

# The Interplay of Pedestrian Navigation, Wayfinding Devices, and Environmental Features in Indoor Settings

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## Abstract

*Zusammenfassung*  
The focus of this study is on wayfinding in large complex buildings with different wayfinding devices. The interaction of pedestrians of such devices is always also interplay with the surrounding environment and its specific features. Furthermore different wayfinding assistances can elicit different needs for additional information from the environment to make accurate choices at decision points. We aim to shed light on how characteristics of decision points in combination with different wayfinding devices shape wayfinders' visual attention. 60 participants individually looked for three destinations in the same order. They navigated with 1) a printed map, 2) a digital map, or 3) without a map, only using full-coverage numeric signage. To gain first insights fixation frequencies on maps and signage as well as the correct and incorrect route options were recorded with a mobile eyetracker and analyzed for 28 decision points and four decision point categories. The results indicated that starting points play a special role in planning the route ahead. Furthermore points that allow for a floor change lead to a higher attention and information search.

**Concepts:** • Human-centered computing ~ Human computer interaction (HCI); Empirical studies in HCI; Field studies

**Keywords:** Wayfinding assistance, navigation, spatial cognition, mobile eye tracking, pedestrian navigation

## 1 Introduction

The metaphorical space of a computer becomes usable via graphical user interfaces (GUI), for the physical space maps and signs can fulfill the same function of easing navigation [Schnitzler and Hölscher 2015]. Classic in-car navigation devices give the driver route instructions. There are several approaches to support pedestrians, e.g. with vibro-tactile or auditory interactions but their main navigation devices are still maps – printed or digital – offering a survey perspective on the surrounds [Ishika-

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wa and Montello 2006; Siegel and White 1975]. Those different presentation modes each have their specific benefits. While navigating we have to constantly update our current location, acquire, store, recall and decode information about our relative location and goal [Downs and Stea 1973]. While route instructions allows drivers to keep their main attention on the traffic [Dingus et al. 1988; Kun et al. 2009], this more passive mode, where the route is defined by the system, limits acquiring knowledge about the surrounding environment [Held and Hein 1963]. On the other hand the standard device for pedestrians, maps offer a survey perspective of the surrounds and thereby enable wayfinders to improve their environmental knowledge and have the benefit of controlling the wayfinding process instead of completely externalizing it [Ishikawa et al. 2008; Thorndyke and Hayes-Roth 1982]. Such maps leave the route choices with the navigator. The question which kind of instructions wayfinders prefer is highly dependent on the particular context. While visiting a museum, navigating on one's own and a free, meandering exploration might be desired. In other large public buildings, like airports and administrative buildings, the common goal is to reach a target destination as quickly as possible. Here minimizing search for wayfinding information and decision-making is appreciated. Navigational devices allow people to augment and combine their internal cognitive information processing with perception and manipulation of an external information representation and thereby enable users to perform computational offloading [Scaife and Rogers 1996].

The contribution of this work is to provide a first insight on how much additional environmental and signage information navigators use when they are equipped with either a classical printed mobile map or a digital mobile map.

- First contribution: Understand how classical wayfinding devices support navigators and understand when they recurse to information beyond the one offered by the devices, such as environmental information.
- Second contribution: Contrast wayfinders' information search regarding navigation assistance based on the environmental features of decision points.
- Third contribution: Identify which characteristics of decision points and wayfinding devices lead to more straightforward, satisfying wayfinding and a lower search for visual information and less attention to irrelevant environmental features, like incorrect route options.

## 2 Background

Navigating to a destination is a natural act of everyday life and can be easy and rather automatized [Montello 2005]. For exam-