple parties seek the (visual) attention of the passenger, not only for wayfinding purposes, but also for marketing purposes for example. This causes the passenger to be overloaded with information. To not compete in this fight for (visual) attention, it has been decided to create a wayfinding concept that gives not (only) instructions via the human sense of sight. Of course, passengers will not be blindfolded as they still need to make their way through the airport safely, but the main input and directions will not be provided visually.
Another advantage of creating a different wayfinding system than the one that is used for functional wayfinding, is that those wayfinding systems will not interfere with each other.

The human senses of smell, taste and touch were considered less practical in guiding the passengers through the airport. However, guiding passengers by audio (voice and music) has been selected as a powerful method (see appendix 12 for an overview of considered technologies), which has shown to be fruitful in guiding individuals through unfamiliar environments such as cities and museums.

By guiding passengers through the airport based on audio, they will have the chance to experience the environment of the airport differently and notice aspects that they would have not seen otherwise. Using audio to provide the wayfinding instructions is also an attempt to dislodge passengers from endlessly staring at the screen of their mobile phone, but to open up to the environment surrounding them. Passengers are encouraged to 'follow something else than their eyes', distincting this commercial wayfinding solution from the existing (functional) wayfinding solutions and allowing passengers to let go of the functional airport processes and waiting time.

As Schiphol is a silent airport, passengers will receive the wayfinding audio information via their personal mobile device, which allows for personalization based on for example the preference, location and available time of the passenger.

Image 23 gives a summary of the design vision.

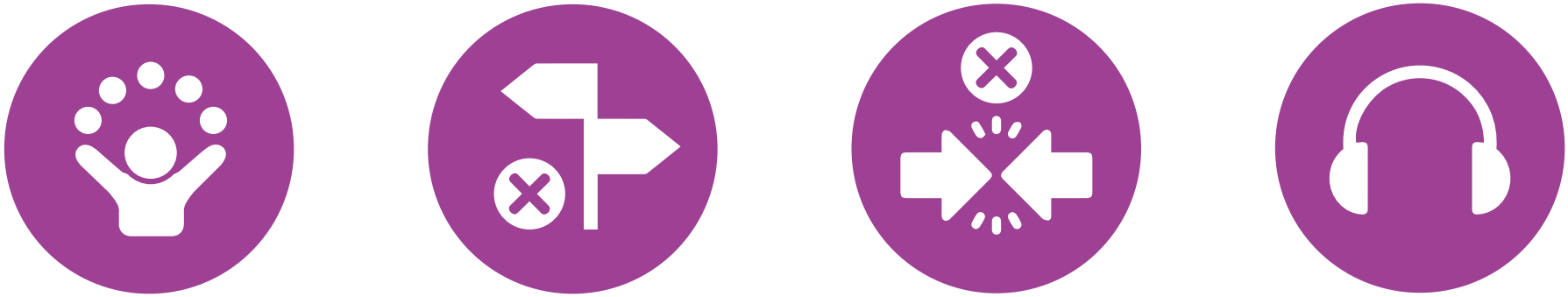


Image 23: Design vision

4.2
Ideation & prototyping

4.2 Ideation and prototyping

For the ideation and prototyping process, an iterative stance is adopted. Therefore, this chapter describes the ideation and prototyping activities together: Ideas are generated of which important assumptions and working principles are tested by creating prototypes to assess its value for passengers.

Delft Design Guide, 2020

Method: lean startup

Ideas are built on assumptions. In the lean startup method, these assumptions are (individually) tested by creating (*build*) and testing (*measure*) prototypes or MVP's (minimum viable products). This way, insights can be gathered on the degree of success of a prototype or assumption (*learn*). With the goal to learn as quick as possible, the design can quickly be adjusted accordingly. The goal is to move as quick as possible through the 'build-measure-learn' loop (image 24).

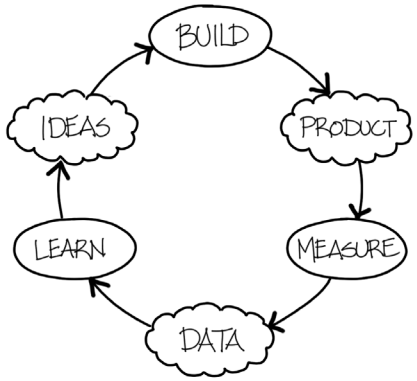


Image 24: Build-measure-learn loop

4.2.1 Initial ideation

As explained in the design brief, the problem with the current commercial wayfinding is twofold, see image 25.

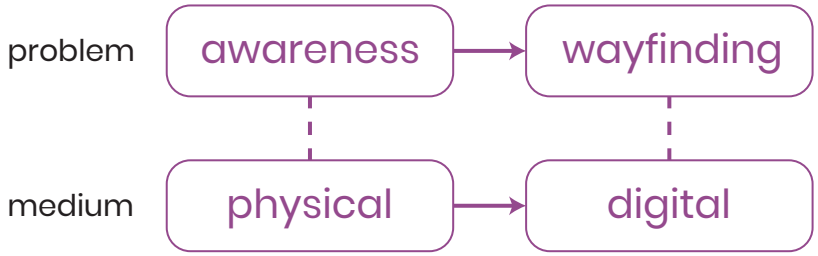


Image 25: Duality problem commercial wayfinding

To get a head start with ideation, an internal brainstorm session at Schiphol was organized (see appendix 13). Appendix 14 includes the continuation of this ideation.

This duality is used for the structure of this chapter, as the two aspects have been prototyped and tested separately in some cases.

4.2.2 Prototyping: awareness

Three consecutive awareness and activation tests have been executed in lounge 2 of Schiphol, which are described in appendix 15. The goal of the tests was to see how passengers were motivated best to scan a QR code, which would lead them to the digital wayfinding concept. This subchapter describes the main conclusions from the tests.

In the first test that was executed, it was already noticed that creating plain 'awareness' is not the sole challenge in this problem: passengers also need to take action (scanning the QR code). Which is essential in order to lead the passenger from the physical world (awareness) to the digital world (wayfinding).

The AIDA model (image 26) created by businessman Elias St. Elmo Lewis already in 1898 is useful to apply in this situation, as it focusses on converting consumers into buyers (e.g. taking action).
The model describes that awareness or attention is only the first step in converting a consumer into a buyer. Activation of an individual (in this project the passenger) is only reached after the steps of awareness, interest and desire have been covered. The model helps to assess the success of the awareness prototypes, by determining which phase in the model is reached and to see where improvements need to be made.

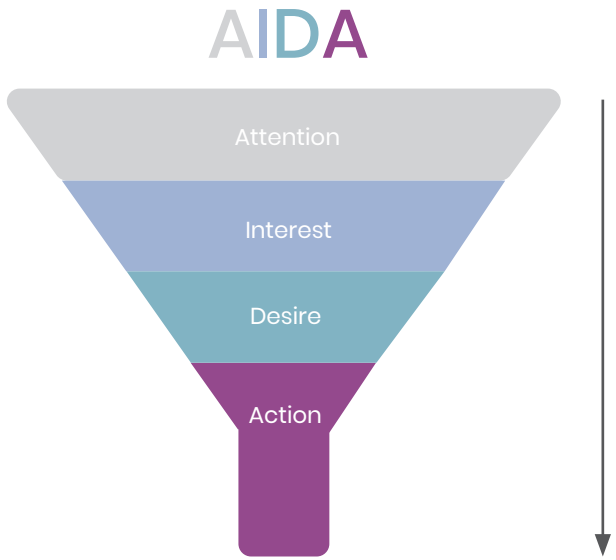


Image 26: AIDA model

Conclusions

- Not only awareness, but also activation of the passengers should be a metric to assess the success of the awareness (and activation) tests.
- A poster or QR code only is not inviting enough to activate passengers: They should immediately get a taste of the experience of the wayfinding concept, to convince them to take action (e.g. scan the QR code).
- Showing the specific commercial services (with pictures) leads to a greater interest and desire among passengers than when communicating the locations as hidden gems. For the wayfinding concept, this will result in the wayfinding strategy to become a quest.
- To create the connection from 'physical' to 'digital', QR codes communicate the affordance of scanning more clearly than NFC allows for: NFC is less intuitive and accessible to use. To make the design as accessible as possible, a QR code is preferred over NFC.
- Providing the passenger insight in available time, walking time, time needed for the activity, routing and guidance are important aspects to make the passengers feel comfortable enough to visit a place that is out of the current 'wayfinding comfort zone.'
- There is much visual competition in the lounges.

4.2.3 Protoyping: wayfinding

Goal
To get first hand experience with locative audio tours, I walked two locative audio tours myself in the city of Delft. The goal was to see what is available and possible in this area, which could serve as inspiration for creating an own tour.

Hypothesis
It is assumed that a locative audio tour is an intuitive (easy to follow) and an entertaining way to find one's way.

Approach
A first hand experience was created by walking the locative audio tour.

Materials
For this, the free ECHOES app was used. The walks 'Tijdreis door Delft' and 'Hidden gems Delft' were walked.

Results

- It was experienced that locative audio tours can serve as an amusing and intuitive wayfinding activity.
- It is nice to find one's way without constantly needing to check the phone for the directions.
- The underlying technology and GPS works very accurately: audio starts playing at the right moment.
- Tours take a different stance towards providing wayfinding instructions. In one type of tour the wayfinding mainly builds on the (visual) map that is shown in the app and it supposes that the users can find their way to the different audio zones (no clear wayfinding instructions). Whereas the other type of tours integrated the wayfinding into the audio (e.g. "turn left at the end of the street").

Conclusions

- Wayfinding is most intuitive if the wayfinding directions are integrated into the audio tour. This way, users can completely immerse in the environment and do not have to be interrupted by looking at their phone for the directions.
- Interactive elements make the audio tour more enjoyable. "Look at one of the passers-by, imagine where they would be heading." or "Search for the fossils in this stone" or "Do you like to play games?"
- Music can have a powerful role in the audio tour, setting the atmosphere of the whole.
- The voice in an audio tour can work calming, but speaking slowly should not be overdone as the chances are that it is ridiculed.

Limitations

It should be noted that these insights are only based on the experiences that I personally had during these two soundwalks, together with another person joining me during each tour. Opinions and experiences can differ per individual.

Also, the situation of following an audio tour through a city can not be translated one on one to an audio tour at an airport. As discussed in chapter 2.5.2 (passenger needs), different factors are at play while traveling via an airport that influence the behavior and perception of passengers.

4.3
Conceptualisation

4.3.1 Ideation to concept

This subchapter describes how the different ideas from the ideation (appendix 13 and 14) and insights from prototyping are brought together to one concept. These aspects were combined into one concept, reflecting the duality of the problem (awareness and wayfinding) (image 27).

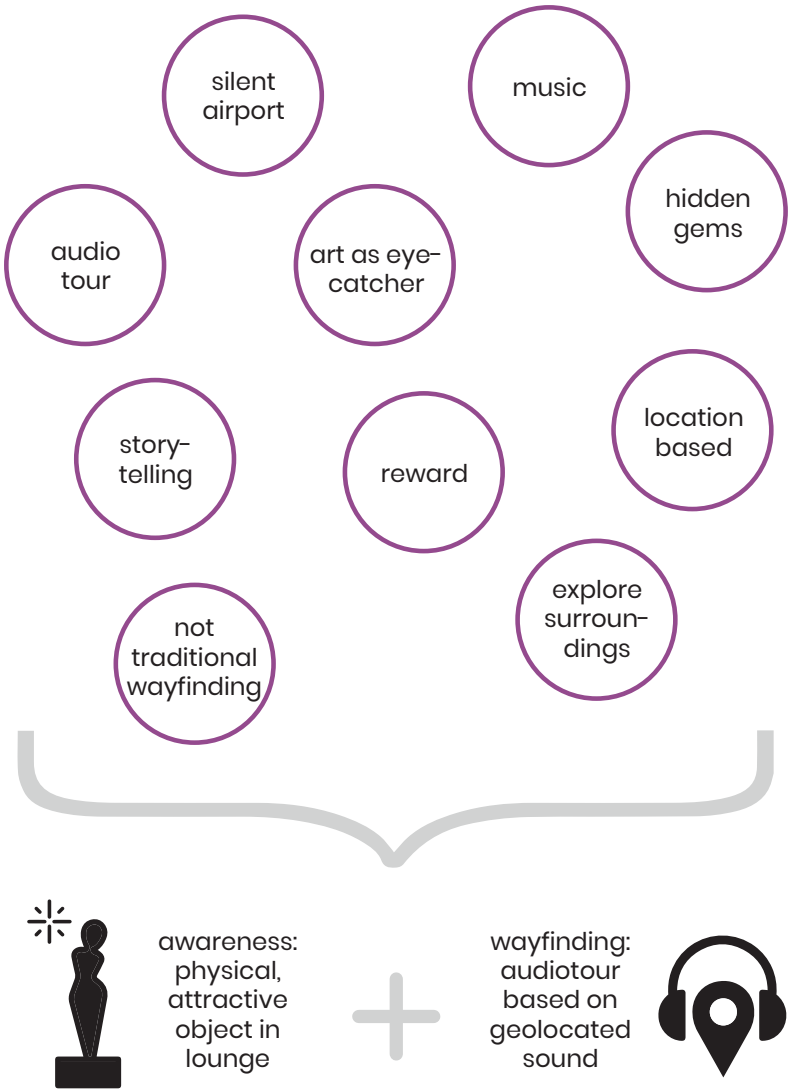


Image 27: Combining ideation aspects into a concept

4.3.2 Conceptualisation

Image 28 gives a visual representation of the concept, which includes raising awareness among passengers in the lounge (left) for the locative audio tour (right).

Awareness

The physical object in the lounge visually shows the different commercial services close by. Each commercial facility is represented by a historical Dutch person (Rijksmuseum: Rembrandt, Nemo: Christaan Huygens, Airport Library: Harry Mulisch). Passengers can scan the QR code to get to the audio tour.

Wayfinding

To not compete with visual stimuli in the lounge (see chapter 2.4.4), audio is used to guide passengers along commercial services at the airport. The locative audio tour expands the passenger's 'recreational territory', pointing out locations they would have otherwise missed since the passengers are unaware of their existence and location. The audio tour not only describes the different commercial services at Schiphol, but also other interesting facts about the airport and must see's, such as artworks.

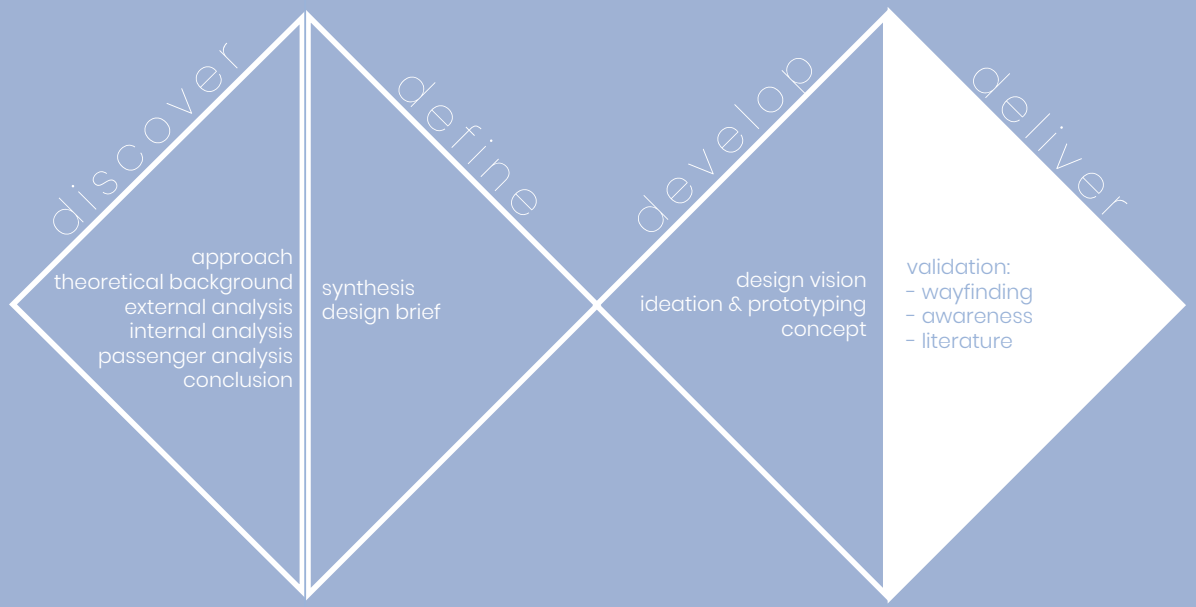
The audio tour is a low effort and low risk manner to introduce (the existence and locations of) the commercial services to the passengers as wayfinding instructions are provided step by step based on the location of the passenger. After the audio tour, passengers have the tools to further explore the airport autonomously.

Although the stress level of passengers is lowest in the lounges, some stress remains from the just completed primary airport processes (e.g. security and passport check) (see chapter 2.5.2). A peaceful voice and music is used to make the audio tour a relaxing experience for the passengers, allowing them to let go of the stress incurred in the primary processes.

The next chapter (deliver, chapter 5) describes the validation of both concepts.

Image 28: Concept for physical object (awareness) and audio tour (wayfinding)

Section 5
DELIVER



5.1 Validation: wayfinding

This chapter describes the prototyping and testing that took place regarding the wayfinding concept.

Wayfinding test - 3rd and 9th of June

Goal

The goal of this test was to get insight in how passengers would experience the audio tour along different hidden gems at Schiphol. It was tested whether (1) the technology works, (2) if people would be able to find their way and (3) how they experience the audio, specifically taking into account the interaction vision (intuitive, guided, explorative).

Hypothesis

#1: Passengers are able to find their way by following the audio tour.
#2: Intuitive: Passengers have to make an effort and need to pay attention to the audio tour to be able to find the way.
#3: Guided: Passengers do not completely trust the audio tour and are afraid that they might get lost.
#4: Explorative: Passengers find the tour very explorative.

Image 29: Start point and first part of the audio tour

Approach

An audio tour has been created which plays audio based on the location of the person walking the audio tour. The tour includes a voice, explaining the passengers what they see and giving them directions to navigate through the airport (see appendix 16 for the specific text), and ambient (piano) music. The tour starts in lounge 2, in the middle of the seating area and passes by different hidden gems in the lounge, finally leading the passenger to the Rijksmuseum (see image 29).

Passengers were asked if they were willing to do the audio tour, which took around 30 minutes. During the tour the passengers were observed and shadowed on 3 meters distance. Afterwards, an evaluation with the passengers was done in the form of an interview, of which the audio was recorded. See appendix 17A for the interview questions used.

Participants

The research was conducted among sixteen departing passengers from lounge 2 at Schiphol. Passengers were selected that seemed not to be busy (e.g. catching their flight, calling on their phone, eating). No selection on age, gender, origin, passenger type (O/D or TRF) or destination was made.

Materials

To create the voice-over, first the route of the audio tour was filmed. The recorded voice-over and music were edited with Adobe applications and used as audio input for Echoes. Echoes is a digital tool to create locative soundwalks. Here, different zones can be indicated on a map, at which specific audio fragments will play if the person is located in this zone (see image 30). The location is determined via GPS. This image is not visible for the passengers during the audio tour.

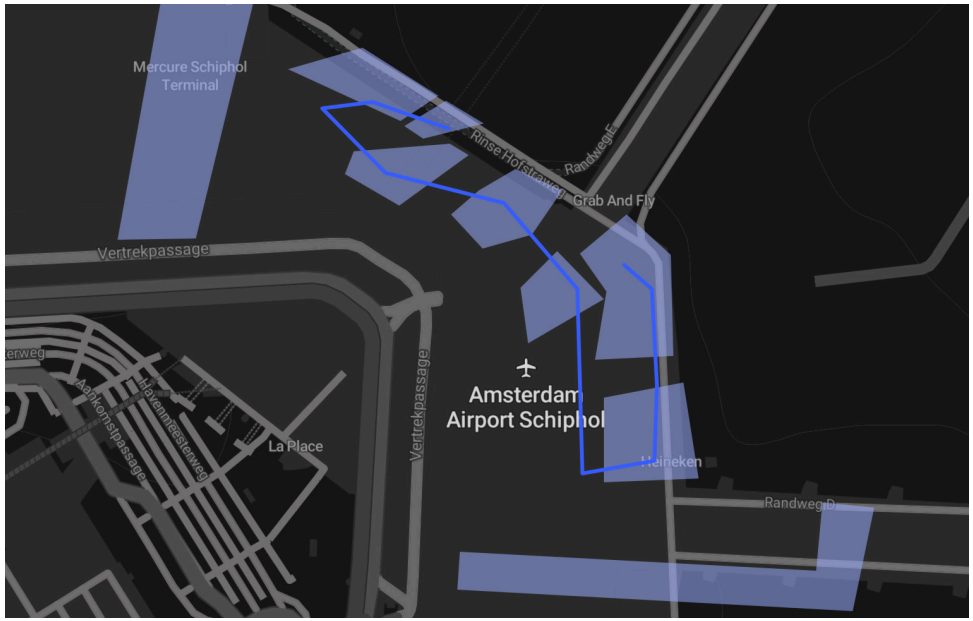


Image 30: Map with different zones for locative audio

In the evaluation afterwards (see appendix 17A for interview questions), a (printed) questionnaire was used for a semi-structured interview. Among others, it was evaluated how passengers experienced the audio tour to assess the interaction vision. For this, a 5-star rating system was used to indicate to which extend the interaction vision was achieved.

Five passengers participated in the audio tour on the first day. Based on the first results, an extra subscription for the Echoes platform has been purchased to improve the accuracy of the audiotour. For the test of the second iteration, again five passengers participated.

Results

This paragraph gives an overview of the results from the observations and interviews afterwards. Appendix 17B includes all quotes from the different passengers and the scores for the interaction vision. The most illustrative quotes for the situations have been selected to give an overview of the results.

Image 31: Passengers during the audio tour (hihi haha artwork and airport library)

First of all, after the tour the passengers were very enthusiastic, specifically about the content of the audio tour and the places that they discovered.

"And it is really nice because it gives you... It broadens your mind because of the little cows and all the different things. That you actually walk by, that you did not notice. So it was really interesting. All the factors and elements to the airport. Going back to the Netherlands: It has a lot of things of its own. That is really nice." (P8)

"That made my day!" (P1)

Technology

This paragraph describes the results regarding the technology. As an iteration on the technology has been made, the two iterations are described separately.

Iteration 1

The locative audio tour is currently based on GPS, which makes the determination of the location less accurate since indoor use of GPS is more difficult and less stable. The zones were set as specific as possible, however in two cases the audio zones did not play and in another case the first and second audio zone played at the same time.

The quotes below illustrate that the timing of the audio tour could be improved. Sometimes, the passengers had too little time to watch an object and the audio tour would already continue. This, in combination with the fact that the location determination via GPS was not accurate, sometimes led to information being provided too early.

"At first I thought it was kind of like a podcast... that would just go. Because when I was here it went so fast and I was like: Oh I just have to keep up with the speed, like a podcast. So I did not know that it was based on location." (P1)

"At the library I was unsure where to go. When you said: In the direction of the toilets, which I knew then. The green textile was mentioned but I could not see it yet. That was a little bit too fast. And with the cows, I also could not yet see them. Maybe say: look up." (P4)

Iteration 2

Based on the above described insights from the first iteration, extra attention has been paid to the timing of the audio. First of all, extra time was added to look at objects. And to make the triggering of the different zones more stable, an extra subscription for the Echoes platform has been purchased to allow for 'conditional playback.' This function enables to create a specific order in which the zones play. For example: Only play zone 2 of zone 1 has finished playing. This allowed to define the zones more accurately which improved the timing of the audio tour.

As there were no other main differences in the experience of the passengers between the two iterations besides the timing, the rest of the results of both iterations are described together.

Wayfinding

The audio tour showed to give passengers a better sense of place, which in its turn improves natural wayfinding. Now that the passengers were guided past the different locations, they had a better idea of the locations that they could visit, what they could expect from the locations and how to get there. They would use the landmarks indicated in the audio tour as reference points.

"I feel more relaxed now! I feel more calm even. Because I think I now know my surroundings better. Because just before that, I was a little overwhelmed because there is so much... And I just did not know where to go or what is the main area... And when it said like: That is the main hall... I was like: Ah yeah, that is the main hall, now I am sure. Because I was always wondering, maybe there is more over there... Or if it is just the gates, or if there is something to see. But now I feel like I can work myself around here." (P1)

"I know where everything is now. Because I walked down the whole airport, I feel more kind of orientated." (P6)

Experience

After the audio tour the passengers were very enthusiastic. They were very pleased to see all different hidden gems during the audio tour.

"I felt really good. It is like entering a different world. Like all of a sudden it is so... You just focus on your surroundings and it is so nice... Because all of those details I would not have noticed to be honest." (P1)

The passengers did not expect an airport to have all of these interesting locations to see and visit. They also think that not every airport is suitable for this type of audio tour.

"It is a much more interesting airport than most airports I think. Newcastle airport for example, that is terrible. There is no heart or anything. It is nothing like an airport worth coming for. A lot of airports are not really worth it." (P6)

"A museum? I'm already in it! This complete airport is a museum!" (P9)

The audio tour exceeded the expectations of the passengers.

"I was very pleased and thankful. It really changed my day. It was 1000% times better than I could expect." (P9)

The audio tour helped the passengers to open up to the surroundings. As the passengers are normally focussed on their phone and not open to the environment, the audio tour helped them to open their eyes again.

"Yeah it was interesting, also kind of eye opening because you realize like how much thoughts are behind things you may just casually walk by, or that you don't see because you are in a rush. Or you want to go from A to B. So I think it is really nice to have a distraction that is not only about being on your phone, but like seeing other things." (P4)

"Normally in an airport, I tend to walk on autopilot. I am busy, for example on my phone and I am not open to the environment, I do not really look or see things. Now it really opened my eyes." (P5)

The passengers indicated that the audio tour made them more relaxed. The voice and the music were very calming. For them, it is very valuable to be able to relax at an airport, a place that is often related to stress (see chapter 2.5.2).

"I felt very relaxed. That is special while being at an airport. It is really nice because of the music and, is it you that is speaking? It is so nice! A very calming voice. You don't even feel that you are in a busy airport, while listening to it." (P8)

The passengers were very happy that they now got familiar with the different locations where they could spend their waiting time. All of them indicated that they would go back to for example the museum and the airport library.

"Yes, time flies by. What time is it now? A quarter to two, at three o'clock I have to be at the gate, so I'm going to look around here. I'll go to the museum, yes, and to the library. I'm going to rummage around again!" (P2)

Passengers were already looking forward to their next stay at Schiphol, to see whether the exhibition of the Rijksmuseum has changed.

"The people of the airport should thank you. Now I have good memories of this airport. For when I come back in 10 days I am already curious whether the paintings in the museum have changed. It really changed my experience here. It is a brilliant idea." (P2.4)

Passengers like to share their experiences with others. They would like to do the audio tour together.

"If I was walking this tour alone, it would not be the same thing. Because if I was alone it would be like: okay, funny, amazing. But the main answers will be okay. But when I will come with you, or with a friend or someone else, I will feel like I am sharing my emotions. So this is the main difference. For me it was much better to go with you, just to be able to share." (P10)

The passengers were very pleased and thankful that they got the opportunity to walk the audio tour.

"No no I don't want any chocolate. You already gave me 10000 chocolates of thank you. Thank you so much that I could have this opportunity!" (P9)

Music

Besides the voice-over calming music was used to add to the experience which worked effectively.

"The music slowed me down. I think it works good to have music to walk slowly and make you appreciate the things around you." (P4)

Based on a recommendation of one of the passengers in the first iteration, for the second iteration music based on the location was used, to add to the immersive experience.

"It would be nice to have more popular music when walking along Heineken. Also when we were walking through the trees, I thought: Oh now it would be funny if you have bird chirping or something." (P4)

Instructions

The passengers found the instructions clear and useful, as it build upon reference points in the environment, on which passengers can orientate themselves.

"It states clearly where you need to go. You can just follow the directions. It is not just saying: turn left, turn right. But you gave clear instructions like: turn left, you will see windows on your left. So it is not like you are going to get lost. But it gives you a clear indication of what is expected. To verify." (P8)

The passengers succeeded to follow the instructions and they all walked the right path. One time in the first iteration, the audio did start too late, but the passenger was able to pick the audio tour up again, without noticing that he missed a turn. As the audio tour uses multiple landmarks to refer to, there is some space for errors to be made by passengers (or GPS) with regards to the wayfinding and routing.

However, the museum is very difficult to find, in the case of natural wayfinding but also with instructions, as passengers find it hard to recognize. In the second iteration, the instructions for finding the museum were made more explicit, giving clear instructions.

"At the museum I did not exactly know where to go. As the location of the museum was not specifically mentioned and it was still hidden." (P5)

Also, some passengers were not aware of the fact that the museum is for free and that they could just enter it. The audio tour should explicitly mention this to reassure the passengers. (this has been adjusted in iteration 2, which solved the issue)

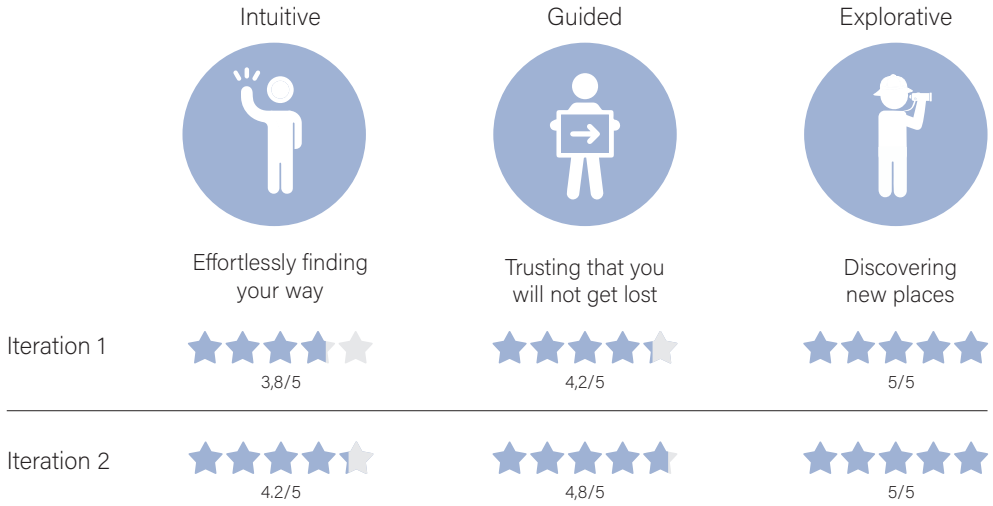
"At first I was kind of nervous if I could enter without paying something or so. So I was a bit nervous to enter the museum. I feel like that is why you are still hesitant because you do not know if you have to pay, because there is no information. Maybe if you say: You can just enter, just walk into the museum: it is free." (P1)

A repeat function would be useful to replay the instructions in the case the passenger missed them, or for example when they forgot the instructions after they have spend time looking at the paintings at the museum.

"Someone was playing the piano so I wanted to listen. But then I was distracted from the audio tour and missed where I needed to go. A playback function would be nice. That you can repeat the instructions if you have missed it." (P5)

"And I walked the wrong way out from the museum. That was only because the audio had stopped, and then I looked around the museum a bit and I had forgotten what the audio had said, about the time I left." (P6)

Interaction vision - Intuitive | Guided | Explorative
To assess whether the audio tour was experienced as intuitive, guided and explorative, the passengers were asked to rate these aspects. The visual below shows the scores for the different aspects for iteration 1 and 2.



It can be seen that for the second iteration, the scores for 'intuitive' and 'guided' improved. 'Explorative' already scored 5 out of 5. However, both iterations have only been tested with five people, so the scores can also vary based on personal differences of the participants. Nevertheless, the second iteration was better evaluated in case of experience (not only in scores) as the timing of the tour was improved.

For the first iteration, it can be seen that 'intuitive' which was translated as 'effortlessly finding your way' was rated lowest with 3,8/5 stars. Passengers indicated that improvements for this aspect could be made regarding the timing of the instructions. Now, sometimes instructions were given for locations that were not already in direct sight, which required them to search for the hidden locations more deliberately. The instructions specifically for the museum could be improved by more clearly stating where the museum is located, as it is difficult to recognize. In the second iteration, close attention has been paid to these items. 'Intuitive' scored 4,2/5 stars for the second iteration.

The passenger that said the following quote, mentioned the word 'intuitive' by herself.

"Very easy, it was very intuitive to find my way. It was clearly stating where to go, very intuitive." (P9)

'Guided' which is translated as 'trusting that you will not get lost' was rated with 4,2/5 stars for the first iteration. Main improvements should be made in the timing of the audio tour to make passengers feel more guided. Passengers were sometimes afraid that they would fall behind on the audio. One passenger asked herself whether the audio would know where she is at that moment. Therefore, it is important to let the passengers experience that the audio is really based on their location and thus can guide them. For the second iteration the timing has been adjusted, which resulted in no passengers mentioning a hasty feeling or the fear of getting lost. The second iteration scored 4,8/5 stars for 'guided.'

"I did not think about getting lost. I was completely in the moment so did not think about it at all." (P9)

'Explorative' which is described as 'discovering new places' was rated with 5/5 in both iterations (unanimous), as passengers were very surprised by all different locations that were pointed out to them and which they did not expect to be located at an airport.

"So amazing! It opened the doors of perception. Which were closed for some reason. I'm not blind but I did not see all those things like omg!" (P9)

Conclusions

Intuitive: The audio tour improves passenger's sense of place and orientation, which enhances natural wayfinding. This is beneficial for both commercial and functional wayfinding. Passengers are enabled to revisit the locations if they want to.

Guided: It is important that passengers know and experience that the audio tour is based on their location, and thus that the pace adjusts to their walking speed. This is important because the passenger should not feel hurried or pressed to make it on time to the next location that is described on the audio tour. This would prevent the passengers from being afraid that they might get lost if they will not make it on time. The timing of the audio tour can easily be adjusted, so that passengers will have more time to look at the different objects.

Explorative: Passengers are happy to be guided to places that are difficult to find by natural wayfinding (for example Modern Dutch World and Rijksmuseum). Normally, they would have missed those places.

Relax: Passengers find the audio tour relaxing. The audio tour allows them to escape the busy atmosphere of the airport (see chapter 2.5.2).

Landmarks: Recognizable reference points in the environment are very important. They work as a check point and confirmation that the passenger is in the right place. It was observed that people really responded when they find the reference point (pointing, nodding, looking at me, smiling).

Experience: The audio tour exceeded passengers expectations. When combining this fact with the challenge of raising awareness for the audio tour, the importance of giving the passengers a 'taster' of the audio tour is again emphasized. Passengers should be able to get a first experience of the audio tour, before having to take a real action (scanning a QR code).

Technology: For the final design, location determination for the audio tour and audio zones would be based on beacons, which are more accurate for location determination than indoor GPS.

Additional considerations
Here, conclusions that are important to take into account for future reference are described. These conclusions will not be taken into account the remainder of this project, except for the recommendations of the final design.

- It was experienced that passengers often have quite some hand luggage with them. This would hinder them from doing the audio tour. During this test, I used a baggage trolley to put all luggage on and I also drove the cart for them. To make the audio tour accessible, there should be enough trolleys available at a location close to the starting point.

- If passengers have limited time, they should be able to choose what they most want to see first and go there directly (without a detour). There should also be options for a short tour (or a tour that only leads to one specific end location) / medium tour / extended tour (with extra information on the different hidden gems).

- If passengers are doing the tour with others, it would be interesting to have time in between to talk with each other. There could be a version that has less explanation, or the audio tour should be easy to pause. Synchronized listening could enhance the experience of doing the audio tour together.

- There should be a repeat function for the wayfinding instructions.

- If the museum shop is closed, the route and instructions of the audio tour should be adjusted. This could be done by creating two audio tours, of which the applicable one is available, based on the opening/closing times of the museum shop.

- The places that are difficult to find (Modern Dutch World and Rijksmuseum) could be made more easy to intuitively find in the first instance. On the other hand, this now makes for a fun discovery experience for passengers.

Limitations
There are some limitations to this research.
As a session with a passenger took around one hour, the research was executed with only ten passengers (five per iteration). This makes the results less reliable. However, the results were quite consistent over the different passengers therefore making the results plausible.

Another important limitation, which mainly impacts the aspect 'guided' was the fact that I as a researcher was walking behind the passengers. This might have impacted the experience of the passengers, as they knew that someone was watching their back (literally).

To get more reliable results, the audio tour should be tested with more participants. Another set up of the research could be considered, with only an evaluation at the end and no observations during the tour, in order to not disturb the assessment of the interaction vision 'guided.'

5.2
Validation: awareness

Image 32: Rembrandt statue for awareness test

5.2 Validation: awareness

Awareness & activation test #4 - 23rd - 25th of June

Goal

The goal of this test was to see whether awareness could be raised for the audio tour by placing a statue of Rembrandt in the lounge. It was attempted to get insight into how passengers behave during their waiting time and how and when awareness for the audio tour could be raised. The ultimate goal was to get passengers to scan the QR code on the sign standing next to the statue so that they would start the audio tour.

Hypothesis

The results of the third awareness test (appendix 15) were used as a reference to set the goals and hypothesis of this test. It is assumed that the awareness (10% of visitors) and the call to action (2% of visitors) of this intervention is (at least) the same as or higher than that test.

Approach

The test took place on three days: Wednesday 23rd of June 12.30-16.30, Thursday 24th of June 8.00-16.30 and Friday 8.00-12.30. The Rembrandt statue was placed in the middle of the seating area of lounge 2, a place where many passengers spend their waiting time, which is also the starting point for the audio tour (see image 33). The pink circle on the image indicates the area in which the statue can attract the attention of passengers.

Observations were done from within the seating area of lounge 2. Passengers were not aware of the fact that they were observed, so their behavior was not influenced by it. For privacy and ethical reasons, no sensitive information was noted, only numbers were tallied if interaction with the statue was observed.

Passengers who sat in the seating area for more than half an hour and who did not interact with the statue were interviewed. Passengers who did take action were only interviewed after completing the audio tour. The aim was to gain insight into how passengers notice, observe and experience the statue, and mainly why they (don't) take action to scan the QR code.

As an extra part of the test, thirty flyers were distributed, asking the question: "Can I give you some information about activities you can do during your waiting time?" It was observed what the effect of this intervention was.

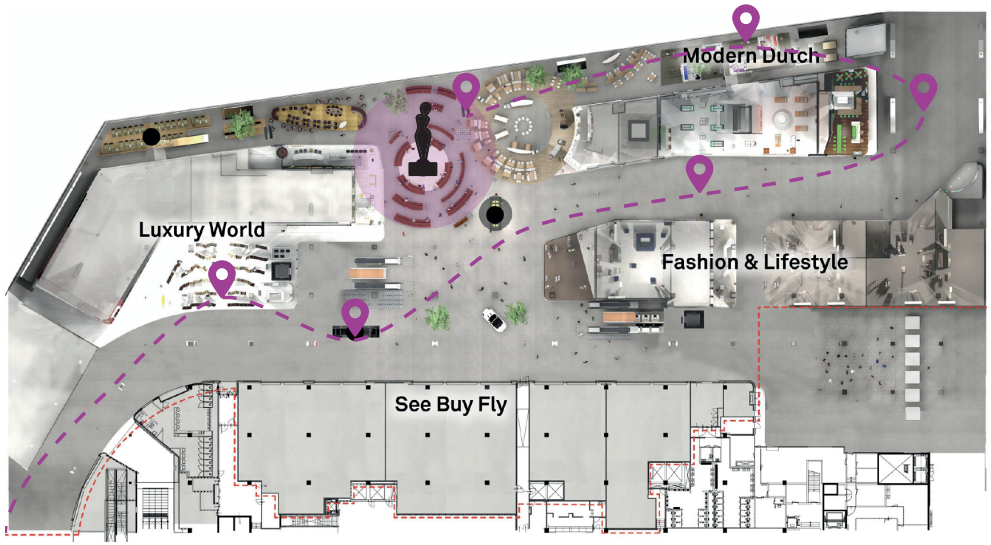


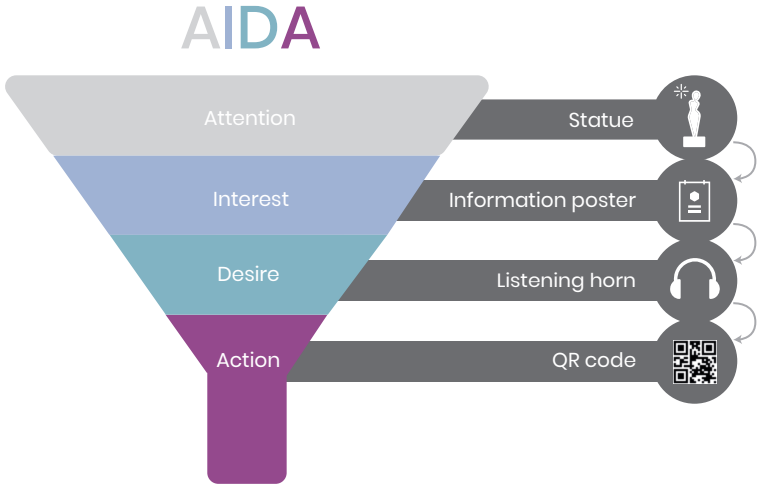
Image 33: Location and reach of statue in lounge

Participants

No selection in participants was made. All passengers in the seating area of lounge 2 were observed. For the interviews, no selection on age, gender, origin, passenger type (O/D or TRF) or destination was made.

Materials

To ensure that the awareness among passengers of the statue was converted into action (scanning the QR code), the AIDA model was again applied.



With this model, the different insights of the awareness tests, together with relevant insights from the wayfinding tests for raising awareness for the audio tour are brought together. Each 'level' of the AIDA model is covered by an element of the awareness concept. Below, each aspect is described.

Attention: Statue
The statue serves as an eye catcher in the lounge (image 32). The Rembrandt statue was created by artist Roy Greve who made his statue available for this test. The icon Rembrandt is a reference to the Dutch history and culture, but also to the Rijksmuseum, the location where the audio tour ends.

As there is a lot happening in the lounge (visually) the statue should be able to compete and attract the attention from passengers. The statue itself is more than one meter high and when placed on the pedestal, it is more than two meters high. The facial expression of the statue is expressive.

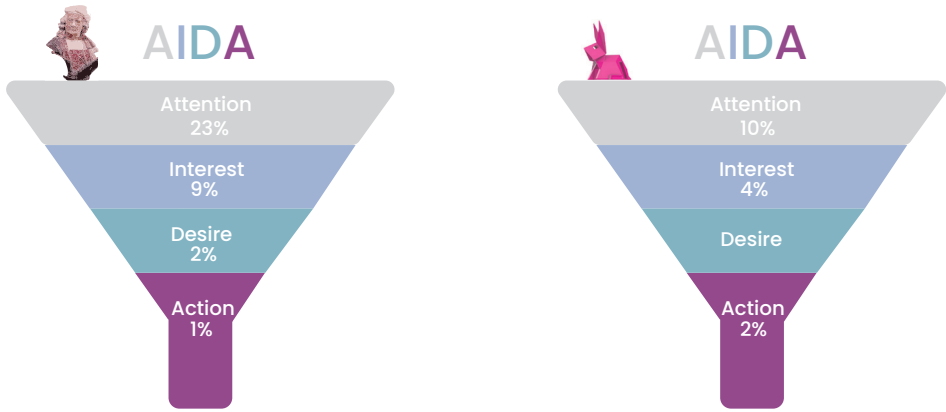
Interest: Information poster
After awareness of the passenger is raised by the statue, the information poster on the sign should arouse interest. It informs passengers that there is an audio tour which they can follow during their waiting time at the airport. Insights from previous awareness tests (chapter 4.3) gave guidelines to design the layout of the poster. It includes both visual and textual information and it is tried to keep the overall design as calm as possible.

Desire: Listening horn
The wayfinding test (chapter 5.1) gave the insight that the audio tour exceeds the expectations of passengers. Therefore it is important that passengers can be given a teaser of the audio tour in a low-key manner. The listening horn facilitates this by playing a preview of the audio tour and recommending the passengers to scan the QR code.
Extra desire is created by stating quotes from other passengers, who were very enthusiastic about the audio tour.

Action: QR code
All steps above should facilitate the scanning of the QR code so that passengers are able to do the audio tour, which is the main goal of this concept.

Results
Awareness to activation
The goal of this test was to reach awareness for the audio tour. It was aimed to reach at least the same level of awareness and call to action as the third awareness test (chapter 4.3) (10% awareness and 2% activation). The percentages indicate the number of passengers interacting with the object compared to all passengers in the seating area of the lounge.

Comparison with third awareness test (see appendix 15)
The goal for awareness with the Rembrandt statue was reached (23%) but the activation was lower (1%). (See appendix 18 for the specific numbers of the observations.)



This difference might be explained by the fact that the visitors in Delft suffer less from information overload (see chapter 2.2.3) than passengers at Schiphol: the market in Delft has free sight lines and the rabbit sculpture is the main object for attention. In the lounges of Schiphol, a lot more is happening visually. Also, passengers are often in a state of stress at an airport (see chapter 2.5.2: Passenger needs) which strengthens the susceptibility for information overload. One passenger mentioned:

"When I arrived here, it was way busier, so there is much happening, therefore I missed the sign."

It can be expected that after the COVID pandemic, it is getting more busy at the airport again, increasing the chance of information overload. Lastly, passengers at an airport have the primary focus on their travel, whereas visitors of Delft might have the primary goal of exploring the city.

Image 34: Passengers interacting with the intervention

Limited receptivity among passengers
It was observed that passengers are not in an active mood during the waiting time. They are mainly focussed on their mobile phone. The majority of the passengers did notice the statue, however many did only unconsciously. And even less noticed the sign that was standing in front of the statue (which included the call to action). The passengers that were personally asked about their perception of the statue and sign did not consciously notice it. Half of them did scan the QR code and follow the audio tour after asking them about their perceptions. This quote exemplifies the situation:

"I did not really look at it. I did see 'free audio tour' but not consciously. However, it sounds good and I am bored. So: I will just do the tour now!" (P2)

Effect of flyers
Passengers are more open to receive a flyer than to start a conversation out of the blue. They are happy to take the flyer when they hear about entertainment during the waiting time, so passengers find this welcome information. However, effectiveness is lower (10%) than with a personal conversation (50%). The language barrier seems to be lower when giving a flyer, but the question is whether the message on the flyer is understood.

A total of 35 passengers have been asked to ensure 30 flyers were distributed, as five passengers did not accept the flyer. Reasons for passengers not taking the flyer were that they had a too little time before their flight would leave or that they had other things to do (e.g. work).

Desire: Listening horn
The listening horn communicated the affordance of listening to audio to the passengers. 2% of the passengers in the seating area listened to the listening horn. The majority of passengers that listened to the listening horn were children (23/33). Which might be because children are more active and explorative than adults. Many of them kept returning to the listening horn and tried to convince their parents to listen too. This resulted in more awareness for the audio tour among parents.
Since it is still the COVID pandemic, it is possible that passengers are extra cautious to take the listening horn because of hygiene reasons.

Person place cues
The effect of person place cues (see chapter 2.2.3: Influential factors) was mainly observed among children (see image 34). If children saw other passengers listening to the listening horn, they also wanted to listen to it. This effect was minimal for adult passengers.

Wayfinding
All passengers were able to find their way: No (real) difficulty with wayfinding was encountered. The results are comparable with previous wayfinding test.

All passengers that did the audio tour came back to tell me how the audio tour was. They were very enthusiastic and thankful and they liked to share their experiences with me.

Conclusions

Information overload: There is a lot of visual competition in lounge 2 at Schiphol. This results in a state of information overload under passengers (see chapter 2.2.3), making them less susceptible for unexpected incentives (which a statue and audio tour are in the context of an airport). This highlights the importance of looking into options to create awareness for the audio tour in another way than in the physical context of the lounge.

Awareness: It can be concluded that the statue provides good awareness. However, awareness of the statue did not result in awareness for the sign and QR code (thus no awareness for the audio tour). To convey this awareness to the sign and ensure a call to action (scan QR code) both objects should be more strongly linked or even be integrated into a whole.

Activation: Although the statue was noticed, passengers were not seduced to have a closer look at it, which explains why the sign was often not noticed. It was observed that passengers were still more interested in their phone than the statue.
This result also gives extra substantiation for the fact that passengers can effectively be reached via their mobile phone, avoiding extra visual competition in the lounge.

Personal: Passengers like to have personal contact as traveling via an airport is often an anonymous and mass process. Passengers experience it as a special occasion if someone has time for them: More activation was reached when approaching passengers personally than when distributing flyers or placing the Rembrandt statue in the lounge. A few times, passengers asked what my name is, illustrating the need for personal contact.
Also personal recommendations work well. Passengers like to hear from others what is fun to do. Children work as a good promoter of the audio tour for their parents.

Favorites: It can be concluded that among passengers, the museum is preferred as 'must see' and the Airport Library is preferred as location to return to and spend more time (chill, relax).

Downloading: For this prototype, passengers needed to download the ECHOES app to be able to listen to the audio tour. It was expected that this would be an extra threshold and passengers would give up. However, this was not the case. All passengers that scanned the QR code had no problem with downloading the app.

Limitations

This test was only executed for a short time (three days). Quantitative research was only done for one day. In the evening the statue did not stay in the lounge so only data from daytime is retrieved.

The plugs located in the seating of the seating area to charge mobile devices were not working during all three days of the test. Many passengers tried different plugs and when they found out they were not working, they moved to another place where the plugs were working. Therefore, less passengers spent a long waiting time in the seating area, whereas they normally would.

For the attentive readers, it could be noted on the pictures that the Maarten Baas clock was not working at the time of the test (due to interference). This may have had a negative impact, as it made passengers even less focused on their surroundings and less receptive.

The AIDA model strictly distinguishes the different steps from awareness to activation. Nevertheless, in practice these phases of the model will be more blurred. One passenger's attention might be grabbed by the statue, while the other's attention might be drawn by the QR code.

5.3
Validation: wayfinding literature

5.3 Validation: wayfinding literature

In chapter 2.2, the theoretical background of information & wayfinding principles for this thesis was given. This chapter validates how this wayfinding literature substantiates the wayfinding concept developed in this thesis.

Three types of wayfinding tasks (commute, quest, explore) are supported by different wayfinding strategies (repetition of locomotion, piloting, navigation by cognitive map and path integration) (Allen, 1999).

The locative audio tour uses piloting strategies to guide passengers around the airport. The voice in the audio tour gives information and wayfinding instructions to the passengers, based on their current location. Landmarks are used as reference points in the surrounding, on which the wayfinding and navigation is based (e.g. 'walk towards the window' or 'walk under the trees'). In both the audio tour and piloting strategies, the focus is always on finding the next landmark in the sequence. Piloting is used in familiar and new surroundings.

The audio tour is a mix of the wayfinding tasks *quest* and *explore* (see image 35): passengers might be navigating to known destinations with an unknown location (quest) (e.g. a passenger knowing that the audio tour will bring him to the museum). But at the same time, passengers are exploring new locations at the airport which they did not visit before, without knowing the exact destination (explore). Since passengers do not autonomously explore the airport, the wayfinding task can be referred to as a 'guided explore' task.

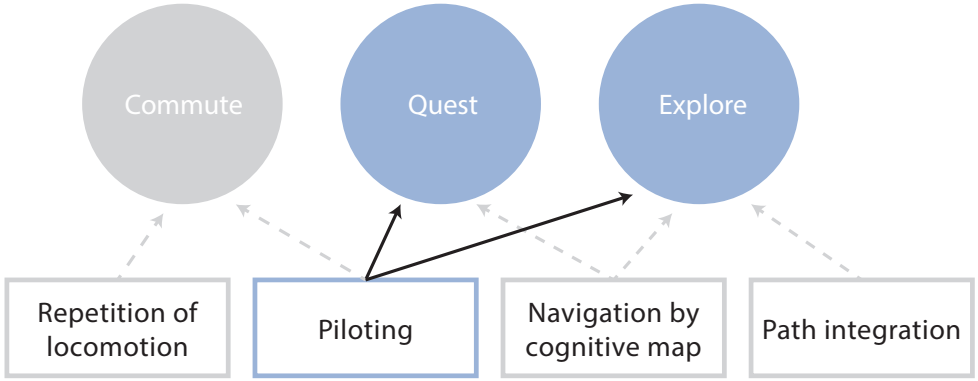


Image 35: Wayfinding tasks and strategy used in audio tour. Adapted from: Allen, 1999

The audio tour strongly builds on following a specific route. Nevertheless, since it is based on the location of the passenger, this allows for some more flexibility as instructions are only provided about the current location.

Route strategies focus on the next step, which is in this case finding the next landmark that is referred to in the audio tour. People unfamiliar with the environment tend to use route-based information and landmarks (Ishikawa & Montello, 2006). Once people get more familiar with the environment they shift towards survey-based strategies (Haq & Zimring, 2003).

This substantiates why route-based information combined with piloting strategies are a powerful method to support passengers in exploring new areas of the airport. After the audio tour, passengers demonstrated their ability to apply a survey-based strategy and find their way without following a route. In doing so, they mainly navigated on the basis of the landmarks (the hidden gems referred to in the audio tour).

According to O'Neill and Jasper (1992), shopping patterns are initially restricted to areas on which information is available to the consumer. As they explore the environment, their 'shopping territory' expands. Thus, the audio tour helps to widen the area in which passengers feel comfortable to navigate in and therefore their shopping territory is expanded.

Image 36 shows the vision of Schiphol on enabling passengers to intuitively find their way. The locative audio tour created in this project contributes to intuitive wayfinding in two ways: First of all, it taps into the natural wayfinding process by relating the wayfinding instructions to the design of the airport (e.g. landmarks). Secondly, the audio tour gives relevant personal information based on the passengers location. Combined with the clearly formulated instructions, the audio tour enables intuitive (recreational) wayfinding for passengers.

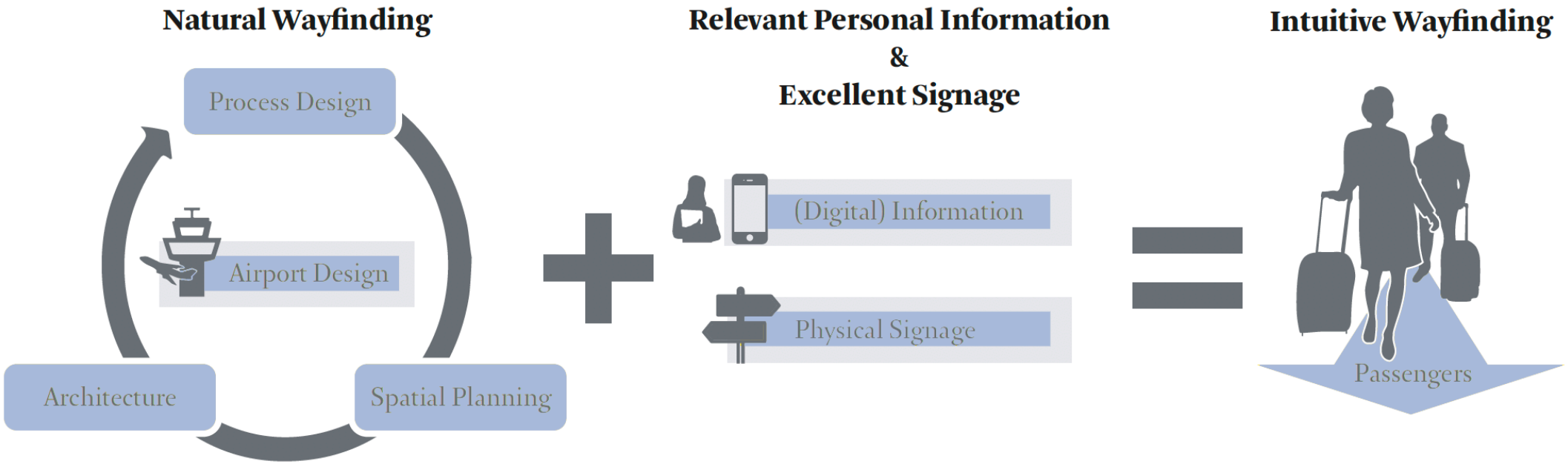
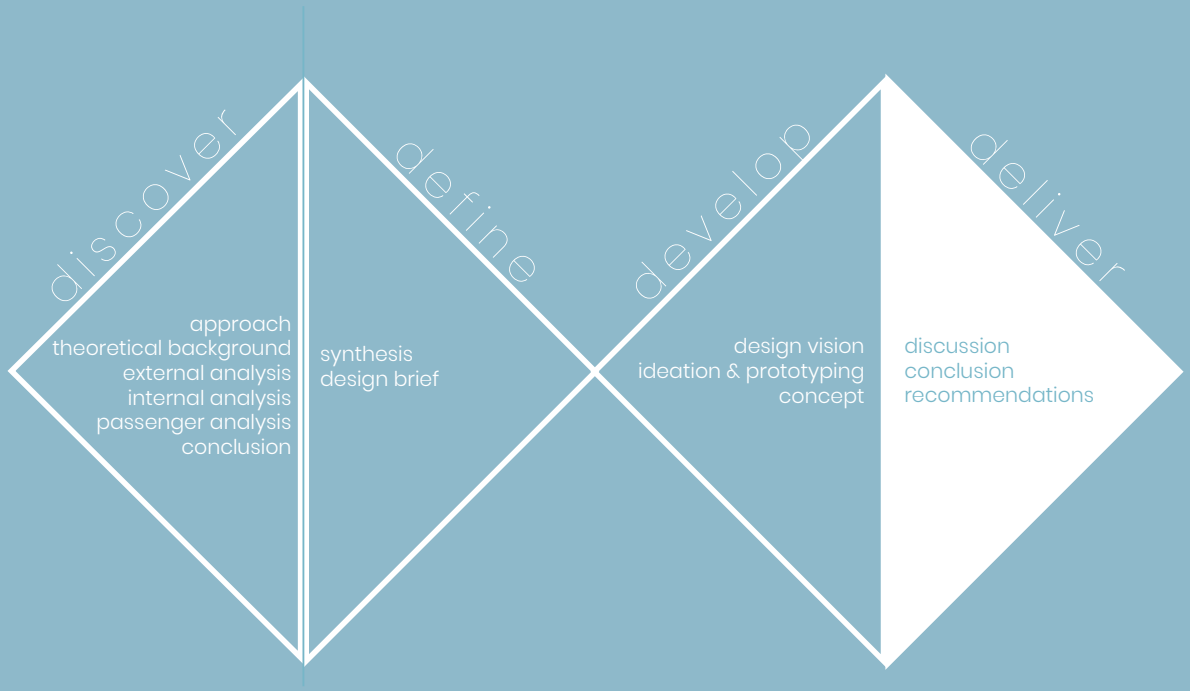


Image 36: Intuitive wayfinding vision of Schiphol Group (Informatie en Wayfinding: visie en implementatie strategie, 2016)

Section 6

DISCUSSION, CONCLUSIONS & RECOMMENDATIONS



6.1 Discussion

6.1 Discussion

The goal of this project was to improve the commercial wayfinding for departing passengers at Schiphol. This chapter discusses the added value but also the limitations of this research.

Methods

Both primary and secondary research was done for this project. In chapter 2.1 (Approach) the specific methods that were used are described. This chapter looks at the implications of applying primary and secondary research on a higher level. For the a more detailed description of the limitations for each of the methods, the individual researches in this thesis can be consulted (chapter 2, 4 and 5).

This project started with secondary research on wayfinding processes and commercial wayfinding (behavior). As basic principles apply to human wayfinding regardless of the situation and context, this was a valuable way to get familiar with the topic of wayfinding. However, a disadvantage of literature research is that the context of interest is never one on one comparable with the context of the earlier performed research. As described in chapter 2.2.3 (Influential factors), different factors are at play while traveling via an airport that influence the wayfinding behavior and ability of passengers. By combining both wayfinding literature and literature relevant for Schiphol (from Customer Insights) it was attempted to create a complete and consistent theoretical background for this thesis. Nevertheless, it should be mentioned that literature and models will (probably) never be able to fully foresee individual's (unpredictable) behavior.

This highlights the importance of primary research. To get more insight in the needs and behavior of passengers at Schiphol, first hand research was executed. Data retrieved from this research is highly relevant for both the context of Schiphol and this assignment. A disadvantage of executing primary research on small scale is that the retrieved data is based on a limited participant sample, where individual differences can have a great impact on the project. Although this remains a characteristic of qualitative research, it was attempted to create reliable and representative results by selecting an as varied group of participants as possible.

All in all, the combination of both primary and secondary research is what makes this research relevant and representative for passengers at Schiphol.

Value for Schiphol

Firstly, passengers do not expect to find such a wide variety of commercial services at an airport as Schiphol currently offers (e.g. museum, library, spa). However, it is expected that in the upcoming years airports worldwide will have more focus on giving passengers a unique experience during their waiting time. Therefore in a few years time passengers might be more open and used to these kind of experiences. Schiphol has the chance to be one of the first to really tap into making the waiting time 'an experience' for passengers. This way, Schiphol can distinguish itself from other airports, strengthening its position in the aviation industry. This research supports Schiphol in making the transition from the airport only being a place for transit to a place to reside (pleasantly).

This research sheds light on a a type of (commercial) recreational wayfinding that is new to airports. Audio tours have been used more than once to lead people through familiar and unfamiliar areas, such as cities and museums. However, audio tours have not been used to guide passengers through airports (as far as is known).

Currently, landmarks are not part of Schiphol's wayfinding vision for intuitive wayfinding (see image 35). Landmarks are also scarcely used in the current wayfinding system of Schiphol (see appendix 19).
However, this research emphasizes the importance and power of landmarks in improving passenger's wayfinding ability at the airport. Both the created audio tour and the benchmark study (appendix 2) provide examples of how landmarks can effectively be integrated in wayfinding solutions.
As landmarks are important to enable intuitive wayfinding for passengers, I advocate for giving landmarks a more prominent place in the wayfinding vision of Schiphol, with the goal to ensure the value of landmarks more broadly within Schiphol.
As landmarks are part of the airport design, they fall under the heading of 'natural wayfinding' (the wayfinding that remains when a building is stripped from all its signage and other wayfinding solutions): Besides process design, spatial planning and architecture, landmarks should be included in the vision for natural wayfinding (see image 35).

Finally, the benchmark study acknowledges that other locations experience the same struggle in combining both operational processes and commercial processes, which is also the case at Schiphol. In the majority of those cases, the operational processes get priority over commercial processes. When balancing all different stakeholder's interests, it should be highlighted not to lose track of the needs and wishes of the end user (in this case the passenger). This research mainly advocated for the interest of the passenger regarding the issue of commercial wayfinding.

Value for wayfinding practice and literature

This research builds upon existing wayfinding literature, but it also brings new relevant insights to the academic world of wayfinding and information.

In wayfinding literature described by Allen (1999), the wayfinding tasks 'quest' and 'explore' are seen as two separate, non-overlapping tasks. However, the audio tour created in this project does combine both wayfinding tasks, as passengers visit known destinations with an unknown location (quest), but also visit unknown destinations with an unknown location (explore). This shows that wayfinding tasks can be integrated, resulting in a 'guided explore' wayfinding task.

This research adopts the model of passenger psychological profiles created by Schiphol (see image 37). This model explains how passengers search for information and how they handle stress during their stay at the airport. This research adds to the model as it proposes how (in line with the psychological profiles) (wayfinding) information should be provided to the passenger (e.g. on site or at home and digital or physical). Schiphol and other airports are the 'senders' of information to passengers (the 'receivers'). For the senders it is useful to know how they can best target the receivers of their messages.

Finally, locative audio tours or 'audio augmented reality' is quite new to the discipline of wayfinding. Together with augmented reality for wayfinding (see appendix 12) locative audio is an emerging technology which might change the wayfinding processes and experiences of individuals (at airports) drastically. These technologies have the power to provide personal relevant information targeted at the individual passenger, possibly making all other wayfinding information redundant. This thesis adds research on this novel technique, in the form of a case study.

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Limitations of research

Commercial wayfinding entails the process of finding the range of commercial facilities (shops, food and beverages and services) at an airport. This thesis solely focusses on improving the wayfinding for the commercial services; it was decided not to include food and beverages facilities and shops in the wayfinding concept. This was done because it was observed and also indicated by Schiphol that passengers have less difficulty to find these locations at the airport, decreasing the urgency of improving the wayfinding to the shops and food and beverage locations. Nevertheless, it is likely that the audio tour has a positive impact on the (commercial) wayfinding of passengers in general.

This project mainly focusses on providing passengers with a longer waiting time (more than 1,5 hours) a valuable stay. However, it is also important to provide passengers with a short waiting time a pleasant time. For short waiting times, passengers are more interested in getting something to drink or eat. Supporting the needs of these passengers was outside the scope of this research.

In this project it was attempted to create awareness for the audio tour, which showed to be difficult because of the overload of stimuli passengers have to deal with in the lounges of the airport. To make sure the audio tour, which showed to be valuable for passengers and therefore also for the commercial services, is brought under the attention of the passengers, more research needs to be done on how to best reach the passenger. Recommendations on this topic are done in the next subchapter.

This research has been conducted during the COVID pandemic. Passenger numbers were low and passengers might have shown different behavior than they normally would show: Some passengers mentioned that they were overwhelmed by the organization around the flight and getting tested. Passengers also indicated that they did not expect many facilities to be open. This could result in commercial facilities to be found even less and passengers to be more inactive and less explorative.

6.2
Conclusion & recommendations

6.2.1 Conclusion

This thesis has the goal to improve the commercial wayfinding at Schiphol. Commercial wayfinding entails tertiary wayfinding activities, which are not related to the travel process (shopping, eating/drinking, relaxing), whereas functional wayfinding gives information about passenger activities related to the airport process.

Individuals can find satisfaction and enjoyment from the (commercial) wayfinding activity itself, which is referred to as recreational wayfinding (Fewings, 2001). This thesis explores how recreational wayfinding can enhance the passenger's experience during their waiting time at the airport:

Passengers at Schiphol seek pastime to fill their waiting time before their flight departs. They are looking for activities to do in the lounges, but mostly visit the known locations such as shops and restaurants (*current territory*). Many passengers just visit the shops only to have something to do and to counteract the boredom, without the intention to buy anything.

However, Schiphol has many other (free) services to offer, which most of the passengers are not aware of (hidden gems). The existence of the commercial services (e.g. Rijksmuseum, Airport Library, Nemo, spa) surprises the passengers and they would like to be notified about their existence and location, so that they can visit them (*territory to discover*).

Currently, the commercial services are not intuitively found, as passengers do not know that they exist. But even when actually searching for the services, the current wayfinding does not suffice and does not easily guide the passenger to the services. The digital wayfinding solutions are user unfriendly, as not all facilities are included, routeplanning is not possible and filtering options are limited.

To solve this two-pronged problem, an integrated concept for wayfinding and awareness has been developed. A locative audio tour which leads the passengers along hidden gems in lounge 2 has been developed. Passengers experienced the audio tour as calming, explorative and eye opening. To raise awareness among passengers about this audio tour, a concept for awareness was created and tested.

How does the audio tour improve the commercial wayfinding ability of passengers?

By leading the passengers along the different commercial services at Schiphol, both awareness of and wayfinding to the locations is improved.

- *Improving awareness of the commercial services:*
  The audio tour points out the function and location of the commercial services to the passengers, which they were unaware of before (low effort).

- *Improving the wayfinding to the commercial services:*
  As the audio tour provides detailed routing instructions based on reference points in the environment, a safe situation to explore the unknown areas of the airport is created and the chance to get lost is minimized (low risk).

- *Supporting the passenger to explore the airport autonomously:*
  By providing a step-by-step instruction based on landmarks in the environment, passengers create a cognitive map of the airport. Based on this map including the landmarks pointed out in the audio tour, passengers are given the tools to find their way through the airport autonomously. This way, passengers are encouraged to explore the airport and to return to the commercial services of their preference. This improves the quality of their waiting time also after the audio tour has finished.

- *Making passengers feel more relaxed:*
  Many passengers experience traveling via an airport to be stressful, especially the passport and security checks (see chapter 2.5.2 Passenger needs). The calm voice and music of the audio tour enables passengers to release the stress that is still present from the operational processes that they went through before arriving in the lounge.

The infographic on the next page gives a visual summary.

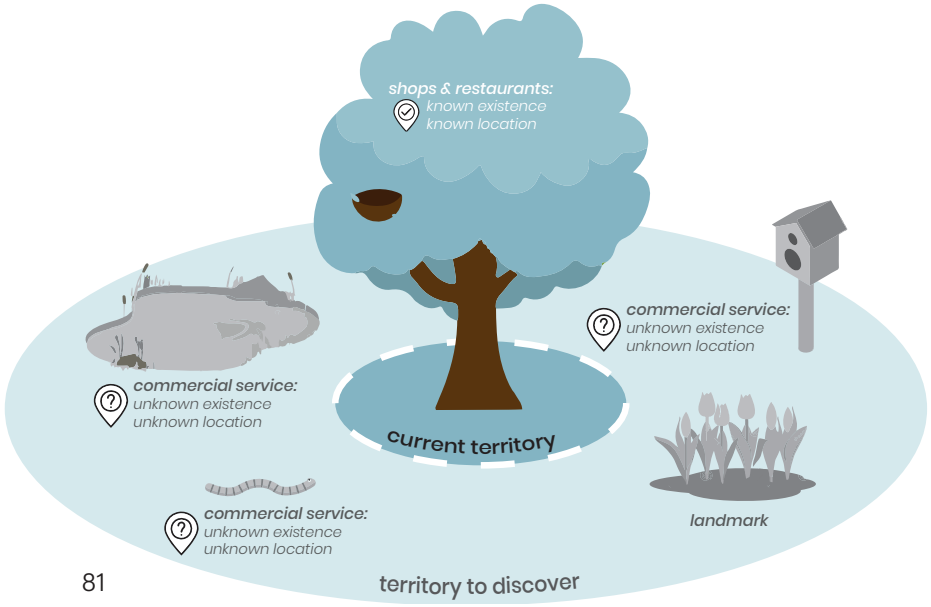
Airport Audio Tour

supporting passengers to explore the surroundings of the airport autonomously

Problem: **The commercial services at Schiphol are poorly found by passengers**

Which results in passengers mainly visiting **known places** (e.g. shops and restaurants).

While Schiphol has many **other facilities** to offer that tap into the **needs of passengers** during their waiting time, which the passengers are currently **unaware** of. (Airport Library, Rijksmuseum, NEMO, Baby Care Lounge)



Solution: **The audio tour expands passenger's recreational territory at Schiphol**

The audio tour improves:

the awareness of the commercial services
by taking the passengers by the hand, pointing out the *existence* of the commercial services
"I'll go to the museum, yes, and to the library. I'm going to rummage around again!" (P2)

the wayfinding ability of passengers
by introducing the *location* of the commercial services and relevant landmarks
"I know where everything is now. Because I walked down the whole airport, I feel more kind of orientated." (P6)

the quality of the waiting time at the airport
by providing a recreational wayfinding activity
"I think it is really nice to have a distraction that is not only about being on your phone, but like seeing other things." (P4)

making passengers feel more relaxed
"I feel more relaxed now! I feel more calm even. Because I think I now know my surroundings better. Because just before that, I was a little overwhelmed because there is so much..." (P1)

Why audio?

There is a lot of **visual competition** in the lounges of the airport (advertisement, other passengers, primairy wayfinding information). It has been decided to not compete with these visual stimuli and to stimulate the passenger via **other senses**. Touch, smell and taste were considered **less practical** to provide wayfinding information, compared with audio. Providing wayfinding instructions via audio has been considered valuable, **highlighting aspects** of the airport in an innovative way (for example by ambient sound).

Lastly, a recap on the design brief is done to evaluate the project:

"Design a personal and location-based wayfinding concept that leads passengers in their waiting time to the commercial services of their preference at Schiphol."

Target audience
Departing passengers (O/D and TRF) that have a waiting time longer than 1,5 hours.

Objectives
Objective 1:
Through **cues** in the environment, the passenger should be made aware of the commercial services.

Objective 2:
The cues in the environment should **connect** the 'physical Schiphol' to the 'digital Schiphol.'

Objective 3:
The digital solution should **guide** the passenger to the commercial services. The wayfinding information should be **route-based** and based on **landmarks** in the environment.

Objective 4:
The digital solution should work **location based** and should give the passenger insight in the **travel process** and **available time**.

Objective 5:
The passenger should feel invited to **explore** the surroundings of Schiphol, while having the feeling of being **guided**, minimizing the risk of getting lost. The wayfinding should be **intuitive**, making it accessible.

The problem that needed to be tackled was twofold:
Objectives 1 and 2 relate to the issue of 'awareness (and activation)' and objectives 3, 4 and 5 relate to the issue of 'wayfinding.'

To raise awareness about the audio tour, a statue of Rembrandt was placed in the seating area of lounge 2. Objective 1 was partly achieved, as the Rembrandt statue was able to create awareness for the statue itself, but not for the sign standing in front of it. So the link between the statue and sign that depicted the information for the audio tour should be stronger to convert the awareness of the statue into awareness for the audio tour. Further thoughts on this to improve awareness of the audio tour can be found under 'recommendations.'

The QR code on the sign, directing to the audio tour, creates a link from the 'physical Schiphol' to the 'digital Schiphol.' However, objective 2 is dependent on the degree of success of objective 1: The accomplished connection will be more used if the awareness of the audio tour is higher.

The audio tour in lounge 2 successfully guided the passengers along the commercial services and other hidden gems (objective 3). The locative audio tour ensured passengers were given information about their surroundings based on their current location. However, the audio tour did not provide the passenger more insight in the travel process, which will be further covered in the recommendations (objective 4).

For the interaction vision, passengers rated the audio tour highest on the aspect of *explorative* (5/5), enabling them to discover new places at the airport. *Guided* was rated second (4,8/5) which means that passengers trusted that they would not get lost during the audio tour. *Intuitive* meaning how easy it was to find one's way was rated with 4,2/5 (objective 5).
See chapter 5.1 for the complete validation of the wayfinding concept.

All in all, the locative audio tour enables passengers to 'guidedly explore' the airport. By using piloting strategies, the audio tour helps passengers to find the next landmark on the route. This helps to expand the wayfinding territory of passengers, empowering them to explore the airport autonomously after they completed the audio tour.

6.2.2 Recommendations

This chapter includes recommendations based on the insights retrieved during this research, for raising awareness (for the audio tour), for improving the wayfinding and the audio tour itself.

General

In a world that is getting more and more digitized, personal contact is considered extra valuable. This was again encountered in this research. Although Schiphol is reducing the amount of staff on site, personal contact is an important service element. It is recommended that Schiphol looks at how they can maintain a personal touch in their communication with passengers to be able to distinguish themselves from other airports.

Raising awareness

Mass vs personal

The awareness test with the Rembrandt statue was another example of sending a message to the mass of all passengers, just like flight information screens do. From the passenger's point of view, it is preferred to only receive information that is relevant to them at that moment, minimizing the risk of information overload (see chapter 2.2.3 and chapter 4.4.2).

Besides this, personal targeting of information also has the advantage that only passengers that are part of the target audience receive the information. In case of raising awareness for the audio tour, passengers who are waiting in the lounge and have a longer waiting time than 1,5 hours should (only) be targeted.

Awareness to activation

Passengers at an airport are often tired, lazy or inactive. It has been tried to create a design for which minimal effort is needed to interact (e.g. getting a preview via the listening horn). However, activation still is a challenge. Some passengers indicated that getting up from their chair was already too much.

To reach a higher activation rate, more research could be done into providing a reward after completing the audio tour, or after visiting a hidden place. The first question that should be answered here is whether there is budget to do this and if this is wanted.

Utterance

More tests and research should be done on the specific utterance and promotion of the audio tour. The awareness tests that were executed can be used as a starting or reference point. Points of attention should be the visual representations and the texts for raising awareness, which might have to be different per passenger type (see image 37). Also the use and effect of a listening horn could be researched.

Raising awareness among passengers about interventions that they do not expect or need for the primary travel process remains a challenge. Placing art (the Rembrandt statue) in the lounge is one way to raise awareness for the audio tour among passengers at the airport. There are many more ways in which passengers can be reached and awareness for the audio tour can be raised. As described in appendix 7A, there are four different passenger types having different psychological profiles. Some passengers like to plan their travel already from home (planners) and others see what happens at the airport (relaxers). To be able to reach all different types of passengers, multiple mediums for creating awareness for the audio tour should be used. Image 37 proposes how the different passenger types can be reached.

For each of the passenger profiles, a way to raise awareness for the audio tour is proposed:

Digital at airport (relaxer)

It was ascertained in this project that the majority of passengers (relaxers, indulgers) do not plan how they will spend their waiting time at the airport (chapter 2.5.2, passenger needs). Therefore it is important to reach passengers during their waiting time at the airport.

Also, as stated in the wayfinding vision of Schiphol, relevant personal information is important to bring about intuitive wayfinding at the airport. Push notifications can be sent to passengers arriving at the lounges, after they passed security and passport control. The push notification should give the passenger insight into the travel process so that they know they have spare time to spend on activities (see image 38).

An advantage of sending personalized messages via the phone is that only passengers who fall under the target audience are targeted (passengers in the lounges, with a waiting time longer than 1,5 hours). Besides this, no extra visual expressions are added to the surroundings of the airport.

Schiphol already has a network of beacons in place, allowing to determine the passenger's location via Bluetooth. Schiphol is planning to use this functionality for sending push notifications about the primary airport processes ("You are getting close to the security check, make sure to have your passport ready.") However, extra (internal) arrangements need to be made to allow for push notifications to be sent for commercial ends.

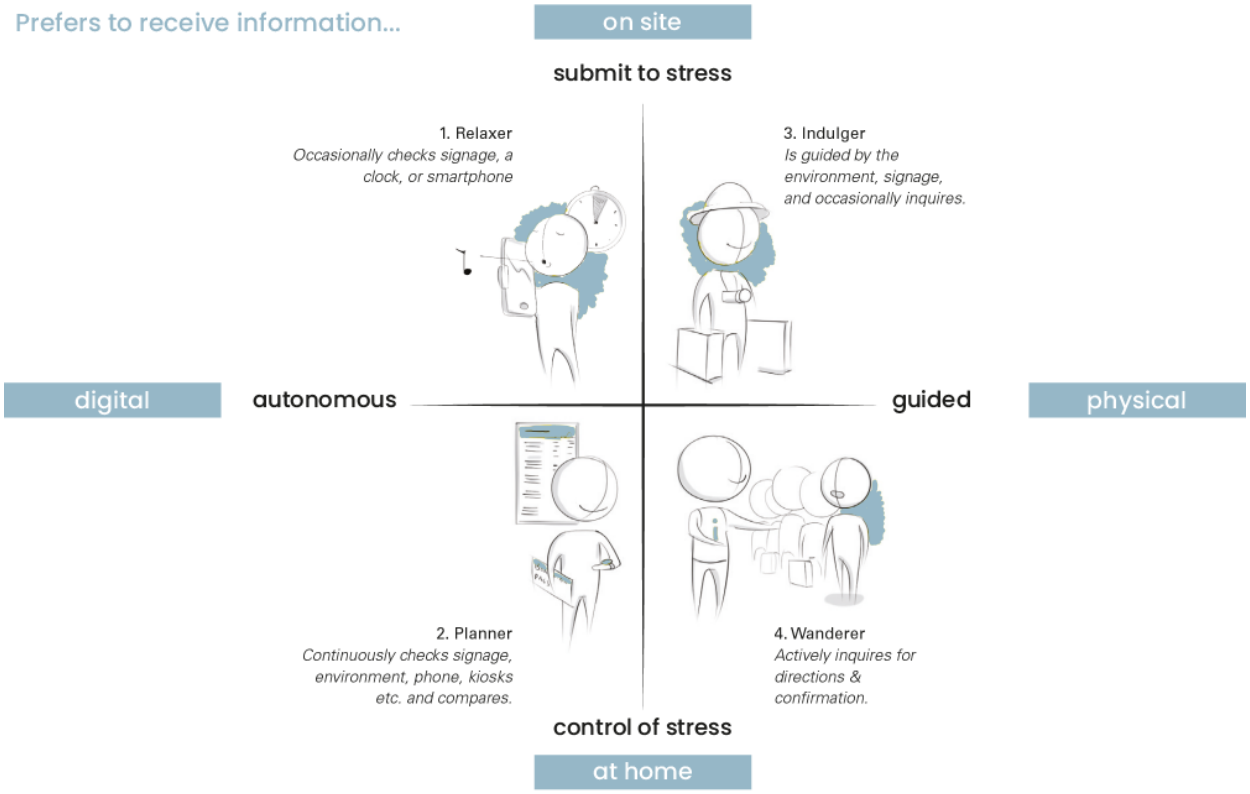


Image 37: Passenger psychological profiles and how to receive information (adapted from Informatie en Wayfinding: visie en implementatie strategie, 2016)

Image 38: Sending push notifications to passengers via beacons

Physical at airport (indulger, wanderer)
Research was done to get insight in when the passenger is most open to receive information about activities to do during the waiting time.

Since there is a lot of visual competition in the lounges, it is advised to not compete for the attention of the passenger by placing another physical object in the lounge. Besides the lounges, there are two locations on airside where visual competition is lower, being the toilets and the gates. Many passengers arrive early at the gate (chapter 2.5.1: Passenger segmentation) who could be encouraged to explore the surroundings of the airport more before their flight leaves. However, when opting to lead passengers again away from the gate to the lounge, the opposing interest from the Operational and Commercial departments come in play: Since the Operational department focusses on getting passengers on time on board, leading passengers away from the gate would only hinder their efforts.

A promising location to raise awareness for the audio tour among passengers that was not investigated in this project are the Self Service Units that are placed at the information zones in the lounges (see image 39). Passengers at information zones find themselves there for a reason: They are open to receive information. With the Digital department of Schiphol, it was discussed that based on the search behavior of passengers at the digital SSU's, recommendations could be given on how to spend the waiting time. A QR code could be generated on the SSU, which the passengers can scan with their mobile device, enabling them to take the personal wayfinding information (the audio tour) with them.

Lastly, personal contact and recommendations showed to be very powerful (for raising awareness for the audio tour). In line with this is a current summer activity of Schiphol where photographers in Dutch costume take polaroid pictures of passengers before departure to enhance the passenger experience (see image 40). It was discussed with the Marketing department that personal contact is indeed considered as the most efficient tool for reaching passengers, however it is also very costly. More research should be done to weigh the pros and cons of this concept for raising awareness for the audio tour. An option might also be to integrate the promotion of the audio tour with the current Airport Assistant shifts.

Image 39: Self Service Units at information zones

Image 40: Polaroid photographers at Schiphol

Digital at home (planner)
Although the majority of passengers do not (like to) plan their waiting time at the airport, a small part of the passengers would like to come prepared. These passengers would prefer to know before leaving home how they could spend their waiting time so that they can prepare by for example packing headphones for the audio tour.

For this project, this type of passenger was left out of consideration as it is very difficult for Schiphol to know which passengers will be traveling via the airport. Schiphol only has access to the data from passengers parking at Schiphol and the Privium passengers.

However, airlines do know which passengers will be traveling via Schiphol. Therefore, it might be interesting to look into the opportunity of creating a collaboration between Schiphol and airlines to provide passengers with information about activities for during the waiting time. KLM would be a good potential first airline to start a pilot with. Passengers that are flying with KLM and who are booking their tickets or checking in online, could receive information about activities during their waiting time (via the website or email). Specifically passengers with a long waiting time could be targeted. Also the KLM app could be used for this purpose, of which the usage rate is higher than that of the Schiphol app.

The proposed concepts for reaching different passenger types are not mutually exclusive: One passenger is more likely to be receptive for cues in the environment, while others prefer to receive information digitally. To ensure all passengers can be reached, multiple mediums should be used.

(Commercial) wayfinding
The first step in creating an airport where every person is able to find his way easily, is to provide for good natural wayfinding. To improve the natural commercial wayfinding, commercial services should be designed and located in a way so that their functionality is more easily identified and better recognizable for passengers. For instance, the main reason why passengers are unaware of the existence of the Rijksmuseum and are unable to find it, is because of its exterior design and location (of the entrances) in relation to walking routes.

Another way to improve natural commercial wayfinding is to organize the commercial facilities in recognizable zones. For the design of lounge 2 Schiphol actually worked with the application of different zones, but since this is not clearly communicated to the passenger, they do not notice this layout.

Although natural wayfinding remains the ultimate goal, this project has also shown the added value for passengers to explore hidden places, making their waiting time more valuable. This power of 'hidden gems' is nullified if natural wayfinding is optimized.

Besides natural wayfinding, the integration of digital elements is important to facilitate intuitive wayfinding. Improvements can be made on the reference and findability of commercial facilities on the digital wayfinding solutions, which are currently user-unfriendly (see appendix 10).
However, in order to reach all different passenger types (see image 37), reference should be made both physically (e.g. signage, SSU's, personal) and digitally (push notifications) to the commercial facilities.

To be able to achieve the goal of intuitive wayfinding, both environmental graphic designers and architects need to work together as wayfinding designers. Architecture should not be considered as one element and signage as another; the roles should be complementary.

Audio tour
This paragraph describes recommendations for the audio tour based on the wayfinding validation (chapter 5.1).

Form
It was assumed that downloading an app for the audio tour would form an extra threshold for passengers. But since this was not the case, it could be chosen to integrate the audio tour with the existing Schiphol app (instead of using a mobile website), which possibly also increases the use of the Schiphol app.

Experience
The music and voice in the audio tour showed to release stress in passengers. This finding is in line with recent research from the NS, which makes use of a calming broadcasting voice to soften negative emotions in travelers (NS, 2021). More research can be done to accurately determine the influence of the voice and music of this audio tour on the emotions of passengers.

Instructions
The instructions of the audio tour are based on the location of the passenger. Nevertheless, a pause function is valuable for passengers in case they want to spend more time looking at an object (for example in the museum) or if there is something else that needs their attention (talking with fellow travelers, going to the toilet). For the same reason, a function to repeat the audio instructions (last 30 seconds) needs to be created.

The audio tour should also be made available in different languages so that all passengers are able to do the audiotour. Now it is only in English.

Versions
In general, children tend to be more explorative than adults. Combined with the fact that children were very interested in the listening horn it is advised to create a special version of the audio tour for children or families. It should be investigated whether the children's version should be an audio tour with information about different locations, or if it is better to have just one location where a story in a fairytale-like format about the airport is provided to children.

Image 41: Design of the digital environment of the audio tour (start screen)

Another target audience that deviated from the rest, were Dutch passengers. Although the majority of passengers in lounge 2 is non-Dutch, this is an important group of passengers to take into account.
The audio tour contains information about the Dutch culture which is interesting for non-Dutch tourists. Dutch passengers indicated to already know a lot of the facts presented in the audio tour. A special version for Dutch passengers could be made that gives information going beyond the 'basic touristic facts'.

Lastly, the option should also be offered to participate in a shorter version of the audio tour for passengers that have less time available or for those who are only interested in a specific location. It should also be possible to view the location of a commercial facility on a map. However, the default option should stay the full audio tour, highlighting the vision of recreational wayfinding.

This way, the concept can be communicated more broadly: Making it a solution to spend the waiting time more valuable by giving tips on activities to do. Further research has to be done whether that is desired (see recommendation 'utterance)'.

Image 41 and 42 propose how the digital environment of the audio tour could take shape. In this design, the brand style of Schiphol is applied.

Image 42: Design of the digital environment of the audio tour (during audio tour)

Personal evaluation

I am grateful that I was able to do this project in the dynamic context of Schiphol, even though it was a little less dynamic due to COVID. I learned a lot from being part of a big organization in which many stakeholders have different interests and needs. The complexity of the assignment, combining both user needs and organizational needs, was a nice way to bring together my knowledge and skills learned during my studies (with DfI and SPD courses).

What I enjoyed most was the contact and interaction I had with passengers from all over the world. Passengers were very open to share their experiences and were happy to be able to talk with someone at a large and anonymous airport. It was nice to hear stories from all over the world. The direct feedback from passengers also helped me to evaluate my prototypes quickly which was beneficial to the project. The very positive and thankful reactions to the audio tour exceeded my expectations and I will keep these memories with me.

As a designer, I like to quickly test my assumptions in the context, to assess their value. However, in the context of Schiphol there are strict rules for approaching passengers and testing prototypes and getting permission is a time consuming process. Nevertheless, by making a clear plan and setting the right priorities, I was able to be fit everything within the planning.

I started writing my thesis early on in the project as I had gathered a lot of information already. In the end, it was challenging for me to boil it down to the core (and final outcome) of the project. In other projects I was used to writing a report afterwards, which ensured I knew the complete story line and towards what outcome should be worked. Therefore, I needed to invest quite some time at the end of the project to be able to create a consistent report.

Lastly, I am very proud that I was able to place the Rembrandt statue in the lounge of Schiphol for a pilot. I am very thankful to artist Roy Greve that I had the pleasure of using his statue for this. And I am very happy that everything went well logistically for getting the statue through security (without any damage to the statue) thanks to the help of the men of Facilicom.

In appendix 20 I discuss my personal learning ambitions in more detail.

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