



Seamless and Attractive Transfers to and Within Public Transport Stations: Responsibilities, Characteristics and New Visions

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Abstract. For tackling societal, health and environmental challenges, it is desirable to increase public transport usage and make transfers to public transport stations attractive and seamless. The study explores which factors are important for an attractive station environment and who is responsible for planning attractive transfers. It focuses on the walk to or from the station and its forecourt. First, stakeholder workshops with practitioners were conducted. Second, an online survey about the station surroundings and transfers was conducted amongst users of two stations in Berlin, Germany. Third, interviews with users applying virtual reality were carried out. Users experience and discuss ‘new visions’ of the station’s forecourt with virtual reality, applying ‘digital Tactical Urbanism’. The survey data was analyzed by using descriptive analysis, the interview data by applying thematic coding. The findings show that cycling-/pedestrian-friendliness is not adequately addressed by practitioners. It is not clear who is responsible to provide attractive, seamless and safe station environments. Wayfinding, quality of the walking environment and safety are important issues of the transfer situation. The results help to understand the needs of users and stakeholders and deliver recommendations to strengthen the combination of walking and public transport by introducing the approach of ‘digital Tactical Urbanism’.

Keywords: public transport · walking · virtual reality · planning

1 Introduction

For tackling societal, health and environmental challenges, it is desirable to increase the share of people who use public transport (PT) combined with walking or cycling. Thus, it is important to make transfers to and within public transport stations attractive and seamless. To ensure that individuals enjoy walking, a pedestrian-friendly environment is an important prerequisite. Taking public transport in urban areas can be challenging: Complex wayfinding and environmental features in and around stations can cause an unpleasant trip experience. Previous work has shown that the design of the environment at a bus stop has an influence on the extent to which journeys to and from the stop are made on foot or by bicycle, and what distance to the stop or waiting times are

considered acceptable [1]. Accordingly, it is desirable that practitioners take the user's needs regarding the PT station environment into consideration. Thereby, a seamless and comfortable public transport experience can be provided.

This paper delivers insights into how the surrounding of PT stations is planned from the decision makers' point of view and which factors are important for an attractive PT station from the users' point of view. In particular, the forecourt of PT stations is explored and new visions for PT stations are made perceptible by virtual reality. The objective of this paper is firstly, to introduce the concept of (digital) Tactical Urbanism (TU) and explore its possibilities to enhance PT station's surroundings and secondly, to investigate potential TU measures and their influence on a perceived seamless and attractive transfer to/from PT stations.

2 State of the Art

About 53% of the total PT travel time takes place inside of a public transport vehicle, the remaining 47% comprises walking to, at or from the stop and changing or waiting at the station [1]. Hence, for improving the attractiveness of PT stations, analyzing the walking environment to/from or within the station is essential. In transport research, walkability has been studied for several years, traditionally with a focus on measurable mesoscale indicators: accessibility or proximity, mixed land use, density, aesthetic design, sidewalks, street connectivity, safety or neighborhood type [2]. In recent years, research has also focused on the microlevel, the perceived walkability and the quality of the walking environment, which often lacks attention in traditional walkability research [3, 4]. The quality of the walking environment is interlinked with the sojourn quality of the neighbourhood, comprising factors such as protection (e.g. traffic or social safety), comfort (e.g. sights, social interaction, places to rest or walk) and joy (e.g. urban design adapted to human scale, positive sensory experiences) [5]. Factors regarding the quality of the walking environment can increase the motivation to walk [3].

Besides land use mix or density, the access and proximity to a public transport stop is often used as an indicator for walkability [6]. Yet, the walking environment around PT stops is often underexplored, as walkability quality analysis is usually based on macroscale indicators. A lack of wayfinding signs, complex entrances and traffic situation around PT stops can cause confusion and stress, which influences wellbeing and health [7]. Moreover, informal or hidden paths and shortcuts, which are often used when walking for transport purposes, are difficult to consider when using macroscale datasets [8]. Yet, informal shortcuts are important route sections that improve the trip experience [9] and can be considered by investigating the microlevel.

In transport-related policy and planning, walking as part of intermodal trips is still underrepresented and also lacks evaluation in national traffic surveys [10, 11]. In Germany, many transport authorities do not adequately address walking as a mode of transport, hence, financial and personal resources are missing [10]. Recently, European countries have applied walking policies, including safe and convenient walking infrastructure, short trip distances, speed limits or traffic calming [11].

One option to call attention to shortcomings regarding walkability is Tactical Urbanism (TU). TU is a tool to draw attention to perceived deficiencies in the physical design

of urban spaces and guide policy principles. TU has been used in urban development, often motivated by the goal of improving cities on a small scale “from bottom up” [12]. TU is often described as “resident-generated, low-cost, often temporary” interventions in urban space [12, p. 135]. It targets long-term change through short-term interventions. Lydon & Garcia (2015) [13] refer to such initiatives as tactical because they use targeted, easy-to-apply means to achieve predetermined goals while providing flexibility in the planning and implementation processes.

3 Methods

The research design comprises different methods in three subsequent stages, focusing both on decision-makers’ and public transport users’ view (Fig. 1).



Fig. 1. Study design: methods, time frame and research aims

The study investigates two structurally different PT stations in Berlin, Germany: station 1 Berlin-Lichtenberg and station 2 Berlin-Haselhorst (Fig. 2). Both stations feature a mobility hub (‘Jelbi’) nearby with carsharing, e-kickscooters and bikesharing.



Fig. 2. View from the subway entrance to the forecourt (own image)

First, (1) stakeholder workshops were conducted online to discuss TU interventions. 14 representatives participated, e.g. district administration for climate protection and for impaired people, mobility providers, an architect, lobby groups for pedestrians and public transport, and science. Participants discussed strengths and weaknesses of the station’s surroundings and evaluated potential measures. Although the workshop results represented a starting point for TU interventions, subsequent discussions found that getting the necessary legal approvals to realize interventions were not feasible due to current

German traffic law regulations: (a) every single measure must be approved separately, (b) traffic data is needed to argue why measures are necessary but could not be retrieved in scope and time frame of the project, (c) many departments need to be involved. Thus, we decided to develop a new methodology that does not require as much effort and legal approval (see step 2 and 3).

Next (2), the needs and requirements of public transport users with regard to the two stations under research were identified by conducting an online survey ($n = 333$) from mid-July until mid-September 2023. For recruitment, non-random sampling methods were used and posters in the PT stations, newsletters, online platforms and flyers in the areas announced the survey, making sure that people knowing the stations take part. Descriptive analysis was used to analyze the data. Based on the results of the online survey, a virtual reality environment for station 1 was jointly developed by DLR Institute of Transport Research, DLR Earth Observation Center (EOC) Science Communication and Visualization department and an architect (Katja Pfeiffer). Virtual reality (VR) is a type of extended reality (XR) technology, with which a person can explore and interact with a virtual world in a 360° setting. Silvennionen et al. (2022) [14] used VR to explore the effect of urban design on user's perceived walkability, showing participants different VR simulations [14]. While they used a complete virtual environment, we decided to use 360° pictures of the PT station 1 forecourt, so that the participants can relate to the station. In these 360° pictures, 3D-elements of urban design features based on the results of the online survey were included, e.g. benches, food truck, drinking fountain, greenery and wayfinding signs (Fig. 3).



Fig. 3. Graphical representation of two example views from the forecourt with VR elements in Berlin-Lichtenberg (image created by DLR EOC)

Finally, (3) Interviews were conducted with 19 participants who wore the VR glasses and explored the PT station with the digital TU features. The interviews took between 27 and 45 min. The participants were recruited from the online survey as well as neighborhood networks and social media. Based on the principle of Tactical Urbanism, the participants could turn different features in their VR world on or off, e.g. take a look how the forecourt looks with or without wayfinding signs, what influence a crowded place has on their perceived walkability or if they prefer the forecourt with a food truck. Meanwhile, the interviewers applied a semi-structured interview guideline while the interviewee moved through the virtual world to explore (a) perceptions and emotions, (b) environmental complexity and wayfinding and (c) environmental familiarity and activities. Hence, digital Walking Interviews were conducted. This intervention, based

on principles of TU, can be referred to as 'Digital Tactical Urbanism'. The interview data was analyzed applying an inductive-deductive approach with thematic coding.

4 Results and Discussion

The findings from the survey data show that a PT stations' surrounding should be clean and safe and have a high quality of the walking environment: features such as greenery, seating options, aesthetics, security personnel, light, toilets, drinking fountains and good shops/gastronomy were desired the most. Furthermore, a safe and short access from the station to other modes of transport (e.g. bus or sharing options) and to the neighborhoods was desired. This is in line with the results from the stakeholder workshops. The stakeholders emphasized the importance of the signage or visibility of the station, proposing pictograms on the sidewalks, as well as seating options and safety through lighting. Generally, the results from the stakeholder workshops showed that the forecourts in front of the station's entrance are rarely considered in planning processes. By investigating who is responsible for planning PT forecourts, it became apparent that the responsibilities are unclear: neither the transport providers nor the municipality seem to be in charge of transfers to/from PT stations. Hence, transfers are lacking attention. This is also reflected in the online survey respondents' answers, which highlighted that the station's surrounding needed improvement regarding safety, wayfinding, aesthetics, pleasantness and comfort.

Applying the digital Walking Interviews using the digital TU intervention showed similar results as the online survey, but gave in-depths insights into the benefits and barriers of TU measures from the user's point of view. The 19 interviewees emphasized that greenery and wooden benches improved the trip experience at the PT station. Seeing people interact and rest at the forecourt can improve perceived safety and influence how often participants would choose to visit the PT station. The digital Walking Interviews using the VR environment improved the immersive experience of potential TU measures, without the need to physically implement them. Participants described their impressions and potential usage of the redesigned station. Tactical Urbanism is a participatory, low-cost instrument to intervene in urban space. Thus, it can contribute to urban transformation processes by including local actors and questioning current planning principles. As the stakeholder workshop has shown, it can be difficult to physically intervene in urban space and change urban environments. As a consequence, this study applied virtual reality as a tool to create digital TU measures by introducing 'digital Tactical Urbanism'. In areas with unclear planning responsibilities and hard-to-reach authorities involving long-lasting decision processes, digital Tactical Urbanism can be an option to make changes in the urban environment tangible, both for laypersons and for decision-makers, in a low-cost and fast way. By taking surveys or interviews beforehand as bottom-up approaches, the design elements for the virtual world are shaped by the users' needs and desires, thus meeting the demand of Tactical Urbanism.

5 Conclusion

This study highlights the access and transfer situation at PT stations. By integrating decisions makers' and public transport users' views, the quality of the walking environment was explored. Digital Tactical Urbanism made new visions tangible and served as a basis for discussing improvements and shortcomings. Hence, we identified ways of making PT stations more attractive and strengthen their role as cornerstones for a sustainable urban mobility system.

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