Cart-Load-O-Fun: Designing Digital Games for Trams

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ABSTRACT
Travelling on public transport can often be an unengaging experience. We see an opportunity to enrich the public transport experience by utilizing digital play in this space, and in response explore the design of a digital game for trams. A study of passengers playing the game helped us identify 3 key dimensions for digital games on trams: utilizing the movement of the space, incorporating the social setting, and orchestrating the attention of the player. We also present 7 design strategies for designers who aim to facilitate play on trams, evoking playfulness in users of public transport, ultimately allowing for more engaging experiences.

Categories and Subject Descriptors
H.5.2 [Information Interfaces and Presentation]: User Interfaces.

General Terms
Human Factors, Design, Experimentation

Keywords
Play, pervasive games, public transport, game design

1. INTRODUCTION
Digital games have often traditionally been confined to arcades and living rooms (the handheld "Game & Watch" being an exception). However, the advent of recent technologies such as mobile devices allows us to play almost anywhere. Spaces that we consider playful are constantly expanding and becoming blurred with existing spaces [16], some examples being city streets [2], shopping malls [17], and public transport [28]. However, one of the problems that game designers face when designing for these new play spaces is the redefining of an existing space, which may lead to conflict in purpose of the space amongst its different users [16]. Although the existing spaces may have the potential for play they may not be widely accepted as such. We look at public transport as one example. In particular, we focus on trams, and notice two key features:

Firstly, the space is populated with people, so there is potential for social interaction, yet this rarely happens between strangers [13]. Poremba states "the act of playing provides players with an excuse and an alibi to do things that break social norms and push the social boundary as a means of exploring concepts and their benefits, values or worth" [19]. This motivates us to explore social play in this space: we see a design opportunity to turn the space into one of social play, allowing passengers of the space to engage in play together to create a more engaging commute.

Secondly, the tram is constantly moving and stopping, an intriguing feature of the space and very different to most other play spaces such as living rooms. In particular, we note that people are moving by means of the tram, and are moved by the tram without moving much themselves.

We see these two features as design opportunities. As such, we are inspired to design a game that draws on these two opportunities. We then use this game to study how tram-riders use such a system to play as part of their public transport experience. This study helps us identify design dimensions for digital games for public transport, and articulate design strategies for designers who aim to support passengers with digital play. In result, our work aims to make the public transport experience more engaging.

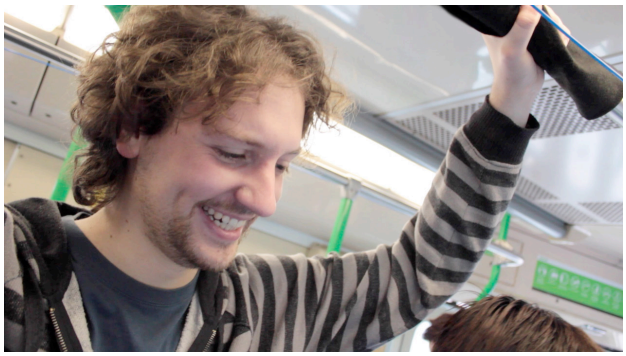


Figure 1. A passenger enjoying playing Cart-Load-O-Fun on a tram.

2. RELATED WORK
Our research was informed by related work from three key areas: social games in public spaces, performances and play on public transport, and playful systems designed for public transport.

2.1 Social Games in Public Spaces
StreetPong is a digital game that allows two pedestrians at opposite ends of a pedestrian crossing to play a game of Pong by means of a controller that is attached to the walking-sign post while waiting for the traffic light to turn green [9]. StreetPong shows us that games in urban environments may have the capacity to engage users of the space in social digital play, and that technology can support this.

Colony, a digital interactive art installation, allows passersby to interact with totems by walking through them or using a mobile device to manipulate and play with them [14]. The totems also communicate with one another using light and sound, encouraging users of the space to interact and collaborate. Colony suggests that having an interactive system in an urban environment can draw

attention and spark curiosity in passersby through visuals and audio, and also facilitate social interactions among users. Technology acts as a means of interaction between players and the digital game.

Lummoblocks is a public installation designed to evoke collective interaction in an urban environment [11]. Passersby are able to engage in a game of Tetris using their bodies to control the game. Two players are required to play the game. One of the players controls the direction of a falling block while the other rotates it. This work shows that collaborative digital games in public spaces can be performative, creating a crowd and engage bystanders.

We felt inspired by these systems, which inform us of design opportunities for social interactions in public contexts through the engagement of multiple people in these games and systems. This is further supported by the fact that gaming is often as much about social interaction, as it is about interaction with the game content [15].

2.2 Performances and Play on Public Transport

Goffman states that playing in public creates the chance to take both players and non-players out of their habitual patterns of social engagement, allowing them to escape everyday social roles, demands and conventions [10]. Public performance groups such as Everything Is OK [24] and the Love Police [26] draw on play in public with their street satires. For example, the two groups board trains with a megaphone and announce the train carriage the "happy carriage" or the "love train", spreading awareness of playfulness through humor and satire. By performing in a public space like subways, these two groups challenge the perceived expectations of the users of these spaces. Although being public performances rather than games, we learn from these examples that social play on public transport is possible if orchestrated correctly.

Copenhagen Game Collective's Train Mafia [28] is an extension of the folk game Mafia with a modified rule set designed to be played on trains. The game is played simultaneously on two trains. Players split into two teams and all board a train. Losing players are required to leave the train at the next stop and wait for the next train, where the game continues. A moderator is placed on each train to ensure the games run smoothly. This non-digital game demonstrates the potential use of public transport space in a playful manner. This is achieved using player's social skills as a game mechanic on public transport. Our work extends this idea to digital games.

2.3 Playful Systems Designed for Public Transport

Artist Daniel Disselkoen has created a simple non-digital game for tram passengers called Man-eater [7]. Passengers who are sitting on a window seat can place their head against the window, close one eye and move their head up and down to 'control' a piranha sticker placed on the window. The goal is to make the piranha 'eat' the heads of pedestrians who are walking along the street outside. Man-eater demonstrates simple ways of engaging passengers and creating a playful atmosphere within a tram. We build upon Man-eater and extend the playful interaction as part of the space to the digital realm, while also offering the opportunity for multiple passengers to engage in play together.

The London-based public transport game Chromaroma [8] uses passenger's Oyster Cards [25] to track and record their locations and awards points for completing tasks and missions, such as visiting unexplored locations. Players are able to compete with one another on a national leaderboard. The game is accessed through a mobile device and provides visualizations of the passenger's travelling routes. We find this to be an interesting way of engaging passengers, and understand that such games do not disturb or intrude on the privacy or comfort of others in the space. However, we believe there is a missed opportunity to incorporate both the passengers and the immediate physical space into play, and allow for the passengers to engage in play together to facilitate more engaging commute experiences.

When it comes to existing digital systems specific to the tram space, the concept system "Strap Game" [20] sits in this design space, as it aims to augment the public transport space with digital systems. Strap Game involves strapping a small display to the handles that passengers hold onto while travelling, allowing them to play existing games like Tetris through tilting the strap and pressing buttons on the strap [20]. We are inspired by the idea that handles and bars, which are important parts of commuting, can be augmented to support playful interactions. Unfortunately, this system is only a proposed concept and therefore there are no further insights available on how passengers would engage with such a bar-controlled game.

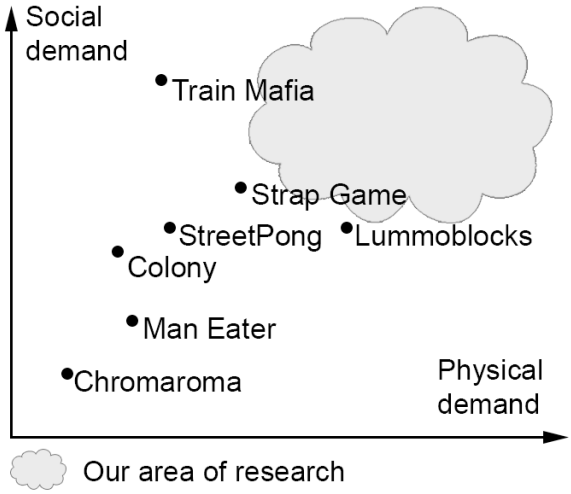


Figure 2. The scope of Cart-Load-O-Fun when positioned in relation to existing work.

We place related work on a graph (Figure 2) that depicts the amount of physical and social demand each work asks of its users. Some works such as StreetPong and Lummoblocks are similar to our research, however they are not in a public transport environment and so they do not offer much knowledge on how to design for public transport.

To conclude, we examined existing works that explore the relationship between the player, the game and the audience in a public setting, some of these games being digital games, others being non-digital. However, there is yet to be a digital game within a public transport space with a study that can act as guidance for designers on how to design digital games for this space. This motivates us to answer the research question: How do we design digital games for public transport?

This is challenging because most digital systems fall short when it comes to engaging passengers of the public transport space while also allowing for multiple players within the same space to play together at the same time. Our solution is to build a new game that

acts as a research vehicle to explore the ways in which digital games that incorporate both the physical and social features of the public transport space can enhance the experience of travelling on public transport.

3. CART-LOAD-O-FUN

Cart-Load-O-Fun is a two player collaborative game designed for trams. Two players collaborate to control a single character from a top-down third person perspective. One player controls the character's movement on the x-axis while the other player controls the y-axis. This is done by holding onto the bars that have sensors attached to them and applying force by squeezing. Holding on tighter increases the value that correlates to the x and y position of the character in the game. We chose squeezing the bar as the means for input as passengers already tend to hold onto bars or handles when travelling and grip harder when a tram is accelerating and decelerating.

Players must work together to collect gems that randomly appear in the level, while avoiding enemy characters that bounce around the level (Figure 3). Each gem collected adds two seconds to the timer. The game starts with 45 seconds on the timer, and usually lasts 60 seconds through the collection of gems. So far, the game only supports two players at a time, however, we can envision a version of the game with additional sensors that support more players at the same time.

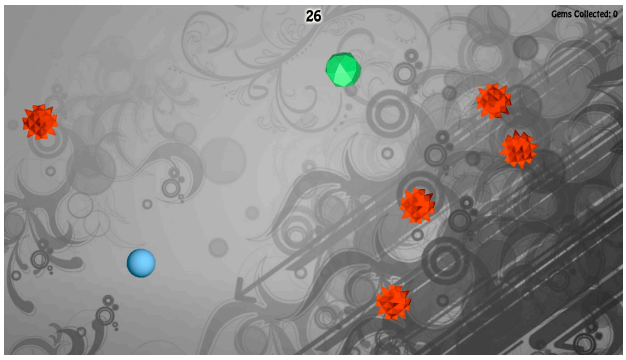


Figure 3. A screenshot of our current game including the player character (blue), the gems (green) and enemies (red).

Cart-Load-O-Fun uses two force sensors that are connected to a computer running the game via an Arduino Uno with custom firmware [5]. The force sensors are attached onto horizontal and vertical bars of the tram that passengers hold while travelling (Figure 4). This setup makes holding onto a bar a game action. We saw this as a suitable method of playing the game as passengers in the space who are standing are already holding onto these bars.

We initially started with using a pico-projector to project the game onto a flat surface in the space (either on the floor or ceiling), but due to sunlight reducing visibility at times, we also used a laptop screen to display the game to the players. However, we can envision future iterations that mount dedicated display monitors above the windows and onto the walls of the tram.

4. STUDY

We conducted a study to understand how passengers play and experience Cart-Load-O-Fun as a means of gaining knowledge about the design for games for trams. For this study, we gained permission from the local tram authority to install Cart-Load-O-Fun in their trams and observe and interview tram-riders.

4.1 Participants

A total of 30 participants played our game on the tram, 20 of which were interviewed afterwards. Our team interacted with over 50 passengers, including players and non-players on the tram, over 7 tram sessions in a period of a month.

4.2 Procedure

We boarded the tram as a team of three researchers, each with a specific role assigned to them (interviewer/announcer, observer/note-taker, cameraman). The game ran for the duration that the researchers were on the tram, which was approximately 40 minutes per session. Only one tram per session was used. We used public announcements to a) make passengers aware of the game and our presence (this was also a requirement of the tram authority) and b) invite players to play the game. The passengers that were invited to play the game included those who had just entered the space and those who were already present. Once players were finished playing the game, we asked if they would like to be interviewed, providing that they were over the age of 18 (we focused on adults in this study as per ethics requirements).

4.3 Measurements and Analysis

The researchers observed participants during game play. This was followed up with a brief interview guided by key questions using the laddering technique [3]. All game sessions were recorded on video (with audio), providing that consent from the participants was acquired. These recordings were used for analysis, to seek common themes coming out of the data while also looking out for synergies and anomalies. Each tram session was discussed with fellow researchers afterwards. Video logs of the discussions and recorded thoughts were kept after each study. These were analyzed along with the recordings of the participants.

The video data taken from participants and the researchers were transcribed and then watched a number of times. Common themes that arose were grouped, and design dimensions were sought through an iterative discussion process. Venn and Affinity diagrams were used to support this process.

4.4 Challenges

Due to the nature of the space in which the research was conducted, there were several challenges that we faced. For example, passengers constantly entering and leaving the space made it challenging to conduct interviews, similar to the challenges O'Hara identified with games in public city squares [18]. We addressed this by keeping the play time and interviews brief.

5. FINDINGS

From our studies conducted on trams, we report on the following (F)indings. Common themes have arisen from these findings, thus we group them into three key categories – the digital, the social, and the spatial.



Figure 4. Cart-Load-O-Fun on a tram. The sensors attached to the bars are squeezed and released by a passenger to play the game.

5.1 Reactions to the Game (Digital)

5.1.1 (F1) Cart-Load-O-Fun is Compelling

Responses from participants were all positive with the majority of the passengers replying with very positive responses.

> P3: "Yeah it was fun as, bro."
>
> P1: "It was great for me, I love it. It was quite cool."
>
> P2: "You should put that on every tram."

The smiles the participants displayed during play (Figure 1) further support the sense of enjoyment of the game.

5.1.2 (F2) Perception of Travelling Time Changes as a Result of Playing

A strong theme that arose was the passengers on the tram perceiving time passing by faster while playing the game. This seemed to be a positive result as participants who reported this were smiling.

> P11: "Time just flies."
>
> P10: "Yeah, you just zone out, it was good!"
>
> P2: "It's exciting because the travelling might go faster."

When prompted for the reasons, responses suggest this was tied to the design of the game.

> P10: "You're fully focused on trying to navigate [...] you're just really focused on getting this thing [the character] to where it needs to go."

One player pointed out it might have to do with playing with others.

> P12: "It felt faster with someone else than it did playing something by myself."

5.1.3 (F3) Comparing to Existing Methods of Pastime

Of the participants who filled out our survey, about half noted that they play games on mobile devices and handheld consoles while they travel. During game play on the tram, a number of players referred to their previous experiences of playing games on trams.

> P10: "When I am playing something on a tram it'd be on my iPhone so it's obviously just a one player thing, no interaction with anyone else on the tram. […] I usually play games anyway on the tram, just on my iPhone. But it's obviously a different, umm, different elements involved."
>
> P12: "I usually play iPhone games or, like, 3DS or something, on the tram or the trains, and umm, I'm not sure why exactly but the, uhh, it's that- playing with someone else sort of made it, I dunno, made the trip faster. […] It felt faster with someone else than it did than playing something by myself."

5.1.4 (F4) Distracting from Travel Priorities

Participants pointed out that they were in risk of missing their tram stops while playing the game. As a strategy to avoid this, one of the players moved their focus from the game to the road and back again to make sure they would not miss their tram stop.

> P3: "You might miss a couple of stops."
>
> P4: "I think that's about enough, otherwise we're likely to miss our stop."
>
> P10: "You can get really lost in the game, probably miss your stop."

5.2 Reactions To and From Other Passengers (Social)

5.2.1 (F5) Cart-Load-O-Fun Can Create a Social Atmosphere

Players would often express their enjoyment together through grunts, smiles and laughter while playing the game (Figure 5). Many of the players pointed out the potential the game has in being able to create a social atmosphere on the tram.

> P6: "It was fun and original, I guess, uh, making it a bit more, you know, friendly, and stuff. […] You know, creating, uh, creating some kind of, you know, a sense of community with the users and everything. Yeah, it's nice. […] I think it lacks in public transport in general. Like, you're always uncomfortable looking at people and everything, interacting with them."
>
> P10: "It was interesting just coordinating a game with someone else there who's in control of half of what's happening on the screen. [...] It's also different 'cos, usually when you're playing on your own you're kind of zoned out in this very, um, like, isolated kind of, um, atmosphere. Whereas playing with someone else and having people watching on as well makes you a bit more aware of your surroundings."
>
> P12: "To put that into a public space where you have to be playing with someone else that you may or may not know [...] can often be a conversation starter."

5.2.2 (F6) Verbal Communication Between Players As Part of Gameplay

Despite the tram being a space where strangers rarely interact, the passengers playing the game would often communicate with each other verbally while playing the game, aiding each other in the form of giving directions. This also happened with players who were strangers to one another, which shows us the potential social games have in reframing a social space.

> P12: "Here we go up."
>
> P13: "Yep. I'm going left and right... I think. […] Up, up!"
>
> P12: "Yeah, I'm going up!"



Figure 5. Two strangers playing Cart-Load-O-Fun.

5.2.3 (F7) Spectator Engagement

During the game sessions we observed many non-player passengers in the space being drawn to the game and enjoying watching as a spectator. This was evident in the smiles and intrigued glances the spectators displayed while observing the players play the game. Some spectators decided to try the game after watching other players play.

> P13: "It's good to sort of have something to look at other than outside."

However, we also noticed that at certain points, some of the spectators had trouble observing the game when other passengers obstructed their view.

5.2.4 (F8) Being Self Aware While Playing in a Public Space

Playing Cart-Load-O-Fun in a tram can be a performative experience as there are spectators at most times. Participants noted the following about being self-aware in a public space.

> P12: "I guess it's just sort of, there was more of a self-awareness, that, uh, I'm not used to, um, when you're playing a game. [...] The idea of having it in a public space is, it's intriguing. [...] It felt like I should have been self-conscious, [...] it only sort of lasts a few seconds really, but then once you sort of get into the game, you-you sort of lose that [...]"

> P10: "[…] playing with someone else and having people watching on as well makes you a bit more aware of your surroundings. [...] At first I was so concentrated on just getting the character to move that it didn't really occur to me that other people would be looking on. But then as you kind of start getting the hang of the game and playing it more efficiently, um, yeah, I think you start looking around more. [...] It wouldn't bother me very much, I guess I wouldn't be too self-conscious about people watching me play."

5.2.5 (F9) Declining an Invite

We also note that the majority of the passengers declined our invite to playing the game. We asked them why they would not join playing, and the common reasons for declining an invite were; being too tired to play, too old to play, not knowing how to play, not being someone who plays games, having to leave the tram very soon, and the sensors being too high to reach. Although we were curious about some of these answers, we decided to not disturb these tram-riders any further.

5.3 Reactions in Regards to the Space (Spatial)

5.3.1 (F10) Movement of the Tram Impacting Gameplay

The tram constantly accelerated and decelerated between tram stops. Two players explained how the tram moving back and forth impacted their game.

> P3: "The ball is moving and the tram is moving and all that, it was like, noo. Haha."

> P11: "The trams stop and go abruptly, it can affect your game play."

5.3.2 (F11) Location of Controller Can Effect Play Experience

The force sensors that were used as the input devices were placed on bars located above standing passengers' heads. These are the bars that passengers hold onto while travelling. A pair of participants noted that holding onto these bars of the tram for long periods of time may cause irritations in their arms.

> P10: "If you're playing it for a while your arm could get tired, just from squeezing and having your arm in an upright position."

We also received feedback from a non-player elderly lady, who expressed her interest in playing the game, but was unable to play due to not being able to stand for long periods of time.

6. DESIGN DIMENSIONS

We use our findings to derive a set of design dimensions for understanding how to design digital games for public transport. We do not intend these dimensions to be an exhaustive analysis of the design space; rather, we use this discussion to highlight interesting dimensions that may not be immediately apparent to researchers and designers who aim to understand the design of digital games for public transport.

6.1 Utilizing the Movement of the Space

Our first dimension looks at the extent to which the game allows being controlled by the space, in particular the movement of the space. On one end of the pole of this dimension the game is completely controlled by the player, as is the case with most current games on mobile devices. On the other end, the game is controlled by the movement of the space; in our case, by the movement of the tram. In Cart-Load-O-Fun, the player's control over the game (i.e. the amount of pressure applied to the sensors) is disturbed as a result of the acceleration and deceleration of the tram (F10). As such, in Cart-Load-O-Fun, there is an ongoing shift of control between the player being in control of the game and the movement of the tram 'taking' control of the game.

Designers can place their design along this dimension and vary the degree to which the game makes use of the amount of control taken from the player by the movement of the public transport space, and using it as a game mechanic. We believe this has potential in creating novel experiences, as the movement of the space is an intriguing feature of public transport. We foresee other moving spaces being explored as spaces for play in the future, such as elevators, escalators, and other means of public transport.

We identify two key approaches for leveraging movement features of public transport in a digital game: direct and indirect leverage of control.

6.1.1 Direct leverage of movement control

This approach of control involves the game detecting the change in movement of the public transport space using sensor technology (i.e. accelerometer, gyroscope, etc.) and leveraging this in the game directly as a game mechanic. Similar to games on mobile devices that use sensor technology to manipulate game objects, sensors attached to the public transport space can assist in feeding data about the movement of the space to the game, which can then be used as a game mechanic. This is the proposed method for the concept game system Strap Game [20]. One advantage of this method is greater accuracy in comparison to the indirect leverage method.

6.1.2 Indirect leverage of movement control

This method of control relies on the input of the player to detect whether there is change in the movement of the space. Sudden disruptions caused by the movement of the public transport space could often lead standing passengers to hold onto the bars or handles in the space to counter the force applied to them. In the case of Strap Game's handle, which is suspended from a bar, the sudden movement of the space would lead to players moving, which would in turn lead to an involuntary tilting of the handle, triggering the sensors within the system. Cart-Load-O-Fun also employs this type of "indirect leverage of movement control" (F10), using player movement as facilitated by the movement of the tram, as game input. Using this method of control can require different (and often cheaper) sensors in comparison to the direct approach. With Cart-Load-O-Fun, this was achieved with simple force resistive sensors. We see this indirect leverage of movement control as a unique design opportunity to further the positive experience of digital games on public transport (F1).

6.2 Incorporating the Social Setting

Our second dimension concerns the extent to which the game incorporates the social setting of the space. On one end of the pole of this dimension, the game ignores the social setting of the space, and on the other end, the game facilitates the player actively engaging with and affecting the social setting that exists on public transport. In Cart-Load-O-Fun, this is done through the game engaging players in a way that is visible to other passengers, motivating a kind of performance: for the participants, playing in front of other people on a tram was a performative activity (F8). The 'amount' of performance demanded from the player can be varied through game design. As a result of this, players are able to alter the social atmosphere of the space by creating a spectacle within the space through performative gameplay (F5, F7).

Furthermore, Cart-Load-O-Fun asks the player to affect the social setting in another way, too: players who enter the space without a partner must approach and invite a fellow passenger to the game if they wish to play with another player. This invitation may also impact the social atmosphere in the space.

Designers can place their designs along this dimension by varying the degree to which the game asks the player to perform, and in turn affect the social space. To achieve this, we identify two key approaches: indirectly through reactions, and directly through actions.

6.2.1 Incorporating the social setting indirectly through reactions

This approach involves reframing the results of the movement of the tram into player performance to affect the social setting. In Cart-Load-O-Fun, the player's control over the game shifts when the tram is moving and stopping (F10). When this occurred, passengers displayed emotional reactions, which led to communication between the players. This was expressed through grunts, smiles and laughter, while communication occurred in the form of coordinating commands between the players to avoid the risk of losing the game (F6, F7, F8).

6.2.2 Incorporating the social setting directly through actions

One example of how a game might facilitate the player in affecting the social space directly might be through the game explicitly asking the player to perform certain performative actions. We give two examples of this in existing digital games. Guitar Hero [1], a digital rhythm game which uses a guitar as a game controller, encourages performance at certain points during the game by giving bonus points for actions that the player performs, such as lifting the guitar up. The digital game B.U.T.T.O.N. [27] asks players to carry out playful and often silly actions such as "Act like a monkey" or "Make bird sounds".

Designers should note that this method of directly affecting the social space through asking for performance may be challenging to some players (F8) as they may go through some extent of evaluation apprehension [4], a fear of their behavior being judged by others in the space.

6.3 Orchestrating the Attention of the Player

Our final dimension describes the extent to which the game orchestrates the attention of the player. The two poles of this dimension are made up of the game demanding full attention from the player on one end and the space demanding full attention on the other. Games can demand undivided focus and attention from players, allowing players to enter a zone of flow for optimal experience [6]. While some designers might argue that 'flow' must be achieved to create an engaging experience, this may not be desirable in some cases as it may distract the player from other priorities they may have. In our case, players of Cart-Load-O-Fun had the priority of leaving the train when they reached their stop (F4). If players were to enter a state of flow and become isolated from their surroundings, the risk of missing their stop would increase due to the perception of time changing as a result of playing (F2). By allowing the game to orchestrate the attention of the player between the game and the space, players can enjoy both the game and the social atmosphere created by it (e.g. interacting with other players and non-players, as well as performing and observing the surroundings (F8)) while also being mindful of other priorities. Cart-Load-O-Fun supports this to some extent by offering short games that allow players to shift their attention to the tram stops in-between games, however, few players were still concerned they might miss their stop (F4).

Designers can place their design on this dimension by varying the degree to which the game demands the player's attention. This can be achieved through game design, through placement of sensors within the space (F11) and through the sensors detecting change in movement within the public transport space.

7. DESIGN STRATEGIES

We now provide a set of design strategies that we derive from our study. While the above design dimensions provide an abstract framework for thinking about digital games on public transport informed by prior work and our experiences with Cart-Load-O-Fun, the following strategies complement those dimensions by offering practical lessons learned for designers as to how to build better digital games for public transport.

7.1 Vary the shift of control of the game between the player and the space

One of the most intriguing aspects of the tram is that it moves. Our findings show that this was an appreciated feature (F1, F10) and playing a game that leverages this feature was different to existing games that passengers currently play (e.g. iPhone, handheld consoles) (F3). It is up to the designers to decide how much of this feature they leverage (D1). However, we believe it is a feature that designers could use to their advantage. In particular, based on the experiences with Cart-Load-O-Fun, we suggest designers make use of this design opportunity by allowing the movement of the space to vary the shift of the player's control over the game, shifting back and forth from the player having control to the space taking control to create an engaging experience. This is a feature that the designers of the conceptual game system Strap Game [20] might also benefit from.

7.2 Rapidly vary the shift of control of the game to fuel communication between players

Findings from Cart-Load-O-Fun suggest that the shift of control between the game and the space (D1) can create an opportunity for social interaction to occur during play (F5, F7). This is a result of the movement of the public transport disrupting the player's control over the game; in particular the rapid shifting back and forth contributes to this (F10). Designers can take advantage of this by encouraging communication between players through game design (D2). By changing the sensitivity of the game's response to the movement of the public transport space, designers are able to increase the rate of which this shift of control occurs, encouraging player communication as part of the gameplay (F6).

7.3 Exploit the game's capacity to support player's self-expression to increase spectator engagement

When playing Cart-Load-O-Fun, players expressed their enjoyment through grunts, smiles and laughter (F5), and they also communicated verbally as a means of coordinating gameplay (F6). Basing off Cart-Load-O-Fun's ability to create a social atmosphere within the public transport space (F4), we point out and place an emphasis on the ability to engage spectators. Playing a performative game in a space that is populated with other people can gain their attention (F7). Deriving from the extent to which the game facilitates the player in incorporating the social setting (D2), we recommend designers to place their designs on the higher end of the dimension, where players are more self-expressive and performative to allow for a more engaging spectator experience.

That being said, designers must also keep in mind that not all passengers may want to be engaged in the game. Cart-Load-O-Fun aims to address this by keeping auditory feedback from the game to a minimum (i.e. no constant music in the background, which may become an irritation). We believe imposing audio onto passengers may disturb some of them, as is the case with the public performances using a megaphone by Everything is OK [24] and the Love Police [26].

7.4 Use the game to shift the player's focus from the space to the game to decrease the level of self-consciousness of performing

Certain players may feel uneasy when playing in a public setting like public transport, especially due to the performative aspect of playing in public (F8). Our recommendation to designers who wish to address this is to shift the player's focus from the space to the game (D3). This can be achieved through game design. By designing the game to demand more attention from the players (e.g. more intense second-to-second gameplay), players can become more focused on the game rather than the space. As explained by the designers of the digital game Musical Embrace [12], where players engage in socially awkward play by hugging one another to apply pressure onto a suspended pillow-like controller that sits in between the players, being able to watch and focus on the screen rather than the players and the space allows players to shift the awkwardness arising from the awkward interaction between players. This confirms O'Hara's elaborations on public play and self-consciousness when it comes to play on big screens in urban spaces [18].

7.5 Orchestrate the focus of the player frequently towards the surroundings to support other priorities of the player

Players on public transport who have a priority of leaving when they arrive at their stop may be at risk of missing their stop as their perception of time changes while playing (F2), resulting in a distraction from other priorities (F4). By allowing the game to orchestrate the amount of attention it demands from the player (D3), passengers are more likely to be mindful about their priorities. One way of doing this can be through sensing whether or not the public transport is moving. Designers may decrease the difficulty of the game as the public transport is coming to a halt, relieving the player from the engagement. Another simpler way is by keeping games very short.

7.6 Make sure passengers are able to decline an invite

We find it important for passengers within the space to be able to decline an invitation to the game, as some passengers may not be fit or willing to play (F9). This is also important from an ethical view, as players should not be forced into play: Montola et al. point this out in the 'Ethics' and 'Unaware Participation' section of their book 'Pervasive Games' [16]. Apart from that, designers must acknowledge that some passengers may simply want to relax alone during their public transport experiences. Therefore we suggest designers keep this in mind while designing their games.

7.7 Place the game in a location visible to spectators

Playing on public transport often creates spectacle. We have found that other passengers enjoy watching players play the game (F7). Thus the passengers are engaged even if they are not playing, and at times are enticed to participate [23]. For digital games with a display, we believe it is important for the display to be visible not only for the players but also for the audience as the location of the hardware can impact both the player's and the spectator's experience (F7, F11). This can be done by having both an appropriately sized display and also by placing the display in an appropriate location where bystanders will not obscure it.

For our studies, upon initially using a pico-projector to project the game onto the floor of the tram, we found that spectators had a hard time seeing the projection due to it being blocked by bystanders. In addition to this, the tram's constant moving and turning corners would at times allow sunlight to shine through the windows onto the projection, preventing the screen from being

very visible, hence hindering the experience for both players and spectators.

8. LIMITATIONS

As with any in-the-wild [21] study, our work is also characterized by practical limitations, which we discuss below.

Firstly, our research investigates digital games on trams in one particular cultural setting. We acknowledge that countries and communities with different social and cultural norms may have different reactions and responses to Cart-Load-O-Fun. Secondly, our research is conducted around a single game. We believe studies around multiple games that require other methods of gameplay (for example, competitive play rather than collaborative), over a longer period may also lead to supplementary findings, however we believe this work presents a useful starting point for future work in this space. Finally, we believe that researchers being present during game play may have impacted the experience and behavior of the players. As such, responses to the game may vary if the game is played without supervision. However, it was important from a research and ethics standpoint to be present during game play. We therefore believe our insights can be a valuable initial exploration into this exciting field of digital games for public transport, aiding researchers in investigating this domain further.

9. CONCLUSION

We have presented Cart-Load-O-Fun, a digital game designed for trams. We reported on findings from a study conducted on trams with Cart-Load-O-Fun installed. Our game acts as a research vehicle to explore the ways in which digital games that incorporate both the physical and social features of the space can enhance the experience of travelling on public transport. We presented 3 dimensions for digital games and provided 7 design strategies as guidance for game designers who aim to facilitate play in public transport, allowing for more engaging experiences.

10. ACKNOWLEDGEMENTS

We would like to thank Eric Dittloff, Wouter Walmink, Danielle Wilde, Sebastiaan Pijnappel, Ruth Sancho Huerga, Harry Lee, Gina Moore, Rohit Khot, Markus Montola and Jesper Juul for their feedback. We would also like to thank Ian Stokes from Yarra Trams for granting us permission to use the tram facilities.

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