

# Guidelines for the visually accessible display of public transport routing

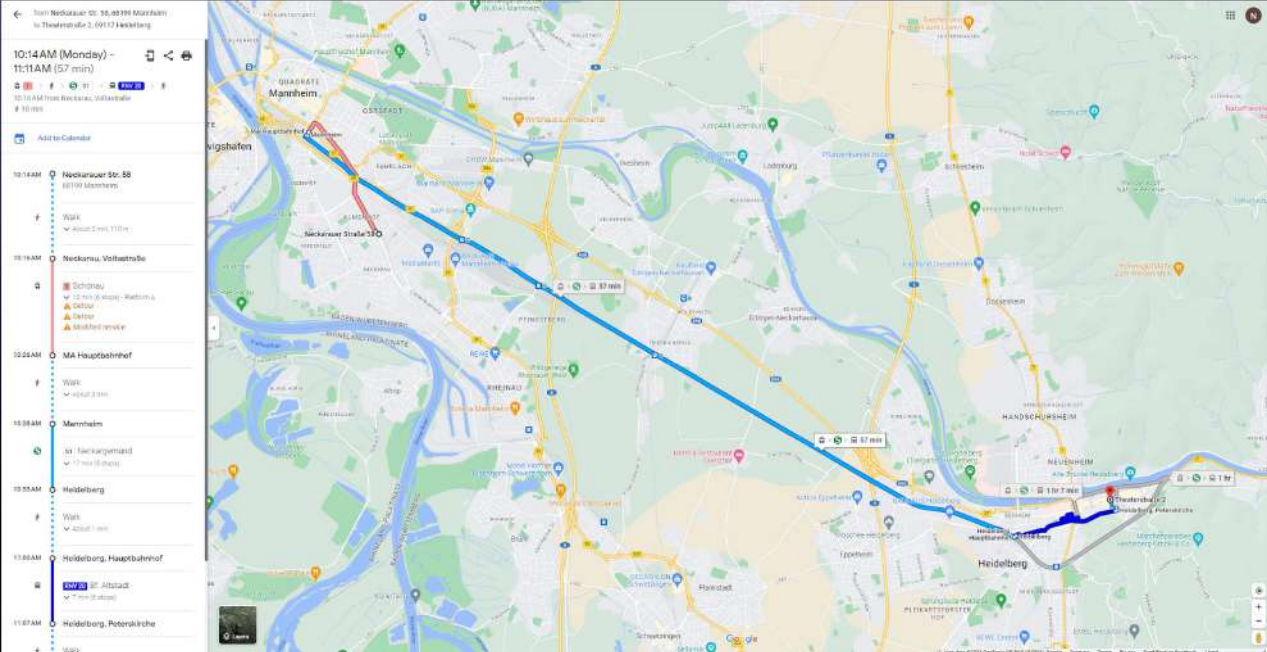
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Small research group “Smart Mobility”

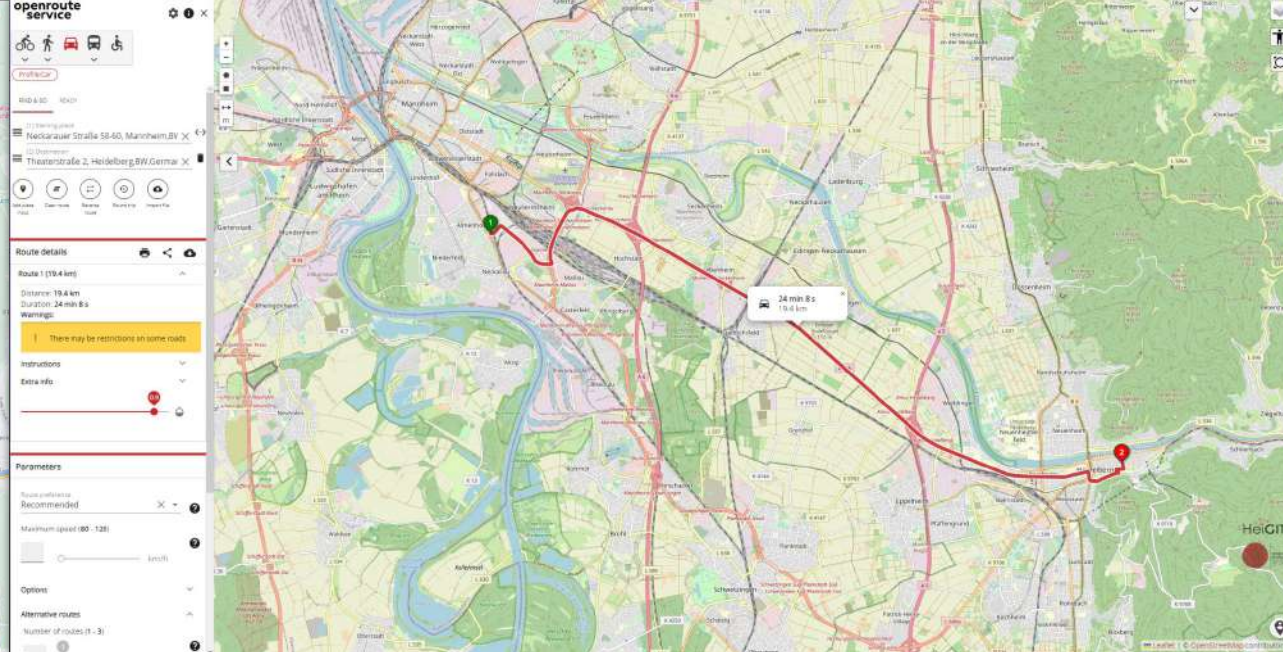
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04.09.2023



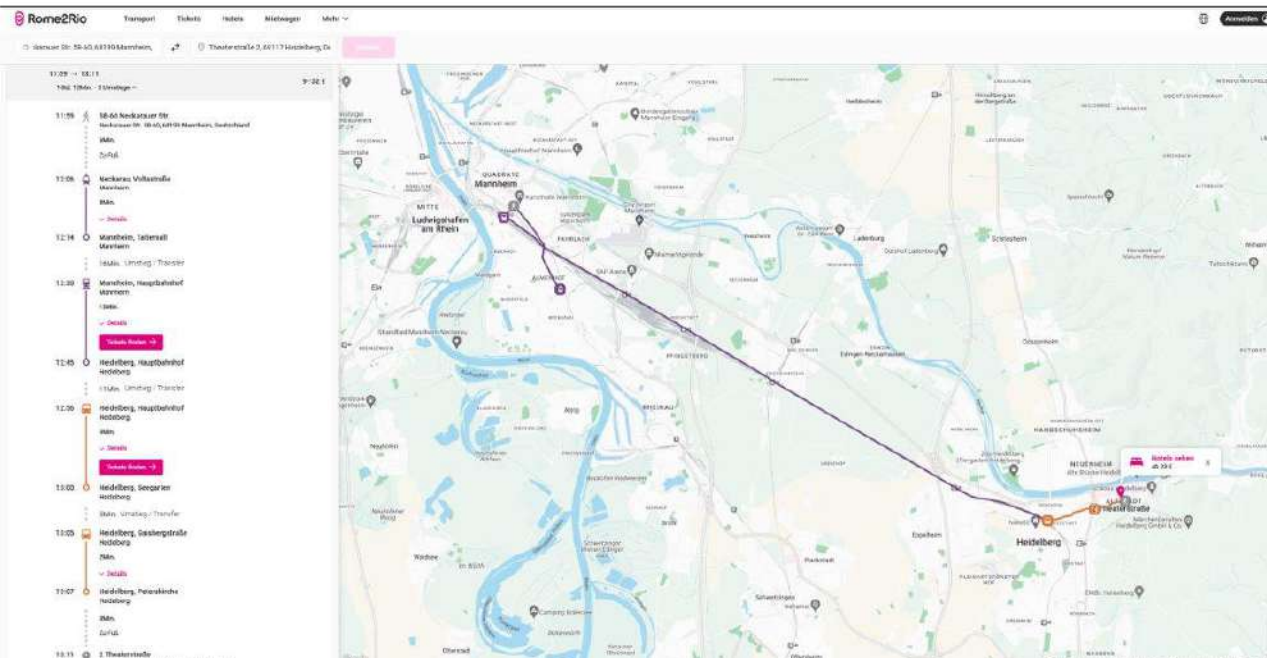




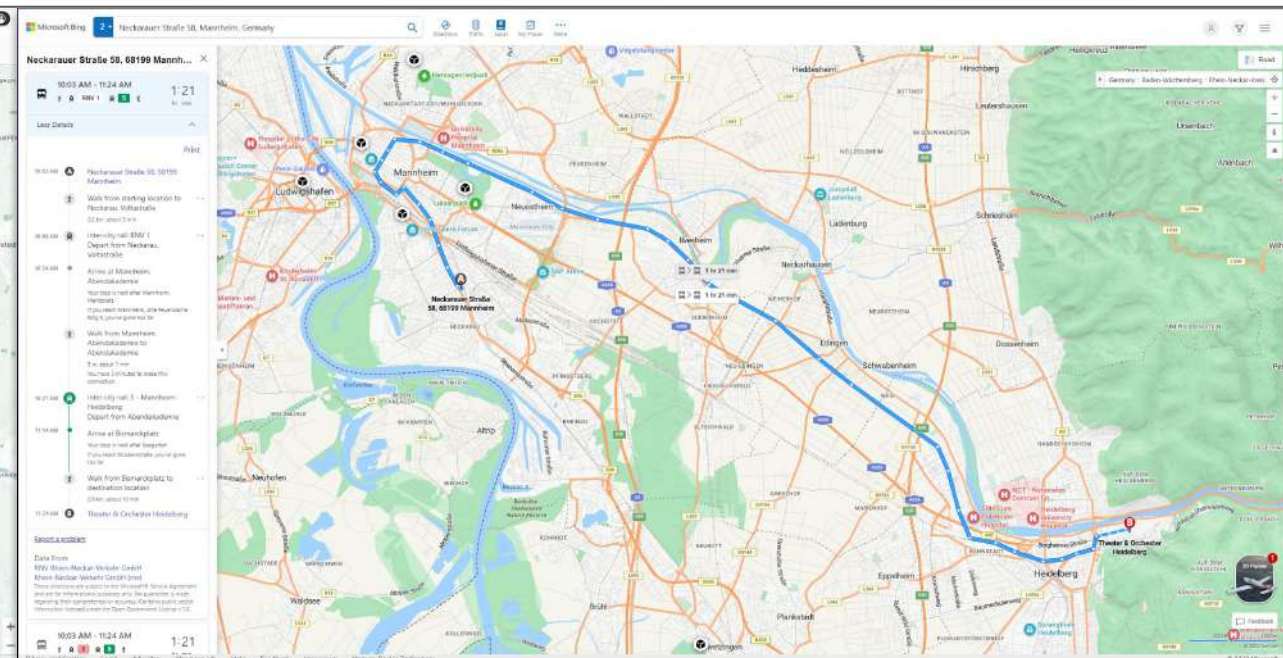
Google Maps



OpenRouteService



Rome2Rio




Bing Maps

# Research question

How to display public transport routes visually appealing and accessible?

- Part 1: What are current good/bad practices?
- Part 2: What is needed to improve the visual accessibility of public transport routing displays?
- Part 3: What has to be considered when developing or improving a public transport routing service to make it more appealing?

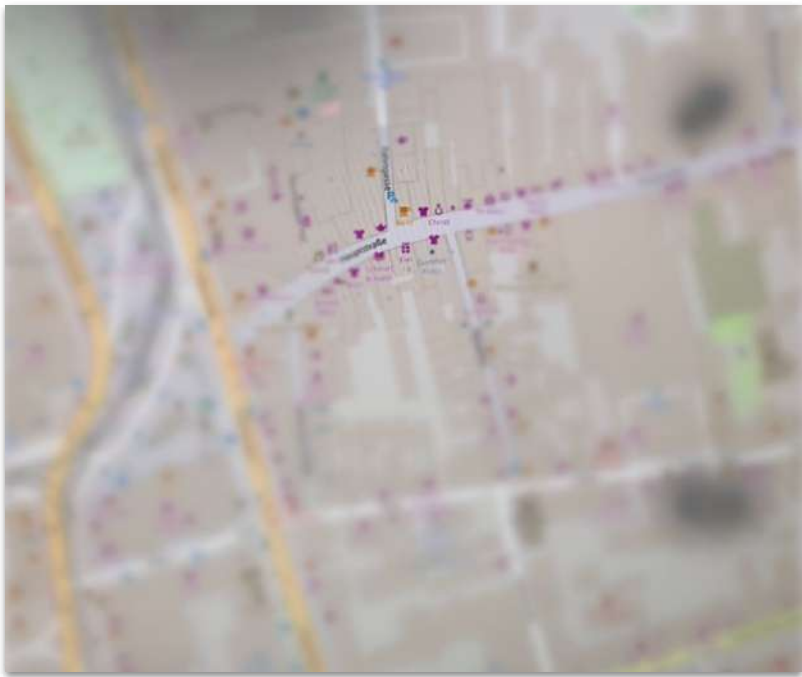
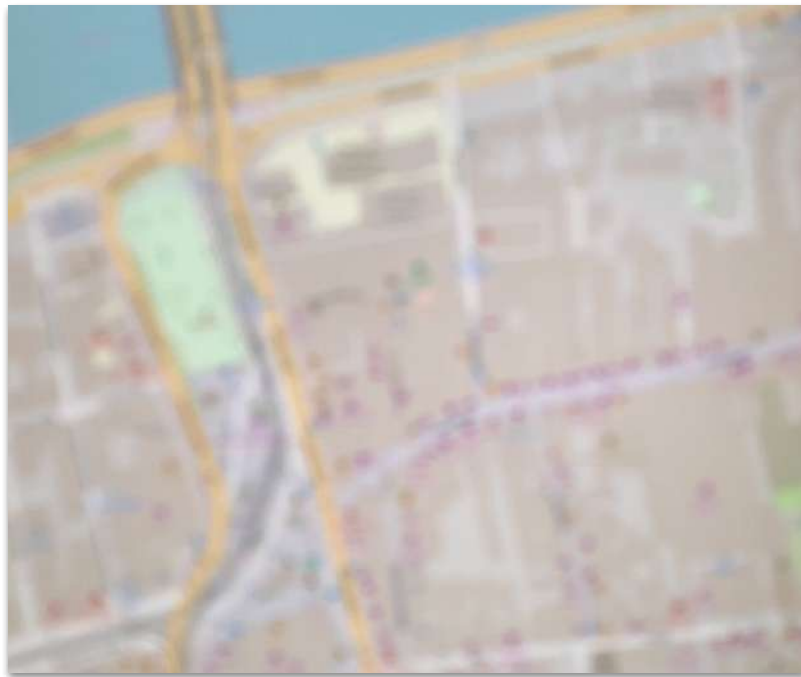
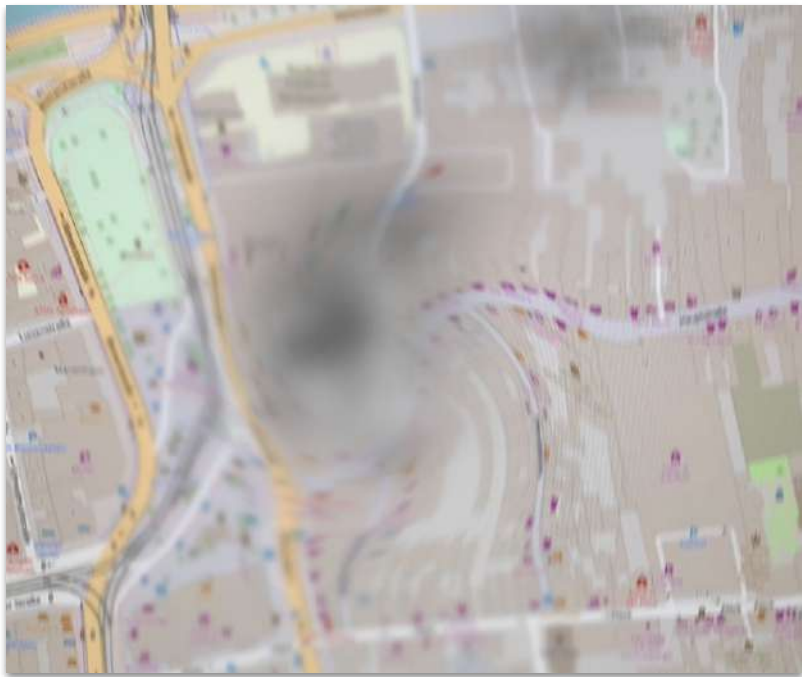


The background image shows the interior of a bus. It features rows of blue seats with a colorful, abstract pattern. Yellow handrails are visible, and the bus is brightly lit, likely from windows on the left side. The perspective is from the front of the bus looking towards the back.

# Theoretical Background & State of the Art

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# What is visual impairment?



2.2 billion people affected and numbers are rising globally

## **Visual Impairments:**

- Encompass various degrees of impaired vision
- Range from blindness, where minimal or no vision exists, to visual impairment with blurred vision
- Causes include genetic factors, diseases like macular degeneration and glaucoma, as well as refractive errors like nearsightedness and farsightedness

## **Color Blindness:**

- Special form of visual impairment where certain colors are difficult to distinguish
- Most common forms are red-green and blue-yellow color blindness

→ Diverse symptoms require different adjustments

# Guidelines for accessibility

- W3C published the Web Content Accessibility Guidelines, describing best practices for accessibility:
  - Distinguishable Information (Font Size, Contrast and distinguishable colors)
  - Operable Interactions (Keyboard accessibility, compatibility with assistive technologies)
- **Accessible Rich Internet Applications (ARIA)** by W3C provides a framework for integrating compatible Design
- Certain Legal Bodies and Countries require accessibility by law, eg. for services paid by the Government

# Accessibility guidelines for virtual maps

- There are few resources and no concrete guidelines
- Minnesota IT provides an overview of suitable color schemes and shows examples how to integrate high contrast
- the W3C provides an overview over alternative Technologies, including:
  - Tactile Maps & Virtual Tactile Maps
  - Nouvelle Braille Displays
  - Audiovisual Maps



# Goals for route map design

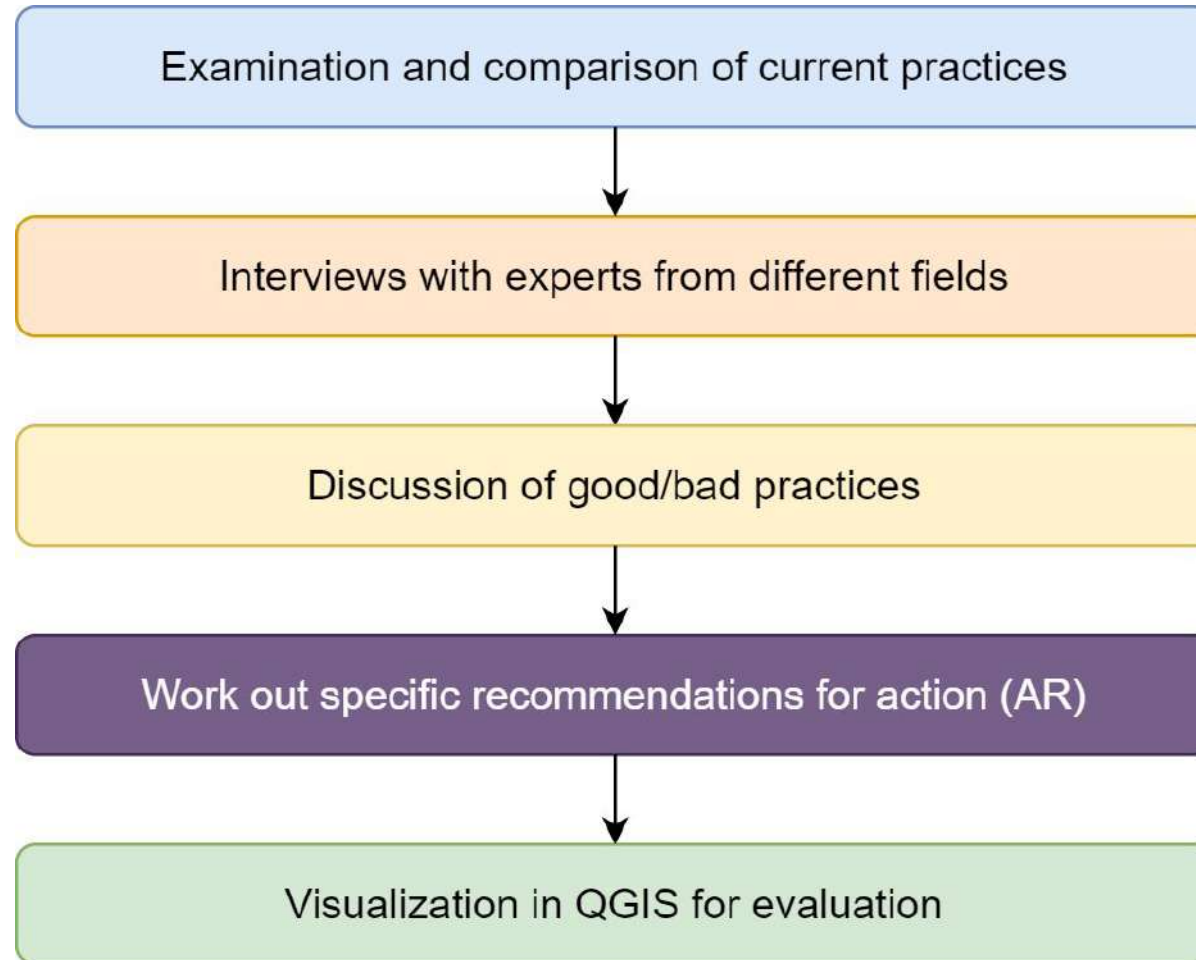
- **Readability:** All essential components of the route, especially the roads, should be visible and easily identifiable.
- **Clarity:** The route should be clearly marked and readily apparent even from a quick glance. The map should contain only as much information as is necessary.
- **Completeness:** The map must provide all necessary information for navigation.
- **Convenience:** A good design should take into account how, when, and where the information is used.

# Methodology & Results

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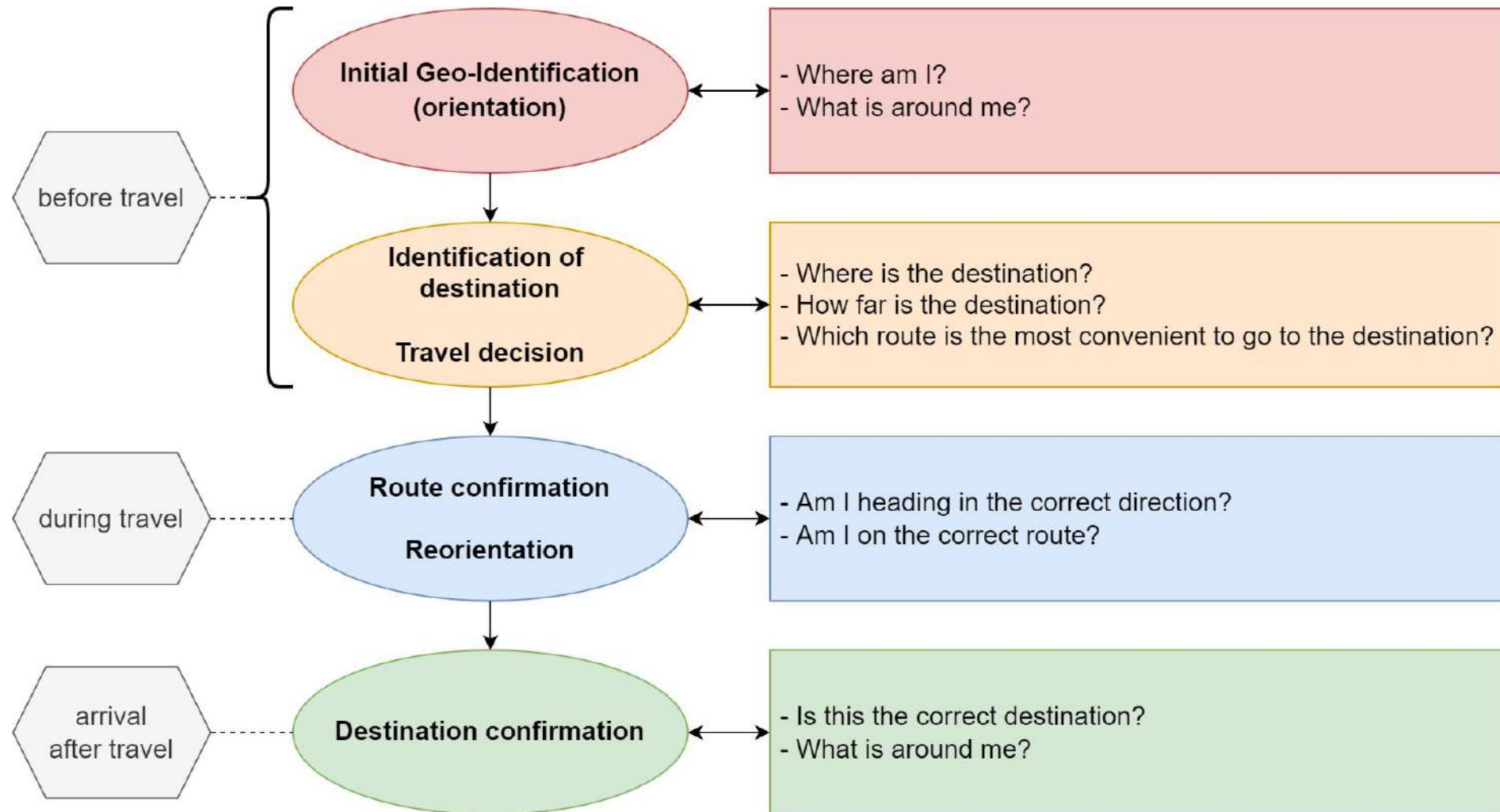


# Methodology





# Process of finding routes



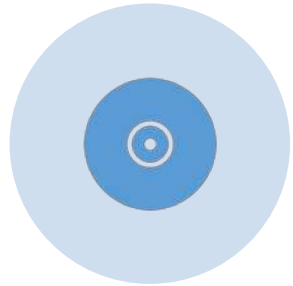
# Fundamental statements



Information on need/  
on demand



Overview first,  
information second



Target group &  
application dependent



Use of learned things

→ Interactivity, scalability and customization!

# Fundamental statements - accessibility

Best practice possible?  
No.

- Many different visual impairments with different needs
- Providing services for all is not accessible anymore
- (Graphic) design aims to be unique and draw attention

→ “Good enough” practice

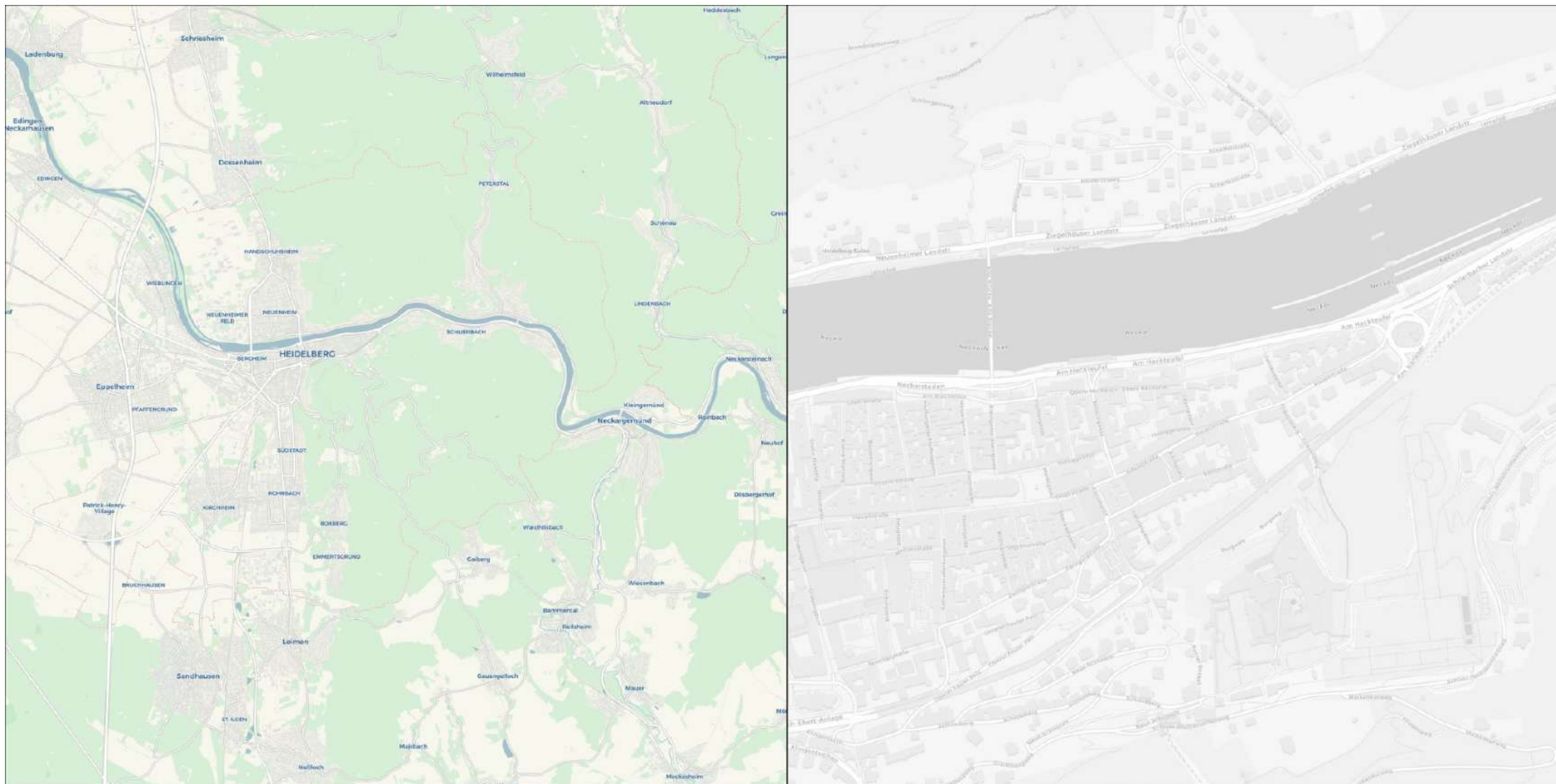
- Good basis for end-user devices (own accessibility methods)
- Contrasts, line properties, basemaps ...
- Interactivity, scalability and customization



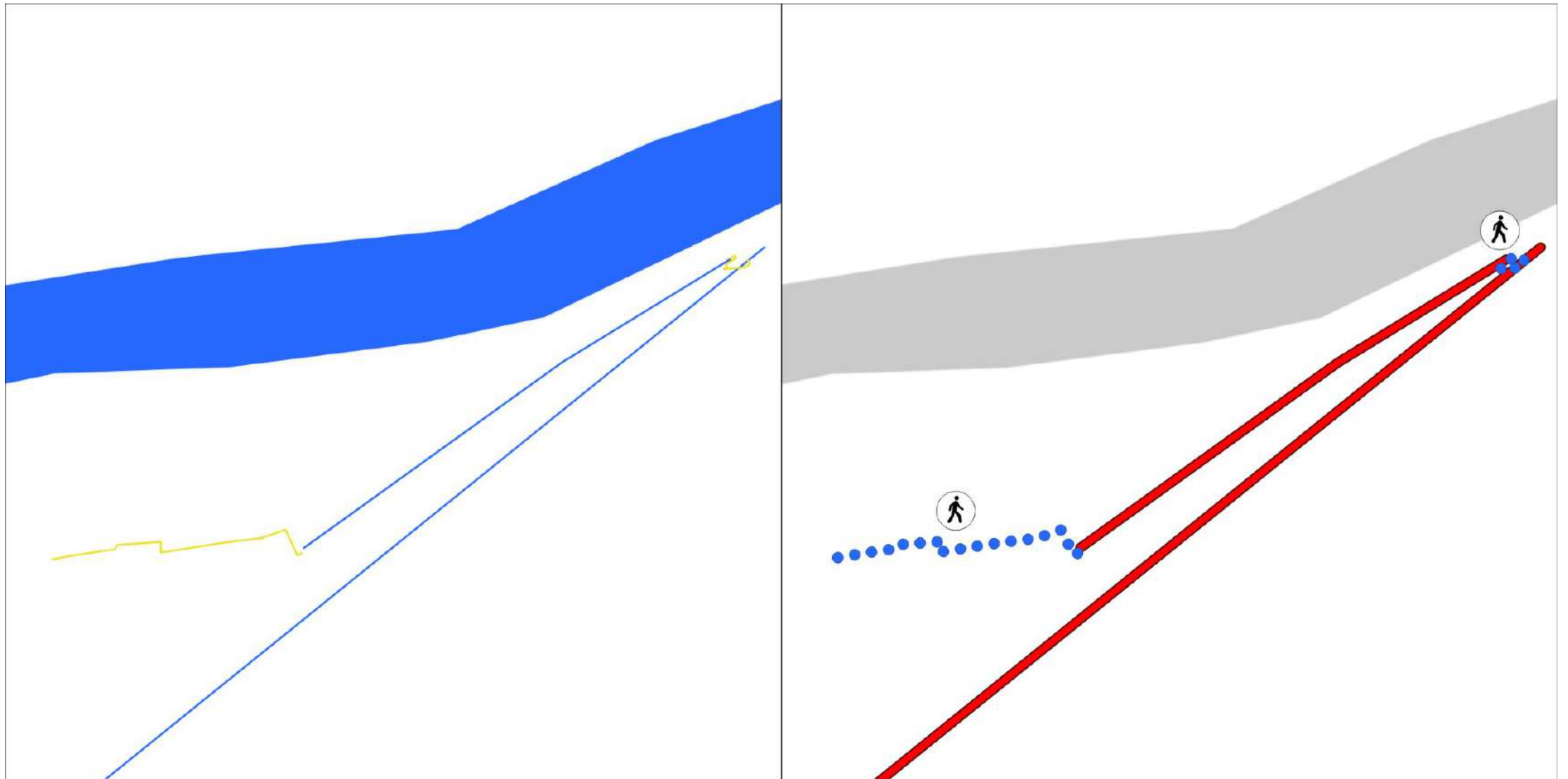
# Action recommendations: basemaps



# Action recommendations: basemaps



# Action recommendations: linestyle





# Action recommendations: focused mapping



# Action recommendations: focused mapping



# Action Recommendations: Fonts



Kreisbogen



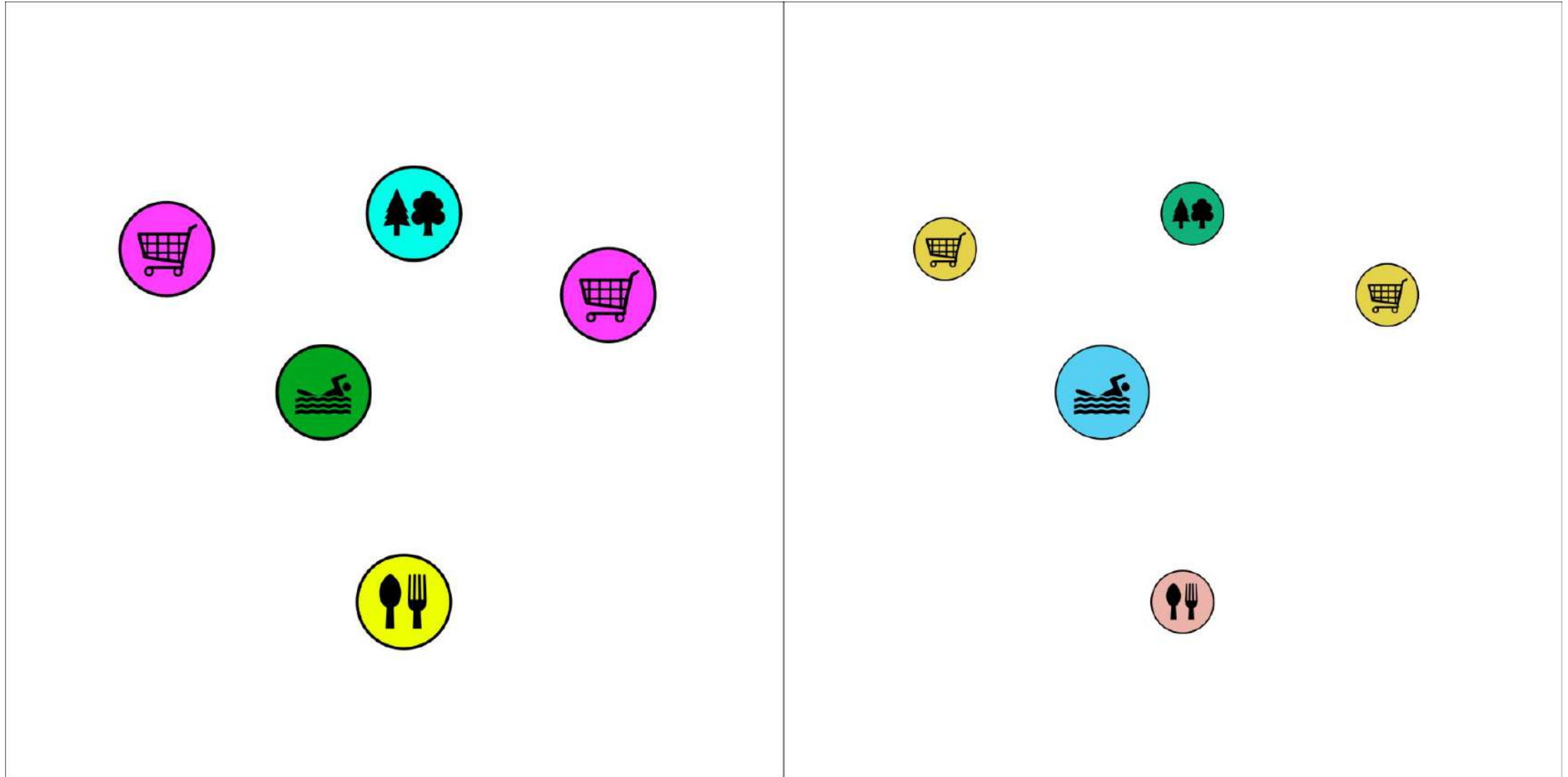
Kreisbogen



Kreisbogen



# Action Recommendations: POI's



The background of the slide is a photograph of the interior of a bus. It shows rows of blue seats with a colorful, abstract pattern. Yellow handrails are visible, and the perspective is looking down the length of the bus towards the front. The lighting is bright, coming from the windows on the left.

# Take-home messages & Outlook

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# Take-home messages

- Many different visual impairments - you cannot satisfy them all!
  - Finding routes is a process - each step requires different information
  - Ask yourself: which information can be depicted in alternative forms?
- Therefore, make your service interactive, scalable & customizable
- Provide only necessary information, but let the user be able to access more
- Consider accessibility during development already



# Outlook

- Paper:
  - recipe-like with further recommendations for action that can be implemented directly
  - questions that should be reflected during the development process based on the route finding process
- Interview about technical realizability
- Evaluation through usability tests needed - potential for further projects/theses

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# Thank you very much for your attention!

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04.09.2023

# Sources

Agrawala, M., & Stolte, C. (2000). A design and implementation for effective computer-generated route maps. *AAAI Symposium on Smart Graphics*, 5–46, <http://graphics.stanford.edu/papers/maps/>.

Agrawala, M. (2002). Visualizing Route Maps. Dissertation, [http://graphics.stanford.edu/papers/maneesh\\_thesis/](http://graphics.stanford.edu/papers/maneesh_thesis/).

Delikostidis, I. (2011). Improving the Usability of Pedestrian Navigation Systems. Volunteered Geographic Information (VGI) for Disaster Management: A Case Study for Floods in Jakarta. Vario-scale geo-information, <https://www.researchgate.net/publication/272025784>.

W3C (2023). Web Content Accessibility Guidelines (WCAG) 2.2, <https://www.w3.org/TR/WCAG22/> [as of 30.08.2023].

WHO (2023): Blindness and Vision Impairment, <https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment> [as of 02.09.2023].

Used apps and routing services:

- ViaOpta Simulator, app by Novartis Pharmaceuticals Corporation, <https://apps.apple.com/us/app/viaopta-simulator/id778653985>.
- Google Maps, <https://www.google.de/maps>.
- Bing Maps, <https://www.bing.com/maps/>.
- Rome2Rio, <https://www.rome2rio.com>.