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Human-Centred Design Approach for Revisioning Public Transportation System in Malaysia

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Abstract

Improving urban transportation systems requires an emphasis on users' end-to-end journey experience, from the moment the user steps out of their home to when they arrive at their destination. In considering such end-to-end experiences, Human Centred Design (HCD) must be integrated from the very beginning to generate viable urban planning for the public. An HCD approach will encourage innovative outcomes while acknowledging all factors that need to be understood along the journey. We provide evidence through field research analysis to show that when designing and planning for well-integrated public transportation in an urban setting, it is not just about the physical manifestation of a particular outcome; moreover, it is about the context and human behaviours that need to be considered throughout the design process. Humans and their behavioural factors are vitally important to implement sustainable public transport systems for future urban infrastructure successfully. Through an in-depth literature review of HCD approaches for urban transportation systems, we provide a base to exploit the benefits and highlight the importance of including HCD in public transportation projects for greater patronage, resulting in more sustainable cities. This paper will provide a much-needed rationale behind the HCD approach in all public transportation projects to understand different levels of user experience, from the setting of transport policy to the implementation of urban infrastructure, vehicle and interface design.

Keywords: human-centred design, public transportation system, urban planning, user observation, urban infrastructure

1. Introduction

Many cities focus on improving their public transportation systems in response to traffic congestion (Rabinovitch, 1992; Tirachini & Hensher, 2011; Khoo & Ong, 2013; Hamre & Buehler, 2014). Moreover, COVID-19 presents significant challenges when rethinking the way people use or want to use public transportation post-pandemic crisis (Tirachini & Cats, 2020). The principles and theories of HCD are practised worldwide when designing a product or a system. In this paper, we present a systematic analysis of literature focused predominantly on applying HCD principles to public transport to emphasise its need in developing future public transportation. We detail user observational studies in three Malaysian cities to demonstrate a design framework

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using one of the HCD methods to guide appropriate design decisions.

Understanding the perspective of the users of public transportation is crucial to creating a safe, viable public transport solution. The HCD approach ensures that the user perspective is included in all stages of the design (Kuys et al., 2015). The elucidation of these objectives and how they influence the direction of future public transportation projects validates the HCD approach for public transportation design. By understanding these factors and identifying methods within HCD, a thorough set of criteria can be established to develop an optimum public transportation system.

2. HCD Approach

A key aspect of the successful development and implementation of a transportation system is the inclusion of the user when planning (Evans & Azmin-Fouladi, 2005). Gebauer, Johnson and Enquist (2010) emphasise the importance of understanding the value of co-creation during developing a new system. This includes activities such as customer engagement, self-service, customer experience, problem-solving and co-designing. COVID-19 has posed a great challenge for the public transportation sector (Tirachini & Cats, 2020), making it even more important to understand the user perspective to overcome the contemporary negative perception public transportation is currently experiencing in Malaysia.

While self-service can reduce costs and save time, it can also be a negative experience for some users.(Gebauer, Johnson & Enquist, 2010). One example of this is petrol/fuel stations, where service has all but disappeared in some countries. Commuters must exit their vehicle and pump their own petrol, which was done for them in the past. Another example of this is currently occurring in supermarkets, where self-service check-outs are becoming a mandatory inclusion (Demirci Orel & Kara, 2014). While some like it because they can get in and out of a supermarket quicker, others feel that the service culture is diminishing and becoming less 'human' and more 'machine-driven'. There is a fine line between efficiency and good service, which must be balanced against the costs associated with each activity. To replace an entire checkout system at a supermarket with self-checkouts is expensive, but the payback over time, though reducing staff, is worthwhile. However, the side-effects of such a system – increased theft, service/maintenance and increased security costs – resulting in a loss of revenue also need to be considered (Bulmer, Elms &Moore, 2018). An HCD approach is not just about the users interacting with physical products within a system but a holistic approach to the entire system. Public transportation services may need to be redesigned to efficiently and effectively accommodate users' demands and also oblige restrictive capacity and health considerations due to the impact of COVID-19. One of the main challenges will be providing viable public transportation systems that respond to public health considerations in anticipation of improving user perception.

2.1. HCD Approach

The following literature outlines two prominent companies focusing on the HCD process – IDEO and 2nd Road. For public transport system development, which involves a wide variety of users, it is important to consider all possible scenarios (Woodcock, 2012). A study by Gebaur et al. found that customer experience leads to positive emotional bonds between the system and the customer. Problem-solving within such a system gives self-controllable opportunities for the customer. The customer should be able to navigate and solve a problem with the given system, with easy interactions between the system and the customer, creating a user-friendly environment (Gebauer et al., 2010). Norman (2002) aims to 'humanise technology' and ensure it is easy to learn, easy to use and easy to understand. Understanding the user perception of public transportation is essential. To do this, the system must understand the user – validating the use of HCD as an appropriate design methodology in this paper.

Shown in Figure 1, Brown's diagram (2008) demonstrates that the HCD process begins by understanding needs and examining people's behaviours towards an identified problem. The design stage, 'Desirability', is where a range of possible solutions are created and worked through to ensure feasibility and viability. By having 'Desirability' as the starting point, the optimum outcomes can be presented and then refined to ensure the final solution is plausible. This process will need

to be adapted to current settings to ensure that creativity and innovation are relevant to current situations. HCD contributes to developing a set of principles which will help provide an optimum solution for public transport users. This should underpin the design development in any public transportation development with an outcome that will encompass all three factors – that is, the solution should be desirable, feasible and viable.

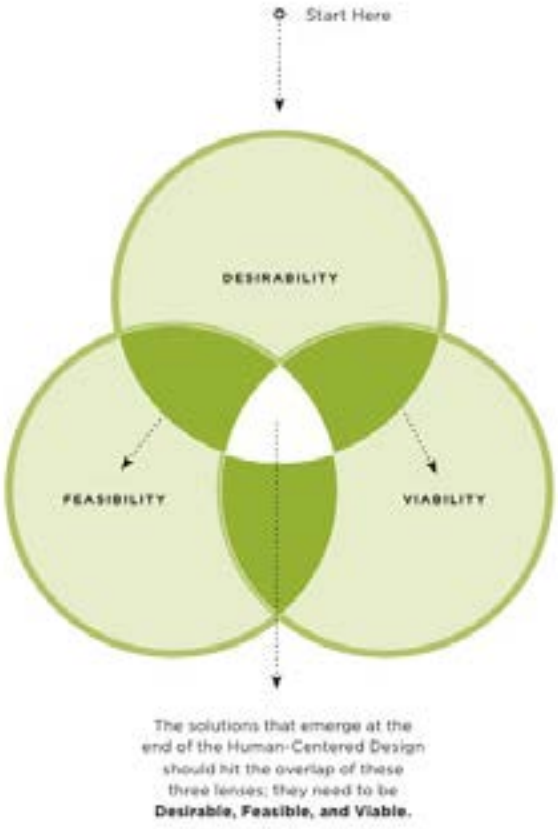

Figure 1. Brown, T. (2008). Design Thinking. 1st edition Harvard Business Review, pp.1–9.

According to global design company IDEO, there is a strong emphasis on building a deep empathy with the people's needs and motivation in the HCD process (see Figure 2).

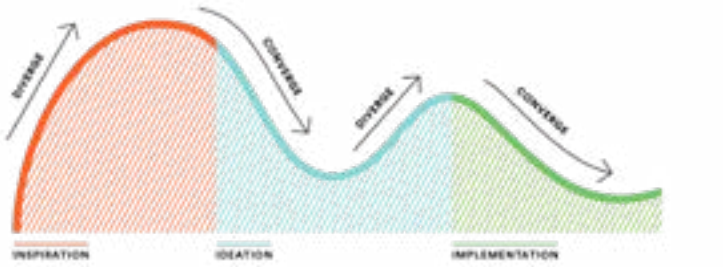

Figure 2. IDEO's human-centred design process (ideo.org, accessed 14/05/2020).

Another key facet of HCD developed by IDEO is the notion of providing outcomes that are innovative, effective, and sustainable – all of which are key attributes of transportation developments. Figure 02 shows the intentions of the HCD process, which is to develop innovative, effective, and sustainable solutions for social change. For this paper, the Inspiration phase of this HCD approach was followed for the observational research studies to provide solid foundations for future research. An 'engineering-focused' approach is required for transportation development, which has the risk of failing to push the innovation, creating an unusable product or a system (Steen, 2011). With fixed milestones and a schedule driven by technological advances, many public transportation projects are at risk of not fulfilling optimal outcomes (Khoo & Ong, 2013). However, creativity and innovation do not just come to those with time and means; innovation comes with successful collaborations, while timelines enforce structure and hard work enforces

quality outcomes. Many businesses and organisations embrace user involvement approaches to avoid certain risks in their innovation process (Steen, 2011). User-based approaches such as HCD are more likely to reveal genuine issues that need addressing throughout the design process (Maguire, 2001). The direction of public transportation projects needs to be guided by these emerging issues revealed by users, especially to address issues raised due to COVID-19.

Another design-driven company that implements strategies around HCD approaches for business improvements is 2nd Road in Sydney, Australia. 2nd Road uses the principle of HCD to provide consulting services in the areas of strategy and innovative development around the world (www.secondroad.com.au, 20/08/2020). Like IDEO, 2nd Road provides a series of key objectives to help organisations innovate with the user front of mind. 2nd Road describes itself as playing at the intersection of three major fields of professional practice, as highlighted in Figure 3.

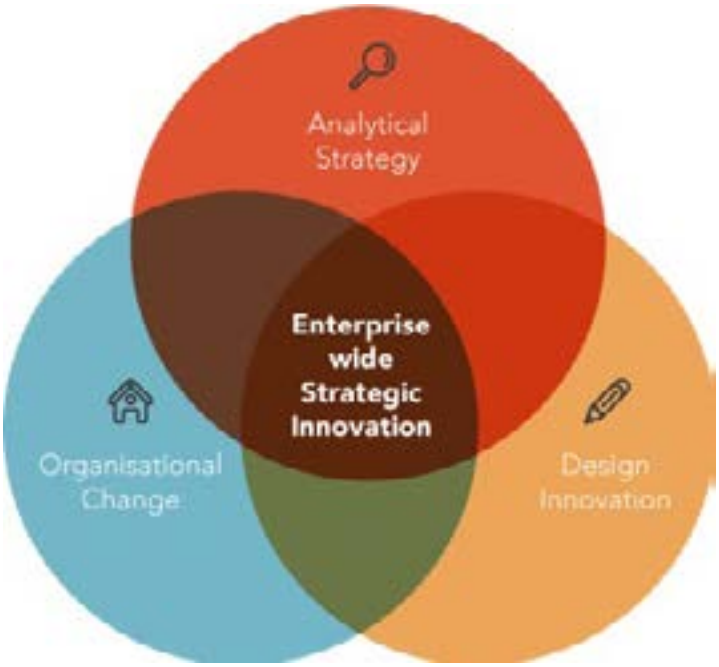

Figure 3. 2nd Road's statement of intent titled, 'What makes us distinctive?' (http://www.secondroad.com.au, accessed August 2020)

This is similar in structure to IDEO (Figure 2); however, it is framed more on organisational-based innovation rather than a targeted approach specific to HCD. Both have merit, and both can be used to guide the design direction of new public transportation projects. 2nd Road aims to demystify and lift design's problem-solving toolkit to work on the problems that businesses face today. 2nd Road's deep heritage in language and conversation brings a new perspective to design, taking it from a creative method to a rigorous discipline that is honed in boardrooms and is suited for corporate strategy and culture.

3. Method

There are many different approaches (methods) that can be used to help solve problems by involving the human perspective in all steps of the problem-solving process common to HCD research. For this paper, we outline one of the most useful approaches in the context of public transportation, which is user observation. User observation is not a new method and has been used throughout human history in an effort to better understand the world (Baker, 2006). User observation is a popular method used in the design process to understand and identify problems in current systems and services (Maguire, 2001). In this paper, a critical method is used to understand the local context of the project and document the issues that currently exist to provide a framework for design solutions.

User observation in human science concentrates on the behaviour of people and their relationships in social and technical environments. Using user observation methods from human research in design is suitable because design is fundamentally a human-centred activity (Hanington, 2003).

At the beginning of a project, when the user and their environment are unknown to the designer, it is critical for the designer to immerse into the user's world to identify current problems in need of developing (Hanington, 2003). A design approach may also identify somewhat subliminal issues that a user may not instantly identify with or do not see as an issue; however, once improved upon, it may create a better user experience. Returning to Malaysia, the current bus network is sub-standard; however, many users think this is adequate because that is the limitation of their experience. Long delays, poor infrastructure, and uncomfortable buses are the norm without any alternatives. By having an external eye work on this project to identify problems, then improvements can be made that will ultimately enhance the local user's experience. When outlining the current issues, user observation contributes to a better understanding of context. By observing people in their daily routines, designers have better insights into what makes a good product or service experience.

Figure 4 shows the positioning of user observation methods used in human-centred design at IDEO. This shows the importance of user observation methods in the early stages of a project, ensuring that the design process genuinely addresses the needs of the user rather than simply going through the design process without a clear end goal. This paper highlights research done in the 'Hear' stage that focuses on concrete examples of the current status of the public transportation system in KL, Malaysia.

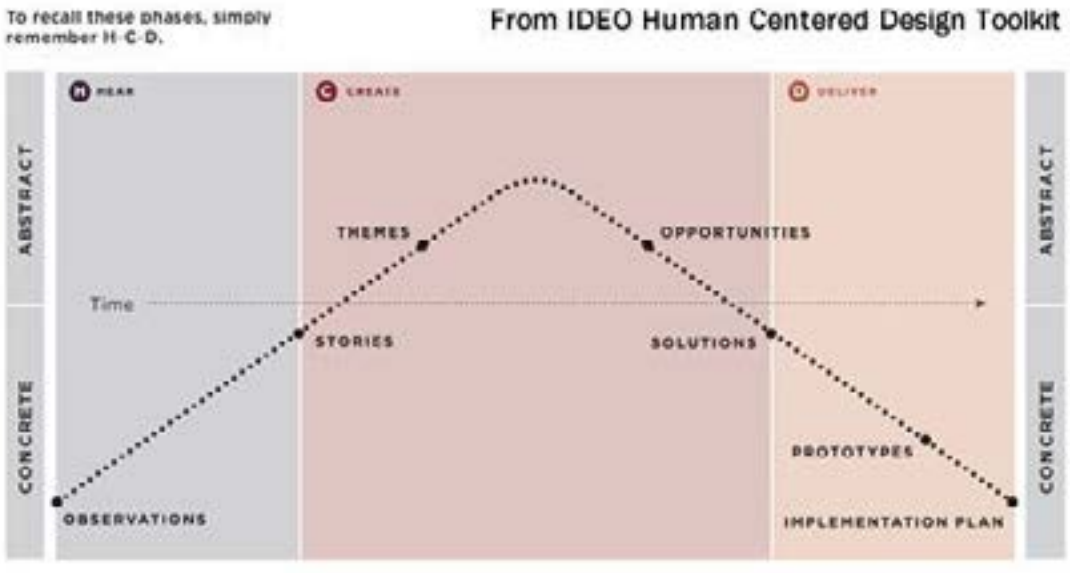

Figure 4. IDEO Human-centred design toolkit (ideo.org, accessed 14/05/2020).

Once details are collected through user observation scenarios, knowledge can be created to understand the current and potentially future issues. While observational research is not the only factor to determine improvements, it is used to set key boundaries for further investigation. It is used in this paper as an important introduction to the context to help familiarise the author with foreseen issues that will lead to a deeper investigation as this study matures. Identifying current problems and potential opportunities through observational research focused on public transportation helps set parameters for the design intent as well as better understand the context in which the design will be used.

3.1. User observation studies – field research

A two-week observational study was conducted in Malaysia in 2019 to investigate current issues focusing predominately on bus systems. This also included the environment, the people, and the public infrastructure – all core areas that need to be understood in order to propose an appropriate (feasible) design outcome. Observational studies were conducted in Kuala Lumpur, Penang and Kuching to provide a detailed understanding of requirements for HCD intervention (See Figure 5). In this paper, the authors will concentrate on the findings of field research done in KL, Malaysia.

Figure 5. Map of Malaysia highlighting the geographic location of the three cities user observational research was conducted.

The observational study was conducted to understand better the process of taking the bus. As noted in Figure 6, with no indication of when the bus would arrive, the passenger waited over 25 minutes to get on the bus, which, when stopped, was stopped on the road not using the bus lane provided. This was because of the inconvenience to the bus driver having to navigate back onto the road among traffic with a lack of bus priority. In terms of bus usage, changes to the environment around the bus stops, real-time displays, intelligent ticketing systems, priority signalling and the introduction of dedicated bus lanes have a direct influence on increasing the bus usage (Woodcock, 2012).

Figure 6. Bus user observation completed in Kuala Lumpur, Malaysia, 22/01/2019.

During the field research, an innovative ticketing system was highlighted as one of the areas to implement. During inclement weather in Kuala Lumpur, the cash ticketing system on board creates more than a 10-minute delay in bus boarding time. Having different methods to pay a bus fare, including having to have the exact fare with one person operation, can be confusing for both locals and tourists who are unfamiliar with these different systems (Stradling et al., 2007). Smart ticketing systems have been implemented worldwide and have dramatically improved efficiencies and travel times. According to Woodcock, the smart ticketing service contributes to a significant increase in the use of bus services (Woodcock, 2012). Smart ticketing systems are now common practice in most major cities around the world, such as the Oyster Card for

London, the Octopus Card for Hong Kong and the Myki Card for Melbourne. However, Malaysia still uses outdated ticketing systems. Currently, Malaysian buses all have different methods of purchasing a ticket. Metro Bus has a person on board collecting fares; on Rapid KL, one must have the exact change that the bus driver collects. This can cause a great deal of confusion and inconvenience. As seen in public transportation development examples worldwide, the need to prioritise and understand the importance of service quality surrounding the bus system is essential.

The second phase of the observational Study was conducted to understand better the external influences that may be preventing public transportation usage. A study by Chiu Chuen, Karim and Yusoff (2014) supports observations made during the fieldwork by identifying the quality of pedestrian roads and accessibility of bus services, as well as the bus network, bus transit time, and travelling time as significant factors that require greater design input to attract more public transport usage. Some of the poor road conditions jeopardise pedestrian safety, as it often involves forcing pedestrians to navigate around poor environments. During the observation, problems around disconnections between different modes of transport were highlighted with an assessment of the negative effect on accessibility.

Too often, the rules concerning pedestrian safety are ignored. When designing for an urban environment, including pedestrian needs should be embedded to promote safer journey experiences (Evans & Azmin-Fouladi, 2005). There were many occasions witnessed during the field research where lanes designated for buses and taxis were entirely ignored by both car drivers as well as bus drivers. Even designated bus stops/lanes were ignored because it was inconvenient for the bus driver to 'pull in' to the bus stop and then have to negotiate their way back into traffic.

4. Discussion

The observational research uncovered issues with the current context from those interacting with and understanding the Malaysian bus system best. This led to a broader scope beyond just the bus itself but required a more comprehensive focus on the surrounding system. This helps provide a design framework used to direct design decisions in a manner relevant to Malaysia's current context. The result was the ability to work through the design research methods in the context of Malaysia to ensure the design outcomes addressed core areas uncovered within the literature.

The reviewed exemplar companies following the HCD approach (IDEO and 2nd Road) are committed to a philosophy of co-design, which means it involves a wide range of stakeholders in the design of change and has a well-developed toolkit supporting group thinking and creativity. Co-design involves a process of 'doing with' rather than 'doing to'. The process of 'doing with' is vitally important to ensure the context of new public transport development is thoroughly understood.

According to Lee and Abuali (2011), innovation assesses users' needs, applies appropriate technology to meet those needs and provides new products and services to the market while advancing technology. With the public health crisis, there is a necessity for how we can revise public transportation and how its role can positively contribute to the post-COVID-19 recovery path (Budd & Ison, 2020).

The tangible observations for an individual from this research can be summarised in three key areas:

- Public transportation systems need to increase their efficiency both in arrival times and ticketing systems.
- Dedicated bus lanes that are enforced in public law will significantly increase efficiencies.
- The surrounding infrastructure needs major improvement to create a pleasant and informative waiting experience to entice increased public transport patronage.

5. Conclusion

This research outlines the much-needed HCD approach required to maximise the public

acceptance of an improved bus system for Kuala Lumpur. Considerations such as designing with people, not for them, understanding needs, examining people's behaviours towards an identified problem, and developing innovative strategies are all crucial to successful project outcomes. However, many of these tools are based on solid theory to help organisations become more innovative, which in turn aims to make them more profitable. This paper addresses this; however, there is a significant component of the 'tangible' that needs to be created to complement the design methods. The intangible outcomes that will follow methods from IDEO and 2nd Road can be positioned as 'Design Thinking', where the ability to 'think' like a designer aims to explore opportunities 'outside the box' that may not arise if thinking is confined to what is known. This is a successful approach to construct recommendations for future urban design planning. This research is specific to Malaysia but could easily translate to similar cities needing urban planning worldwide. The 'Design Thinking' elements will propose innovative ways to improve the system in the future (shown within this paper), while 'Design Doing' will propose innovative outcomes for tangible benefit.

Conflict of Interests

The author declares no potential conflict of interest was reported by the author.

Endnotes

This paper has been presented at the SPACE International Conference 2021 on City Planning and Urban Design.

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