

User experience and Psychological Comfort at the Platform-Train Interface

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ABSTRACT

Platform-train interface (PTI) is a shared space with several interactions between travellers. These interactions lead to congestion phenomena causing delays, safety concerns at PTI and resulting in a negative experience for users. It is thus important to understand individual behavior to help in improving pedestrian flow at stations and users' experience, and finally in supporting and promoting public transport use. This study aims to understand individuals experience and behavior in such places. More specifically, we investigate psychological comfort and its link with approach/avoidance strategies used by travellers at PTI. Based on the critical incidents technique, 22 interviews were conducted. Participants were asked to describe multiple trips according to their valence (positive versus negative). 77 critical incidents representing 125 sections of route involving a station were collected, coded and analysed through a multiple correspondence analysis (MCA), in order to determine what characteristics were associated to the valence of the incidents. For the 125 sections, we used a descriptive analysis to identify the approach/avoidance strategies used by individuals at PTI. Results show that trip characteristics are linked to each psychological comfort dimension. Furthermore, individuals potentially apply approach/avoidance strategies to increase psychological comfort. Finally, we observed that even though crowds are mostly associated with avoidance strategies, some approach strategies were identified towards crowds.

CCS CONCEPTS

• **Networks** → Network properties; Network mobility; • **Social and professional topics** → User characteristics; • **Applied computing** → Law, social and behavioral sciences; Psychology..

KEYWORDS

Psychological Comfort, Behavioral Strategies, Shared Spaces, Commuters

ACM Reference Format:

Xavier, Leonce, Jean-Marie, Burkhardt, and Lucia, Bosone. 2024. User experience and Psychological Comfort at the Platform-Train Interface. In *European Conference on Cognitive Ergonomics (ECCE 2024)*, October 08–11,



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ECCE 2024, October 08–11, 2024, Paris, France

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ACM ISBN 979-8-4007-1824-3/24/10

<https://doi.org/10.1145/3673805.3673824>

2024, Paris, France. ACM, New York, NY, USA, 5 pages. <https://doi.org/10.1145/3673805.3673824>

1 INTRODUCTION

Shared public spaces, such as train stations and shopping malls, are shaped by both architectural elements and the activities that take place there. Depending on the time and circumstances, these spaces can be sparsely populated, or on the contrary concentrate a high density of people, resulting in crowd-related congestion, particularly at peak hours [1], causing problems in traffic management [2], which can be costly in terms of time and money. Congestion phenomena can on one hand entail risks for passenger safety ([3]; e.g., crowds of passengers can exceed the safety line [4] or cause accidents such as falls on escalators [5]; difficulties in evacuation and possibly leading to turbulence and jostling [6]) and, on the other hand, negatively impact users' experience [7]. In fact, multiple sources of psychological comfort and discomfort in shared spaces are identified in the literature, such as social interactions (e.g., having reduced personal space due to crowding [8]), spatial perception [9], perception of safety (e.g., fear of aggression [10]), and perception of control over the trip (i.e., perceived independence [11, 12]. In the field of transport, the service offer can contribute to the emergence of positive emotions by increasing passengers' personal control, as well as by recreating the comfort that individuals have at home [13]. Psychological comfort is thus expected to shape passengers' behaviour, for example by prompting them to approach or avoid some elements in their immediate environment at the Platform-Train Interface (PTI). But what are the contextual elements that influence people? Shared spaces are characterised by the presence of other people, creating both a spatial and a social context that could influence the travellers' experience on the platform. This presence of others—particularly groups of individuals—may create a perception of risk in public transport, as studies have reported an association between social contact and a higher perceived risk of aggression [14]. However, research also points to possible positive effects of crowds. Notably, the presence of others can have an informative function [15], as a group can share information about the situation and the behaviour to adopt effectively or not. As such, others can be considered as a source of information about the environment and the right behaviour to adopt in a specific situation [16], particularly in contexts of uncertainty [17]. Thus, crowds can be perceived either as a risk or a threat to be avoided, or as a source of information, certainty and security [18]. The way in which the space is designed and arranged influences individuals' perceptions and behaviour [19]. Numerous studies show that the infrastructure and the environmental design

Table 1: Variables, percentage of mentions, definitions (and corresponding abbreviations into parentheses), and verbatim excerpt for the reason of the valence

Variables (percentage)	Definition: Any mention in the discourse related to. . .	Modalities and verbatims
Trip (66%)	Access to the destination. Distance/duration. Transfers.	“As I was saying, it’s only a 15-minute walk.” “And it’s a simple journey too because there’s only one connection.” “Because I don’t have a bus connection. I don’t particularly like taking the bus, it’s not my preferred mode of transport.” “I would say now I’ve found the ideal route, it’s not too long.” “The platform at RER d at Gare du Nord is something. Well, it’s packed as can be.” “There’s not too many people usually in the morning.” “The train is always on time.” “Oh, there’s a metro coming in 3 minutes, which means it’ll be here in 6 minutes, I love it, life is beautiful. [sarcasm]” “I have a seat.” “But it’s not at all comfortable, you can sit down, but again, there are very few chairs.” “The tram is quiet.” “It’s cold on the platform, not always, but it can be cold.” “I arrive at the metro platforms. Oh yes, there, it smells bad.” “At Châtelet, the ceiling is really low and it’s poorly lit.” “And I can read, it’s almost the only time when I can really read, do personal readings for myself on the way there and back.” “Always very clean.” “It’s unsanitary.” “Often people smoking and it’s not super pleasant.” “I got jostled so much that my hand got stuck in the two metro doors and it hurt me.”
Density (39%)	The line/mode of transport. High density. Low density.	
Network Operation (38%)	Positive network operation. Negative network operation.	
Infrastructure (22%)	Useful and present. Useful and absent.	
Sensory Elements (21%)	Noise/music. Temperature. Smell. Light.	
Activity (10%)	Possible activities carried out or available during the journey	
Cleanliness (10%)	Cleanliness. Dirtiness. Incivilities.	
Unsecurity / Safety (8%)	An accident, collision, fall, etc., or a feeling of safety.	

(e.g., pavement marking lines, [20] as well as the physical ambience (light, sound, heat, etc.; e.g., [21]) influence travellers’ decisions and behaviours at the PTI. Muñoz et al., [22] for instance, studied the case of a metro station in Santiago (Chile) where the organisation of the space (in particular the placement of exits on the platform) creates a crossover of passenger flows on the platform at the time of disembarkation. Indeed, users on the south side of the metro trying to reach the exits via the stairs on the north side of the platform, cross paths with users on the north side of the metro going to the stairs to exit on the south side of the platform. This cross-flow results in longer platform occupancy times for users, with the next metro often arriving before they have been evacuated, causing further congestion at the PTI. The installation of a gantry at the point where the flows cross, only allowing passengers to go from north to south of the platform (and not the opposite), facilitated the crossing of flows and reduced the occupancy time of users on the platform. The infrastructure (stairs) and layout (gantry) of the platform are, among other things, decisive aspects of passenger movement. The majority of studies aiming to understand travellers’ behaviours at the PTI focus on either factor related to the spatial environment [23], or to the social environment [17]. However, these studies do not apprehend the relative impact of the different factors and their interactions. The role and interactions of the various factors remain thus poorly understood. The present research aims to fill

this gap in literature by exploring how spatial and social features (e.g., crowd, seats. . .) are linked with psychological comfort at the PTI. For this purpose, we carried out a qualitative exploratory study, collecting users’ lived experiences, referring to what individuals can remember about their feelings, perceptions, thoughts, actions, which occurred during a specific situation [24].

2 METHOD

Semi-structured interviews were conducted using the critical incidents technique. Participants were asked to recall and describe positive and negative situations they had experienced on public transport, either on routine or non-routine routes [25]. They were encouraged to make clear all contextual elements related to the positive and negative valence and psychological comfort (the interview guide is available on OSF). Twenty-two public transport users (of which 11 women) aged between 20 and 62 years ($M = 35.7$, $SD = 13.2$) were recruited through the authors’ social networks. The participants were informed of the aims and procedures of the study and gave their informed consent. The interview ended when participants had reported the four critical incidents (positive vs negative; routine vs non-routine) or if they could not remember any more trips. For each of the trips recalled, they were asked to specify the exact route and connections, and then to describe the

Table 2: Contribution of variables and modalities on axis 1 and/or on axis 2

Axis 1: Contribution of 11 modalities on axis 1 (>1.5%) written in column “left” or “right” about their coordinates				Axis 2: Contribution of 11 modalities on axis 2 (>1.5%) written in column “top” or “bottom” about their coordinates			
Left	%		Right	Top	%		Bottom
	15,63	Safety		Sensory Elements 1	18,78		
	14,71	Low density		High Density	15,35		
	14,37	Positive Network Operation		Cleanliness 1	11,38		
	10,32	Presence of Useful Infrastructure			9,29	Density N/A	
	8,69	Cleanliness 1		Mode Aversion	8,18		
	5,61	Activity 1		Safety	7,51		
	4,98	Short Time		Unsecurity	4,98		
Strong density	4,69			Negative Network Operation	4,26		
	4,35	Few transfers			4,17	Sensory Elements N/A	
Long Time	3,27				3,68	Activity 1	
Negative Network Operation	2,53				2,18	Preferred Mode	
Total contribution	89,15			Total contribution	89,76		

experience of each train station, how they navigated in the station and how they behaved at the PTI and the associated emotions. The interviews were carried out from January to March 2022 (mean duration of 49 minutes, Min = 25’58”, Max = 79’50”). We collected 77 critical incidents, each corresponding to a trip ($M = 3.6$ per participant, Min = 2, Max = 4; 44% negative, 32.8% positive and 23.2% described by participants as neutral). The incidents were fully transcribed and rearranged chronologically for a global analysis. Each incident was coded in terms of the emotional valence (positive vs negative) elicited by the participant and associated with the whole trip and the reason attributed by the participant to this valence. These reasons were organised into 12 categories (cf. verbatims for main reasons in Table 1) through a bottom-up analysis, whereby a coding grid was created by the authors of a comprehensive reading of all the incidents. Two judges used the grid to categorise the incidents independently and then reached a collegial agreement in case of disagreement. We then used multiple correspondence analysis (MCA) to analyse the association between the elements cited as reasons.

3 RESULTS

To see which elements contribute the most to the user experience, we conducted an MCA with the categories mentioned by the participant (cf. Table 2). Two dimensions emerged from the MCA (cumulative modified rate = 67.23%). Categories were selected if their contribution was above the average ($100/29 = 3.45\%$, with 29 being the number of categories). We also selected categories close to the average contribution and not exceeding a difference of 1.5% between the average and the selected category (see Table 2 for categories and contributions). Axis 1 (cumulative modified rate = 50.29%) can be interpreted as representing the valence dimension (cumulative modified rate = 50.29%); it is composed of feelings of safety, density (high and low), network operation (reliable and unreliable), presence of infrastructure judged useful, cleanliness of

places, individual activities, duration/distances (short and long), and low number of connections. Modalities on the right pole represent positive elements such as feelings of safety, low density, reliable network operation, presence of infrastructure judged useful, cleanliness of places, individual activities, short duration/distances, and low number of connections. Conversely, the left pole involves more negative dimensions such as high density, long duration/distances, and unreliable network operation. Axis 2 can be interpreted as a dimension of perceived control over the incident’s course (cumulative modified rate = 16.94%); it is composed of density (high), cleanliness of places, modes of transport (preference and aversion), insecurity and feelings of safety, presence of sensory elements (noise, smell, light, and temperature; present), unreliable network operation, and individual activities. Modalities on the top pole represent the perception of external factors involved in the situation such as high density, cleanliness of places, aversion to a line or mode of transport, insecurity and feelings of safety, presence of sensory elements (noise, smell, light, and temperature), and unreliable network operation. On the opposite pole, we found internal factors such as individual activities, and preferences for a line or mode of transport. Finally, the valence of the incidents was the only supplementary variable included in the MCA that was retained because coordinates showed a deviation of more than 0.5 from dimension 1 and considered “notable” [26]. The modalities concern positive valence to the right of dimension 1 and negative valence to the left of dimension 1.

4 DISCUSSION

This study aimed to understand how contextual elements in both the social and spatial levels is linked to psychological comfort. The results show that the valence of incidents and the emotions expressed during incidents are mainly associated with events external to the participant’s control (others, infrastructure, and the trip). The MCA reveals that the sources of negative emotions were associated

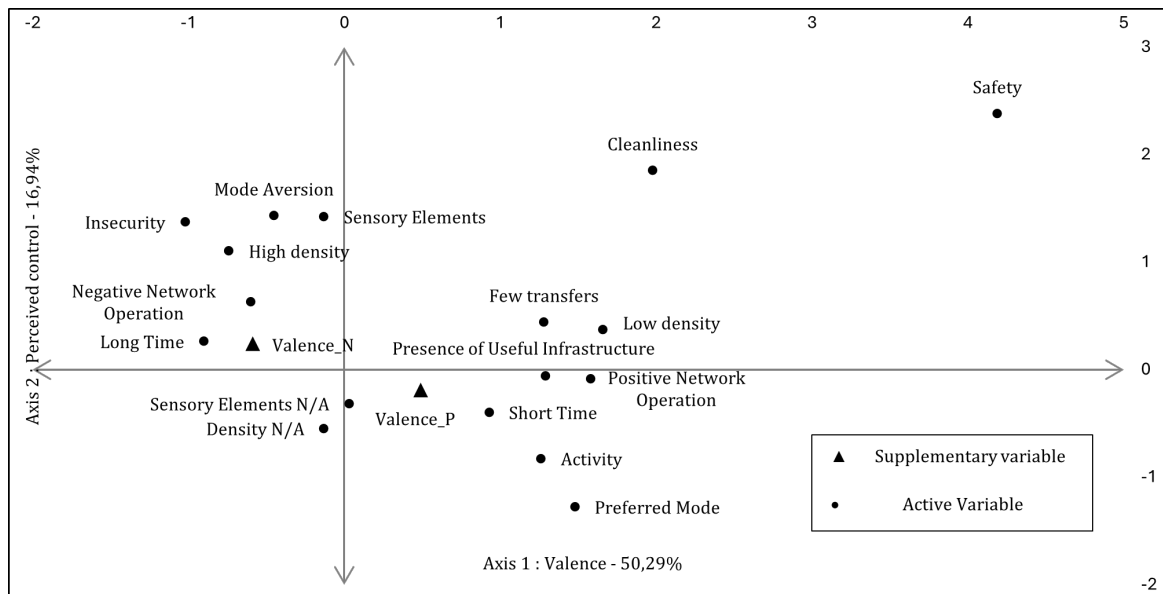


Figure 1: Graphical representation of active categories contributions in 2 dimensions plane. These categories made opposition on 2 axes to form 4 contexts of significant elements.

with problems external to the participants, related for instance to a sense of insecurity (e.g., presence of a crowd) or unreliable transportation operations. Conversely, positive experience was mainly attributed by participants to internal reasons. This is particularly obvious in the MCA at the level of the association of reasons and valence of trips with activities mentioned by participants. Perceived control, i.e., the perception of acting on events, therefore lies on an internal-external axis. External explanations express a low perceived control over the situation, while internal explanations express a high perceived control over the situation. This is consistent with previous studies that show that one barrier to using public transport is the lack of control over their movements that users feel [27]. Indeed, it has been demonstrated that travellers' comfort depends on control over travel time and the need for independence and freedom [28]. Moreover, crowding in transport is also linked to discomfort, as it does not allow a comfortable experience [29]. This study highlighted a link between density and satisfaction in transport: as density increases, passenger satisfaction decreases. This study presents some limitations. First, participants' experience recollection might have been impacted by the fact that the study was carried out during the COVID-19 pandemic, when trips were limited by public policies. Secondly, it was not possible to include in present analyses the objective features of the spaces participants mentioned (e.g., underground train stations versus open-sky ones), given the diversity train and metro stations mentioned in each critical incident. Future studies should test the influence of the social context and individual differences in controlled spaces, for instance, by using vignettes describing specific train stations and controlling their spatial characteristics. Present findings highlighted the importance of density, network operation, time/distance, etc., as elements that justify the valence of the passengers' experience. These elements are all linked to the notion of psychological comfort, which

seems to be the primary motivator for pedestrian travel in shared spaces, offering a new perspective on individuals' behaviours and decision-making in these spaces as mainly motivated by the search for psychological comfort. Identifying the sources of psychological comfort will enable operators and institutions to implement strategies to improve the comfort and experience of users during their stay in these spaces, by for instance adding more seats, or more signs about carriage density and/or alternative itinerary. It would lead to a better flows management, avoiding congestion and, more broadly, improving the psychological comfort and experience of users during their stay in these spaces.

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