# EXPLORING SOCIO-TECHNICAL RELATIONS: PERCEPTIONS OF SASKATOON TRANSIT'S GO-PASS SMARTCARD AND ELECTRONIC FARE SYSTEM

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By

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## ABSTRACT

It is essential to consider what new technologies mean to the people who use them and the ways in which they are experienced and used. In the context of public transit services in Saskatoon, understanding what the recent changes from a manual to an electronic/automated system means to users and the broader community is critically important to the overall assessment of the service. Investigating users' lived experiences and interpretations of technical artifacts is valuable to understanding socio-technical relations or the embodied interactions of humans and machines as "technologies-in-practice."

Research into socio-technical relations has primarily focused on large scale technological systems and expert practices while less attention has been paid to "seemingly mundane" technologies or technical artifacts routinely used in everyday life. At the same time, this preoccupation has overshadowed or downplayed the importance of exploring users' experiences and interpretations of technologies.

The goal of this research is to contribute to the sociological understanding of mundane technologies-in-practice and socio-technical relations more broadly. In order to gain insight into this relationship, this thesis focuses on bus riders' (users) and the community's perceptions of the Go-Pass smartcard and electronic fare system used by the public transit service in Saskatoon. The perspectives of Go-Pass users and community stakeholders (n=15) were investigated using qualitative semi-structured interviews to gain deeper understanding into the complex relationship between users and technologies.

Drawing from Science and Technology Studies (STS) and the sociology of technology literature, I propose that a sociomaterial theoretical perspective following a mutual shaping framework offers insight into socio-technical relations. Both critical and feminist technology

studies literature has been helpful for developing an understanding of the wider social and political contexts of technical use which underscores this study. In particular, the conceptual insights of "socio-technical assemblages" (Suchman, 2007) and "intra-action" (Barad, 2003) have been helpful tools for exploring agency, subjectivity and power which is key to uncovering the intricacies of socio-technical relations and human-machine interaction. The four main themes emerging from this study were: 1) shifting human-machine roles and relationships; 2) the socio-technical construction of the bus rider; 3) configuring users' and technologies; and 4) structural issues and social justice implications of technologies-in-practice.

The findings demonstrate that the use of this new system is mutually co-constructed by both social and technical factors whereby both the users and the technology inform perceptions and use. There was also the unexpected connection between users' everyday situated uses, experiences and interpretations of the Go-Pass technologies to wider social-political contexts. There were a number of issues raised in relation to the implementation of the Go-Pass system which had negative effects or unintended social and technical consequences particularly for those most marginalized economically. At the same time, there were important benefits and positive effects on riders' quality of life and use of the service. Finally, participants' perspectives have contributed to understanding what the Go-Pass technologies mean to them, the ways in which they are used in practice and the ways in which the mixing of people and seemingly mundane technologies shape relations in everyday settings.

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## DEDICATION

For my family,
Carol, Jessica and Brian

To my mother,
Carol Ann Leader
whose presence and insight always inspires me

And to my father,
Joseph Michael Leader
1941-2011
who continues to inspire and guide me
you will be forever missed

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# CHAPTER 1: INTRODUCTION

The introduction of the Go-Pass smartcard and electronic fare system has transformed the way the public transit service is used in Saskatoon. As a long term bus rider, and now user of the Go-Pass system, I have witnessed the changes from the visual verification of passes and fares by the bus driver to the new automated system. The Go-Pass presents interesting changes to the way I understand myself as a bus rider; in particular, my use of the service and experience as a bus rider has become digitized. The features offered by the new system, such as its capacity to read my Go-Pass card and determine whether I have the correct amount of fare to use the service and its ability to record/track this information for future use, has translated my use of the transit service in such a way that information about my transit use is represented as systematized data. I found myself questioning not only what these changes might mean to the service but also what they might mean to other bus riders and users. My interest in human-machine interaction and the sociology of technology and society more broadly led me to want to examine the meanings users attach to the Go-Pass technologies.

On a broader scale, the increased presence and use of digital technologies and technological systems is now a pervasive feature of contemporary social life, leading to fundamental changes in the way people live and understand the social world (Law, 1991; Bauchspies, Croissant & Restivo, 2006; Prus & Mitchell, 2009). The coalescing of machines and humans points to palpable changes in the way people live, interact and relate to the world, transforming experiences and social landscapes. These new socio-technical experiences, relationships and ways of seeing the world have captured the sociological imagination. Social studies exploring society-technology connections have focused attention to the way science and technology are practiced in action (Latour; 1987; Latour & Woolgar, 1986), produce knowledge (Knorr-Cetina, 1981), reconfigure the boundaries between humans and machines (Haraway,

2000; Suchman, 2007; Barad, 2003), and connect to wider social, cultural and political contexts (Pinch, 2010b; Martin, 1998; Wajcman, 2002; Winner, 1980).

Most of the research in Science and Technology Studies (STS) and the Sociology of Technology has focused largely on mass scale technological systems, and technical and scientific practices in laboratories, organizations and industrial settings (Sismondo, 2010). Few studies have focused their attention on technologies which are "seemingly mundane" or routinely used and interacted with in everyday life (Timmermans & Bergs, 2003, p. 108; Pinch, 2010a; Inglesant, 2007), the role of users (Oudshoorn & Pinch, 2003), or the lived experiences and embodied interactions with technologies (Dourish, 2001). Although a relatively underexplored area, studying mundane technological artifacts nonetheless provides a window into socio-technical relations by uncovering what has been largely taken-for-granted and made invisible with everyday use (Latour, 1992; Pinch, 2010a). Investigating users' lived experiences and interpretations of technical artifacts is valuable to understanding technologies-in-practice.

Given the gap in research, this thesis seeks to uncover the lived experiences, interpretations and embodied use of mundane technical artifacts, and in particular, users' perceptions of the Go-Pass smartcard and automated fare collection system used by the public transit service in Saskatoon. The perspectives of the community and bus riders who use the Go-Pass system were investigated using face-to-face qualitative interviews (n=15) in order to gain insight into the complex relationship between users and technologies. More specifically, the goal of this research is to contribute to the sociological understanding of mundane technologies-in-practice and socio-technical relations.

Drawing on Science and Technology Studies (STS) and the Sociology of Technology literature, I propose that a sociomaterial theoretical perspective drawing on a mutual shaping

framework offers insight into these relationships. Both critical and feminist technology studies literature have been helpful in developing an understanding of the wider social and political contexts of technical use underscoring this study. In particular, the conceptual insights of "*socio-technical assemblages*" (Suchman, 2007) and "*intra-action*" (Barad, 2003) have been helpful tools for exploring agency, subjectivity and power which is key to uncovering the intricacies of socio-technical relations and human-machine interaction. Socio-technical assemblages refer to the diverse arrangements or groupings of people and technologies which form in relation to their specific intra-actions; i.e., the specific ways in which humans and non-humans co-produce actions and performances that shape relations. These concepts will be discussed more fully in Chapter 2.

## 1.1 Background and Context

### 1.1.1 What is the Go-Pass System?

The Go-Pass system is an automated fare collection system used by the public transit service in Saskatoon, Saskatchewan, featuring the Go-Pass smartcard bus pass and electronic fare machines. The Go-Pass smartcard is a reloadable and reusable contactless RFID (Radio Frequency Identification) card that can record and store data for the use of fare payments on city buses. The electronic fare machines are onboard systems located on each of the buses that automatically read, verify and collect fares in the form of electronic data. Fares include monthly and term based bus passes or electronic tickets loaded onto the Go-Pass card. Cash fares in the form of coins also are read by the machines while paper money and tickets have been phased out in the new system. Bus riders are able to load/reload their Go-Pass smartcard with fares at the downtown transit services office, as well as at select vendor locations around the city. The Go-Pass system is networked to the transit company's computer terminals which collect and keep

track of transit information and transactions in a centralized database used for management and operations such as gathering statistical information about transit use and ridership.

### 1.1.2 Transforming Transit Services in Saskatoon: The Transition to the Go-Pass System

In recent years there has been increased usage of the public transit systems across Canada. Saskatoon Transit follows this trend with a 28% growth in ridership from 2006 to 2009 (Saskatoon Transit, 2010). In February 2010, the Saskatoon Public Transit Service implemented the Go-Pass smartcard and electronic fare box which replaced older forms of transit fare, aside from coinage, by combining an electronic fare machine with smartcard technology (Canadian Urban Transit Association [CUTA], 2010). The addition of the new system has primarily transformed the methods for paying and collecting fares and the way the transit service is operated and used. The Go-Pass system has altered the operation of the transit service from the purchasing of monthly bus passes and tickets as well as the ways in which users board and pay fares on the buses.

In the previous system, paper monthly bus passes, tickets and cash or coins were used with a manually operated fare box. Bus drivers would inspect visually bus passes and fares to check to see if they were valid. In contrast, the new system features a reloadable smartcard bus pass the “Go-Pass” and electronic fare machines which automatically verify, count, track and record the fares collected. The machines accept coins and transfers with barcodes or the Go-Pass loaded with a minimum of ten tickets and a term or monthly bus pass. A similar technology was also adopted by the University of Saskatchewan’s bus pass program, the U-Pass, which uses electronic stickers in place of paper ones.

The electronic fare machine scans a chip embedded in the Go-Pass smartcard recognizing a unique digitally signed number and can be “personalized” or linked to a user’s contact information (Christensen, 2010; CUTA, 2010). The U-Pass uses a sticker with an

electromagnetic strip which is compatible with the electronic fare machines (Christensen, 2010). The transformation from paper bus tickets, disposable monthly passes and paper currency to a plastic, readable smartcard has modernized and reshaped the transit system.

According to an article in *Currents,* a quarterly newsletter published by the City of Saskatoon, the motivation to switch to the Go-Pass system was to reduce or eliminate disagreements about fares and to collect accurate records and data on transit use and ridership to plan future routes ("Saskatoon Transit Unveils", 2009). Little was said about the impact that the new transit fare technologies might have on transit services or whether these changes would potentially improve or affect bus riders' experiences and use of the transit service. This lack of discussion led me to question the implications of implementing and using transit technologies, particularly the ways in which the Go-Pass technologies are experienced by bus riders and the community.

### 1.1.3 Studying Mundane Technology and Everyday Users' Experiences

Exploring users' experiences and users-technology relations in the context of the Go-Pass system can make visible the connections to wider socio-cultural, economic, and political dimensions of technical design and use. In the current context, the transit company's focus has been primarily on the enhancements that the technology has afforded the service in collecting and tracking ridership data, preventing fraud and increasing efficiency of the service and overall ease for management and operations. Investigating and understanding the ways in which the introduction of the new system has affected bus riders (users of the Go-Pass) and the community have been unexplored and relatively overlooked. As Myers (1994) has pointed out, key questions to be asked surrounding the implementation of new technologies focus on what those technologies mean to people and the ways in which they will be used. In other words,

understanding what these changes mean to users and the broader community is critically important to the overall assessment of the service.

In the absence of a discussion surrounding the impact of the new transit technologies on users, this thesis explores the ways in which bus riders and community stakeholders perceive, interpret and make meaning out of their interactions and experiences with the Go-pass system. Bus riders or "users" are relevant and valuable social groups due to their distinct and uniquely positioned perspectives and experiences with the Go-Pass system. Users engage with, interpret, embody, shape, enact upon and are enacted upon by technologies (Downey, 1998; Woolgar, 1991). The perspectives of users are viewed as important to this research because of their direct, personal and first-hand knowledge, experiences and interactions with the technologies. At the same time, community stakeholders provide insights into the larger community's views of the transit service since they interact with a variety of bus riders, transit staff and management and are complimentary to the perspectives of bus riders.

### 1.1.4 Perceptions of Public Transit and Social Equity

One of the main concerns and objectives of transit companies has been to change the perceptions and use patterns of public transportation services. Public transit often is associated with transportation for marginalized groups such as the poor, disabled and elderly, pejoratively referred to as "welfare on wheels" (Greenwood, 2011) and as a result, using public transit in Canada and the United States is stigmatized (Transportation Research Board, 2000). In response, transit companies are trying to focus more on attracting "'choice' riders – those with regular access to vehicles" such as business people working in downtown city centers – than "the needs of those who – due to age, poverty, or disabilities – must depend on public transit" (Garrett & Taylor, 1999, p. 7 & 18). This focus on choice riders often comes at the expense of riders who are socially and/or economically marginalized. As Garrett and Taylor (1999, p. 6) argue, "less

attention and fewer resources tend to be devoted to improving well-patronized transit service in low income, central-city areas serving a high proportion of transit dependents." The shifting of attention and resources from long-term dependent riders toward new riders is problematic since it excludes or dismisses the realities of dependent bus riders. For this group, taking public transit is not a choice; they take the bus because they lack access to a vehicle or alternative transportation and/or have physical mobility problems.

Individuals who are more likely to require and use the service are those whose household income is in the lowest income category (Statistics Canada, 2007). This statistic demonstrates the way in which socio-economic status is an important demographic factor to consider in relation to perceptions of the Go-Pass system used by the public transit service. Following this observation, demographic characteristics (socio-economic status as well as their age, sex, employment status, area of residence and education level) of participants in this study were recorded. Dependency on public transit and length/frequency of use information was also collected from participants (see Chapter 3).

### 1.2 Purpose and Objectives of the Research

The purpose and goal of this research is to contribute to the sociological understanding of mundane technologies-in-practice and socio-technical relations more broadly. Two broad questions guide this research: 1) *in what ways do bus riders (users) and the community interpret and experience the Go-Pass transit technologies/system?* 2) *how can agency, subjectivity and power be conceptualized or understood within the context of human-machine interaction and socio-technical relations*? The focus on individuals' lived experiences and use of technology has assisted in uncovering the multiple interpretations and meanings attached to technological use and the perceived relationship between users and technical artifacts. Examining socio-technical

relations through the eyes of users allows for a unique, rich and in-depth understanding of the implications technologies have in the context of public transit services in Saskatoon.

Through in-depth interviews, this thesis specifically explores bus riders and the community perceptions, the meanings they attach to their use of and interaction with Saskatoon Transit's Go-Pass smartcard and electronic fare system. The four objectives for this research were:

- understand the factors that influenced the ways in which users interpret, relate to, experience and attach meanings to the Go-Pass technologies through their use of the Saskatoon public transit service;

- investigate the ways in which users' and the community's perceptions of the Go-Pass system enable or constrain their sense of self, identity or perceived agency;

- explain the ways in which users enact upon or are enacted upon by the Go-Pass technologies;

- explore the connections to broader social or structural relations (i.e. class, gender, or other social relations) that may impact the way technologies are used and experienced or perceived by users as enabling or constraining;

Engaging in developing a broader understanding of the interrelationship between technology and society could benefit both current and future users, the larger community, as well as city planners and designers of the system.

### 1.3 Thesis Chapter Outline

In this introductory chapter I have outlined the background and context of the research topic and the purpose and objectives of the research study. In chapter two I examine and

summarize the current literature in the area of Science and Technology Studies (STS) and the Sociology of Technology. The review of the literature is divided into 3 sections: 1) Theorizing Technology: Beyond Determinism and Essentialism in which I examine the debates around technological determinism, social constructivism and the mutual shaping framework; 2) Agency, Subjectivity and Power in User-Technology Relations which focuses on conceptualizations of human and non-human agency and its implications for subjectivity and power; and 3) Summary of Theoretical Framework: The Mutual Shaping of Socio-Technical Relations where I summarize briefly the theoretical framework adopted for this thesis. I conclude that the sociomaterial perspective, drawing on the mutual shaping framework, offers a more balanced approach to the study of socio-technical relations because they take into consideration the importance of humans and non-humans, their co-constitution and co-agential relationship, while at the same time recognizing the differences between them; that is, the way in which various human and non-human actors are arranged differentially, forming multiple and diverse, if not unevenly distributed, socio-technical assemblages.

Chapter three describes the research methodology; the methodological approach and specific methods used. I give an overview of the interpretive-constructivist approach guiding this research, the research design, participant recruitment strategy and introduce each of the participants and their demographic information. In Chapter four I provide a summary of the data analysis which includes the coding methods, use of memos and the development of themes used for my thematic analysis. I discuss the ways through which credibility was achieved and maintained throughout the research study and reflect on the methodology and my role as a researcher. Finally, I conclude with the ethical considerations and procedures followed by this study.

In Chapters five, six and seven, I present a detailed overview of the findings and my analysis of the four major themes and sub-themes that emerged from the interview data: 1) *shifting human-machine roles and relationships* (Chapter 5); 2) *socio-technical construction of the bus rider* (Chapter 6); 3) *configuring users' and technologies*; and 4) *structural issues and social justice implications of technologies-in-practice* (Chapter 7). What unites these themes is the concept of the bus as a sociotechnical space in which the Go-Pass system (the different technologies used) and social actors (bus drivers and riders) co-construct socio-technical relations, creating new sociotechnical assemblages. I provide an overview of the themes and present my analysis of the findings and theoretical connections drawn from the existing literature. I draw on the theoretical and conceptual insights of "socio-technical assemblages" (Suchman, 2007) and "intra-action" (Barad, 2003) to illuminate understanding of this phenomenon and to substantiate my claims that the bus is experienced as a socio-technical space influenced by multiple social and technical actors.

Finally, a discussion and conclusion is presented in Chapter eight. I begin this chapter with a brief overview of the findings. Next, I present a theoretical discussion and summary indicating the specific ways in which the four themes align with a mutual shaping framework and the ways in which agency, subjectivity and power are re-conceptualized. I discuss the limitations and strengths of the study and future directions, and finally my reflections on the outcome of this study and possible recommendations.

# CHAPTER 2: LITERATURE REVIEW

Debates surrounding the relationship between humans and technology have a long history, and have a central focus within the Sociology of Technology and Science and Technology Studies (STS). Within the STS literature, one approach argues that technology influences and determines social relations and human practices, while another views technology as a product of the social shaped by human actions (Sismondo, 2010). According to the former view, identified as technological determinism, technologies are thought of as autonomous and essential to society's functioning and betterment or alternatively leading to the disconnection and disruption of social solidarity and the fragmentation of meanings and identities (Shiling, 2005). Technological determinism ultimately holds the view that technology shapes society. In contrast, strong social constructivism or social essentialism, positions social processes at the forefront in shaping technologies. That is, social essentialist accounts focus on understanding how technologies are designed, implemented and used by social actors in society (Sismondo, 2010).

These debates lead to important questions about the types of relationships humans have with technologies and whether the interaction between people and technologies constitute the breaking down or facilitation of social relations. The STS literature indicates that understanding the ways in which both the physical features/properties of technical artifacts that enable certain actions and constrain others, as well as the socio-cultural and political implications of human-machine relationships, requires moving beyond determinist and essentialist positions and is a valuable entry point for researching the connections between technology and society. A balanced approach has been identified within the literature as a mutual shaping perspective which takes a middle ground stance between the two extremes mentioned above. The mutual shaping approach aims to demystify essentialist/determinist claims that there is an inherent one-way causal

relationship between society and technology. As a result of these debates, three main theoretical approaches to studying socio-technical relations have emerged.

The on-going and heated nature of these debates signifies the importance of and the need to better understand human-machine interaction and socio-technical relations. Drawing on these key debates within the STS literature, this chapter will begin by surveying the theoretical approaches of technological determinism, social constructivism/essentialism, and mutual shaping to identify their usefulness for studying socio-technical relations. Next, I will focus attention toward the differing conceptualizations of agency in order to examine their relationship to subjectivity and power and the ways in which they operate within socio-technical relations. I identify that a mutual shaping approach provides a more nuanced analytical framework which enables in-depth discussions and a re-conceptualization of agency, subjectivity and power.

In the third section I argue that a sociomaterial perspective (Barad, 2003; Suchman, 2007; Orlikowski, 2007; Introna, 2007), which builds upon the mutual shaping theoretical framework, offers a balanced lens for understanding socio-technical relations in the context of this study. The key analytical concepts of "*sociotechnical assemblages*" (Suchman, 2007) and "*intra-action*" (Barad, 2003) are found to be instructive for theorizing agency; in particular, action is understood as emerging from the relationships between human and non-human machine actors rather than something that exists inherently in one or the other. Importantly, these concepts emphasize the co-production of action through the mutual constitution of humans and non-humans while at the same time provide critical analysis of the situated, on-going and diverse nature of various human-nonhuman arrangements. In short, these concepts direct our attention to the differences across socio-technical assemblages with respect to the diversity of social situations and groups acting within technical spaces. These concepts are deeply connected with

four interrelated ideas, "*multiplicity*," "*temporal emergence*," "*performativity*" and "*sociotechnical agency*," and provide insight into the intricacies of sociotechnical relations. As discussed later on in this chapter, the mutual shaping framework offers a language to speak about human and non-human agency and its implications for both power and subjectivity.

## 2.1 Theorizing Technology: Beyond Determinism and Essentialism

Theoretical approaches to the study of technology developed within the social studies of technology or STS literatures can be located in one of three overarching frameworks: technological determinism/essentialism, social constructivism, or mutual shaping (Sismondo, 2010; Hess, 1997). In their most simplified and extreme versions, the first account assumes that technology determines social relations and actions (the technical shapes the social) while the second account assumes that technologies are essentially a product of social relations and actions (the social shapes the technical). Determinist or essentialist approaches place emphasis in varying degrees on either technological or social relations, which have a unidirectional effect on the other. The third approach—a mutual shaping approach—assumes that both social and technical influences co-constitute or mutually shape socio-technical relations. In the next three sub-sections of this chapter, I outline these frameworks and examine their potential strengths and weaknesses for providing a thorough analysis to better understand socio-technical relations. In this discussion, however, I provide only a broad overview of these frameworks since the debates within and between them represent a diverse range of perspectives within this interdisciplinary field.

### 2.1.1 Technological Determinism

One approach to the social study of technology asserts that technologies actively shape the social world including social relations, institutions and structures. This approach emphasizes the powerful role with which material, technical and rational logic take in defining social,

historical, economic and political relations. Technological determinist perspectives suggest that technical materiality determines social change, organizations and relationships and is the driving force of history (Sismondo, 2010). In its most extreme form, technological determinism argues that technologies act autonomously outside of social relations or actions, and their influences are inevitable (Winner, 1977). Simply put, technologies shape social relationships. While there are a range of concerns and varying degrees, such as hard and soft versions of technological determinism, this approach generally takes technology as its object of study and focus, and is concerned with the effects of technology on the social.

Technological determinist approaches vary in terms of what is considered the determining force of technology. Some writers focus on the rational logic and goals which actuate technologies while others emphasize the physical form of technical artifacts. With respect to the former view, Ellul (1964) developed the concept of technique, referring to the domination of social, political and economic life by technical relations, and is enforced through the adoption of rational logic and the goals of efficiency. Here, technique is "the totality of methods rationally arrived at and having absolute efficiency (for a given stage of development) in every field of human activity" (Ellul, 1964, p. xxv, cited in Mitcham, 1994, p. 308). According to Ellul, "technique" embodies the idea that norms of efficiency and productivity replace ethical norms, and thereby relinquishes society's control over technology.

Similarly, in his earlier work, Winner (1977, p. 29) describes technology as autonomous and "out-of-control" arguing that "[h]uman beings still have a nominal presence in the network, but they have lost their roles as active, directing agents." Social action is therefore viewed as limited within the network of technical logic. Illustrating this view further, Lewis Mumford uses two concepts, polytechnics and monotechnics, to explain the ways in which different modes of

technical logic shape the industrial work setting in enabling and constraining ways. Mumford's concept of polytechnics has been interpreted as machines that are oriented toward "human needs and potentials" while "'monotechnics' are described as producing 'mega machines' that can increase power dramatically, but by regimenting and dehumanizing" individuals (Sismondo, 2010, p. 9). In Mumford's view, technologies are autonomous, possessing the capacity to act on social relations that enable or constrain human potential.

Theorists emphasizing the physical or material form of artifacts focus on the ways in which technologies shape the social world, human activities and meanings in relation to technical use. The technical shaping of society is evident when technological tools enable or constrain social life by reorganizing their connections to the material world (Law, 1991; Bauchspies, et al., 2006). Broadly speaking, technologies are viewed as acting on the social world through shaping and (re)organizing the ways in which people work, live and interpret the world. Applied to user-technology relations, technological determinists emphasize the impact of technical features which act on or influence users, but underestimate the reverse. From this view point, users of technologies are therefore represented as passive actors that bend to the actions of technology. Paradoxically, technological determinist accounts tend to hold the view that technologies operate outside of the social world, yet influence and enact upon people and society.

Strong technological determinist accounts are criticized for ignoring the socio-cultural or political influences that have shaped technologies (Sismondo, 2010). This oversight is particularly evident when technologies are assumed to be created outside of human efforts and social factors. For instance, while the concepts of polytechnic and monotechnic technologies are useful for examining the effects of technology on workers, these concepts are limited in explaining the actions of workers in response to these technologies, and in providing a critical

analysis of wider social, cultural, economic and political influences shaping those contexts (MacKay & Gillespie, 1992).

In contrast, social constructivists emphasize the ways in which social and cultural realities influence the properties and uses of technology and argue that users play an active role in shaping technology. Social constructivists argue that technological innovation, production and use are intertwined in complex webs of actions involving various actors, that range from the writing of research proposals and obtaining government or industry funding to the organization of teams that design, test, implement or market technologies.

### 2.1.2 Social Constructivism

Social constructivist positions assume that science and technology are shaped by social and cultural relations (Latour & Woolgar, 1986; Downey, 1998). Scientific and technological products are said to be created within social, cultural and political spheres and can be examined in their historical and contemporary contexts (Sismondo, 2010). As MacKay and Gillespie (1992, p. 686) have pointed out, “although technologies clearly have impacts, the nature of these is not built into the technology but depends on a broad range of social, political and economic factors.” In a broad sense, this approach is concerned with explaining the role of interests, values and social processes in shaping scientific and technical knowledge and practice. Strong social constructivist perspectives challenge the claims made by technological determinists that technology shapes society; instead, they reverse the equation by suggesting that society shapes technology.

One approach closely associated with social constructivism is the Social Construction of Technology (SCOT) perspective which emphasizes the role of social processes in shaping technologies and technical systems (Bijker, Hughes & Pinch, 1987). Moreover, the SCOT concept of interpretive flexibility argues that technologies contain diverse meanings for

individuals designated as “relevant social groups” (Pinch & Bijker, 1984, p. 421). Bijker, et al., (1987) have suggested that the “sociocultural and political situation of a social group shapes its norms and values, which in turn influence the meaning given to an artifact” (p. 46). From the SCOT perspective, examining the broader social contexts and positioning of relevant social groups is key to understanding the range of meanings associated with technologies and their presumed inevitable closure. The SCOT perspective suggests that the material or technical properties of artifacts are “determined by the interpretive frameworks and negotiations of relevant social groups” (Brey, 1997, p. 6). Simply put, the social shapes the technical.

Social constructivist literature emphasizes the powerful role of discourses in the social construction of technologies and the shaping of users’ identities and meanings; however, constructivism is limited in its analysis of the material features of technologies which influence their use and impact on social meanings and practices. Generally, social constructivist accounts have been criticized for ignoring technology’s capacity to perform on or have certain effects on individuals and society.

In much the same way that technological determinism argues that technology shapes society, in its most extreme version, social constructivism slips into essentialism, claiming that technologies are social products through which their technical properties and relationship to the social world are socially constructed (Sismondo, 2010). Social essentialism suggests that technologies are “blank slates to be interpreted and rendered meaningful by culture” (Timmermans & Berg, 2003, p.101); rather, they are viewed as containing no essential properties of their own that may have real effects on individuals outside of the socially constructed and infused meanings given to them. Social essentialist approaches have been criticized for ontologically separating – what is considered the being or reality of – the social from that of the

technological; in particular, they are criticized for ignoring the roles that a technology's specific material properties or features play in shaping social relations, interpretations, meanings and actions (Barad, 2003; Suchman, 2007; Orlikowski, 2007). Social essentialism tends to displace technical and material factors overlooking the potential for technical or non-human agency (Bauchspies et al., 2006).

Determinist and constructivist approaches present only one side of the relationship between society and technology because they prioritize either the technical over the social or the social over the technical. As a result, these approaches ignore the interrelationship of social and technical processes and interactions constituting socio-technical spaces. A mutual shaping perspective offers an alternative to determinist and constructivist accounts.

### 2.1.3 Mutual Shaping

Mutual shaping presents an alternative or middle ground framework between determinist and essentialist positions, and emphasizes the co-constitution of social and technical worlds (Sismondo, 2010). Mutual shaping takes the view that neither technology nor society straightforwardly determines one another; instead, they are mutually shaped by social and technical factors. Simply put, the social shapes the technical and the technical shapes the social.

There are two predominant forms which the mutual shaping perspective takes. Although both forms avoid privileging either the technical or the social, the first posits that social and technical worlds mutually shape social relations in a multidirectional way (see for example, Boczkowski, 2004; Reimers, Johnston, Klein, Wagner & Shellhammer, 2008). In other words, social and technical influences are viewed as separate forces that come together to mutually shape relations. Alternatively, the second form views relations as emerging from the mutual constitution of social and material/technical relations and is often referred to as a sociomaterial

perspective positioned under the umbrella of the mutual shaping framework (see for example, Latour, 1992; Suchman, 2007; Barad, 2003, Orlikowski, 2007).

Mutual shaping frameworks that use a sociomaterial lens move beyond a multidirectional approach, arguing that society and technology are mutually constituted. This perspective argues against the separation of the social from the technological as presented in multidirectional accounts of technology and draws attention to the ways in which human users and non-human technical artifacts are co-constructed in a reciprocal and relational (albeit, not necessarily equal) fashion (Latour, 1992; Suchman, 2007; Barad, 2003). In other words, social and technical worlds are co-produced and mutually shape social relations through their "constitutive entanglement" (Orlikowski, 2007, p. 1437).

Mutual shaping utilizes the analytic strength of social constructivism while acknowledging the increasingly important role of technical and material artifacts prevalent within society. On the one hand, society and people shape technology in various ways through their development and use by inscribing socio-cultural values and political agendas, which become entangled in economic and socio-political relations (Mackay & Gillespie, 1992; Pinch & Bijker, 1984; Hess, 1997). On the other hand, technologies shape people and society by producing discourses which filter into everyday life, reflecting and configuring new identities and meanings about the world (Doolin & McLeod, 2012; Ingram, Shove & Watson, 2007).

In taking into account the influences of both technical and social forces, a mutual shaping/sociomaterial lens offers an analytical framework to examine fully socio-technical relations, whereas determinist/essentialist accounts present only a single view point of these multidimensional and complex processes and interactions (Bauchspies et al., 2006). As Kline and Pinch (1996, p. 767) have suggested: "it is important to show not only how social groups

shape technology, but also how the identities of social groups are reconstituted in the process." Social studies of technology should therefore aim to capture the reciprocal intertwining of socio-technical relations. For the purpose of this thesis, a sociomaterial perspective guided within the mutual shaping framework is found to be most instructive of the three general approaches because this lens deals directly with the topics of agency, subjectivity and power in user-technology relations.

### 2.2 Agency, Subjectivity and Power in User-Technology Relations

Concepts of agency within technological studies parallel the determinist/essentialist and constructivist accounts of technological relations. In human-centered or subject-centered accounts, the concept of agency commonly is defined as the capacity for action through which the intentionality or moral capacities of human actors are viewed as central to action (Introna, 2007). In this definition of agency, technical artifacts are recognized as important mediators in user-technology relations because they support or prohibit certain actions, but these artifacts are not thought to be involved in action. Introna (2007, p. 4), however, has criticized human-centered inter-actional accounts of agency because they subscribe to a dualistic view of user-technological relations that assume that "socio-technical agency is originally human i.e. humans are doing things with or through technology" and not the other way around.

Human-centered approaches offer a limited vocabulary to explain fully the complexity of sociotechnical relations and adopt a one-sided view of action that ignores technology's capacity to enact upon and shape social relations as fully fledged actors within socio-technical spaces (Introna, 2007). At the same time, techno-centered approaches overemphasize the capacities of technical artifacts to influence social relations and enact upon users of technology, and ignores individuals' potential roles in shaping relations. As a result of separating the social and technical

into discrete and disconnected worlds, polarized views of agency emerge which position either the human or non-human as the central and influential actor.

Although the need for a balanced approach to examine socio-technical agency (i.e., the various roles that users and technologies play in shaping social relations) has been acknowledged and endorsed by many writers, (see for example, Doherty, Coombs & Loan-Clarke, 2006; Orlikowski & Iacono, 2001; Introna, 2007), Doherty, et al., (2006, p. 571) argue that some researchers, in attempting to present a "middle ground perspective," too often fall back on user-centric or human-centered positions where "the role of technical artefact has typically been down-played, if not completely ignored." At the same time, Orlikowski and Iacono (2001, p. 122) have suggested that, in some accounts, technologies "tend to be taken for granted or are assumed to be unproblematic" through preformed notions that they are stable or fixed. In other words, the focus on the social constructions of technology takes center-stage and the technology itself tends to "disappear from view" or becomes black-boxed; i.e. the inner workings of the technology – how it ended up the way it did, what alliances were formed and interests negotiated – are made invisible (Orlikowski & Iacono, 2001, p. 121).

More recently, STS scholar have conceptualized the inseparability and performativity of the social and technical through a sociomaterial practice lens or technology-in-practice perspective (Doolin & McLeod, 2012; Timmermans & Berg, 2003). A sociomaterial perspective assumes that both social and technical influences (users and technologies) play a role in shaping relations and defining their relationship to one another through their interaction or "intra-action" (see Barad, 2003). A number of related concepts have been used to describe agency as a co-constitutive process such as actor-networks (Latour, 2005; Callon, 1986), or networks of agency (Downey, 1998), seamless webs (Hughes, 1986), technological lifeworlds (Rod & Kera, 2010),

socio-technical ensembles (Bijker, 1995), object-centered sociality (Knorr-Cetina, 1997), mangles (Pickering, 1995), sociomaterial assemblages (Suchman, 2007), constitutive entanglement (Orlikowski, 2007) and intra-action (Barad, 2003) among many others.

These concepts argue for the inseparability of social and material aspects, and by doing so, provide a more nuanced account of agency by demonstrating that socio-technical relations are produced through interactions between social and technical agents. From this perspective, technical and social objects are viewed as active "co-agents" in shaping user-technology relations (Michael, 2006, p. 50).

### 2.2.1 Human and Non-Human Agency as "Actor-Networks"

The STS literature increasingly has viewed non-human actors as viable subjects of study, carrying properties of both expertise and sociality (Latour, 1992; Suchman, 1998, 2007; Knorr-Cetina, 1997). In this view, techno-social objects are considered active entities that are both manipulated by human actors and inform human understanding and action (Jensen, 2004; Bruni, 2005). The idea of human and non-human agency has been conceptualized most famously in Actor-Network-Theory (ANT), which suggests that non-human actors play an active role in the making of technical and scientific knowledge, culture and practice (Latour, 1992).

In his example of a door-closer (or groom), Latour (1992, p. 154) demonstrates that non-human actors are "delegated (or translated or displaced or shifted down)" to take on the roles of humans. In particular, Latour (1992, p. 159) uses the concept of "anthropomorphism" to mean "attributing a human characteristic" to a non-human object such as a door-closer which is "usually considered 'purely technical'." He writes (p. 160):

> The groom is indeed anthropomorphic, in three senses: first, it has been made by humans; second, it substitutes for the actions of people and is a delegate that permanently occupies the position of a human; and third, it shapes human action by prescribing back what sort of people should pass through the door.

Latour demonstrates the roles usually associated with human actors are delegated or shifted to non-humans, suggesting that agency is related to the "distribution of competences between humans and non-humans" (p. 158, emphasis original). Instead of focusing on intentionality, action is based on having the competence to perform various tasks and roles. Those roles that are normally played by human actors now are being taken on by machines, and in turn, shape social meanings and human actions. In other words, attaching human characteristics to non-humans or anthromorphism is related to occupying the position or role of a human, while at the same time, people's ideas or meanings associated with humans and non-humans also are shaped or "prescribed" in the process (Latour, 1992, p. 160).

Human and non-human actors, "actants" or "actor-networks," are conceptualized as symmetrical within relational or heterogeneous networks (Latour, 2005, 1992); i.e., various parts of the network such as people, money, equipment, institutions, technical objects and knowledge simultaneously shape material and social relations. The concept of symmetry in ANT is used to avoid privileging humans over non-humans as a way to level, analytically speaking, the playing field and to "not to impose a priori some spurious asymmetry among human intentional action and a material world of causal relations" (Latour, 2005, p. 76). In other words, asymmetries may exist, but they have to be explained or earn their place in the analysis. But, despite ANT's promise of the symmetrical treatment toward humans and non-humans, some authors have criticized ANT's contradictory focus on the practices of heroic scientists while leaving the actions of other actors relatively invisible (Suchman, 2007).

### 2.2.2 "Socio-technical Assemblages" and "Intra-action"

Positioned within a mutual shaping framework and drawing on feminist technology studies and sociomaterial perspectives, Barad (2003) and Suchman (2007) conceptualize agency as co-produced through the interactions/"intra-actions" of various social and technical actors. In

her studies of human-machine interaction, Lucy Suchman (2007, 2005 and 1998) refines the concept of agency by arguing that it is not a characteristic that is possessed, but is an effect of interaction. She argues that human-machine relationships form diverse and creative socio-technical or "sociomaterial assemblages" that not only allow for the creation of new effects, but also "alternate conceptualizations of what it means to be human" (Suchman, 2007, p.281). In Suchman's view, agency is defined as "doing things" or the "possibilities generated… through specific sociomaterial assemblages" (p. 242). In other words, agency is the outcome of actions or 'doings' produced by different sociomaterial arrangements or configurations ("assemblages" between humans and machines).

In order to examine socio-technical relations, Suchman (2007) suggests that we need to simultaneously hybridize and purify human-machine distinctions through reconfiguration by focusing on the mutual constitution and situated practices/differences between multiple arrangements of humans and machines. In her analysis, she argues that we need to recognize "the deeply mutual constitution of humans and artifacts, and the enacted nature of the boundaries between them, without at the same time losing distinguishing particularities within specific assemblages" (p. 260). Examining sociomaterial relations from a similar view point as Suchman, Orlikowski (2007) has observed that, "the social and the material are *constitutively entangled* in everyday life. A position of constitutive entanglement does not privilege either humans or technology […] the social and the material are considered to be inextricably related – there is no social that is not also material, and no material that is not also social" (p. 1437, emphasis original).

For Barad, (2003, p. 826-27) the concept of "intra-action" is defined as "a matter of intra-acting; it is an enactment [...] not an attribute whatsoever—it is "doing"/"being" in its intra-

activity." Intra-action re-defines agency as an inseparable practice from the interactivity of humans and machines; action is viewed as an emergent and hybrid process of enacting human and material or technical agents or "the ongoing reconfigurings of the world" (Barad, 2003. p. 818).

The term enactment signals a shift in understanding agency from something that is possessed to something that is done or produced. Adopting Mol's (2003, p. 32-33) understanding of the verb "enact," Barad draws attention to the inseparability and performativity of subjects and objects or humans and non-humans. This co-constitutive or "posthumanist notion of performativity" (Barad, 2003, p. 808) offers an alternative account of agency to human-centered or techno-centered approaches by focusing on the enactment of both social and technical actors. The concept of intra-action offers a precise vocabulary to speak about human and non-human agency. In order to make visible the differences between various arrangements and to gain a deeper understanding of socio-technical agency, Barad (2003, p. 815) argues that we make "agential cuts" or "effecting a separation between 'subject' and 'object'" to expose specific intra-actions that mutually constitute socio-technical relations.

Developing on the work of Barad and Suchman further, Introna (2007, p. 9) has created a model to expose the "co-constitutive intra-actional agencies" by separating and cataloguing various social and technical components. In his study of plagiarism detection software, Introna (2007) breaks down intra-actions into four categories: "Affordances/prohibitions"; "(Cyborg) Identities"; "(Cyborg) Practices"; and "Discourses." The four categories relate to the co-constitution of material artefacts/users and the way of "being", "doing", or "talking" about them as either enabling or constraining (Introna, 2007, p.9). The first category relates to the material configurations which constitute the artifact and the properties which afford or prohibit certain

actions over others. Cyborg identities and practices focus on the ways of being someone (one's identity) or doing something (actions played out) and that which enables or constrains certain identities or actions. Discourse is defined as "the ways of talking (or making claims) about something in particular…as well as that which constrains and enables that which can be said legitimately" (Introna, 2007, p. 9). Introna's model demonstrates the concept of agential cuts as proposed by Barad through momentarily separating and exposing material configurations, identities, practices and discourses.

The concepts of intra-action and socio-technical assemblages are most valuable for their recognition that, while social and technical actors are mutually constituted, they form diverse assemblages that do not emerge on an equal or level playing field. In contrast, although Latour argues that actants occupy an equal footing in the analysis, ANT lacks a clear and thorough analysis of the asymmetries emerging between diverse assemblages of humans and non-humans. As a result, ANT overlooks critical insights that would help explain the potential consequences or effects on particular assemblages and to recognize potential power differentials existing within or outside of particular networks. As Suchman (2007, p. 269) observes, the concept of symmetry detracts attention away from the idea that "persons and artifacts do not constitute each other in the same way." ANT also has been criticized for examining only those actors who are visible within the immediate network of relations; that is, it ignores actors who are relatively invisible within socio-technical spaces (Suchman, 2007).

The concepts of intra-action and socio-technical assemblages are related to four main ideas: multiplicity, temporal emergence, performativity, and socio-technical agency (Doolin & McLeod, 2012). As outlined by Doolin & McLeod (2012), socio-technical assemblages and relations are multiple and diverse which have different meanings for different people.

Assemblages are temporally emergent – neither stable nor fixed but always in a state of becoming – and are reconstituted across particular times and spaces. The idea of performativity signals that socio-technical arrangements are performed actively and produce varied effects and intended/unintended consequences through their intra-activity. Socio-technical agency is the idea that action is co-constituted and enacted by various social and technical actors.

The concepts of intra-action and socio-technical assemblages are particularly informative for locating agency within the complex web of human-machine relationships. Intra-action provides a language to speak about human and non-human action without assuming agency is located essentially in human actions; rather non-humans or technical artifacts also 'do things.' At the same time, the concept of socio-technical assemblages provides a path forward to examine the diverse effects and arrangements, and their political and social consequences, through its recognition of both the mutual constitution of humans and machines and the differences between the specific ways they are assembled or arranged.

### 2.2.3 Roles of Users and Technologies and Co-configuration

Most studies of electronic or smart card fare systems in public transportation have focused primarily on institutional issues (Yoh, 2008), costs and benefits of adopting a smartcard system (Iseki, Demisch, Taylor, & Yoh, 2008), or user loyalty and acceptance (Trepanier, Habib & Morency, 2012). Few studies have focused on transit users' experiences with the exceptions of recent research on London's Oyster transport smartcard (Inglesant, 2007; Inglesant & Sasse, 2007). Indeed, within the STS literature, little attention has been paid to the everyday use of mundane technologies by lay persons or users in comparison to the analysis of technological systems as they operate within expert or scientific fields (i.e. laboratory or organizational studies) (Pinch, 2010a; O'Brien, Rodden, Rouncefield, & Hughes, 2006). It is only recently – and within feminist/critical technology studies and media/cultural studies paving the way – that

STS has drawn attention to the importance of users and the roles that users and technologies play (Oudshoorn & Pinch, 2003; see also, Kline & Pinch, 1996; and Mackay & Gillespie, 1992).

According to Oudshoorn and Pinch (2003, p.3), users and technologies are inseparable objects of study suggesting that they are "two sides of the same problem." In other words, users influence, shape and configure technologies and technologies influence, shape and configure users and their use of technologies in different ways.

Drawing primarily on Latour and Akrich's (1992) application of Actor-Network-Theory (ANT) to the study of users, STS scholars have adopted the vocabulary of human and non-human agency. Users of technologies are "configured" (Woolgar, 1991) or scripted as well as actively involved in the "reconfiguration" (Suchman, 2005, 2007) or "de-scription" of technologies in creative new ways (Akrich, 1992; Akrich & Latour, 1992). According to Woolgar (1991, p. 59), the "identity" and "future actions" of users are "configured" during the design and production of technologies, which in turn, reformulates the user-technology relationship. Technologies configure users to better suit their designed features which have important effects on individual users and society more generally (Oudshoorn & Pinch, 2003; Woolgar, 1991). As Oudshoorn and Pinch (2003) argue, users of technologies also matter in their ability to bring about technological change not only through their role in adapting technologies to suit their local or immediate needs, but also shaping the design and production of technologies through their use of technologies. Similarly, Wajcman (2002, p. 353) argues that technological change is a "contingent and heterogeneous process" whereby "users can radically alter the meanings and deployment of technologies." Users of technologies are therefore relevant and important actors who are not manipulated simply by technologies; rather, they engage and re-

configure technologies in diverse ways. Users' perspectives are valuable for gaining insight into their relationship with technologies.

### 2.2.4 The Social and Technical Construction of Meanings

The ways through which meanings about technologies are formed/constructed and maintained is important to the study of socio-technical relations. One of the core concepts within the Sociology of Technology, following the SCOT approach, is "interpretive flexibility" which refers to the way technologies are multiply interpreted (Pinch & Bijker, 1984); technologies mean "different things to different actors" which influences the ways in which people think about, use and design technologies, as well as produces unintended meanings or consequences that sometimes differ from the original intentions of the designers (Law & Callon, 1992, p. 24). More recently, the concept of interpretive flexibility has been framed within a mutual shaping or sociomaterial perspective that contributes an analysis of the way in which a technology's specific material configurations shape users' interpretations of technology and the shaping potential of technologies more generally (Doherty, et al., 2006). In a general sense, interpretations and meanings applied to particular technologies are guided by both social and technical/material influences.

In their introduction to sound studies, Pinch and Bijsterveld (2004, p. 637) acknowledge the influential role that technologically-produced sounds play, such as the audible "hum and beep" of a machine, in generating meanings and interpretations. More recently, Soltanzadeh's (2009) research on persuasive technologies demonstrates that, the beeps and sounds produced by electronic technologies are interpreted in meaningful ways that are influenced by both social and technical factors. Using the example of an anti-shoplifting gate, Soltanzadeh (2009) found that meanings associated with the beep produced when the gate detects unauthorized passage is shaped by both the technical artifacts (the scanner reading RFID signals) and the socially

constructed meanings associated with that particular sound (p. 20-26). This body of work demonstrates the ways in which the meanings associated with technical sounds are co-constructed by social and technical aspects.

Recent research has also suggested that the physical spaces in which technologies are used also matter and influence interpretations of technical use. Using the concept of "telegeography", Oudshoorn (2012) explores the ways in which the use and meanings of technologies are place-dependent. She argues that "places in which technologies are used affect how technologies enable or constrain human actions and identities" and how technologies are made meaningful in their everyday use (p. 121). In her study on ECG recorders, Oudshoorn (2012, p. 134) argues that the beeps produced by the recorders "invite specific actions or give feedback to users" in ways that facilitate use as well as "place constraints on users." She found that the beeps were experienced negatively, as a violation of participants' privacy, where the recorders acted as "disruptive actors" making their "heart problems publicly visible" (p. 134-135).

This research illustrates the powerful role of technical sounds in making particular socio-technical relations and subjectivities visible, such as identifying patients with heart problems, through which intended or unintended consequences are co-produced by social and technical actors. Socio-technical agency is therefore bound up with and performs new subjectivities and shapes or reinforces power relations. Moreover, these studies demonstrate that both spatiality and sound are incredibly important to the study of socio-technical relations.

The mutual shaping framework extends SCOT's concept of interpretive flexibility by analyzing the interplay of social and technical realities in shaping interpretations of technology. More specifically, reconnecting both materiality and space to the social construction of

technology directs attention to the way different material configurations combined with the personal histories or socio-cultural positions and backgrounds of different groups produce different socio-technical arrangements or "diverse assemblages" (Suchman, 2007, p. 268). Not only are technical artifacts interpreted differently by different individuals or groups, the different material configurations through which technologies are built also influence the ways in which technologies are interpreted and experienced.

### 2.2.5 Ongoing (Re)configuration vs. Closure

According to SCOT, the interpretive flexibility of a technology is not permanent; instead, it eventually reaches a state of closure where dominant interpretation emerge (Pinch & Bijker, 1984). In contrast to this idea, recent research suggests that users continue to (re)interpret and (re)configure technologies after they have been designed, implemented and imbued with specified meanings and uses (see for example, Mackay & Gillespie, 1992; Mackay, Crane, Beynon-Davies, & Tudhope, 2000; Prout, 1996; Ingram, et al., 2007; Mamo & Fishman, 2001; and Doolin & McLeod, 2012). More specifically, Mackay and Gillespie (1992, p. 701) argue that "there is a crucial role for the decoder of the text" whereby the "subjective, social appropriation of a technology is thus a crucial force in the social shaping of technology." They suggest that users play active roles in shaping technologies through their "social appropriation of a technology" and through "decoding" the meanings that technologies convey which often differ from the designers' original intentions through which technologies are "encoded" (p. 702). The concept of decoding implies that users reconfigure technologies to better suit their needs and suggests that the interactions between users and technologies are meaningfully interpreted by users.

Expanding on the idea of decoding, Mamo and Fishman (2001) identify users and technologies engage in mutual (re)configurations. They suggest that "even after the scripts of a

technology are ‘built-in’ […] by the dominant meanings inscribed on it, the technology’s meanings and uses are not fixed or ‘stable’” and can therefore be “reinterpreted and resisted” (p. 19). Their analysis adopts the concepts of scripting and de-scripting as proposed by Akrich and Latour (1992) to examine the ways in which technical objects configure users through certain scripts or programs of action; scripts may be unwritten or renegotiated. Similarly, Ingram, et al., (2007, p. 10) argue that users appropriate or configure technologies through which “alternative scripts and unnoticed affordances emerge as users and consumers position objects—symbolically and materially—within existing complexes of possession and practice.” This finding suggests that although technologies configure users in particular ways, users also play important roles in configuring technical artifacts, their meanings and material properties through use. In order to describe the ways in which technologies are reconfigured continually in creative ways, and in situated and emerging contexts, Suchman (2005, p. 11) has applied the concept of “artful integration,” and Pickering (1995, 2003) has used the idea of “becoming.”

The metaphor of “tinkering” has been applied primarily to studies of scientific practice in a laboratory setting in order to describe the ways in which scientists configure scientific and technical objects to achieve desired results (Knorr-Cetina, 1979, 1981; Zenzen & Restivo, 1982; Nutch, 1996). But more recently, this concept has been used to examine the configuring practices of lay-persons and users of technology in everyday life (see Waksman, 2004; Perlman, 2004; Dunbar-Hester, 2008). In order to describe the way users configure technologies (symbolically and materially), the concept of tinkering might prove useful for gaining insight into the co-produced or enacted engagements between users and technologies.

The STS literature outlined in this section demonstrates that technologies are understood to be in a constant state of flux rather than stable or fixed, thus opposing the concept of “closure”

or the presumed emergence of a shared meaning about a particular technology (Pinch & Bijker, 1984, p. 424). At the same time, these ideas re-conceptualize and extend the concept of interpretive flexibility by offering an analysis of configuration which considers both symbolic meanings or interpretations of technologies and their material properties.

### 2.2.6 Invisible Actors as Excluded Others

Important to the discussion of human and non-human agency is the way in which non-relevant groups become invisible or irrelevant in the analysis of technology-society relations. The SCOT approach has been criticized for closing down the discussion of users too early, particularly for ignoring the ways in which "users could actively modify stable technologies" (Oudshoorn & Pinch, 2003, p. 3-4). Moreover, the concept of the relevant social group is viewed as problematic since it excludes the interpretations of invisible actors or "non-relevant social groups"; that is, individuals who are not considered relevant stakeholders (p.4), or who are not direct users or connected to technologies (Winner,1993). For example, in their study on the impact of the moog synthesizer, Pinch and Trocco (2002, p. 313) suggest that salespeople have traditionally been neglected as relevant actors, but are important mediators or "boundary shifters" between the worlds of production and consumption through their connections to both manufacturers and users.

Drawing on Star and Griesemer's (1989) notion of boundary objects, Pinch and Trocco (2002, p. 314) suggest that people act as boundary shifters by crossing "boundaries and in so doing produce a transformation." Similar to the way boundary objects take on different meanings in different settings, people's identities shift as they cross boundaries between different worlds; for instance, they may be users in one setting and engineers or musicians in another. The concept of boundary shifters extends the analysis of actors beyond the relevant social group and introduces the idea that identities and positions of persons or groups are fluid, shifting between

boundaries rather than remaining static. Moreover, the criticisms described above point to the issues of exclusion and marginalization of certain groups that are embedded in hierarchical power relations, suggesting that a critical approach to the study of technology may be provide more insight to address issues of power and inequality.

### 2.2.7 Feminist and Critical Studies of Technology

Feminist technology studies offers a way forward with respect to understanding socio-technical relations within a framework that recognizes power relations that exist between privileged and marginalized groups. For instance, Haraway (2000, p. 292) has offered the metaphor of the "cyborg," or "a hybrid of machine and organism," to deconstruct the traditional binary oppositions, such as male/female, human/machine or nature/culture, which privileges the first term over the second. The cyborg offers a political strategy through which the blurring or blending of humans and machines allows us to "question that which is taken as 'natural' and 'normal' in hierarchic social relations" (p. 149). Feminist researchers working within an STS framework have argued that technologies are neither neutral nor exist within vacuums, but rather co-produce or reinforce uneven power relations and inequalities that operate within wider social and political contexts (Wajcman, 2000; Faulkner, 2001; Casper & Clarke, 1998; Suchman, 2005; Barad, 2003; and Oudshoorn, et al., 2004). In other words, gender constructions and other social locations are positioned alongside social and technical realities.

Critical studies of technology have addressed the political and non-neutral effects of technical and material artifacts, and in particular, the ways in which the use of technology "transforms experience" (Ihde 1979, p. 53). For instance, studies have examined the way scripts or gender-scripts are inserted into technologies during the design and production of technologies which are interpreted and made meaningful through their use (van Oost, 2003). For example, Winner (1980) addresses the political implications of the bridges in Long Island that were

designed deliberately to be too low for certain automobiles. One side effect was that the bridge's design prevented public transit from transporting bus riders, who were primarily racial minorities and low-income groups in this particular context, to access the parkways and beaches that were connected by this route (Winner, 1980, p. 124). Here, social inequalities may be materialized through the design and use of technologies suggesting that material objects, environments and technical artifacts have politics. In addition, Mackay and Gillespie (1992, p. 690) argue that technologies may also embody politics through unintended consequences, suggesting that "because a technology may not be consciously encoded with political qualities does not mean that it cannot help to reproduce economic priorities or power relations inherent in the social formation."

This body of work demonstrates the ways through which technologies are bound up with social, cultural and political contexts whereby gender, race and class inequalities are intentionally or unintentionally reinforced by technologies. As Winner (1993, p. 368) has argued, social studies of technology should be concerned with "[w]hat the introduction of new artifacts means for people's sense of self, for the texture of human communities, for qualities of everyday living, and for the broader distribution of power in society." In order to gain a clearer picture of socio-technical relations which takes into account power relations, we must examine the political and non-neutral effects of technologies.

### 2.2.8 Subjectivity, Identity and Power

As STS research has shown, technologies are designed with intended users in mind which may be in contrast to or impact social groups differently (Oudshoorn, et al., 2004). For instance, Oudshoorn, et al. (2004) point out that, in order for technologies to be implemented successfully, the gendered (and other) identity articulated by designers and performed by users need to align. Likewise, scholars argue that users multiply articulate and influence the meanings associated

with technologies, lending many interpretations in the design and use of technologies (Oudshoorn & Pinch, 2003). Connected to the multiplicity of interpretations, Prus and Mitchell (2009) suggest that the social world is "thoroughly interfused with instances of technology" through which interactions between social groups and technologies vary over time, between and within societies and across diverse subgroups (p. 18). The idea of multiplicity aligns with Suchman's (2007) concept of sociotechnical or "sociomaterial assemblages" and the idea of temporal emergence since it emphasizes the fluidity and diversity of socio-technical relations and cuts across different times and spaces.

Growing interest in the topic of agency of non-humans also points to the blurring of human–machine boundaries and subjectivities (Haraway, 2000; Turkle, 1995; Suchman, 2007; Knorr-Cetina, 1999). Mort, et al. (2005) have focused attention on the malleable nature of human-machine boundaries, suggesting that agency is co-produced and exercised through interactions with machines that constitute hybrid subjects. In their study on anesthetic practices in the medical field, Mort et al. (2005) found that agency was not something possessed but a product of and exercised through the patient's and doctor's interactions with machines. They found that the boundaries between humans and machines were traversed, constituting a new hybrid subject. Similarly, the concept of "reconfiguration" has been adopted in the literature to refer to the way in which user-technology relationships are malleable and productive by creating new assemblages (Knorr-Cetina, 1999; Suchman, 1998, 2007).

STS researchers also have pointed to the ways in which technologies are embodied and envisioned as extensions of users' bodies and identities and form new subjectivities in the case of simulated or digital identities (Shah, 2008). As Kruger, Magnet and van Loon (2008) argue, the interactions between technological systems and users through the use of electronic and digital

data signals the creation of new subjectivities; that is, they move from the corporeal individual into a newly transformed "data subject" (p. 110).

The topic of agency raises questions surrounding the production of subjectivities and power in human-machine interaction. Although there has been widespread effort to examine human-machine relations in recent literature, few studies focus on understanding the ways in which these interactions might enable or constrain agency and the production of identity and power (Winner, 1993). The complex task of uncovering these interconnections leads not only to questions surrounding social relations and action but also to broader questions about social structures and power relations. In particular, technologies which are "seemingly mundane" or "infrastructural" often go unnoticed as sites where "deeply relevant, social issues are 'hidden' – such as inclusion/exclusions of certain groups or voices, or the subtle restructuring of […] identities" (Timmermans & Berg, 2003, p.108). With respect to understanding power relations, surveillance studies have offered insight into the intricacies of mundane and ubiquitous or infrastructural technologies by closely examining their capacity to reshape and impact the experiences and identities of users in everyday life.

There is a growing body of literature pointing to the way increased use of smart and mobile technologies act as tools of surveillance whereby "movement in urban spaces is no longer a means of evading the gaze" (Lyon, 2006, p. 211). As Lyon (2006) has suggested, observation is no longer limited to static persons stuck in a particular space or time. Increasingly, the gaze is mobile through the expansion of mobile technologies with monitoring and tracking capabilities. At the same time, Haggerty and Ericson (2000, p. 614) have used the concept of the "surveillant assemblage" to describe the way in which power is both invisible and everywhere. From their perspective, power is dispersed and differentially structured within society and acts much like a

rhizomic plant or unruly weed that continually expands and regenerates. They argue that surveillance "systems often introduce identity categories that encourage new forms of self-identification" and produce new subjectivities in relation to constructed identity categories (Haggerty & Ericson, 2006, p. 15). Categories used to identify persons, for instance, based on demographics such as a persons' socio-economic position, gender, or ethnic background or detailed information such as purchase histories and internet browsing habits, may enforce or constructed new identities.

The ability to trace mobile individuals and populations presents new questions regarding power and control. Lyon (2007, 2006, and 2003) argues that technologies with the potential to track, monitor and store information also may be used to sort and categorize people in non-neutral and discriminatory ways. Similarly, Cameron (2006) points to the potential or unintended consequences of GPS and RFID tracking of smartcard bus passes on public transportation systems through their data generating capacities to record, group and track riders' movements. As a result, Cameron (2006, p. 236) argues that "low-income riders are confronted with the dilemma of sacrificing their privacy or having to pay more" since "other [transit fare] options are more expensive." The overrepresentation of low income individuals as bus riders suggests that surveillance is unevenly distributed, affecting, in this case, those who are most marginalized economically – and including other social locations such as race, gender and age that intersect with class inequalities. The uneven effects of technologies on the experiences of users demonstrate that they are neither innocent nor neutral; instead, technologies produce intended or unintended consequences which have important effects on different groups of people, which are increasingly hidden or embedded into the structuring and operations of transit systems (Cameron, 2006). The intention, however, to surveil is not a pre-requisite for "the effects of

surveillance to be felt," particularly with regards to the data-capturing technologies which have the potential to monitor "in real time or at a later date" (Monahan, 2009, p.297). But Monahan (2007, p. 378) suggests that data capturing systems have the "vast potential for function creep" or used for "purposes that were not originally intended."

One challenge within the Sociology of Technology and STS has been to address the social and technical/material dimensions of technologies and their important effects on social justice. As expressed earlier, feminist and critical technology studies have pointed to this deficiency by drawing our attention to the structural implications of user-technology relations. Critical approaches incorporate an analysis of technology that captures the uneven distribution of power and power relations more generally. The theoretical framework and conceptual ideas adopted for my analysis are outlined briefly in the final section.

### 2.3 Summary of Theoretical Framework: The Mutual Shaping of Socio-Technical Relations

Using a mutual shaping framework, I follow the works of Karen Barad (2003, 2007) and Lucy Suchman (2007; see also Orlikowski, 2007, 2010; and Introna, 2007) who conceptualize agency as the co-production of action by various social and technical actors through their intra-action. Importantly, these authors speak to the mutual constitution and (re)configuration of humans and artifacts, while at the same time, recognize differences between multiple and diverse socio-technical assemblages in their situated practices. This theoretical framework allows for the critical understanding of difference while avoiding the assumption that agency is inherently possessed by human actors.

The conceptual insights drawn from the works of Barad and Suchman allow for the critical analysis of technology through questioning the distinctions between the social and technical, as well as recognizing the multiplicity of socio-technical arrangements and the

important differences between them. One way to explore the differences across different socio-technical assemblages is to examine meanings they hold for individuals who use them. As Winner (1993) has made clear, we need to focus on what new technologies mean for people and society and to question their potential for creating, reinforcing or disrupting power relations. At the same time, Pinch (2010b, p.81) has observed that political relations emerge "in our everyday interaction with the infrastructure and material fabric of life" pointing to the important role of the material or physical design of technologies and their influences on the social and political world (Pinch, 2010b, p.81). In order to get a clearer picture of technologies in practice, we need to analyze the social and political (intended and unintended) consequences that potentially may develop in relation to the use of technologies.

A critical analysis of technology requires conceptualizing agency as the capacity for both humans and non-humans (i.e. machines or technological artifacts) to play a role in or enact on social relations (Barad, 2003; Suchman, 2007). Agency, as adopted within this thesis, is extended to include both human and non-human capacities to enact beyond that of subject-centered approaches that focus solely on action as a human accomplishment (Mort, et al., 2005). By envisioning both humans and non-humans as actors/actants, it is possible to explore the often taken-for-granted experiences through which users engage and interact with technologies. Barad's (2003) conceptualization of "intra-action" and Suchman's (2007) "sociotechnical assemblages" offer powerful theoretical concepts to understand human-machine interaction.

# CHAPTER 3: METHODOLOGY

The methodological approach informing this study about local bus riders' and the community's perceptions of the Go-Pass system, is a blended interpretive-constructivist perspective. In the first section, I identify the key characteristics and methodological assumptions of interpretive and constructivist perspectives highlighting the ways in which they complement and are appropriate for this research study. In the following two sections, I focus on the specific methods used for data collection: the research design and the selection and recruitment of participants. Bus riders or "users" (n=12) of the Go-Pass system and community stakeholders (n=3) participated in one face-to-face, semi-structured qualitative interview. I describe the procedures for selecting user and stakeholder participants and recruitment through the use of poster advertising and word-of-mouth, using theoretical or purposeful and snowball sampling techniques. In the fourth section of this chapter I introduce each of the participants who took part in the study by providing key background and demographic information.

## 3.1 An Interpretive-Constructivist Approach

The personal accounts and lived experiences of bus riders and the community are explored using qualitative research methods that draw on an interpretive-constructivist methodological approach. This research places importance on the varied and multiple accounts of participants' lived experiences and acknowledges the role of both participants and the researcher in the research process. In particular, this study focuses on the experiences, meaning-making practices and interpretations from the perspective of individuals who use public transit and the Go-Pass system in their daily use.

Interpretive approaches hold the view that there are multiple social realities rather than a single, objective or fixed reality, and assume that individuals interpret and create meanings about

their social worlds in multiple and varied ways. Interpretive researchers attempt to unfold the "complexity of views" and focus on the "specific contexts in which people live and work" so as to understand participants' "historical and cultural settings" (Creswell, 2009, p. 8). The interpretive paradigm draws on the philosophical insights of phenomenology which aim to uncover meaning-making practices through gaining in-depth knowledge of individuals' lived experiences or lifeworlds (Schutz & Luckmann, 1973; van Manen, 1984). According to Bailey (2007) researchers who follow interpretive methodologies focus on gaining insight into the everyday lived experiences of participants by examining the "meanings, symbols, beliefs, ideas, and feelings given or attached to objects, events, activities, and others" (p. 53).

A constructivist approach complements interpretive epistemology because it draws on participants' lived experiences and interpretations of their everyday lives as key resources to understanding social phenomena. According to Denzin and Lincoln (2005a) constructivist paradigms assume "a relativist ontology (there are multiple realities), a subjectivist epistemology (knower and respondent co-create understandings), and a naturalistic (in the natural world) set of methodological procedures" (p. 24). Constructivist and interpretivist paradigms frequently are used interchangeably in the literature, illustrating their closely positioned ontological, epistemological and methodological frameworks (Bailey, 2007).

Constructivist and interpretive positions similarly acknowledge the multiplicity of meanings and social realities, and challenge positivist claims to an objective truth or single reality that can be discovered. The social world is understood as "local, temporally and historically situated, fluid, context specific and shaped in conjunction with the researcher" (Bailey, 2007, p.53). Denzin and Lincoln (2005a & b) have suggested that reflexive, relativist and interpretive research positions are well suited for developing insight into individuals' lived

experiences through eliciting the perceptions and meanings that individuals attach to social situations and experiences. In contrast to positivist approaches which use the criteria of internal/external validity, reliability and objectivity, interpretive-constructivist approaches rely on the principles of credibility, transferability, trustworthiness and confirmability (Denzin and Lincoln, 2005b; Berg, 2001).

Acknowledging the interpretive role of the researcher, Charmaz (2005) points out that "theoretical analyses are interpretive renderings of a reality, not objective reportings of it" (p. 510). Researchers' analyses are therefore embedded within interpretive frames and help to co-construct data during the research process with participants. They reject the view that "value neutrality is essential to the research process;" instead, they acknowledge the role of the researcher's interpretations and beliefs in shaping the research process (Bailey 2007, p. 54). In order to avoid glaring biases or misrepresenting participants' views, researchers are encouraged to practice reflexivity in their writings, making the researcher's subjective views visible (Bailey, 2007). With respect to data collection through qualitative interviewing, the interview situation is understood as a collaborative effort and an interactive situation between participants and researcher (Charmaz, 2008).

Interpretive-constructivist approaches advocate taking into account the various perspectives and standpoints of the interviewer and respondent, the "structured and historically grounded roles and hierarchies" (e.g., gender, race and class), which shape the interview process (Warren, 2001, p. 84-85). Unstructured or semi-structured interviewing techniques with open-ended questions are thought to be an appropriate method to elicit participants' experiences because these techniques attempt to disrupt the traditional power hierarchies between the

researcher and the researched, and their open format encourages participants to shape the direction of the interview (Warren, 2001).

Interpretivists and constructivists similarly reject the idea that meaning and knowledge are produced objectively outside of personal beliefs and social, historical, political or cultural contexts (Warren, 2001). They emphasize the ways in which individuals distinctively experience and perceive their social worlds. Moreover, the contexts through which experiences take place are considered important, requiring the researcher to examine participants' interpretations and meanings of those experiences to understand their effects. Interpretive and constructivist approaches "share the goal of understanding the complex world of lived experience from the point of view of those who live it" (Schwandt, 1994, p. 118). More specifically, they hold the view that the "world of lived reality and situation-specific meanings that constitute the general object of investigation is… constructed by social actors" (Schwandt, 1994, p. 118-119). Interpretive-constructivist paradigms focus on understanding the effects that certain experiences have on social groups from their own perspectives (i.e., the "how" questions), as opposed to explaining the causality of social phenomena in objective or concrete terms.

An interpretive-constructivist methodological approach to studying users' perceptions of technology is helpful for gaining an in-depth understanding of their experiences; that is, it allows us to better understand the ways in which the material or physical properties of technologies are experienced. Bailey (2007) argues that materiality is an inseparable part of our social world and it is important to understand "the socially significant meanings attached to the physical world" (p. 54). Participants act, interpret and create meaning out of their physical, material worlds situating their experiences in particular social/material contexts.

The focus on lived experiences and subjective interpretations of material and social worlds positions the interpretive-constructivist approach as suitable for researching socio-technical relations. In particular, research into users' interpretations of their daily practices and embodied interactions with technical artifacts means directing attention to the situatedness of the phenomenon. Following this approach, individuals' meanings, interpretations and experiences are understood in connection to the social (processes, contexts and others) and material (physical objects and surroundings) worlds which shape their life-worlds. The subjective experiences, interpretations and perspectives of participants are elicited through qualitative in-depth interviews which provide rich first-hand data. For the purpose of this study, an interpretive-constructivist perspective was found to be a useful and appropriate approach for examining first-hand the ways in which individuals experience, relate and interpret their use of the Go-Pass system. Through studying the lived experiences of participants and the meanings they attach to the Go-Pass technologies, the social and material factors situating them, it is possible to gain a fuller understanding of socio-technical relations and human-machine interaction.

### 3.2 Research Design

In order to examine the relationship between users and technology, fifteen in-depth qualitative interviews were conducted with twelve bus riders or "users" of the Go-Pass system and three community stakeholders. Interviews with participants were one-on-one, with the exception of one interview conducted with two individuals who preferred to be interviewed together. The interviews were carried out in an informal, face-to-face setting using a semi-structured interview format. A number of open-ended and probing questions were incorporated into the interview guide to explore participants' perspectives. The interview guides for users and stakeholders can be found in Appendix A and B.

This interview format allowed participants to discuss the topics presented by the researcher, as well as to identify themes/issuess that they felt were essential to their experiences. General questions surrounding participants' history of using public transit services included the length and frequency of use, and dependency on the service. Specific questions focused on participants' experiences and use of the Go-Pass technologies, as well as the impact of the changes from the old to new system. As new directions and topics were introduced by participants, the interview guide was updated to reflect new insights as the research progressed.

On average the interviews were approximately 60 minutes in length, which ranged anywhere from 25 minutes to 4 hours depending on the individual interview. At the beginning of each interview, I indicated that the length of time of our meeting was open, flexible and dependent on the amount of time the participant would like to engage in the discussion. The interviews often resulted in thorough and in-depth conversations that explored a number of themes and led to unanticipated directions and topics, such as the connections between the Go-Pass technologies and the context of poverty and inaccessible transportation, the significance of the beeps and sounds produced by the machines and their impact on users experiences, and the ways in which re-defining and configuring use of the technology by participants was perceived as remedying the constraints they encountered with the system.

Field notes were taken during the interviews to capture the essence of the conversations including participants' facial/bodily gestures and non-verbal cues which often signaled emotional responses to certain topics. Recording these important moments assisted in contextualizing the interview situation and developing my interpretation of the participants' experiences which otherwise may have been lost by simply reading the transcripts.

The interviews were audio-recorded and transcribed almost immediately after the interviews were completed (approximately 1-2 days post-interview). Beginning with the first interview, I started writing memos and notes used to draw out the general topics and issues raised in the interviews. During this process I started the initial coding of themes based on general categories. Participants' transcripts were analyzed for significant topics where themes were constructed based on my understanding of the participants' words and meanings, and included coding for both similar and unique themes and concepts. This technique allowed me to identify key issues and emerging themes that required further exploration in subsequent interviews.

After the transcripts were completed, they were delivered to all participants who were given time to read through their transcripts and to make any corrections or changes they felt were necessary. Follow-ups with a number of the participants occurred in person, through email or over the phone to discuss their transcripts and the accuracy of my interpretations of their interview comments and meanings. Nine out of the fifteen participants (8 users and 1 stakeholder) were followed up with post-interviews while six participants were unavailable or chose not to make changes/additions to their transcripts. The follow-ups allowed participants to bring any discrepancies in their transcripts to my attention and to make changes or additions, as well as elaborate and reflect on the comments they made in the interviews.

My follow up with Melody, for instance, involved reviewing parts of her interview transcript in person with her allowing me to ask questions and clarify my interpretations. She was able to expand on her comments made about the eligibility processes for obtaining her Go-Pass card as a low income person and her feelings towards personalization (i.e., linking a person's contact details to the Go-Pass card) as a protective feature in case the card is lost. I also

had regular contact with Jack who shared new insights with me regarding his experiences using the Go-Pass for six months after our interview. In my follow up with Cory and Libby, whom I spoke to on the phone after the interview, I asked them how they would rate the user-friendliness of the Go-Pass. Consultation allowed them to illustrate some of the difficulties they had with using the Go-Pass. In some of the follow-ups with participants I reiterated comments they made from our interviews using my own words and asked for approval that I had interpreted them correctly.

The transcript review and follow-up process helped to ensure their words/meanings were not taken out of context or misinterpreted. This consultation process was helpful in validating my interpretations of the interview data by the participants themselves and was beneficial in gaining further context into their experiences and interpretations.

### 3.3 Participant Recruitment Strategy

In order to carry out the research study, I recruited a total of fifteen participants from Saskatoon, Saskatchewan consisting of twelve bus riders/Go-Pass users and three community stakeholders. The voluntary nature of participation meant that participants were willing to share their experiences and be audio-recorded during the interviews. Two separate interview schedules were created and used as guidelines for the interviews with users and stakeholders (see Appendices A and B). "User" (or bus rider) participants were recruited based on the criteria that they currently, or previously had used the public transit system. This study did not include bus riders who use the Access Transit service designed for individuals who have reduced mobility.[1]

[1] The decision to exclude Access Transit bus riders was due to the differences in how the service is operated (those using Access Transit must call in advance for use of the service) and was viewed as a strategic move to narrow the already wide-ranging scope of this research topic. While this work recognizes the importance of including the perspectives of differently able-bodied persons, it is felt that an entire study on users' perspectives of the Go-Pass who use Access Transit services could be conducted to better represent their voices.

Despite this exception, some participants in the study identified as having physical as well as mental/emotional disabilities or conditions.

In order to access a diverse range of perspectives I aimed to recruit participants of different genders, a variety of ages, geographic locations (East/West sides of the city), education levels, racial/ethnic background, employment statuses and length/frequency of use of the transit service/Go-Pass system. The sample was varied in terms of the demographic makeup and backgrounds of participants.

Participant recruitment used a combination of purposeful/theoretical and snowball sampling techniques, which primarily took place through poster advertisements and word-of-mouth (See Appendix C for poster advertisement). Posters were used to draw in potential participants for the study and were located at a number of the major bus stops/malls and terminals in Saskatoon: Downtown Service Centre Terminal, University of Saskatchewan campus (lower Place Riel), Lawson Heights Mall, Market Mall, Confederation Mall, Centre Mall, SIAST Kelsey Institute bus stop on Idylwyld Drive and 33rd Street, Stone Gate Mall, Forest Grove stop, and the Safeway on 33rd Street and Avenue C. These poster locations, in easily accessible public spaces, offered a discrete method of gaining participation and ensured the anonymity and confidentiality of potential participants who inquired about the study. Participation in this study was assumed to be voluntary because telephone contact with the researcher was initiated by potential participants. Alternatively, my own perception of what "easily accessible" means or the locations I selected may have biased the sample; that is, advertisements were not posted in remote areas of Saskatoon but instead placed in locations that I felt were most accessed and populated (e.g., major bus malls) which may have underrepresented individuals who do not use the main routes.

Community stakeholders in this research were identified as individuals who are directly involved with individuals who ride public transit and use the Go-Pass system. Stakeholders engage and interact with the wider community of bus riders and are considered to have a unique and diverse stock of knowledge about the ways in which public transit and the recent changes to the system impact individuals who ride the bus. Community stakeholder participants were selected based on having close connections to the bus rider community and the Saskatoon Transit service.

Community stakeholders were consulted and recruited for their understanding of the dynamics at play in the larger socio-cultural, economic and political atmosphere impacting Saskatoon as a whole, and in particular, the community of bus riders. Community perspectives provided an understanding of the broader context of transit that is associated and complementary to the individual, subjective positions taken by the riders/users themselves. The stakeholders included: 1) a community programming coordinator at a local community organization who works with and advocates for individuals who frequently use public transit services and who has also pinpointed key issues for delivering program services to individuals as a result of transit changes; 2) a student representative at the University of Saskatchewan who directly lobbies Saskatoon Transit on behalf of undergraduate students and consults transit management and city council; 3) and a city councilor who has ties to both local constituents and transit management staff.

Snowball sampling was primarily used to recruit potential community stakeholders. My supervisor acted as an informant who identified individuals in her network of contacts that could connect me to potential stakeholders. Through this chain of contacts, I was able to meet with and

interview individuals who were not only willing to participate, but were deeply passionate, involved and interested in the topic and the project.

It is important to note that while I had met with Saskatoon Transit staff to answer technical and logistical questions for consistency and accuracy, I was unable to interview bus drivers or transit staff as I had originally intended. Despite my attempts to connect with and engage Transit staff in this project through emails and formal letters of invitation, they had not responded or followed up (see Appendix D - Letter of Invitation). I anticipated that interviews with transit service staff, such as transit designers/planners, management and bus drivers, would provide a balanced view of the new system and insight into the perspectives of individuals who use and work closely with the technology – through designing, managing and operating the Go-Pass system on a daily basis.

### 3.4 Participants' Background Information

In this section I introduce each of the user and stakeholder participants who took part in the study by providing key background and demographic information. Each participant is identified by a pseudonym name that they have either chosen or were assigned to ensure anonymity and confidentiality. I introduce each of the participants providing background and demographic characteristics, as well as the length and frequency of public transit use, dependency on public transit and length of use of the Go-Pass. The demographic characteristics of the user participants are summarized in Table 1, which provides a breakdown of age, sex, area of residence, racial/ethnic background, employment status, education level, and estimated annual household income. Participants' public transit usage information and a summary of the descriptive statistics are shown in Tables 2 and 3. In addition to social demographic characteristics, I outline stakeholders' positions and roles within the community, their interest in or use of public transit and connections to bus riders in Saskatoon summarized in Table 4.

**User Participants:**

**Libby and Cory**: I received a call from Libby the second day after I started putting up posters around Saskatoon. Both her and her husband Cory wanted to participate in the study and we set up a dual interview right away. I met with Libby and Cory that same week at the main public library in downtown Saskatoon, which they preferred to a closed interview setting at the university. From the beginning of the interview, both participants were enthusiastic and started sharing their experiences with the Go-Pass system right away, raising many issues that they have had over the last couple of years. Both Libby and Cory were long term (20+ years) riders of the public transit system in Saskatoon and had used the Go-Pass since it was implemented. They had so much to talk about that we talked for nearly three hours.

Libby is a Métis woman from the West side of the city between the age of 34 and 43, and her husband is between the age of 24 and 33, Métis and also from the West side. Libby's highest level of education was high school while Cory's highest level of education was elementary school. For both of the participants, public transit was their primary mode of transportation (i.e., they were dependent on transit) and they frequently rode the bus multiple times a day, every day. They estimated their household annual income to be between $10-19, 000 in a household of 6 (2 adults and 4 children).

**Mindy**: The third participant whom I interviewed was Mindy; she also wanted to meet at the downtown main public library since this location was convenient for her. She came directly after work to meet with me one evening. Mindy has used public transit for close to six years and had used the Go-Pass since it was implemented. Mindy is also a Métis woman, between the age of 54 and 63, married, employed full-time as a cashier and lives on the West side of the city. Her highest level of education completed was high school, and she estimated that her household annual income was between $60-69,000. Mindy uses public transit, every day and multiple times

a day, mainly to get to and from work. While her husband owns a vehicle, she was fairly dependent on public transit as her primary mode of transportation to get around in Saskatoon; occasionally she would walk or cycle to places that she needs to go.

**Buck**: Buck was the fourth participant I interviewed in the study and who expressed an interest in the topic of the Go-Pass particularly because he experienced the switch from the old to the new system and wanted to discuss his thoughts about the technologies. We met at the qualitative research interviewing room at the University of Saskatchewan. Buck has used public transit for ten years and has used the Go-Pass since the beginning. Buck is a Caucasian male in his mid-sixties (64+), who is partially visually impaired and lives on the East side of the city. Public transit is his primary mode of transportation around the city, and he has become more dependent on public transit as his eye sight has gotten worse over the years. Buck frequently uses transit on a daily basis, sometimes multiple times a day. Buck is on social assistance, has a university Bachelor's degree and estimates that his annual household income is in the $10-19,000 income range.

**Barbara**: I received a call from Barbara several weeks after the advertisements were posted. She explained that she had never been a part of a research study and would like to participate. She was the fifth participant interviewed in the study and we decided to meet at the downtown main public library. When we met the library was closed (an oversight on my part), and we decided that since it was such a nice day we could do the interview across the street at city hall on one of the park benches. Her interest in the study was demonstrated by the fact that our conversation started as we crossed the street. Barbara is a young (24-33) Caucasian female from the West side of the city, who has a high school education and is employed as an early childhood educator at a daycare. She uses public transit everywhere she travels, outside of

carpooling with friends and family on occasion. Barbara has been using public transit for over fourteen years and is her primary mode of transportation. She uses mainly public transit to get to and from work during the week and uses transit multiple times a day.

**George**: The sixth participant was George who started using the Go-Pass only within the last two months; however, he was a long term public transit rider in the past before the recent changes (4+ years). While we had some difficulties meeting the first time since his bus pass ran out, we rescheduled for a later date and met at the qualitative research interview room on campus at the University of Saskatchewan. George is a Caucasian male between the ages of 24-33 who lives on the West side of the city. Although he only used public transit approximately 15 times in the previous month, he had started using public transit nearly every day, and sometimes multiple times a day.

**Jake**: The seventh interview was with Jake, who was a long term public transit rider and had used the Go-Pass since the beginning through the U-Pass program and later, using a regular Go-Pass card. I met with Jake at the Qualitative Research Centre at the University. He was quite interested in the topic, particularly from the standpoint of the smartcard technology, because he works in the field researching passive and active RFID or "smart" technologies. Jake is a Caucasian male, between the ages of 24 and 33 and is a student who resides on the East side of the city. While he has access to a vehicle through carpooling, he rides the bus approximately three to four days a week primarily for going to and from school, once or twice a day.

**Eternal Turtle**: The eighth interview was with Eternal Turtle (or "Eternal" for short) who picked an interesting pseudonym name based on his character from the massively multiplayer online role-playing game (MMORPG) World of Warcraft. I met Eternal at the entrance to the university since he was unfamiliar with the campus locations, and we walked to

the Qualitative Research Centre. During our walk to the interview room the conversation quickly evolved into talk about video games that we both play and enjoy, which served as an ice-breaker.

Eternal is a young (24-33) Caucasian male who is employed as a retail clerk, lives on the East side of the city and has a post-secondary level education. He estimated his annual household income to be between $20,000 and $29,000. Eternal has used the Go-Pass since moving to Saskatoon approximately a year ago, but has used other transit systems both in and outside Canada. He is dependent on public transit as his primary mode of transportation, which he uses mainly to get to and from work during the week.

**Jack**: The ninth interview was with Jack who heard about the study through word-of-mouth. Our interview took place in the qualitative research interview room at the university. Jack is a Caucasian male between the ages 24 and 33 who resides on the East side of the city and is a full-time student. He is also employed part-time. Jack has used the Go-Pass since it was implemented, and also is a long term public transit user in the past (6-7 years ago). He primarily uses public transit to get to and from school on an average of five to six days a week and has access to a vehicle (i.e., he is not dependent on transit).

**Jackal**: Jackal, who was the tenth participant interviewed, also found out about the study through word-of-mouth and later contacted me to participate in the study. We met at a local coffee shop at his convenience where we quickly engaged in conversation. Jackal is a young (between the ages of 24-33) Caucasian male who lives on the East side of the city and has used the Go-Pass for approximately three months. He also mentioned that he previously used public transit for over four years prior to the new system. Jackal has completed a Bachelor's degree and is also a current student. While he primarily uses public transit for going to and from school on

an average of five to six days a week, he also has access to a vehicle which he uses for transportation around Saskatoon.

**Ben**: Ben, who was the eleventh person I interviewed, had heard about the study through word-of-mouth from one of my colleagues. We met at the qualitative research interview room where we quickly engaged in conversation. Ben is an international student who is of African ethnic background and between the ages 24 and 33. He noted that he has used public transit in Saskatoon and the Go-Pass for a little over a year; however, he has used public forms of transportation in other cities for much longer. Ben currently uses public transit every day, multiple times a day mainly for getting to and from school. He lives on the East side of the city and his highest level of education completed is a post-secondary graduate degree. He estimated his annual household income to be within the $20-29, 000 income range.

**Melody**: Melody was the final user participant who was interviewed in the study. She called me in mid-December wondering if it would be possible to participate in the study. We decided to meet at a local coffee shop that was close to her residence and most convenient for her. Melody identified her ethnic heritage as a combination of Métis, European and African. She is a senior (64+) adult who did not complete high school (elementary school education) and resides on the West side of the city. She started using the Go-Pass since it was implemented and has been a rider of public transit for over twenty years. Melody pointed out that she has had experience with transit systems in other provinces in Canada, as well as in other countries. She is dependent on public transit as her primary mode of transportation, which she uses most days, often multiple times a day. She is on social assistance receiving an income supplement, but she also works part-time as a delivery person. Her estimated annual household income is within the 10-19, 000 income range.

Table 1: User Participants' Demographic Information

| Participants: | Age | Sex | Residence | Education Completed | Employment Status | Est. Annual House-hold Income |
|---|---|---|---|---|---|---|
| Cory | 24-33 | Male | West | Elementary | Social Assistance | 10-19k |
| Libby | 34-43 | Female | West | High School | Social Assistance | 10-19k |
| Mindy | 54-63 | Female | West | High School | Employed | 60-69k |
| Buck | 64+ | Male | East | Post-secondary (bachelor degree) | Social Assistance | 10-19k |
| Barbara | 24-33 | Female | West | High School | Employed | n/a |
| George | 24-33 | Male | West | High School | Social Assistance | n/a |
| Jake | 24-33 | Male | East | Post-Secondary (certificate) | Student | n/a |
| Eternal | 24-33 | Male | East | Post-Secondary (certificate) | Employed | 20-29k |
| Jack | 24-33 | Male | East | Post-secondary (Bachelor degree) | Student | 20-29k |
| Jackal | 24-33 | Male | East | Post-Secondary (Bachelor degree) | Student | n/a |
| Ben | 24-33 | Male | East | Post-Secondary (Graduate degree) | Student | 20-29k |
| Melody | 64+ | Female | West | Elementary | Social Assistance | 10-19k |

Table 2: User Participants' Public Transit (PT) Usage

| Participants: | Length of PT Use | Frequency of PT Use | Dependent on PT (yes/no) | Length of Use of Go-Pass System |
|---|---|---|---|---|
| Cory | Long Term (20+ years) | Multiple times a day | Yes | Since Implementation |
| Libby | Long Term (20+ years) | Multiple times a day | Yes | Since Implementation |
| Mindy | Long Term (5-6 years) | Multiple times a day | Yes | Since Implementation |
| Buck | Long Term (10+ years) | Multiple times a day | Yes | Since Implementation |
| Barbara | Long Term (14+ years) | Multiple times a day | Yes | Since Implementation |
| George | Short Term 2 months recently (LT in past) | Multiple times a day | Yes | Post Implementation 2 months (at time of interview) |
| Jake | Long Term (10+ years) | 3-4 days a week | No | Since Implementation |
| Eternal | Short Term 1 year recently (LT other provinces) | 5-6 days a week | Yes | Post Implementation 1 Year (at time of interview) |
| Jack | Short Term 2.5 years recently (LT in past) | 5-6 days a week | No | Since Implementation |
| Jackal | Short Term 3 months recently (LT in past) | 5-6 days a week | No | Post Implementation 3 months (at time of interview) |
| Ben | Short Term 1 year recently (LT other provinces) | Multiple times a day | Yes | Post Implementation 1 year 2 months (at time of interview) |
| Melody | Long Term (20+ years) | Multiple times a day | Yes | Since Implementation |

* PT = Public Transit, LT = long term

* Dependency on public transit services relates to a participant's access to a vehicle. Dependency means the participant's primary mode of transportation is public transit with no access to a vehicle (includes other modes of getting around such as walking or bicycling).

The above tables summarize information about the participants' demographic characteristics and their public transit usage information. Table 1 shows that there was an even split between participants who resided on East and West sides of the city. Distinguishing the area of residence is particularly important within the context of Saskatoon because the East and West sides of the city commonly are perceived as the dividing line between poor and rich neighbourhoods. Some of the other demographic groupings, such as highest level of education completed, employment status and length of use, were relatively even, while others such as gender and age categories were unevenly distributed. For instance, there were more males than females and a larger proportion of younger participants (67% compared to 33% in both cases). Approximately 7/12 or 58% of study participants identified as Caucasian compared to 5/12 or 42% who identified as either Metis (34%) or of African descent (8%). A slightly larger proportion of participants were either employed or students (58%) compared to those who were unemployed/on social assistance (42%). There was an even split between those participants who had completed up to a high school education and those who had completed some form of post-secondary education.

Table 2 shows that approximately half (7/12) of the user participants have used public transit services consistently on a long term basis (5+ yrs.), while three participants (1/4) were long term users in the past and in the short term more recently; two participants (1/6) indicated that they have been long term public transit users in other provinces and short term users recently in Saskatoon (up to 1 year). Frequency of public transit use was split into two groups; those who use public transit multiple times a day (n = 8 or 2/3 of participants) and those who may use public transit anywhere from three to six days a week (n=4 or 1/3 of participants). Nine (or approximately 3/4) of the study participants indicated that they did not have access to a vehicle

and were dependent on public transit services while three (or 1/4) of the participants used public transit but had access to a vehicle and were not dependent on public transit services. Roughly two thirds (n=8) of the participants used the Go-Pass since it was implemented while 4 (or 1/3) of participants started using the new system as recently as two months to one year at the time of the study. Table 3 is a summary of the descriptive statistics based on the first two tables.

Table 3: Descriptive Statistics

| **Age:** | | **Sex:** | | **Area of Residence:** | | **Highest Education Level Completed:** | |
|---|---|---|---|---|---|---|---|
| 24-33 | 34+ | Male | Female | East | West | Up to high school | Post-secondary Education |
| 67% (2/3) | 33% (1/3) | 67% (2/3) | 33% (1/3) | 50% (1/2) | 50% (1/2) | 50% (1/2) | 50% (1/2) |

| **Ethnic/Racial Background:** | | **Employment Status:** | | **Est. Annual Household Income:** | | | |
|---|---|---|---|---|---|---|---|
| Caucasian | Métis or African | Student or Employed | Unemployed/On Social Assistance | 10-19k | 20-29k | 60-69k | n/a |
| 58% (7/12) | 42% (5/12) | 58% (7/12) | 42% (5/12) | 33% (1/3) | 25% (1/4) | 8% (1/12) | 33% (1/3) |

| **Length of PT Use:** | | **Frequency of PT Use:** | | **Dependent on PT:** | | **Length of Use of Go-Pass System:** | |
|---|---|---|---|---|---|---|---|
| Long Term | Short Term | Multiple x/day | 3-6 days/wk | Yes | No | Since Implementation | Post Implementation |
| 58% (7/12) | 42% (5/12) | 67% (2/3) | 33% (1/3) | 75% (3/4) | 25% (1/4) | 67% (2/3) | 33% (1/3) |

**Stakeholder Participants:**

**Kristina**: Kristina was the first stakeholder participant I interviewed; the interview took place at her office where she is employed as a programming coordinator for a community-based organization. She is highly involved in the community, taking on numerous roles as a programming coordinator and social worker. She is also a rider of public transit and uses the Go-Pass on a daily basis. Kristina was told about the study by a key informant, identified by my supervisor, and immediately expressed interest in the study, agreeing to share her contact information with me. In particular, she had interest in the topic of public transit, its connection to the organization to which she was affiliated and the broader issues concerning accessible services in Saskatoon.

**Alfred**: Alfred, the second stakeholder participant in the study, is a student representative at the University of Saskatchewan who directly lobbies Saskatoon Transit for reduced transit rates for students. He is involved with the student body, particularly those students who use public transit through the U-Pass program. Alfred's direct connection to students who are bus riders and Saskatoon Transit management staff locate him as a valuable stakeholder within the community. Alfred is also a bus rider and user of the U-Pass card. I was contacted directly by Alfred who saw my poster advertisement on the university campus. He was interested in participating in the study due to his interest and experience with the topic of public transit more generally. The interview took place at Alfred's office.

**Dean**: The third stakeholder interview was Dean, a community member who sits on city council, who is highly interested in promoting and developing public transit to meet the city's needs. Dean is involved in dealing with Saskatoon Transit management staff directly, as well as communicating with local bus riders, primarily constituents in the area that he represents. Although Dean is not a bus rider himself, he often speaks to people in the community who use

public transit on a daily basis. Initial contact with Dean was made by my supervisor after which further communication took place through email. The interview was held at a local coffee shop.

Table 4: Stakeholder Participants – Background Information

| | | | | |
|---|---|---|---|---|
| **Participants:** | **Sex:** | **Occupation/Position** | **Role and Connection to the Community** | **Public Transit Rider** |
| Kristina | Female | Community Programming Coordinator | Directly involved in the community. Distributing bus tickets to individuals coming to programming, understanding of those from lower income backgrounds using public transit. | Yes |
| Alfred | Male | University Student Representative | Directly involved with student bus rider community. Lobbying Transit on behalf of university student bus riders, direct communications with Transit management. | Yes |
| Dean | Male | City Councillor | Directly involved with the general bus rider community (constituents) and city/ Transit management staff. Making recommendations to improve services. | No |

## 3.5 Summary

Interpretivist and constructivist perspectives are found to be appropriate methodological approaches for studying users' perceptions of the Go-Pass system because they both focus on an in-depth elicitation of participants' experiences and interpretations. Interpretivism emphasizes understanding individuals' interpretations by contextualizing their experiences with respect to their personal histories, backgrounds and positions. Interpretivists recognize that there are multiple ways of seeing and interpreting the world. Constructivism complements this focus on participants' lived experiences because it holds the view that lived reality is pivotal to understanding social relations and phenomena and understand the way in which people experience the social and material world around them are also varied and multiple. These two

approaches combined offer a strong methodological framework to explore socio-technical relations and to elicit the meanings that technologies have for users. In the following chapter, I focus on the data analysis and methods used for the interpretation of the data in more depth. I discuss Constructivist Grounded Theory (Charmaz, 2006, 2008) as a research template and strategy for coding and interpreting the data.

# CHAPTER 4: DATA ANALYSIS

Constructivist Grounded Theory was adopted as a general research strategy to guide this research study with regards to organizing, analyzing and reporting the interview data and developing theoretical insights. Following Charmaz (2000, 2006, 2008), grounded theory is approached as a guide rather than a set of prescribed methods and focuses on the reflexive and interpretive nature of the research process. The research situation is treated as collaborative, where both participant and researcher interpret and co-construct the data. Charmaz (2008) suggests that, in contrast to traditional Grounded Theory that focuses on abstracting data, researchers should keep participants' voices, perspectives and contexts intact throughout the analysis and theory building process. As Strauss and Corbin (1994) have stressed, it is important to "give voice" to participants "in the context of their own inevitable interpretations" (p. 281). This approach makes it possible to "elicit fresh understandings about patterned relationships between social actors and how these relations and interactions actively construct reality" (Suddaby, 2006, p. 636).

Following Constructivist Grounded Theory insights, this research aims to elicit and preserve the contextualized accounts of participants' lived experiences and interpretations to better understand the social phenomenon under study. In doing so, I strive to keep participants voices intact during the data analysis process as reflected in the coding practices, theme development and analysis, and in the presentation of the findings, analytic discussions and theoretical development. Constructivist Grounded Theory is compatible with interpretive and constructivist ontological, epistemological and methodological positions and is a useful research strategy for analyzing qualitative data.

This chapter is a continuation of the research methods discussed in the previous chapter, describes the data analysis process and methods. I start by outlining the coding methods,

memoing and the development of themes used to organize the data for thematic analysis. Next I discuss the ways in which evaluative criteria for establishing credibility is determined and maintained throughout different parts of the study. The third section of the chapter is dedicated to reflecting on the methodology and my role as a researcher. In the final section, I introduce the ethical considerations and procedures that apply to this study.

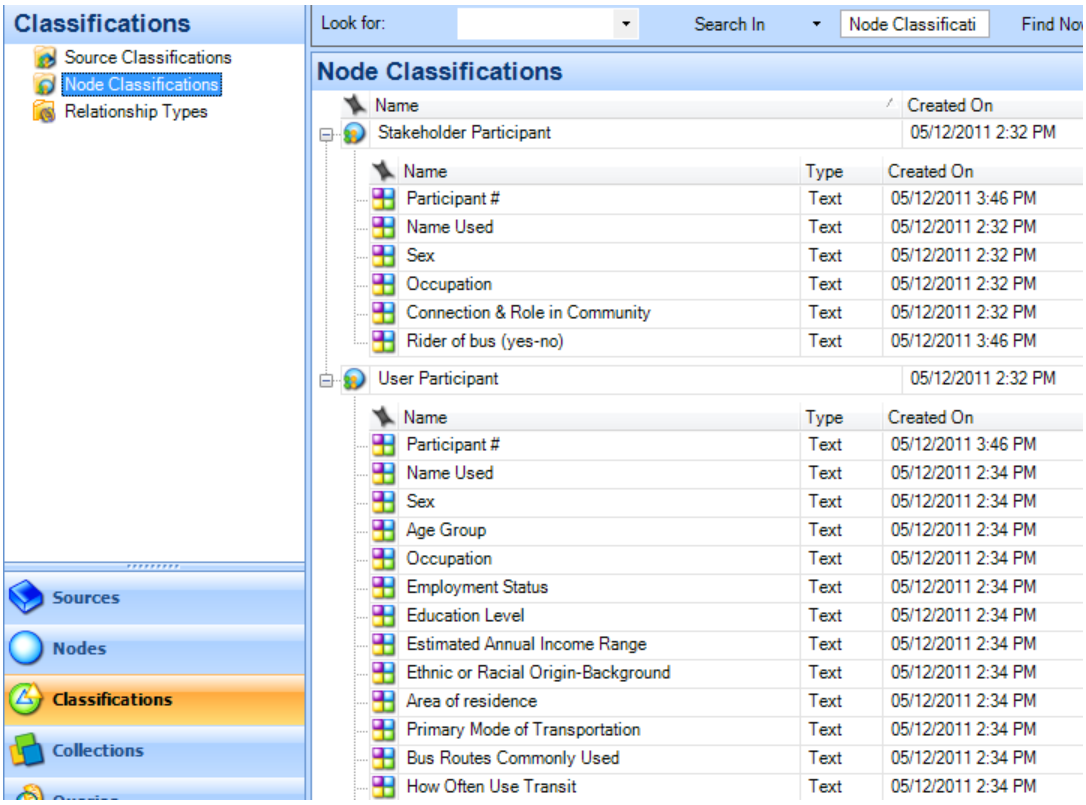
### 4.1 Coding, Memoing and Theme Development

Interviews were audio-recorded with a digital recorder, transcribed and imported into NVivo 9 qualitative research software for developing codes. Data analysis was an iterative process taking place throughout the various stages of the research study starting with the first interview. My initial analysis took place after the first interview was completed and assisted in developing the interview guide for future interviews. Preliminary analysis involved a combination of steps: reading field notes from the interviews while listening to the audio-recorded interviews, taking notes during the transcription process – creating a list of key ideas, topics and issues that were predominant during the interviews – and reading the finished transcript fully once or twice in order to ensure the key topics to be explored further were identified. This process assisted in developing questions or probes to be added or revised in subsequent interview guides. Including topics introduced and deemed to be significant by other participants allowed me to compare and contrast the similarities and differences among participants' experiences and interpretations.

After the interviews were completed and transcribed, they were imported into NVivo 9 where the data was organized by "cross-sectional indexing" or creating a common scheme which to organize the data (Mason, 2002, p. 150). A classification system was created in NVivo which linked user participants' demographic characteristics to their interviews, enabling comparisons

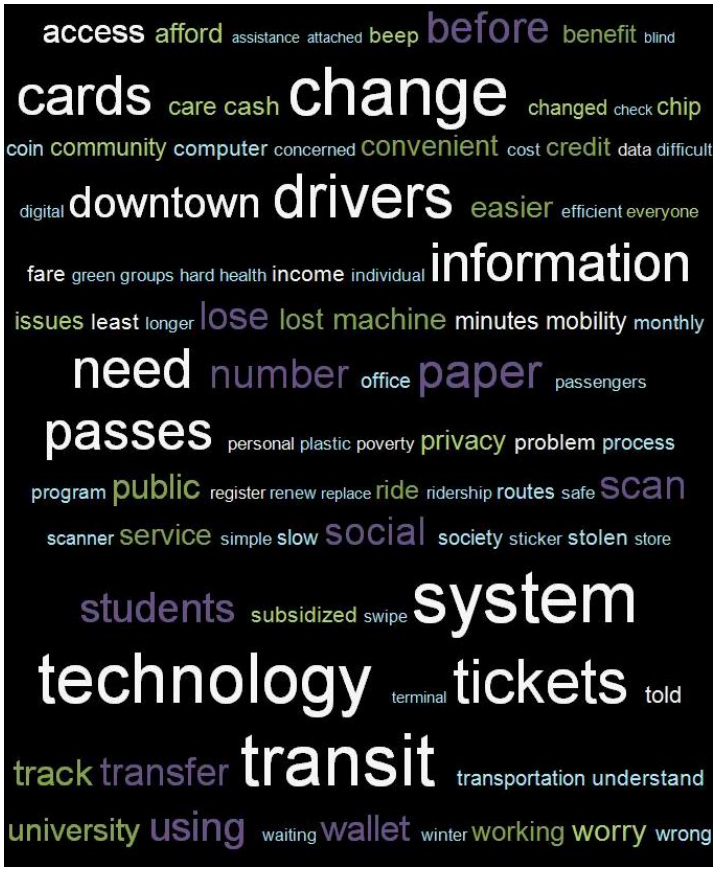
between different variables or demographic groupings within and between various themes (Fig. 1).

Figure 1: Node Classifications




The data was organized further into broad topics based on prompts to the questions from the interviews, allowing for quick comparison of participants' responses to the questions I asked during the interview. In order to have a general overview of the data, word clouds were created which mapped out general topics or ideas based on word frequencies. Figure 2 below is an example of the word cloud generated for both user and stakeholder participants.

Figure 2: Word Cloud




After the initial organization and overview of the data, I started coding the interview data using a two-phased coding strategy which included an initial line-by-line and paragraph-by-paragraph coding process or "open coding" and then focused coding ("axial" or "theoretical" coding). The initial coding process involved breaking up complete interviews into "more manageable segments that can be grouped together and used during later stages of the analysis" (Bailey, 2007, p. 128). Initial coding included: re-reading each interview fully and holistically to better understand participants' meanings and their contexts; reading the interview data line-by-line and paragraph-by-paragraph as a strategy to study the data closely and draw out as many categories, ideas, topics, events and interactions that were present. These coding techniques were

helpful for developing broad themes and to further organize the data. Close readings of the interview data allowed for unique responses and multiple perspectives to be acknowledged.

In order to ensure that participants' original meanings and contexts were kept intact, whole segments of text were coded over single words or incomplete phrases to avoid de-contextualizing participants' comments. Although coding whole segments sometimes resulted in coding paragraphs into more than one category, for instance, due to the multiple topics emerging from a single paragraph, I refrained from over-coding the data into too many categories when not necessary. During this stage I found it helpful to sub-divide categories where participants expressed positive and negative feelings toward a topic.

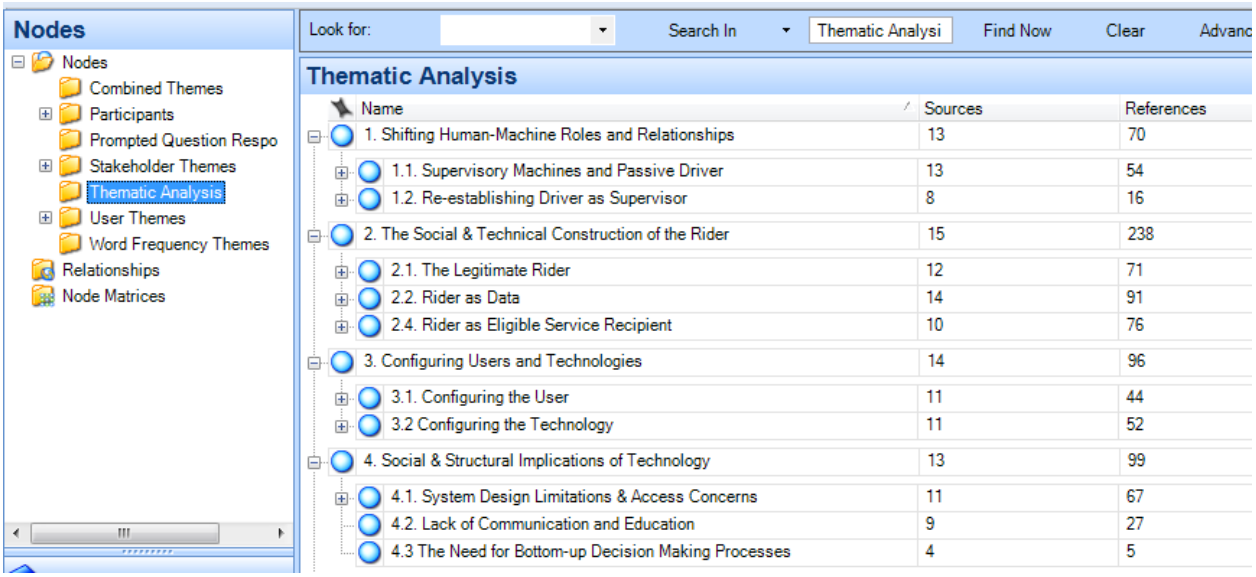
After the initial coding phase, I engaged in focused coding which is the further reduction of data by grouping initial codes into larger categories by "moving from a fairly literal code... into a more conceptual one" (Bailey, 2007, p. 129). Focused coding included: re-reading coded data from the initial coding phase to ensure categories were reflective of participants' meanings; reducing categories by merging overlapping topics; and constructing conceptual or themed coding trees which umbrella many of the initial categories developed in the first coding phase. The continual comparison of new cases to the initial codes and the recoding of the data allowed me to identify themes across the data, as well similarities and differences among and between the participants. Major themes are defined as the "recurring patterns, topics, viewpoints, emotions, concepts, events, and so on. (Bailey, 2007, p. 153)" Themed coding trees were useful building blocks for identifying and creating the major themes and sub-themes from the data.

Following the focused coding phase, I examined the themed coding trees, comparing them to the original interviews in order to gain a clearer picture of participants' meanings and interpretations as they related to each theme. This comparison was used to ensure the coding

scheme represented what the participants were saying – including both similar and unique experiences – and to reassess the connections between the different categories for their relevance and coherence in this final phase.

Through the thematic analysis, I was able to compare and draw connections within and across the themes. I created conceptual maps or "thematic networks" (Attride-Stirling, 2001) that assisted in visualizing these patterns and connections. The visual display of data was valuable and informative for examining the complexity of the data and the generation of theory (Bailey, 2007; Charmaz, 2006). Themes drawn from the interviews with users and stakeholders were originally developed and analyzed individually and later merged into four overaching themes, as well as subthemes (See Fig. 3 for final thematic coding). The four major themes coming from my thematic analysis of the interviews were: 1) *Shifting human-machine roles and relationships*; 2) *The social and technical construction of the bus rider*; 3) *Configuring users and technologies*; and 4) *Structural issues and social justice implications of technologies-in-practice*.

Figure 3: Thematic Analysis



Analytic and reflexive memos were written throughout the research process which began directly after the initial interview. Memoing was useful for making conceptual connections between categories and the development of themes. Memos include my initial reactions to the interview data or "gut feelings," as well as drawing connections among codes, themes, sub-themes and the similarities and differences between them. Memo writing assisted in constructing and defining themes during the coding process and initial analysis. The use of analytic and self-reflective memos throughout the research process enhanced the identification and examination of relationships and connections presented in the interview data and the generation of concepts.

Each stage of the coding process involved interpreting and making decisions about which piece of text fits into what category or theme. Interpretation of the data involved comparing experiences, stories and meanings, deciding how to code the data in a way that represents participants' ideas and thoughts, as well as identifying and making sense of the similarities and differences within and between themes. According to interpretive methodologies, the use of interpretation to decipher interview data is an acceptable method to gain understanding of the studied phenomenon (Schwandt, 1994). The product of theme development and analysis is a result of my interpretation of participants' comments and their meanings, and represents only one version of reality or way of thinking about the data (Charmaz, 2008).

Although Charmaz (2006) acknowledges that it may be impossible for researchers to remove their preconceptions, achieving intimate familiarity through in-depth knowledge and understanding of participants' experiences is one strategy to ensure that our preconceptions do not determine how we make sense of the data. In order to limit the preconceptions that may be influenced by consulting the literature early on in the research, I bracketed this knowledge by not reviewing it until after the data analysis was completed. Instead, I focused on the holistic

reading/re-reading of interviews and the iterative process of comparing already coded data with newly generated data, which enabled a deeper understanding of participants' experiences.

The later stages of the analysis included comparing the themes across participants' demographic characteristics in order to better understand the situated and diverse perspectives of user participants. Participants' demographic information was linked to their interviews through NVivo's classification system. This feature allowed for detailed data outputs to compare specific themes across demographic categories after the final themes were developed. In other words, I was able to tie user participants' information, such as age, gender, ethnicity/race, employment status, education level, dependency on public transit, etc., to their interviews, as well as any segments that were coded into categories or themes for comparative analyses through the use of coding matrices produced in NVivo. The classification and matrix coding query features assisted in my analysis, particularly with respect to understanding the ways in which differently situated social groups experience the Go-Pass system.

Although some demographic information was collected for community stakeholder participants, such as gender and occupation, as well as their roles and connections to the bus rider community, this information was not grouped and compared in the same way as users' demographics. Stakeholder information was not compared because their roles were unique, and because there were so few in number that comparisons did not provide any additional insight.

Although the coding matrices used for comparative analyses provided a detailed view of the breakdown between different demographic categories of users participating in this study, it was difficult to assess the importance of a particular theme because the precise variations within demographic groupings were unable to be calculated or quantified. This difficulty relates to the nature of coding qualitative data into themed categories where the comparative reports are based

on the number of references coded into a particular theme and does not lend itself easily, to quantitative calculation. Instead, coding matrices or cross-comparative reports were utilized as a quick and general assessment of emerging patterns by demographic groups, but they were not relied upon as an exact measurement. Instead, different methods were used to examine the differences between demographic groupings and the various themes: holistic and in-depth readings of participants' interviews; comparative analysis tools with the assistance of NVivo and the creation of visuals or thematic network maps.

### 4.2 Establishing Credibility

Although assessing the validity of the researcher's interpretations is important in qualitative research, the goal of attaining a single or unifying truth is unachievable due to the subjective nature of interpretation (Charmaz, 2008). Qualitative research focuses on credibility/confirmability or trustworthiness of the findings instead of objectivity and value-neutrality; researchers "embrace the role of values" and engage in "concerted reflections in the data collection and interpretation" process (Berg, 2001, p. 184). In order to develop trustworthiness, conducting and presenting believable results, qualitative researchers focus on establishing the credibility of their qualitative inquiry so the reader can "see how the researcher arrived at the conclusion he or she made" (Bailey, 2007, p. 181). Credibility is achieved by ensuring that the research results are the product of rigorous methods yielding high quality data that are "systematically analyzed with attention to issues of credibility" (Patton, 2002, p. 552). . Within Constructivist Grounded Theory, credibility focuses on whether the data makes sense as accurate representations to participants rather than on establishing internal validity which focuses on building confidence in the truthfulness of the findings. In order to ensure credibility, Lincoln and Guba (1985) recommend the use of "member checks" where the "data, analytic categories,

interpretations, and conclusions are tested with members of those stakeholding groups from whom the data were originally collected" (p. 314). Member checking allows participants to respond to the researcher's findings as to whether they make sense, by agreeing/disagreeing with the researcher's interpretations

In order to establish credibility of the research findings and my interpretations of participants' experiences, I engaged in a technique described by Patton (2002, p. 560) as "analytical triangulation;" i.e., the extent to which participants are able to relate to and confirm the description and analysis offered by the researcher. This process included member checking including feedback from participants during interviews and follow-up discussions and clarification after the interview. During the interviews I would reiterate what I felt participants were saying and meaning in order to clarify and ensure my interpretations were appropriate. In turn reiterating what participants said allowed me to gain immediate feedback and to better contextualize their perspectives and experiences. The process of asking for clarification often led to more in-depth and context-rich discussions and led participants to elaborate more fully on their experiences. Once the interviews were transcribed, the full transcripts were delivered to the participants, and they were asked to make any changes if they wished. Follow-up conversations with some of the participants involved telephone, email or face-to-face meetings to discuss their transcripts, the process of the research and my interpretations of our conversation. During this time I also took the opportunity to clarify any questions I had with participants' transcripts in order to ensure that I clearly and accurately understood what they meant. Finally, describing the measures to another individual also helps to enhance the quality and rigor of the data analysis is considered another strategy for enhancing credibility and assessing the validity of interpretations (Bailey, 2007; Mason, 2002). Discussions with my supervisor on the construction of the

interview guide and the orientation of themes provided helpful feedback to assess my methods of collecting and interpreting the data.

In order to ensure that the data accurately resembled what participants said, all interviews were transcribed in verbatim. Silverman (2001) advocates the use of verbatim accounts of participants' stories and experiences rather than reiterations and renderings by researchers to avoid misrepresentations in reporting information that may be potentially influenced by the researcher's own perspective. Consequently, all thoughts shared by participants, including seemingly unrelated or trivial topics, were recorded and deemed important for gaining a more complete understanding of participants' points of view. The quotations used in the findings chapter include words such as "um" or "like" to preserve participants' voices in the natural spoken state. Minor editing to the original texts included adding punctuation where it fit with participants' natural pauses or breaks and inserting words that were helpful for improving the clarity of the text.

The objective of this research study was to explore bus riders' and the community's experiences, interpretations and use of the Go-Pass system in order to understand human-machine interaction. Qualitative, face-to-face, semi-structured interviews were appropriate methods for generating and collecting data in that they allowed me to access the lived experiences and perspectives of these groups. In addition, since the topic was exploratory with a focus on local perceptions/meanings, in-depth accounts and a contextualized understanding of the setting, the generalizability of the findings was neither achievable nor an objective of this research; but the use of thick descriptions of the setting might allow other researchers to determine the applicability or "transferability" (Bailey, 2007, p. 182) of these findings to other settings.

Scholars working within qualitative research frameworks have pointed to the importance of documenting the role of values and researchers' positions in the research process and suggest that reflecting on their roles help to reduce the potential for biases in qualitative research (Berg, 2001). Charmaz (2006) encourages researchers to incorporate reflexive accounts highlighting the ways in which the data may have been shaped by the researcher as a method to ensure the credibility of the research. Reflexivity involves reflecting on how research data is interpreted and making the researcher's subjective views, values, background and beliefs visible and apparent. In the next section, I locate my role and potential influence as a researcher during the collection and interpretation of the data, illustrating the insights and pitfalls that I encountered.

### 4.3 Methodology Reflections and the Role of the Researcher

Interviews were viewed as interactive situations where my role as a researcher was understood as co-shaping the data and results. As Patton (2002) has pointed out, research following constructivist and interpretive perspectives are "informed by attention to praxis and reflexivity; that is, understanding how one's own experiences and background affect what one understands and how one acts in the world, including acts of inquiry" (p. 546). Following Patton's (2002) observation, this section attempts to highlight my role as a researcher in the context of the study.

My interest in researching bus riders' perceptions of the Go-Pass system was motivated by my position and experiences as a bus rider, and the goal of understanding the complexities of human-machine interaction more generally. As I entered into this research study, I assumed that the Go-Pass system was viewed as a relatively "mundane" technological system and that its use may go unnoticed or be taken-for-granted by participants through their daily and routine use of the system. Instead, I found that many of the bus riders whom I interviewed were cognizant of

their interactions with the Go-Pass system and already were interpreting their use of it, as well as expressed enthusiasm in sharing their stories and experiences.

As I reflected on my role as a researcher, I learned that my own perceptions going into the study, in particular regarding individuals' motivations for wanting to participate, were also important to examine. One of my perceptions was that the recruitment strategy used (poster advertisements and word-of-mouth) may have contributed to attracting certain individuals to the study and that there may be differences in the perspectives between those who volunteered to participate compared to those who did not. . Reflecting on these assumptions, prior to the data collection phase I acknowledged the possibility that only individuals who felt negatively toward the new system would be more inclined (or passionate) to participate than those who held positive views. This assumption was based on the pre-conceived idea that individuals are more inclined to take action and speak to issues that affect them in unfavourable ways. Instead, the participants discussed a wide range of issues including their hopes for changes to the new system; nearly all of the participants described both negative and positive experiences and feelings toward the Go-Pass system. Rather than recruitment being an opportunity for those who are disgruntled to voice their opinions, the willingness of the participants to be part of this study seemed to be fuelled by their passion for the topic; that is, individuals who feel, one way or another, that they are affected by and have made meaning out of their use of the Go-Pass system were more likely to participate.

As a researcher, it is important to consider the ways in which initial presumptions could potentially influence the interview situation or the ways in which participants comment on or express their experiences. For example, the way questions are phrased by the researcher, may signal to participants that they should respond in a particular way, which could potentially

undermine the overall credibility and trustworthiness of the research. Although it is unclear whether my presumptions about the recruitment strategy affected the outcome of the results, nonetheless my initial speculations may have affected my interpretation of the first interview. I remember feeling quite surprised by the way the first two participants expressed an understanding of the problems and difficulties that they encountered with using the new system. Despite my efforts to come into the interview with an open mind and express neutrality toward the topics, I found the need to evaluate the ways in which I may have shaped the interview process. It is possible that the phrasing of my questions were delivered as though I was expecting a negative response based on my pre-conceived assumptions, and thus, may have shifted the mood of the interview. In subsequent interviews, I paid closer attention to how I presented myself and the ways in which I phrased the interview questions. This close evaluation allowed me to reflect on the potential affects my presence had on participants during the interviews.

My experience as a long term bus rider (20+ years) situates me as a participant within this research context. My history of using the public transit service and being a member of this community has facilitated building rapport with participants, which perhaps would have been more difficult as an "outsider." Similarly, the ability to speak in terms that are familiar to both the researcher and participants was beneficial for establishing a common ground and mutual understandings. My position as a bus rider, however, does not translate into privileged knowledge about participants' perspectives nor are mutual understandings automatically or always achieved; socio-economic positions, backgrounds and personal histories shape the perspectives of participants and may differ from my own. My relative social position differs from many of the participants who belong to a variety of ethnic/racial backgrounds, age categories, economic positions and educational backgrounds, and in some cases, gender. My own

perspective as a Caucasian, lower middle class, twenty-nine year old female who has a post-secondary education may differ from a Metis woman in her mid-sixties who lives on social assistance and has an elementary school education.

### 4.4 Ethical Considerations and Procedures

This final section outlines the measures taken to ensure that this research study followed ethical procedures and guidelines. Prior to the data collection phase of this study, ethics approval was gained through the University of Saskatchewan's Behavioural Research Ethics Board (REB). The original application included a summary of the proposed research design, an outline of the ethical considerations and procedures used to ensure the study would be conducted according to ethical guidelines, a copy of the consent forms, interview guide and recruitment materials.

Since taking the bus is part of the participants' daily routine, I anticipated that participants would experience no more harm by participating in this study than what they would normally face in their everyday lives. The topic of research and the interview questions related to and reflected participants' use, experiences and meanings or perceptions of using the Go-Pass smartcard as a daily and routine practice. Although the overall interview guide remained fairly consistent throughout, I had made several revisions during the data generation phase to include additional questions and probes based on previous interviews, but these revisions were consistent with the questions outlined in the original interview guide, and therefore, did not require further approval from the REB.

An important ethical consideration for conducting social research studies is gaining informed consent. Informed consent relates to giving participants adequate information about the research being conducted, informing them that they are being researched and the nature of that

research so that they may decide to participate voluntarily (Punch, 1998). All participants were informed of the research process, purpose, aims and the anticipated use of interview data in my thesis and published reports. In order to take into consideration the potential for different literacy levels of the study population, both written and verbal consent forms were created for gaining consent[2]. Following the University's guidelines, consent was gained before the interviews began; participants were given as long as they needed to review the consent forms and to ask any questions they had. All fifteen participants willingly gave written consent after their review of the consent form and acknowledged that they understood their right to withdraw from the study at any time, for any reason without penalty.

Maintaining confidentiality and anonymity was another ethical consideration for this research study. Confidentiality and anonymity is necessary to prevent the identification of participants and to protect their privacy. Confidentiality includes concealing their personal information such as their name or location, and that the data collected be secure (Punch, 1998). Confidentiality was assured through the use of alpha-numeric codes and pseudonyms in place of participants' real names, the deletion of any personal information within the transcripts and other identifying information such as persons or locations. Interview transcripts and recording were labeled using the alpha-numeric codes and kept in a separate place from consent forms and participant reference lists such as pseudonym-coding sheets and contact information to ensure participants could not be identified by others. All digital data collected, such as audio files or typed transcripts, were stored on an encrypted external USB drive. Written and signed physical documents were stored in a locked filing cabinet when not accessed for data analysis. Upon

[2] Translation of the consent form into another language was not required for any of the participants in this study, but I had anticipated that I might to hire a translator in the case that language would be a barrier to gaining informed consent and conducting the interview.

receiving and reviewing their transcripts, participants signed a transcript release form approving the use of their transcripts in published form, including quotations from the interviews.

Since the research was publicly advertised, participants included potentially vulnerable groups of different backgrounds, social positions as well as different physical or mental capacities. Without the inclusion of all users of the public transit service using the Go-Pass system, including vulnerable groups, the research data would lack representation of all potential participants of the targeted population. As a result, I concluded that the benefits gained from such a study outweighed the potential harms to participants.

### 4.5 Summary

The goal of qualitative research which draws upon Constructivist Grounded Theory is to capture the voices of the participants so that their experiences (in this case, of the Go-Pass transit system) become visible. Unlike positivist research, qualitative research is not based on establishing objective measures of reliability and validity; rather the strength of qualitative research lies in its credibility and trustworthiness. In part, the requirements of the ethics protocols help to ensure the privacy and confidentiality of the participants, and that no harm could come to them. In part, the credibility and trustworthiness is established by the rigorousness of the research design, collection, coding, and analysis of the data. The research process involved multiple steps such as organizing the data and developing a coding scheme; linking participants' demographics to their interview; writing analytic and reflective memo writing; and the initial and focused coding of the interviews; and the development and analysis of the themes. The process of coding and analyzing the themes was based on iterative process, in which I consistently checked my interpretation of the data with the original interviews (and in some cases, with follow-up interviews) in order to ensure that the participants' meanings and interpretations

prevailed. This process also led me to reconsider some of my original assumptions about riders' view of the Go-Pass system specifically, but also of research, more generally. I found that participants were eager to participate in the research and have their voices heard.

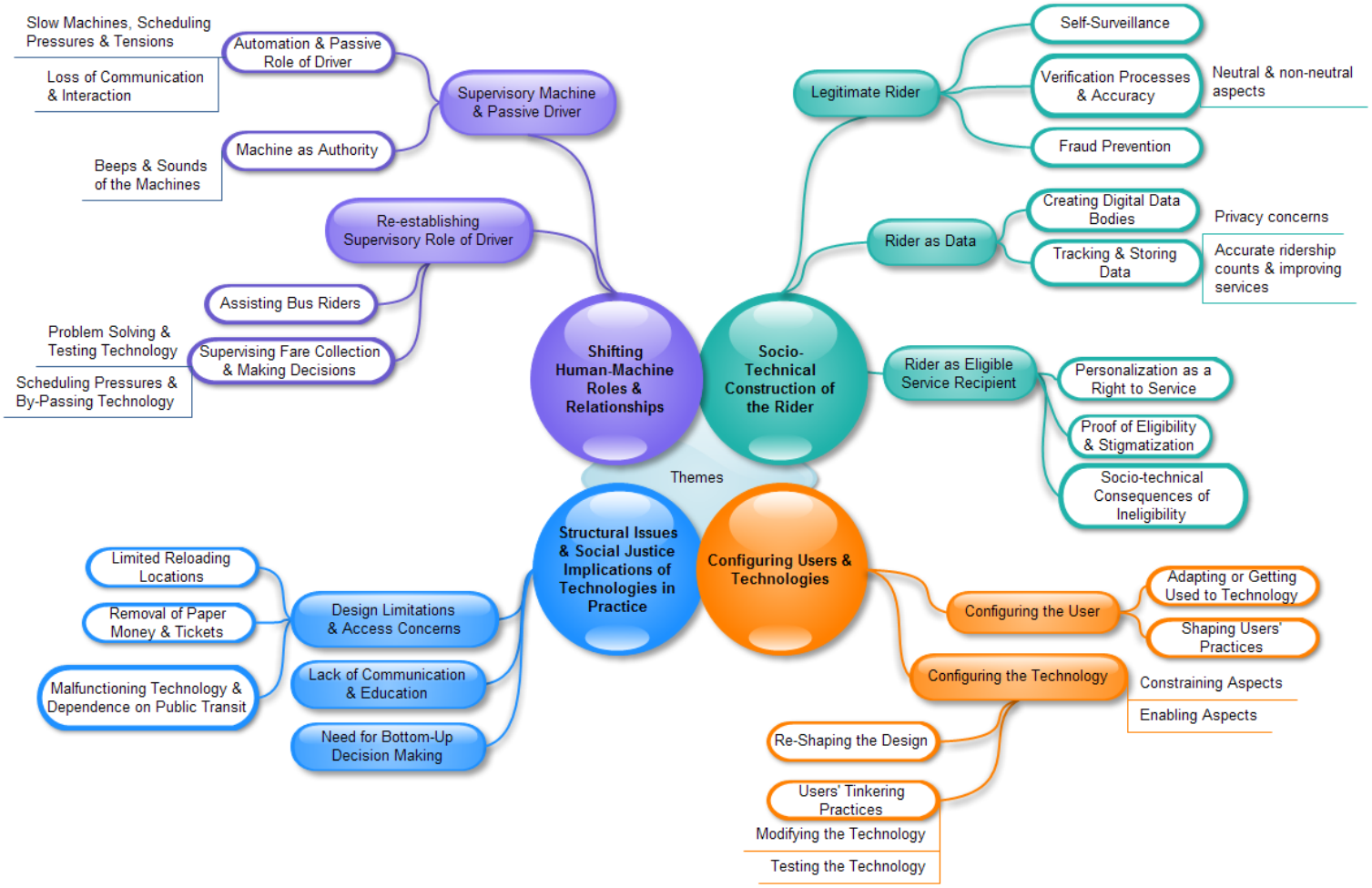
# CHAPTER 5: FINDINGS AND ANALYSIS I

Most people do not think about riding the bus; they get on the bus, pay their fare, take their seat (if one is available), and get off at their stop. Despite this seemingly mundane activity, many people are dependent upon the bus service and public transportation as they navigate their everyday lives, and this observation is particularly true for those who are economically marginalized. Taking the bus, however, as the findings of this study demonstrate, involves the coordination of human and technical actors; bus drivers, riders and the Go-Pass technologies all were found to be influential in shaping relations in Saskatoon's public transit service. The findings of this study suggest that the bus is experienced as a socio-technical space where humans and machines form creative and diverse sociotechnical or "sociomaterial assemblages" reconstituting the traditional boundaries between them (Suchman 2007, p. 242)

In the following sections and sub-sections of this chapter I present and analyze the findings drawn from my thematic analysis which was detailed in Chapter 3. Four major themes emerged from the qualitative interviews with bus riders/users of the Go-Pass system and community stakeholders: 1) *Shifting human-machine roles and relationships*; 2) *The social and technical construction of the bus rider*; 3) *Configuring users and technologies*; and 4) *Structural issues and social justice implications of technologies-in-practice*. The first theme, "Shifting human-machine roles and relationships," is presented in this Chapter, while themes two, three, and four are presented in the following chapters (i.e., theme 2 in Chapter 6 and themes 3 and 4 in Chapter 7). Although the themes and sub-themes are presented in separate sections, they are highly interrelated and connected to one another, which is illustrated in Figure 4. Taken together, the themes are helpful for building a deeper understanding of participants' experiences and meanings attached to the Go-Pass technologies and of socio-technical relations more generally.

My analysis of the four themes and sub-themes directs attention to the specific ways that users experienced, interpreted and attached meaning to the Go-Pass technologies in connection to their everyday use of the bus service. Participants' insights provide a window into exploring socio-technical relations and human-nonhuman agency; in particular, their comments reflect the ways in which human and non-human roles and relationships are perceived to be shifting and as a result, form new and interesting socio-technical assemblages. The findings suggest that social and technical actors co-construct and mutually shape social relations in the context of the Go-Pass system, aligning with a sociomaterial/mutual shaping theoretical perspective.

Figure 4: Thematic Network Map



### 5.1 Shifting Human-Machine Roles and Relationships

One major theme identified in the interviews was "shifting human-machine roles and relationships." This theme captures the different ways through which participants attach meanings and interpret the roles played by various social and technical actors on the bus and their relationship to them. Roles refer to the perceived positions occupied by or associated with particular social or technical actors in connection to the tasks and responsibilities they perform, while relationships are the perceived meaningful ties or connections between different social and technical actors.

In this study, participants made important links connecting social and technical actants in shaping human-machine roles and relationships. They interpreted the Go-Pass Smartcard and the electronic fare system as a substitute to be stepping in for bus drivers, taking over the supervisory role of fare collection. The automated machines became actants/actors in this interaction because they assumed an authoritative role in the collection and validation of the fares. As a result, the automated fare collection system removed the need for bus drivers to be involved actively in supervising fare collection, and in turn, reduced the amount of communication between the rider and driver. Alternatively, bus drivers re-establish their roles as supervisors when dealing with technical problems or limitations presented by the system, making decisions when the technology breaks down or is too slow, and when assisting riders with using the technology. For example, drivers may choose to by-pass the technology or engage in problem-solving and testing the technology when these issues arise. The supervisory role shifts between machine and driver with respect to the functionality of the automated system. Moreover, roles and relationships are viewed as not strictly played by either humans or machines, but rather, are shifting between them.

Figure 5: Thematic Map – Shifting Human-Machine Roles and Relationships

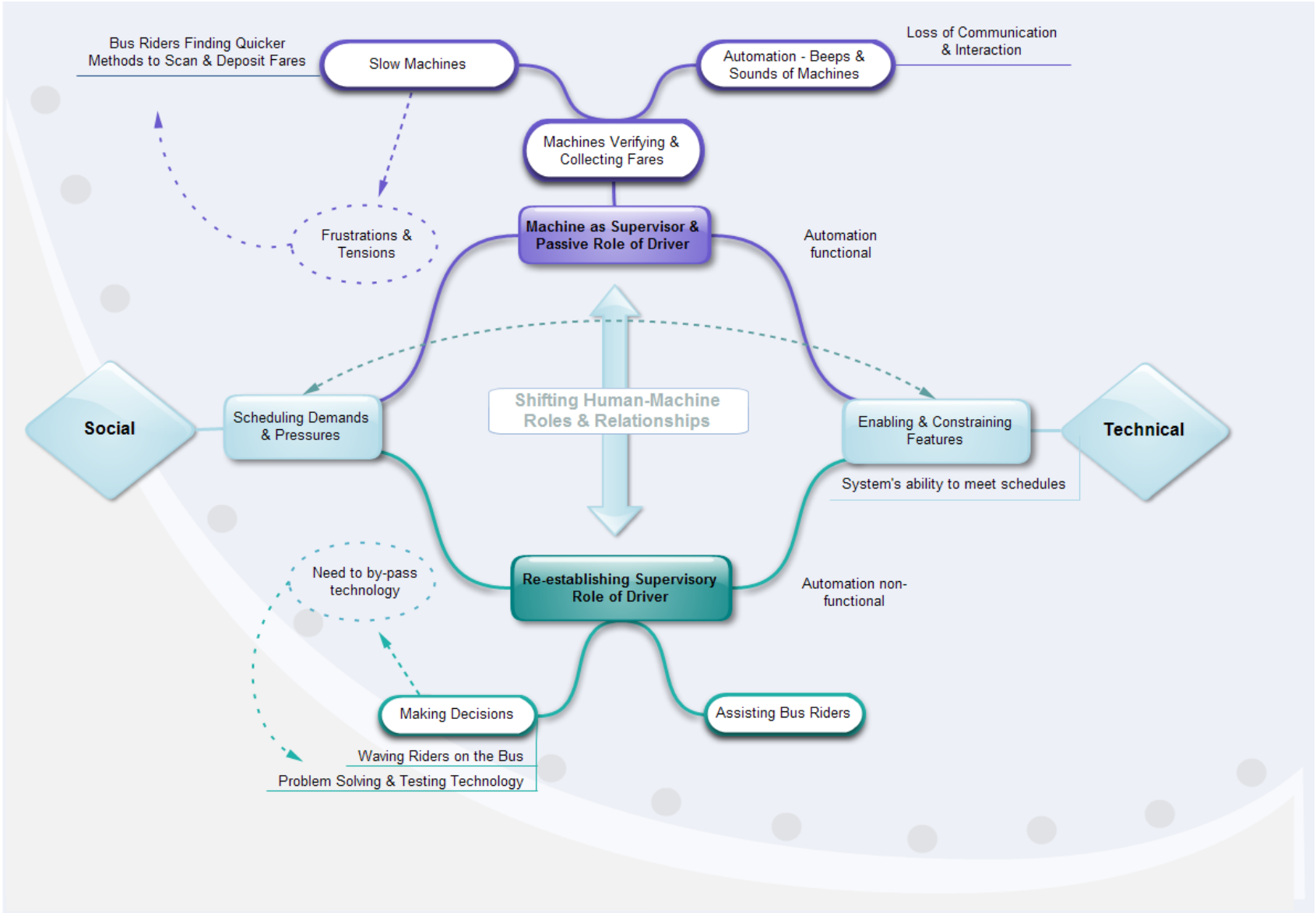


Figure 5 represents a thematic mapping of the overarching theme *shifting human-machine roles and relationships*, and illustrates the interrelationship of the two sub-themes *"supervisory machine and passive driver"* and "*re-establishing the supervisory role of the driver."* The image diagrams the ways in which bus drivers and the electronic fare machines shift between playing passive and active (supervisory) roles depending on a combination of technical and social factors; i.e. whether automation works smoothly and the degree to which scheduling demands foster the need to bypass the technology. The two sub-themes represent the active or passive roles of bus drivers and machines, and are highly interrelated. The findings support the claims that humans and non-humans play active roles through which the boundaries between them are shifting and malleable (Latour, 1992; Mort, et al., 2005; Haraway, 2000).

### 5.1.1 The Supervisory Machine and the Passive Driver

In the past bus drivers played a fairly visible role in inspecting individuals' bus passes, tickets, coin fares or transfers to ensure the appropriate fare was collected. The driver's role was supervisory in nature where they would inspect and verify riders' bus fares to approve their use of the bus service. Thirteen participants noted a distinct shift in the supervision of fare collection from bus drivers to the electronic fare machines with the implementation of the Go-Pass and electronic fare system. Some participants argued that the bus driver's presence is not required to board the bus, and instead riders, interact with and are required to gain approval through the electronic fare machines to complete their transactions. For example, Ben explains that: "because of the technology [...] you only need to justify to the machines that you are using the right card [...] the driver is not needed," and that "you don't need any interaction between you and the bus driver." Not only does Ben's comment illustrate the shift in the supervisory authority from the driver to the automated fare machines, it also demonstrates the ways in which the automated fare collection system becomes an actant because it assumes an active authoritative position in the

interaction. While the bus driver still remains an actor, his/her authoritative role is diminished since he/she is “not needed” for this transaction to take place.

The change simply from showing the transfer to the driver to scanning the barcode on the machines was viewed by some participants as a role reversal between the driver and the machine. Eternal points out that instead of the driver verifying your transfer, people are “trying to get a machine to say ‘okay, you’re good’.” He noted that: “it’s just easier to give the transfer to the bus driver...‘here’s my time’.” In this case, the machine authorizes the barcode rather than the driver visually inspecting the time on a transfer indicating a shift in roles. Eternal interpreted the confirmation beep of the machine as equivalent to the driver confirming that the rider has a valid pass and communicating to them that it is alright to board the bus.

#### 5.1.1.1 Machine as Active Authority

Beeps and Sounds of the Machines:

Participants suggest that the machines’ beeps and sounds take over the communication between bus riders and drivers; both actors focus on waiting to hear the machine recognize the fare with a “beep.” As riders input their fares, by scanning the Go-Pass smartcard, the barcodes on paper transfers or inserting coinage, the machine reads and verifies whether the correct fare has been collected by producing a sound and light. Correct fares are indicated by a green light and a confirmation beep while incorrect fares display a red light with an error tone usually accompanied by an onscreen error message. All of the participants acknowledged and demonstrated the sounds produced by the machines during their interviews, suggesting that the sounds are interpreted as meaningful or play an important role in their experiences in using the system.

In order to make meaning out of their interactions with the machines, participants translated the confirmation beeps and error tones into comprehensible messages and attributed human-like qualities to the machines such as speech or thought. For example, in receiving an error tone that communicates to the user that their card is not working and that they need to try again, George, mimicking the machine, stated it "might just go 'Wah! … Sorry try again', you do it again 'okay it works'." Not only does the electronic fare system use a language, it also has a mind or some form of intellect. For example, George indicates that "the machine knows" whether the same card has been scanned twice detecting potential misuse. Similarly, another participant, Barbara, explains that with the new system "now you got to have this time, it's scanned; it knows exactly how long it is." She points out that since the machines scan the cards and barcodes they will "know" how much time is remaining on a transfer. This demonstrates how the electronic fare machines are not only more precise than the previous system but that they are perceived as actively engaged in fare collection processes through verifying fares and giving feedback to users.

The communicative ability of the machines serves to re-constitute the relationships between riders and drivers within the space of the bus. Participants felt that bus drivers no longer needed to be present during fare collection and instead only had to interact with or "justify" to the machines by listening to the sounds. In this sense, the machines were viewed by the participants as replacing the supervisory role of the driver and the associated relationships connected to this role. This relationship is in part signaled by a change, in the dominant sense, from the old system through which approval was dependent upon visual verification by the eyes of the bus driver to the new system where approval is dependent upon visual, electronic lights and auditory verification (tones and beeps). The authority of the machines to command the

riders to attend to the machine can be attributed, in part to the active role that the machines play in the verification process, and in part because the rider interprets these sounds in anthropomorphic ways (see Latour); i.e. the rider assigns human qualities to the machines. The new system then represents a new sociotechnical assemblage—a reconfiguration of the social (a human voice/language) and the technical.

These findings reflect the claims made by other researchers who argue that electronic sounds produced by technologies are interpreted in meaningful ways (Soltanzadeh, 2009; Donner, 2008). Users of the Go-Pass attach meanings to the beeps produced by the fare machines; that is, meanings are constructed in relation to the socio-cultural meanings associated with particular sounds and the tangible electronic machines that produce them.

The extent to which the machines' beeps and sounds shaped participants' experiences, interpretations and use of the Go-Pass system also is highlighted and connected to the sub-theme *shaping users' practices* (see section 5.3.1.1). This sub-theme identified the ways in which participants actively avoided reproducing the error tone which in turn shaped how they scanned their Go-Pass cards.

#### 5.1.1.2 Automation and the Creation of a Passive Role for the Driver

Some participants felt that the new system has automated the process of paying fares and boarding the bus in such a way that bus drivers tend to play more inactive or passive roles in fare collection than in the past.

> ...purely from the point of bus drivers inspecting [...] passes, you know there's, I suppose I would say that the bus drivers tend to be a bit more passive now [...] they will frequently wave people through more than they will call them back, which is what it used to be with the paper passes […] and with the machines counting up the actual money, I guess there's you know less… less attention required from the driver at that point. [...] it just seems to have taken away […] the supervisory nature of it. You know that fact that they have to keep an eye on everybody. It seems to have made that more automated. (Jake)

According to Jake, bus drivers are no longer needed to inspect passes or count money since those functions are now automated, but in making this observation, Jake observes that that not only has the supervisory gaze shifted, but the machine has assumed a panoptical position (in the Foucauldian sense) and is able "to keep an eye on everybody," presumably both the rider and the driver. With the new automated system, some participants felt that bus drivers are more likely to interact with the computer instead of interacting with riders. For example, Cory pointed out that as long as the card is not stolen and the scanners are working, there is little reason for bus drivers to interact with riders, "[t]hey just look at the computer, that's it." From the rider's point of view, the bus driver and the automated fare system represent a new sociotechnical assemblage, resulting in diminished interaction with the riders.

Some participants felt that drivers tended to take less responsibility for the transactions that were completed automatically by the machines and were viewed as passively sitting by watching the machine rather than interacting or communicating. In his experience, Eternal recalls that when the barcode scanners for the transfers give riders difficulties, drivers tend to "just sit there and watch." Jake similarly points out how during the fare collection process where riders enter the bus and scan/pay their fare: "you have the driver there sort of watching people going by and that's … that's what you expect them to do." Drivers are perceived as playing an inactive role in fare collection which is generally expected by riders.

Slow Machines, Scheduling Pressures and Tensions:

Despite the initial expectations that the new system would increase the speed of boarding the buses, nearly all participants reported that the new system seemed to be much slower compared to the old one. For instance, Jackal found that scanning the Go-Pass has slowed down the process of boarding the buses; in the past, all that was required was "a 'quick flash' [of the

paper pass]" and this "was always quicker than a 'quick scan'." Buck found that instead of flashing the paper pass where: "the driver sees it and then you walk. You got to stick it on there [and] it takes a few more seconds. It might take 5, 6 seconds or maybe even longer." Moreover, Buck observed that since the machines are slower: "some of the routes...I know they had to increase the time on them."

Participants acknowledged that scheduling demands and time-management in operating the transit system have created social pressures and tensions, particularly when technologies break down or are perceived as not efficient enough. George, for instance, felt that: "some bus drivers get frustrated because they're sitting there 'okay I have a schedule to keep but I have to wait for this machine'." Similarly, Melody felt that riders and drivers are frustrated when the system functions slowly. She explains: "there's this big line-up of people outside and there's all these people sitting inside and there's the driver wanting to meet his schedule [...] there's this tension around hurrying up in order to fit into the system." Melody pointed out that riders must adapt to the new technologies and quickly learn to use the machines efficiently so that riders may better fit into the system.

Loss of Communication and Interaction:

In the view of the participants, the automation of the new system and the focus on scheduling and getting onto the bus quickly altered the relationship between drivers and riders by reducing the quality and quantity of interaction. Since the focus has shifted to scanning bus passes and waiting to hear the machine 'beep', there is often less communication between the driver and rider. For example, Jackal felt that the communication between drivers and riders that was present in the old system is now lost. He comments: "...with the old card you'd have that eye contact and you'd usually [get a] 'hey' or 'hi' or 'thank you' or 'bye' or whatever. Now […] you

just ‘beep’' go sit down, ‘beep,’ go sit down.” Jackal’s comment demonstrates that not only does the machine’s beep stand in for the communication between drivers and riders, but also that the machines serve to shape the process of boarding the bus. Although the bus is a sociotechnical space, riders seemed to enjoy being “known” by the bus driver; i.e. that is, they are recognized by the driver as fellow human beings on this short journey together. Cory, for example, preferred the paper/visual method because: “it would force the bus driver to actually look, you know?” Similarly, under the old method of payment, Ben explains that a rider would have some communication with the driver; “some of them might smile to you and you smile back... because you were directly dealing with a person.” Most of the participants attributed the decline in interaction to the demand of keeping to the schedule.

> I think you lose a little bit of the, what’s the word… like when I got on the bus, the bus driver would be like ‘oh hey how’s it going?’ […] as you were getting on the bus, whereas now...you lose some of that because a) I’m like ‘I want to get it done fast,’ scan, [and] I’m out, or b) it’s like the bus drivers don’t even really think about it anymore because they are thinking ‘scan and get out’.

In this example, Barbara illustrates the ways in which she believes that the bus driver is urging compliance with the schedule (“they are thinking ‘scan and get out”) even though the bus driver does not state directly this goal. Moreover, Barbara modifies her own behavior in relation to the perceived schedule “I want to get it done fast”.

Despite the fact that riders perceive that the bus drivers want to maintain their schedules, some drivers and riders take the opportunity to interact during the time that it takes the machine to scan the Go-Pass. For example, since there is a 3 or 4 second window while scanning your Go-Pass Jack has observed that “some people will take the time to say hi to the driver and [...] sometimes some drivers are really good you know, they’ll say ‘hey how you doing?’ kind of thing, ‘thanks a lot’ and others just completely ignore you while you’re scanning it.” Jackal points out that the driver is: “there to drive the bus, occasionally he’ll say “good morning” and

stuff like that depending on the type of personality you have but I think it's just come and go, come and go." He suggests that, while the kind of communication between the rider and driver depends on each individual's personality, the system is designed so that riders scan their cards and move on.

### 5.1.2 Re-establishing the Driver as Supervisor

According to eight of the study participants, bus drivers tend to regain their roles as supervisors when dealing with technical problems or limitations presented by the system, making decisions when the technology breaks down or is too slow, and assisting riders with using the technology. Drivers may by-pass the technology or engage in problem-solving and testing the technology when problems arise, suggesting that the supervisory role shifts between machine and driver with the functionality of the automated system.

#### 5.1.2.1 Supervising Fare Collection and Making Decisions

Although much of the fare system is automated, there are times when the driver is engaged actively in the fare collection process, when, for example, the coin fares do not register properly and at times, run right through the machine into the coin return slot. In other cases, if the rider is unfamiliar with the system, he or she may walk onto the bus and sit down while the machine has not yet beeped or given an error. According to Buck, when this happens, "the driver has to call him back, take [his] coins out and run them through again." Drivers also are involved in various tasks including the constant monitoring of the machines and making sure everyone scans their cards. Jack recently noticed that drivers were also "ticking off how many people got on at each stop" suggesting that they are "making sure it's actually accurate." He suggested that drivers are actively engaged in observing and supervising the boarding process.

Scheduling Pressures and By-Passing Technology:

The perceived social pressures around scheduling and the technical barriers such as the slowness or malfunctioning of machines also shape the ways in which the Go-Pass system is used. When the machines are too slow or malfunction, participants observed that bus drivers by-pass the technology by waving passengers onto the bus rather than requiring them to scan their passes. Similarly, Buck found that "when the machines aren't working the bus driver will just wave you through, they don't worry about it." Jake also points out that: "often times the bus drivers would just wave people through if it was going slow" because the bus driver needs to meet her/his schedule. According to Jack, "if you're getting on one of the main routes and everybody's scanning, some of the bus drivers will just put their hand over the [scanner] and just say 'get on.'" The participants felt that there is an obvious conflict between drivers wanting to meet their schedules and the slowness of scanning the cards.

When problems occur, drivers rely less on the machines to verify passes and return to visual verification, and thereby tend to re-gain their role as supervisors in the fare collection process. For example, Eternal described a situation where the machines would not read his Go-Pass card and the driver made the decision to wave him onto the bus, bypassing the electronic fare machines entirely. He explains that: "drivers will just say 'continue on' if you tell them it's a month pass. Because the next bus […] will read [the card]." Since the Go-Pass can be read only electronically, drivers have no way to verify if a pass is valid or invalid when the machines break down. Cory found that when the scanners are malfunctioning drivers will often say: "'Scanner's broken, go ahead,'" making the decision to let passengers on the bus, therefore by-passing the automated system entirely.

Problem-Solving or Testing the Technology:

Some bus drivers engage in problem solving by testing the technology. For example, when the machines have trouble reading cards, Ben observed that the driver plays an active role in verifying and making decisions to grant entry onto the bus. For instance, drivers test other riders' cards to check whether the machine or the individual's card is malfunctioning. In his experience, "the driver had to make me [Ben] stand there for somebody, the [person] after me to also try and since it was doing the same thing, he allowed everybody to go sit down." One reason for checking other passes, as Ben explained, was to ensure that there is a technical problem and that the rider has a valid pass rather than simply attempting to get a free ride. When the problem reoccurs, the driver acknowledges the technical problem, allowing riders to get onto the bus. Thus, when the machines break down, the supervisory role shifts back to drivers and the driver is the authority.

#### 5.1.2.2 Assisting Bus Riders

Drivers not only investigate problems, test the machines and make decisions to wave people on the bus, but they also assist riders in scanning their Go-Passes, transfers or inputting change. When Cory first started using the Go-Pass, he had trouble scanning his Go-Pass and "the first time the bus driver told me, 'you don't need to open your wallet to scan it. You just set it on there with your wallet and it scans'." Similarly, Barbara was unsure how to use the machines; however: "the bus drivers, you know, just kind of directed me and told me what they were finding works best." As indicated by participants, when drivers are involved in assisting riders with the technology and other supervisory tasks and responsibilities, there is more frequent communication and interaction between riders and drivers.

### 5.1.3 Summary

Overall, this theme demonstrated that human-machine roles and relationships were mutually constituted and reconfigured in different sociotechnical assemblages depending upon the context. An important finding was the perceived interconnectedness of both social and technical factors in shaping human-machine roles and relationships. In the new automated system, when it functioned properly, participants interpreted the automated machines to be a substitute for the bus driver; the automated fare collection system took over this function previously conducted by the driver, removing the need for bus drivers to be actively involved in supervising fare collection. In part, riders accepted the authority of the automated system because they translated its actions (beeps, sounds and lights) into a language that attributed human characteristics to the machine. This finding provides evidence that the Go-Pass smartcard and electronic fare machines were perceived by the participant riders as technical actors in this space. Yet, when riders felt the dominance of the automated fare collection system—the technical actor—, they experienced a sense of loss both in terms of the quality and quantity of interaction between the drivers and the riders.

The shift in human-machine roles and relationships also became evident when both bus drivers and riders were confronted with the technical limitations of the automated system while trying to adhere to the bus schedule. The perceived social pressures related to scheduling (goals and expectations), combined with the slowness of the technology (technical limitations) to scan and verify fares, presented tensions, as well as contributed to shifting roles and relationships. Although the automated system was designed to speed up the process of boarding the bus, the

machines were perceived as too slow (one major barrier) [3], resulting in drivers making decisions to by-pass the technology and "wave" people onto the bus. In order to facilitate prompt boarding, bus drivers provided assistance to riders who were unfamiliar with the system. When the automated system broke down or malfunctions occurred, the bus drivers re-established their roles as supervisors of the fare collection system. At the same time, riders felt the social pressures to "hurry up" in order to "fit into the system," and therefore, needed to find quicker methods to efficiently use the machines.[4] In each case, drivers and riders adjusted their behavior to achieve the organizational goal of keeping to the bus schedule and prevent tensions arising from the perceived social pressures attributed to scheduling demands.

Taken together, these findings demonstrate that social and technical relations and actors are not only mutually constitutive, and equally important, but that the boundaries between humans and machines are malleable and changing. Sociotechnical assemblages are being (re)constituted constantly within the space of the bus—between rider and driver; between driver and the automated technology; and between rider and the automated technology, as well as relations among these social and technical actors and the organizational technologies embedded in the bus schedule. These boundaries, as Mort (2005, p. 2036) observes are "temporary, situated, not inevitable or pre-existing;" the roles taken on by human and technical actors—whether they are subject or object, active or passive are context-dependent, shifting and ephemeral (Mort, et al., 2005, p. 2036). This work is reflected in the comments made by participants who interpreted the shifting roles and relationships between human (bus drivers and

[3] For participants, one barrier was the slow scanning of cards into the machines and slower boarding times which often resulted in the unpredictability and decreased overall efficiency of the service to maintain schedules and transport riders in a timely manner.

[4] The shaping of technical use also emerged in the theme "configuring users and technologies" (Section 5.3 of Chapter 5) where participants describe how they test the technology to find the quickest, easiest and most reliable methods to scan their Go-Passes, transfers or input fares.

riders) and machine (Go-Pass and electronic fare machines) actors as taking on passive or active positions depending on the functionality of the automated fare system.

The findings point to a number of important insights that connect with existing STS and technology studies research. The notion of shifting roles and relationships opposes the conventional idea that people and things (or technical artifacts such as the fare machines) are inscribed into a stable series of dualities that are unchanging. In other words, participants interpreted the roles conventionally thought to be played by "human" or "social" (bus drivers) and non-human (electronic fare machines) actors to be shifting. The perceived shifts in roles, from the electronic fare machines to bus drivers as supervisors, demonstrate the ways in which human and non-human actors are interconnected and changing within this space.

In the STS literature, this idea of disrupted or blurred boundaries has led to a discussion of the formation of human and non-human hybrids, which have been conceptualized variously as "*cyborgs*", "*sociomaterial assemblages*" or networks of human and non-human "*actants*" (Haraway, 2000; Suchman, 2007; Latour, 1987, 1991a & b). In line with Latour's (1992) extended conceptualization of the "hybrid" or delegated non-human actor, the Go-Pass system has stepped in or acts as a substitute for the actions and roles previously played by bus drivers. For example, before the introduction of the automated Go-Pass system, bus drivers had to supervise or keep an eye on riders entering the bus in order to verify and collect their fares. In the new system this task is primarily delegated to the electronic fare machines; however, when break downs or malfunctions occur, bus drivers' tasks and supervisory roles are re-established.

The results of this study illustrate through the sociotechnical assemblages noted above, human actors (drivers and riders) and technical actors (the automated fare collection system and the bus schedule) take on passive or active positions within those assemblages and shifted

according to the functionality of the automated system. Moreover, the perceived capacity for non-human machines to play active and influential roles within this space supports research that emphasizes the importance of non-human agency in socio-technical relations (Latour, 1992; Suchman, 2007; Barad, 2003; Mort, et al., 2005).

# CHAPTER 6: FINDINGS AND ANALYSIS II

## 6.1 The Social and Technical Construction of the Rider

What does it mean to be a bus rider? Since taking the bus is a mundane activity, riders often do not think about their identities as a bus rider, but as the theme "the social and technical construction of the bus rider" suggests, participants had much to say about this topic (i.e., all fifteen participants referred to this theme resulting in a total of 248 comments.) This theme refers to participants' interpretations of what it means to be a bus rider as they interacted with bus drivers and the automated Go-Pass system, thus illuminating the ways in which meanings are developed and shift in their social and technical contexts; moreover, these interactions impacted the participants' sense of self and identity as a bus rider. The analysis revealed that the participants adopted three different identity positions—the *legitimate rider*, *rider as data* and *rider as eligible service recipient*—as they navigated the social discourses and technical capacities related to the verification of riders' bus fares and the legitimate use of the transit service, the collection/storing and tracking of transit use/ridership data and the eligibility processes for obtaining the subsidized Go-Pass. In the process, the riders' identities were reinforced (e.g. their economic marginalization) and/or reconfigured through the use of the Go-Pass technologies that have the capacity to verify, collect and track/store data.

Figure 6: Thematic Map - Social and Technical Construction of the Bus Rider

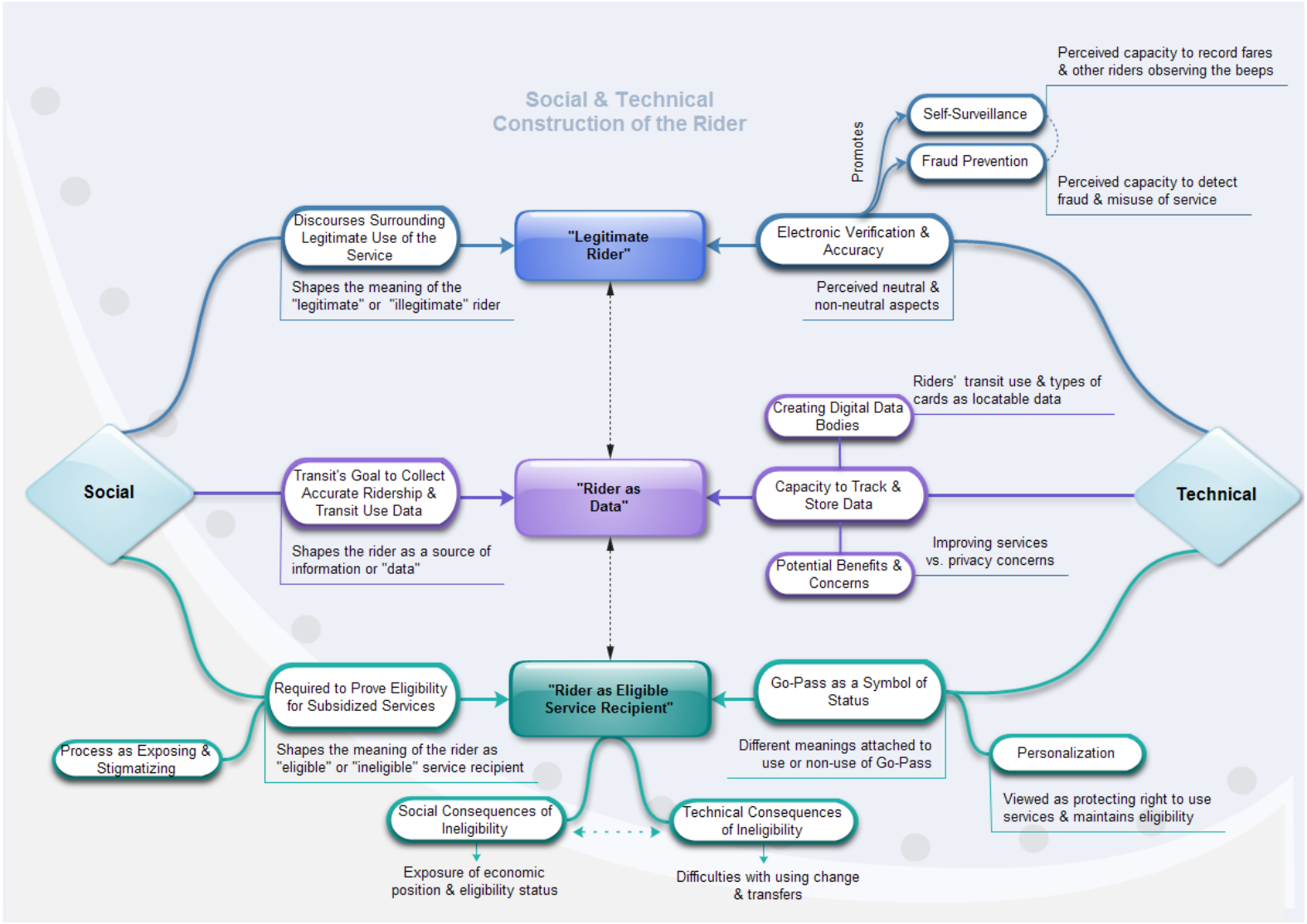


Figure 6 is a thematic mapping of the theme *social and technical construction of the rider*, providing an overview of the social and technical influences which contribute to the construction of the bus rider. Social influences are visualized on the left and the technical influences on the right; Figure 6 demonstrates the ways in which socio-technical influences intersect at each of the three sub-themes. The "legitimate rider" is connected to "rider as data," which is illustrated by the system's capacity to accurately verify and collect fares and track/store this information as data. The "rider as eligible service recipient" may also be constructed as data through the system's ability to identify and categorize the various types of Go-Pass cards being used (i.e., low-income subsidized Go-Pass vs. regular, senior, student, etc.) since the data may be collected and compared.

The findings suggest that bus riders are constructed in particular ways through their use of the Go-Pass system such as the "legitimate rider," "eligible service recipient" or "rider as data," which aligns with existing research that suggests that preferred or intended users are constructed, and that the identities of users therefore are *inscribed* or *scripted* into technologies during design and later (re)interpreted by users (Oudshoorn & Pinch, 2003; Oudshoorn, et al., 2004; Woolgar, 1991; Akrich, 1992).

### 6.1.1 The Legitimate Rider

The Go-Pass system offers a rigid method of verification and fare collection that allows for more effective fraud prevention measures than was possible in the past, and includes riders' self (and other) surveillant practices. Participants describe the ways in which the transit company's focus on maintaining legitimate use of the service is accomplished through intensified verification methods to achieve accurate fare counts. This sub-theme demonstrates the ways in which participants interpreted the construction of the rider' identity as either

"legitimate" or "illegitimate" and is divided into three interrelated sub-sections: 1) verification processes and accuracy; 2) fraud prevention; 3) and self-surveillance.

#### 6.1.1.1 Verification Processes and Accuracy

The Go-Pass system's ability to verify electronically and collect fares accurately has helped shape the meaning of the bus rider. Verification refers to the process of digitally recognizing and determining whether fares or bus passes are valid, and therefore, granting access to use the transit service; accuracy relates to the inputting of exact coin fares, as well as recording accurate ridership counts/data. According to participants, the transit service is focused on verifying bus passes and fares to ensure bus riders are legitimately using the transit service and is reinforced successfully by the technical features of the new system; i.e. the beeps and lights (discussed in the previous section).

The technical features of the system – the electronic scanning of the Go-Pass cards or paper transfers and the counting of coin fares – offer precise methods of verification and the collection of fares. For example, since fares are scanned and counted electronically, George felt that the new system provides a "more legit count," and creates a more rigid system than experienced in the previous system because bus riders do not get away with being short a few cents on fares. George points out that, drivers were less concerned if a rider was short on fare in the past, "but now with the new system [...] if you put in $2.50, well you're short the 25 cents and you don't have that quarter, the bus driver might be able to press a button and just say "go ahead" but I don't know." If a bus rider is short on fare or their allotted time to transfer to another bus has expired, the driver must make the decision to either let the rider on the bus – by pressing a "button" to confirm their fare – or refusing service if they cannot pay the proper fare. In George's experience, bus drivers were more lenient with the times on the transfers in the past, but"[with] this new system, if your transfer expires at 1:53 and it is 1:54, 1:55, they...would

probably just go 'sorry' [and] give you the red [error] beep." George's comments indicate that bus riders are potentially denied access to use the bus service more frequently than in the past because of the system's automatic counting and verification process. Since the machines are programmed to determine the validity of fares down to the exact times on the transfers, there is little room to make decisions outside of the feedback given from the machines, suggesting that there is a high level of focus and reliance on the machines to verify fares. The Go-Pass system is perceived as systematically determining legitimacy, meaning that when the fares are counted or scanned into the machines, they are considered either valid or invalid.

Connected to verification processes, the sounds produced by the machines determine and indicate whether the bus rider is qualified to board the bus based on the machine's feedback; i.e., the confirmation beep signals legitimate use of the service while the error tone signals illegitimate use. For example, Ben explains that the machine "has to beep rightly for you to enter [the bus]...you just need to hear the sound." The sounds confirm or deny access to use the bus service, and therefore enact on or play a role in determining the identity of "legitimate" or "illegitimate" riders. Moreover, Ben commented that, since "you just put [the card] on [the machine] and it detects whether it's working or not working, expired or not expired" the new system is "more effective and easier for the bus driver to identify who is using the right card." Ben's comments suggest that the audible beeps and tones produced by the machines are important and play powerful roles in shaping riders' meanings the construction of the rider and legitimate and illegitimate; they are implicated in the identity construction process.

Verification as Producing Neutral and Non-Neutral Meanings:

The process of verification is understood as producing both *neutral* and *non-neutral* effects and meanings for participants. For example, Alfred, a stakeholder who lobbies for the

university students' bus pass program (the U-Pass) pointed out that, because the paper stickers used in the past would wear down, it was at the bus drivers' discretion to decide "how worn down my crappy little sticker is and whether that gets me to school or not today so." As a result, students had to deal with bus drivers denying them access onto the bus. Due to the increased durability of the electronic stickers compared to the paper ones, and the automated verification and collection of fares, Alfred felt that the new system removes the requirement for bus drivers to judge the legitimacy of riders' fares, producing a much more neutral and effective process.

Similarly, some participants felt that the Go-Pass smartcard and electronic stickers provide a more solid symbol of payment than the paper stickers previously offered, allowing for an accurate and reliable verification method. For example, Alfred explained that the new stickers have "made it much more legitimate and easier because they don't come off and they do beep and I mean it is a pass, it's not maybe a faulty…or a phony sticker. […] it's given more security." The electronic smartcards and stickers are perceived as more socially acceptable as a legitimate bus pass because they can be verified (and beep) and are more durable, enhancing security and ensuring that bus riders can access the service.

Participants argued that the manual inspection of passes in the previous system was problematic because it allowed for the potential to discriminate or make judgments about bus riders. According to Ben, the new system is more neutral and prevents the unfair treatment of riders, Ben commented:

> I feel like everything is fair for everybody and there cannot be any discrimination. Okay and now with the use of the bus pass now, compared to that other one, which I mean there could be anything depending on how the person [driver] interprets your card but this one is fair to everybody. It's an objectivity...to passes.

Ben felt that the new system is a legitimate and fair assessment of riders' entry onto the bus because there "cannot be any discrimination" or judgment of the rider; the machine reads the

data on the Go-Pass and determines whether the person has a valid pass to board the bus. Ben felt that there was the potential for harassment and discrimination with the old system because riders had to show the bus driver their bus pass and access to the service depended primarily "on how the person [driver] interprets your card." He continued, commenting that under the old system "sometimes [drivers] want to look further to see whether you are using the right card."

Since the Go-Pass technologies appear to be more neutral and less discriminatory, Melody argued that the new system has resulted overall in the better treatment of riders by the bus drivers, Melody shared:

> There is a difference in terms of the way that people are treated, um.... and actually come to think of it I think that the Go-Pass has actually freed up drivers and passengers from suspicion, blame, accusations, punishment because the technology makes the decision about whether or not the person has done what was expected of them. So it frees the driver up from saying "your bus pass is out of date" uh "your transfer has expired" um... "your ticket is from 10 years ago..." [laugh] you know?

In Melody's experience, the technology offered a non-biased assessment of the veracity of bus passes and fares, which in turn, frees both the drivers from making judgments about the riders' legitimacy and alleviating the riders' anxieties about being a legitimate rider ("the technology makes the decision about whether or not the person has done what was expected of them").Thus, the Go-Pass has the effect of freeing "drivers and passengers from suspicion, blame, accusations, punishment." Moreover, as Melody indicates, the verification system does not pass judgment on the reasons for a denial of service:

> ...let's say a driver who was having a bad day [said] "don't try to rip the system off" either in his tone of voice or with his actual language. The box just said "this isn't working." I mean it really neutralizes all the reasons that people have for not having a working card...[having] that little grey box [go] "bah," is much simpler than a driver asking to see your transfer, looking at it closely to see where it came from and where that particular driver punched it and all that kind of stuff. Yeah.

Melody indicates that the Go-Pass “neutralizes all the reasons that people have for not having a working card” whereas under the previous system, the “language” and “tone of voice” used by the bus driver can convey his/her disapproval when the rider does not have a valid bus pass/fare. The old system is replaced with a “simpler” electronic sound or “bah” from the machine that does not care why the rider’s card is not working.

In contrast, a number of participants commented on the negative (or non-neutral) effects of the technology during verification processes. In particular, the error tone produced by the electronic fare machines was interpreted as disapproving—suggesting that the rider has done something wrong or is trying to sneak onto the bus—and raises questions about their character and elicits feelings of “embarrassment,” “blame” or “feeling stupid” (inadequacy). In Ben’s experience, for example, he found that when the error tone identifies riders who are illegitimately boarding the bus, “it puts a question mark on you whether or not you were trying to sneak into the system or something. That’s the embarrassing aspect.” Similarly, expressing his difficulties with using the system, Cory explained that when the machines produce errors or malfunction it reflects negatively on his own ability. He commented: “I guess at times I feel really stupid because I think I'm using it right, then when it doesn't work properly...” At the same time, the blatant sound of the error tone was experienced as alarming and potentially humiliating, especially for individuals who are vulnerable to public shaming.

Participants’ feelings of mortification and guilt are based on the belief that the machine is infallible. When the error message occurs, drivers and riders assume that the rider has made an error—not that there is a defect with the machine; that is, human error is responsible for the problem because machines are believed to be more precise and efficient than human beings. Underlying these discourses is the idea or belief that technologies are solutions to the world’s

problems, and that they are more capable than human capacities and potential. As a result, these error messages have a negative impact on the rider's self-identity, and cause a momentary crisis for the rider since his/her sense of as a "legitimate" rider (a position that they presumably have internalized) has been disrupted. The rider now has to negotiate the "illegitimate" rider status that is being conveyed by the machine.

The participants, as noted above, often experience the error tone negatively, and in some cases, it causes feelings of embarrassment, inadequacy or feeling stupid (difficulties with using/understanding the technology) or being at fault (blamed). The error message indicates that they do not measure up, and therefore, they should modify their behavior. At the same time these feelings of shame may be reinforced by the rider's perception that other riders on the bus, hearing the beeps and tones made by the Go-Pass machines, also interpret the "erring" rider as "an illegitimate rider," in turn, affirming the "erring" rider's sense of mortification and confirming that she/he is an "illegitimate rider."

When thinking about the ways in which the error tone shapes bus riders' identities, Cooley's (1964) concept of "the looking glass self" is particularly relevant; that is, the choices that people make about their appearances or behaviours is, in part, influenced by how they perceive others see them. The internalization process which "erring" bus riders engage in relates to how they perceive other riders' interpretations of their identities as legitimate/illegitimate riders and the ways in which the perceived judgments about that identity status may in turn influence the development of their own sense of self. Moreover, the electronic fare machines are implicated in the internalization process; i.e., it is not simply the "erring" riders' behaviours and the perceptions of other riders that are interpreted during this process, but rather the intra-activity

of both bus riders and the machines also is implicated in the construction of the rider's identity as "legitimate" or "illegitimate."

The findings highlight the ways in which meanings/discourses associated with legitimate use and the technical features which identify riders as legitimate or illegitimate (beeps and tones), serve to construct the meaning of the bus rider. Since the automated system appears to be objective, non-blaming, non-discriminatory, and infallible, the systematic verification and collection of fares appears to produce an unbiased mode of entry onto the bus while simultaneously depersonalizing the boarding process. The effects are contradictory; on the one hand, the automated system significantly reduces conflicts between the driver and the rider; on the other hand, it reduces the driver's discretion to allow riders to board the bus when they do not have the correct fare. The participants, however, did not experience the automated system as neutral when an error message was conveyed; rather, it evoked feelings of shame and contributed to their construction as "illegitimate riders."

#### 6.1.1.2 Fraud Prevention

Under the Go-Pass system, electronic verification has enhanced the transit company's ability to detect, as well as prevent, fraud. Fraud in the context of public transit relates to the unauthorized use of the system by tampering with bus passes, transfers or coin fares (including forging of the passes or fares), cheating the system by using the same pass twice, or avoiding payment of services by sneaking on to the bus or other means through which access is not 'legitimately' granted to the user. Many participants in this study felt that the transit company focuses on and is engaged actively in fraud prevention, and that the features enabled by the Go-Pass and electronic fare machines have mitigated fraudulent use of the service. For instance, Ben believed that the new system is the best way for the transit service to collect money because

there are few opportunities to manipulate or fraud the system and that "they can recoup the money and ensure that everybody is qualified to board the bus."

The participants indicated that some riders in the past were quite creative in trying to cheat the system. Jackal, for example, felt that the old system offered very little protection against misuse and forging: he observed that "the earlier paper ones...could have been forged pretty easily" since they could potentially be copied and printed to look like the official passes. According to Cory "with the paper pass it was a little easier to transfer to another person;" bus riders could pass their paper monthly bus passes back to someone else in order to avoid paying fare a second time. Overall, Cory believed that the paper passes were less secure than the Go-Pass cards, but more protection could be added to the Go-Pass, such as adding photo ID to the card. Similarly, Barbara pointed out that in the past, people would try to cheat by folding or ripping their transfers to extend the time left on them. She felt that the new system "cuts down on the counterfeiting, of people trying to get on the bus" since the new system scans the cards and "knows exactly how long [is left on the transfer]." George also believed that the new system was more effective in detecting whether a "card was used twice for 2 fares;" in the past, a "bus driver [could see] this card twice but he didn't know he saw [it] twice."

Socially defined meanings and discourses surrounding fraud are viewed as playing a significant role in constructing riders as legitimate and illegitimate. The participants were fully aware that their cards could be revoked if they were misused fraudulently, and pointed to the terms and conditions of use on the back of the card.

> I noticed with these ones […] it says on here: 'your card remains in the property of the City of Saskatoon and its use can be revoked from misuse, tampering, damaging of the cards. No cash refunds will be permitted. Lost and stolen cards will only be replaced if your card has been registered at the customer service center' [reading back of Go-Pass card]. (Libby)

While termination of the card would be difficult for most riders, for those riders who are completely dependent upon public transit, loss of the card would be very traumatic. As a result, a number of the participants in this study felt that it was very important to prove that they "owned" the card. For example, in the past, when Libby has encountered problems with the card, some bus drivers did not believe that her card was in fact her own. From the driver's viewpoint, Libby was an "illegitimate" rider while Libby contested this position by insisting that she "owned" the card. This dispute was doubly stressful for Libby since she receives a subsidized monthly Go-Pass through social services, and does not have extra money to pay for an additional fare if the automated system does not recognize her card. Libby felt that one way to prevent this issue was by adding a feature (such as a name on the card with a photo of the person) to the card, which verifies that it belongs to the person who is using it.

As illustrated by the participants' comments, there are both potentially positive and negative consequences with regards to the technical system's detection/prevention of fraud and misuse. Many of the participants appeared to approve of the new system's abilities to detect fraud and misuse of the card. However, for some participants, technical glitches and malfunctions may produce errors resulting in negative reactions from bus drivers, as was the case for Libby, and helps to shape riders' experiences and identities as legitimate/illegitimate rider.

#### 6.1.1.3 Self-Surveillance and the Perception of Surveillance by Other Riders

The construction of the legitimate rider is illustrated further when bus riders engage in self-monitoring practices or *self-surveillance*. The Go-Pass system's capacity to automatically verify, detect and monitor fare payments encourages bus riders to be accountable and monitor their actions by ensuring that they pay proper fares particularly when the bus driver is not present during transactions. Reflecting on her experiences, Barbara felt that the new system "definitely does keep us a little bit more accountable because yeah okay so if the bus driver does call me up

they are going to know whether I paid or not." The perceived potential for drivers to "know" whether a fare was paid, even while they are absent, and the perceived accountability of the rider signals a form of self-surveillance. Not only has the Go-Pass system created more accountability among bus riders than the previous system, but at least one participant felt the verification system keeps riders more honest by confirming that everyone on the bus has paid their fare, and is a "legitimate" rider. For example, Barbara commented that "with other passengers I kind of feel like we're more equal and I feel like we're all more honest." In Barbara's view, the Go-Pass system is fairer (more equal), but this objective is achieved in part through self (and others) surveillant practices.

Not only did participants engage in self-surveillance, they also felt that other riders on the bus actively watch and verify whether a bus pass is valid, assessing legitimate access by hearing the beeps and tones made by the machines. Illustrating the way in which bus riders evaluate each other as they board the bus, and in turn maintain the verification process when the driver is not present, Ben explains:

> ...even the bus driver does not need to necessarily be there for you to enter the bus. If it's open you can just get in, scan your card and [...] everybody there, the bus will hear whether it's working or not. [...] since people ride the bus and they can verify whether you are using the right card, when it beeps you know.

According to Ben, riders are involved in verifying whether a bus pass is valid because they will "hear whether it's working or not" through observing and listening to the beeps. He suggested that: "the public can easily evaluate and assess who is coming with the right card. [...] So the public can even do this assessment on their own." Ben's observations suggest that riders perceive that other bus riders play a role in verifying fare transactions. This belief—whether or not is actually the case—is internalized by Ben, and in turn regulates his behavior. Riders' self-monitoring practices might be understood also as a side effect of the perceived surveillant gaze

or the idea that surveillance is everywhere and always present (Lyon, 2006). This potential for constant observation is co-produced by the technology and the interpretations of other riders and in turn perpetuates the construction of the legitimate rider.

This section explored the multiple ways in which participants experienced the socio-technical construction of the rider as legitimate or illegitimate in relation to verification processes and accuracy, fraud prevention and self and other surveillant practices. Importantly, the identification of the machines' error tones producing negative effects demonstrates that technologies are not simply passive or neutral objects; rather, they shape drivers' and riders' behaviours so that the latter strive to become a "legitimate" rider, as well as shape riders' perceptions of who is a "legitimate" rider. The error tone indicates illegitimate use of the service and shapes bus riders' sense of self and their identities as *illegitimate riders* within the public space of the bus; their illegitimate status is made public/visible and interpreted by others who can hear the sounds. The context in which technologies are used – the specific places such as public or private settings – helps to shape their meanings which supports the claims made by Oudshoorn (2012). The meanings associated with technologies are therefore importantly shaped by both the audible cues (error tone) and the physical locations or the contexts in which they are used (public space).

### 6.1.2 The Rider as Data

The Go-Pass system's capacity to automatically collect, track and store information about bus riders' use of the transit service, such as when and where they use the service and the types of users who are using the service based on the cards they use, has enabled the transit company to know more about its ridership. At the same time, personal contact information may be tied to the cards through personalization, potentially linking this information to their use of the service. Participants describe how their movements around the city and their use of the transit service are

translated into data points which may later be accessed and used in potentially beneficial (e.g., improvements to the service) as well as invasive (e.g., privacy invasion) ways.

This sub-theme, *rider as data*, demonstrates the ways in which bus riders' identities are socially and technologically constructed as "data" through the routine collection, tracking and storing of information about riders' use of the service. The two sub-sections that follow highlight the ways in which the transit company's focus on and the capacity for tracking, storing and collecting data presented by the new system is perceived as creating digital data bodies, as well as potential benefits and concerns.

#### 6.1.2.1 Creating Digital Data Bodies

The new system digitally captures riders' use of the service geographically and temporally by linking their movements around the city (e.g., where they travel to is indicated by the specific routes taken) to timestamps, both digitally and printed on transfer receipts, when riders get on the bus. This information is translated into data, creating "digital data bodies." Illustrating the way in which detailed information about her transit use was able to be retrieved, Mindy commented: "I went to the bus [transit office] and they printed me out a form because I gave them my number, my card and it showed every time I got on and off the bus."

Not only is the new system able to collect information about where bus riders travel to but also tracks and sorts who is using the service based on what type of card is being used (e.g., regular, senior, low-income, student pass) and is linked to a particular demographic category. According to Dean, who has ties to both the local community and the transit company, Saskatoon Transit's motivation to switch to the new system was not only "for ease but also for data," and in particular data on the types of users accessing the service.

> The card tracks the different riders as well. You know it will know… is it a seniors pass, is it a high school pass, is it a one of the passes that's provided through social services, is it a regular fare pass. So… it's not just the ridership

> numbers but also who's using the bus in terms of the demographics that are identifiable by the purchase of the card and the refill of the cards. [...] That card will be identified for example, if it's a senior's pass, when it's onboard we'll know that a senior was on with that card. (Dean)

One important feature of the technology is its ability to keep track of the different bus riders using the service. As Dean suggested, the system not only tracks "ridership numbers" but also "who's using the bus in terms of the demographics that are identifiable by the purchase of the card and the refill of the cards" as well as "onboard" the buses allowing for data to be processed in real-time.

The information gathered about how the service is used allows the transit company to get a detailed picture of bus riders' movements around the city, as well as sort this information by demographic category/type of card used. The transit company's focus on and system's technical capacity to collect, track and store detailed information about transit use/ridership demonstrates the ways in which bus riders are viewed as information sources or data. The construction of the rider as data suggests two intersecting and overlapping ideas about riders' identities and use of the service. First, details about where riders travel to and how they use the service is highly personal information that may be connected to their identity as bus riders; when their information is transformed into data, they too become "data." Second, the information about riders' transit use can be accessed, examined and known by others which could have both positive and negative implications for riders.

#### 6.1.2.2 Tracking and Storing Data as Benefit or Concern

Participants are aware that the Go-Pass system's ability to track and store data potentially benefits the transit company and the community of bus riders, as well as potentially raises concerns for riders' personal privacy. Demonstrating some of the potential benefits, Dean points out that the technology affords "the ability to compile the data [which will] help us with all of

our operations, you know, what size of bus do we put on those routes, [...] how frequent do we run those routes and it's all tied to the ridership data." The ability to collect accurate ridership data is viewed as a benefit that will enable transit staff to better operate and manage the transit service effectively. Similarly, Alfred explained that: "in the past they more or less [had] done estimates or head counts … and it has been very difficult to get an accurate reading," but now with the new system in place, "they actually have hard numbers because everybody that gets on [a bus] physically beeps in and they can track that." According to Alfred, having access to accurate data and statistics is beneficial for his position particularly because it allows him "to see the significant impact that [transit] has on students and the students have on Saskatoon Transit" and "gives [him] a stronger lobbying position." Access to reliable data may result in reduced bus pass rates that would benefit the student community.

Participants were optimistic that the new system would also benefit riders in the long run through improvements to the service. For example, Mindy felt that the new system "gives them [the transit company] information, hopefully to put the buses where they should be and take them off of where there are not many riders." Although Jake felt that the transit service benefits the most from the new system, suggesting that: "It does seem to be just a matter of convenience and data points" with "very little change to the individual user," however he also expressed that "it's probably going to improve services" in the future. From Jake's perspective, the benefit of the new system is the added convenience and data offered by the machines.

In contrast, participant expressed privacy concerns in relation to the ways in which data is managed and used. Kristina, who works with a local community organization, for example, suggested that the new system presents "privacy issues" particularly because "[the technology] would be tracking where that individual goes right, whether we want to admit that or not, it does

and if it would be for that intent or not we don't know." An individual's use of the transit service, where they travel to or from, is perceived as sensitive information, especially if coordinated with personal details in the case of personalizing the Go-Pass. Kristina observed that "your name and address and stuff, it's pretty personal information." As a result of concerns for his privacy, Jack explained why he chose not to personalize his Go-Pass card.

> I mean Facebook tracks your posts and targets advertising based on where you go and what you say and all that kind of stuff and your credit card company tracks your purchases and sends you targeted advertising based on that. All that kind of stuff is just, you know, it's everywhere now and it's just one more thing to add to the list and I was like I don't need people knowing where I go on a daily basis. So I just never personalized it. […] I mean maybe they don't use it that way but I mean the possibility definitely exists. (Jack)

Jack is aware that the personalization of the Go-Pass is part of a much larger array of technical systems that have the potential for surveillance. (See for example, online blogging communities such as Facebook, and credit card companies which track or mine what users say or "like" and categorize their purchases so they may send users targeted advertisements.) From Jack's experience, the systematic tracking and mining of users' information is "everywhere," and even though personalizing his Go-Pass would be "just one more thing to add to the list," he never did it because he did not want "people knowing where [he goes] on a daily basis." Jack's comment exemplifies his concern with the possibility that his personal information could be tied to the Go-Pass and used invasively to track where he travels to around the city.

The lack of information regarding the way in which data is managed and used appears to have motivated participants' concerns. For example, Jack mentioned that he did not personalize his Go-Pass card because "[he didn't] know what they're doing with that information so [he] didn't do it," and similarly, Jackal commented that "[he didn't] know…if this is easy to scan by a second party or where this information goes." Barbara, who was concerned about her personal information being tied to the Go-Pass, commented: "if it does fall into the wrong hands, what's

going to happen to it?" Participants' comments suggest that there are real concerns associated with the tracking and storing of transit/ridership, which are elevated particularly because they do not know how their information is being used and the potential risks involved.

Privacy concerns were raised by many of the participants, particularly those who indicated that they receive social assistance; all five of the participants receiving social assistance (n=5) voiced concerns compared to under half (3 of the 7 participants) who were either employed or students. Libby believed that the social services subsidized Go-Pass cards are "easier to track" than non-subsidized or regular cards, and felt that too much information "could be bad for the person. Especially if you owe them or something you know? Or you are on social services for example."

Participants facing the deepest economic marginalization most frequently expressed privacy concerns around the tracking and storing of data;[5] this finding aligns with previous research suggesting that surveillance is unevenly distributed (Cameron, 2006). The Go-Pass technologies, with their capacity to track, monitor and sort data, enable the "social sorting" of bus riders into demographic categories (Lyon, 2003, p. 13), which has the potential to discriminate against these groups. Whether the data is being used by the transit system to track or surveil certain groups is unclear, but as Monahan (2009, p. 297) has suggested, the intention to surveil is not a pre-requisite for "the effects of surveillance to be felt." The perceived intensified tracking and collection of data with regards to the low-income or social services subsidized Go-Pass points to potential privacy issues and raises concerns for lower income groups.

Overall, this sub-theme illuminates the ways in which both social and technical aspects construct riders as data. The perceived goals of the transit service and the capacity of the

[5] The perspectives of low-income or social services subsidized Go-Pass users are explored further in the next sub-theme surrounding the construction of the *rider as eligible service recipient*.

technology to track and store data translates riders' information and use of the transit service into data shaping their identities and what it means to be a bus rider. Participants understood the information about their use of the service as personal/tied to them, representing their identities as riders and persons; riders' use of the service also was viewed as an information source and translated into data to be accessed and understood by the transit company, thus constructing riders as data. Some participants felt that there were potential benefits associated with tracking and storing data, suggesting that the data generated would benefit the transit company and potentially improve services. Alternatively, privacy concerns also were raised by participants particularly by those using the low-income/social services subsidized Go-Pass, which suggests that there are potential social and ethical concerns with respect to the collection and tracking of data. These findings demonstrate the ways in which the rider as data is multiply interpreted and experienced both positively and negatively.

The findings support the claims made by Cameron (2006, p. 236) that, data produced by transit smartcards can "give a detailed picture of the passenger's movement through the urban environment." As a result, bus riders' movements become visible and locatable, which potentially has unintended negative effects. As Lyon (2006, p. 211) has suggested "movement in urban spaces is no longer a means of evading the gaze," and similarly, because technologies are increasingly mobile, invisible and pervasive throughout everyday life, individuals' movements around the city are no longer anonymous activities (Haggerty & Ericson, 2000).

### 6.1.3 Rider as Eligible Service Recipient

Subsidized bus pass programs require recipients to prove their eligibility in order to receive a subsidy that allows them to use the service at a reduced rate. Students and seniors must prove that they belong to either a university or are of a certain age, while low-income individuals are required to prove their low-income status by presenting financial details to the transit

company. For participants, eligibility processes are experienced as stigmatizing, humiliating and disempowering because they not only expose their financial status but also diminish their anonymity, and in some cases sense of dignity.

The Go-Pass represents a higher socio-economic/symbolic status due to the higher costs associated with the card's fare options (ten tickets/month pass), but by using alternative fare options, bus riders' socio-economic status is exposed. At the same time, using change and transfers instead of the Go-Pass presents technical consequences or problems because these fare options are experienced as the least user-friendly and efficient methods of payment (i.e., they produce errors more frequently and are considered the slowest method). Paradoxically, although the feature to personalize the Go-Pass has raised privacy concerns particularly for low-income persons/social service recipients[6], participants also felt that it benefits bus riders' by protecting their eligibility status and right to use the service because it allows them to replace their Go-Pass if lost or stolen.

*Rider as eligible service recipient* is the third and final sub-theme connected to the theme "the social and technical construction of the bus rider." This sub-theme, which focuses on participants' experiences with obtaining eligibility for the low-income and social services subsidized Go-Pass, is divided into three sections: 1) proof of eligibility and stigmatization; 2) social and technical consequences of ineligibility; and 3) personalization as a right to use the service.

#### 6.1.3.1 Proof of Eligibility and Stigmatization

The eligibility process for obtaining a low-income/social services subsidized Go-Pass requires individuals to release information about their income, and as a result, exposes their economic position; the long line-ups at the transit office and the act of producing a letter from

[6] See the previous section (5.2.2.2) on privacy concerns.

social services or providing their financial details exposes the socioeconomic status of riders who are receiving subsidized Go-Passes. Illustrating the ways in which eligibility processes are stigmatizing and disempowering, Melody commented:

> the fact that you can't renew it until the 20th of the month, because the system doesn't allow you to do that and you end up with big long line ups at the office downtown and everybody that comes into the terminal […] can see who is lined up around the 20th and therefore those are the people that are getting the subsidized bus pass and so you lose your anonymity, […] you lose the sense of being the same as anyone and everyone else who has a right to be mobile in this community.

The policy which prevents bus riders who are receiving a subsidized pass from renewing their passes until the 20th of the month contributes to "big long line ups" at the transit office, and in turn, makes visible to staff and other riders those who are receiving subsidized bus passes. The impact of exposing one's economic identity serves to stigmatize and marginalize certain social groups further, which can have severely disabling and disempowering effects as Melody pointed out ("you lose your anonymity, […] you lose the sense of being the same as anyone and everyone else who has a right to be mobile in this community"). Melody explained that for some low-income individuals, the exposure of their economic identity is too high a price to pay because "It's too humiliating, it's too confusing, [and] it's too frustrating" and "you have to be prepared to trade your dignity for it." Similarly, Kristina felt that proving one's eligibility is humiliating especially for individuals on social assistance because: "first you have to go to social services and get a letter from them which is specifically for the transit office. Then you have to go down and be all embarrassed and produce this letter from social services to the person at the wicket and there's a line of people that can hear everything that's being said and you have to say 'I'm on social assistance'."

Some participants felt that the process of proving eligibility for the subsidized Go-Pass mirrors other social support services in Saskatchewan that require lower income individuals to

follow rules and procedures. Comparing the process of renewing her subsidized Go-Pass with that of obtaining her income supplement through social services, Melody commented: “I have to report my income by the 18th of every month in order to qualify for the employment supplement that I get every month. I have to buy my bus pass after the 20th of the month and before the 1st of the month in order to... not interrupt my subsidized bus pass.” Expanding on how these processes produce inequalities, Melody commented:

> ...that constant process of proving that you deserve what you need, because you have paid for it, is to me, very profound because what I’ve experienced as a long term low-income person is that the systems in Saskatchewan, [...] they require that you conform to things that people with money don’t have to.

In Melody’s experience, social systems tend to stratify poor and rich populations because they frequently require low-income individuals to “conform to things that people with money don’t have to [do]” and undergo “that constant process of proving that you deserve what you need.”

Some participants felt that they needed to carry additional proof with them, such as a receipt of purchase or their name on the card, in case there is a problem with the fare machines or their card stops working. For example, Buck who obtains the subsidized Go-Pass through social services commented: “I keep my bill with me in case the thing isn’t registering. In case they don’t believe you that you’ve paid up your pass so I can show them my bill that I actually paid for this month.” Similarly, Libby explained that she writes her name on her Go-Pass card and keeps her wallet open because “it's easier for them to see, ‘okay you're this person.’” In Libby’s experience, when the Go-Pass malfunctioned or stopped working bus drivers often refused to believe that her card was actually her own.

These participants’ comments illustrate the ways in which eligibility is embedded deeply into the structure of the service and is internalized by bus riders. Participants’ feelings of humiliation result not only from the processes by which they are required to prove their

eligibility but also when they are unable to prove that they are eligible to use the service. Carrying additional proof of eligibility appears to be done in response to riders' fears that they will be denied services if the technology malfunctions, and thus serves both to ease their minds and protect their right to use the service.

The focus on eligibility by the transit company and the processes through which eligibility is gained in order to use the transit service serves to construct bus riders as "eligible" or "ineligible" service recipients in ways that are experienced as stigmatizing and disempowering. The humiliation that subsidized Go-Pass users experience during the eligibility process occurs in multiple ways—from the presentation of financial details, letters from social services or statements that they are on social assistance; to their interactions with transit staff, which everyone around them can overhear; or to the line-ups outside of the transit office that make them visible while they are waiting for their subsidized pass. Individuals who receive subsidized Go-Passes undergo the dual processes of gaining eligibility and becoming a legitimate rider; proving eligibility is required in addition to the verification process.

#### 6.1.3.2 Social and Technical Consequences of Ineligibility

Participants felt that the Go-Pass symbolizes a particular socio-economic or symbolic status. Reflecting on her experience as a low-income person/subsidized Go-Pass user, Melody pointed out that "the Go-Pass is a status symbol. If you don't qualify for the subsidization, it's quite expensive. You have to be able to afford it." From her perspective, the Go-Pass indicates that the user has a higher status because he/she can afford to pay $75 for an adult monthly pass. Using change or transfers, in her view, often is a sign of a rider's poorer socioeconomic status and that "there's the whole issue of humiliation and degradation that goes with […] being exposed in terms of your economic class and when you don't have a Go-Pass, [...] it's exposed over and over again." Melody felt that the latter mode of entry onto the bus (e.g., change and

transfers), which is the least user-friendly and the most inefficient fare option, confirmed for low income riders that they are second-class. According to Melody, “part of the chronic stress of poverty [is] when people feel they can’t afford the best that the system has to offer.” This strain is compounded when the coins or transfers are not accepted, reinforcing already existent feelings of shame and humiliation. Alternatively, Melody explained that the universal appearance of the Go-Pass also conceals her economic status and offers financial anonymity unlike change and transfers (see section 5.3.1.1).

Participants frequently commented on the technical consequences or issues they encountered with scanning the barcodes on transfers and inserting change into the coin mechanisms. For example, Eternal commented on his difficulties with inserting change into the coin mechanism on the fare machines, he said: “on all the machines there is a little space, so if you’re going too fast the coin will actually get stuck in the side right and of course that just takes more time and [...] a lot of the coins won’t read.” Cory pointed out that it can be difficult to scan the barcodes on the transfers particularly because “you have to be a certain length away from them to do it.” In other cases, as Libby noted, “some people don't know how to use it and yet half of [the machines], when it scans sometimes it says retry, you retry it and it still doesn't work.” As indicated by participants’ comments, using change and transfers presents many challenges and stresses compared to using the Go-Pass smartcard.

In the view of some of the participants, the failure of the system to read the coins or transfers properly is an indication that the company who designed the product was operating under the assumption that most people would use the Go-Pass. As a result, the new system better serves those using the more “expensive” Go-Pass smartcard and overlooks the problems

associated with other "cheaper" fare options.[7] For example, Melody directly connects problems with using the change and transfer system and the low socioeconomic status of a rider: "the technology doesn't really work well with change and transfers...and because lots of people can't afford a pass, they get sort of trapped in the least efficient part of the system." In addition, Melody noted that the limited time frames on the transfers were stressful for some riders who have limited funds and rely on reusing transfers. She observed that people who had a lower income than her, but did not qualify or were unable to afford the subsidized Go-Pass were "struggling with the amount of time they have on the transfer." These findings suggest that lower income riders who are ineligible or cannot afford the subsidized Go-Pass experience the effects of both social (exposure of socio-economic position) and technical (difficulties and stresses with using change and transfers – i.e., the least user-friendly and efficient options) consequences most frequently.

#### 6.1.3.3 Personalization as a Right to Service

Participants felt that personalization is one beneficial feature of the new system because it allows the Go-Pass to be replaced if lost or stolen, securing riders' use of the service, and in turn, their eligible status. For example, Buck commented: "you can personalize your Go-Pass and then if you lose it, they'll replace it right away. [...] Whereas if you lost the cardboard pass, you know, you're out of luck." Similarly, in comparing the Go-Pass to the old system, Libby explained that: "with the paper one, if you lost it or ripped it, they are going to say 'no you can't get another one.'" From her perspective, the paper bus passes that were used in the previous system offered very little protection. Not only does personalization secure and protect riders' continued use of the service, which was not possible in the past, but also confirms riders' status as eligible service

[7] Although change and transfers appear to be the cheaper option, they are overall more expensive than the month Go-Pass because they limit the rider to a certain number of rides.

recipients because that information also is tied to their card. Participants felt that the option to personalize the Go-Pass improved their sense of security, relieving stresses related to being dependent on public transit with limited financial resources. Melody found that the ease of replacing the Go-Pass (as compared to tickets or the cardboard/paper pass), if it was lost or stolen, offered psychological comfort; "it takes the stress out of having your transportation depend on having enough money to replace something that you might lose or might be stolen or misplaced." Similarly, for Eternal and Cory, personalization was beneficial, especially for low-income individuals because they would not have to pay for the costs of a new pass—an extra cost that most could not afford.

Since many riders are dependent upon the transit service, the personalized Go-Pass also ensures their access to other services such as grocery stores, hospitals, as well as enabling them to get to their jobs or schools.

> ...in terms of the security of being able to get to grocery stores, being able to meet your basic needs. If you're completely dependent on public transit in order to function, in order to take care of yourself, then having that part of your life being secure. So if you pay for it, and it's registered in the computer so if you lose your receipt there's another source of proof that you've paid for it and that gives you security. (Melody)

Personalization provides additional proof that her/his fare has been paid and that she/he is qualified to use the service, and thus helps to de-stigmatize the process of proving eligibility because the cards contain information which confirms that the rider is "eligible."

Under the Go-Pass system, personalization is a technical feature that serves to protect riders' eligibility, offering them a sense of security and assurance that was not possible in the previous system. Overall, this feature was viewed by participants as beneficial, especially for low-income individuals who may not have the financial means to replace a lost or stolen card, and positively impacts their quality of life. Personalization, however, does not remove the

requirement for recipients of the subsidized bus pass to prove their eligibility (i.e., approval must be granted every 6 months), but it mitigates some of the stress and worry related to accessing the service and having to repeat eligibility processes if their Go-Pass is lost or stolen.

This section has illuminated the ways in bus riders who are low income must demonstrate to the transit and social service authorities that they qualify for subsidized fares—that is, they are "eligible" or "ineligible" service recipients. As a result of their marginal status and dependency upon transit services, this group of riders is attuned to the implications of losing their eligibility status. In contrast, participants who use the "regular" Go-Pass card spoke very little about the social significance of different fare options. For this group of riders, using the Go-Pass is an option or a choice since they have access to a vehicle, thus confirming the perceptions of subsidized users that this group represents a high socioeconomic group. For other riders taking the bus, using change and transfers are temporary measures (e.g., their vehicle is in the garage or transit is deemed more practical for a specific purpose). In this case, using change and transfers is not an indication of their lower socioeconomic status—as subsidized riders assumed.

These findings suggest that the use or non-use of particular technologies (whether one uses a smartcard bus pass or not) produces different effects for differently situated users (Cameron, 2006). Riders who are most marginalized economically experience social and technical consequences most frequently; (i.e. lower income individuals have to negotiate between their privacy and paying a higher price to use the service.).Socio-economic positions, personal histories and experiences shape participants' perceptions and the meanings attached to the Go-Pass technologies. The ways in which participants interpreted the Go-Pass differently aligns with the idea that *"diverse assemblages"* of people and technologies co-produce multiple and varied meanings/identities (Suchman, 2007, p. 268). An individuals' background or social

position, as well as the different social discourses and material configurations or affordances/prohibitions of a technology, help shape the type of socio-technical assemblages, and in turn, shape the relations between them, their experiences and interpretations.

### 6.1.4 Summary

The theme "the social and technical construction of the rider" illustrates the ways in which bus riders' take on multiple, yet interrelated, identity positions which consist of *the legitimate rider*, *rider as data*, and *rider as eligible service recipient*. First, the transit company's focus on legitimate use and the technical capacity to collect legitimate fares through verification processes and accuracy, in turn promoting fraud prevention and self-surveillance, serve to construct legitimate and illegitimate riders. Second, the transit company's focus on obtaining accurate ridership data and the Go-Pass system's ability to track and store data about riders' transit use contributed to the construction of the rider as data. Finally, the transit company's focus on eligibility and the processes for obtaining eligibility status for the low-income/social services subsidized Go-Pass construct riders as eligible or ineligible service recipients. In each case, new sociotechnical assemblages were formed, resulting in both positive and negative interpretations and experiences depending upon the situatedness of the rider.

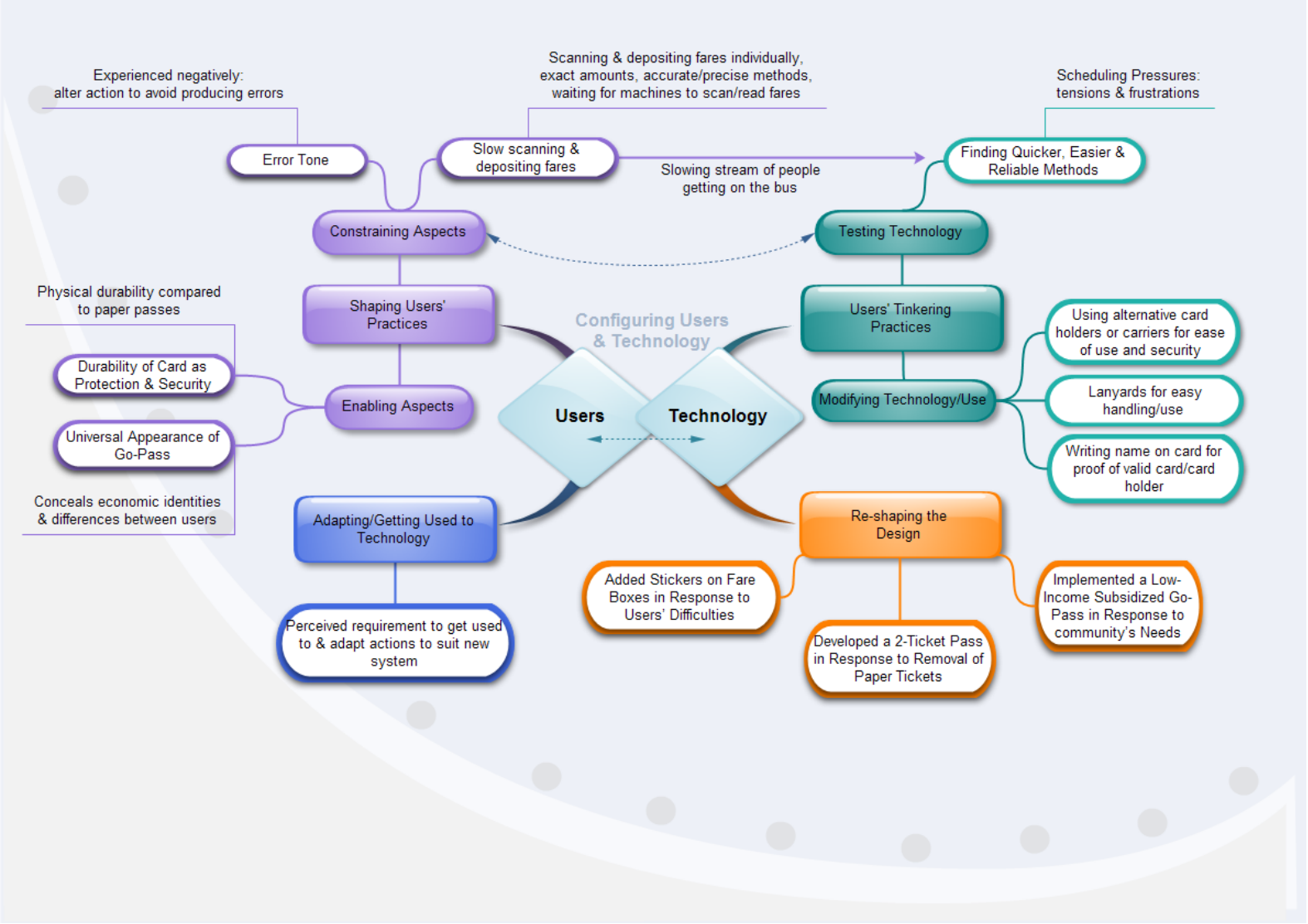
# CHAPTER 7: FINDINGS AND ANALYSIS III

## 7.1 Configuring Users and Technologies

What does action look like within the space of the bus? Since the bus is experienced as a socio-technical space involving the coordination and action of various human and non-human actors, as was explored in the first theme, how can action be described or understood within the context of the bus? More specifically, in what ways do users and technologies "intra-act" or enact upon each other? As the third major theme "configuring users and technologies" suggests, participants perceived the Go-Pass technologies to be shaping their actions in both enabling and constraining ways, and at the same time, participants reconfigured the technologies to work for them by modifying and testing different scanning methods (i.e., "tinkering"), and in some cases, instigated the re-shaping of the overall design. That is, both technologies and users engage in "configuring" practices or enact upon each other within this space.

Figure 7 provides a detailed thematic map outlining the co-configuration of users and technologies and the interrelationship between the various sub-themes identified. This theme illustrates the ways in which: 1) the Go-Pass technologies enact upon and shape bus riders use of the public transit service; 2) users enact upon and shape the technology to suit their needs and improve their use of the transit system; and 3) transit personnel and community organizations re-configured the design of the system in response to users' and the community's needs, in turn affecting wider social and structural changes. Fourteen of the study participants referred to this theme, which is divided into two major sub-themes: configuring the user and configuring the technology.

Figure 7: Thematic Map – Configuring Users and Technologies



The findings suggest that the perceived enabling and constraining technical features impact on users' interpretations, experiences and uses of the Go-Pass system in different ways supporting the claims made by Doherty, et al. (2006) that a technology's specific material configurations shape users' interpretations of technology, and in turn, shape the way they are used. Moreover, the findings support the idea that users of technologies are *configured* (Woolgar, 1991) or *scripted* (Oudshoorn & Pinch, 2003; Oudshoorn, et al., 2004; Akrich & Latour, 1992) as well as demonstrate the ongoing and creative *(re)configuring* of users and technologies (Barad, 2003; Suchman, 2005).The co-configuring of users and technologies points to the powerful role of technologies in shaping users as well as recognizes the continued interpretation and configuring of technologies even after they have been designed and implemented (Mackay & Gillespie, 1992; Mackay, et al., 2000; Prout, 1996; Ingram, et al., 2007; Mamo & Fishman, 2001; and Doolin & McLeod, 2012).

### 7.1.1 Configuring the User

Under the automated Go-Pass system, participants argued that there is a recognizable change in the way bus riders board the bus and pay their fares, such as the precise angle or location they must scan their Go-Pass cards and transfers or insert coins into the machines in order for the technology to work, or the way in which they must enter the bus individually in a single line. That is, users' actions are shaped by the protocols designed into the system. This sub-theme demonstrates the ways in which participants interpreted the technologies to be shaping their use of the service in both enabling and constraining ways; they also perceived the need to adapt or get used to the technologies.

#### 7.1.1.1 Shaping Users' Practices

According to participants, the new system shapes the ways in which they pay their fares or board the bus, and in turn, has transformed the way they use and experience the transit service.

For example, Jackal suggested that the Go-Pass system is: "just basically a process line," referring to the ways in which riders must scan their Go-Passes individually, one by one. The atmosphere on the bus, according to Jackal, has changed as a result of the automation of the system; bus riders line up and scan their passes and move onto the bus in a robotic or programmed way "a process line." Consequently, bus drivers and riders no longer need to interact in order to pay their fares and board the bus; instead, it appears that the riders need only to ensure that they have "beeped" into the machines, rather than communicate with the driver during the fare collection process.[8]

Participants believed that the scanning of the Go-Pass cards or inserting of coin fares into the machines and the scanning and printing of paper transfers slowed riders' entry onto the bus. For example, Jack commented: "It takes a lot longer to get onto the bus. You used to just walk on and flash the card and sit down," but now "you've got to be very deliberate. You have to take out your card and put it exactly in the middle of the [machine] and then, you know remove it after it beeps and sometimes it doesn't read it properly." As Jack points out, this method, which requires the user to be more "deliberate" and precise in their actions, is not as quick as simply flashing a paper bus pass to the driver as was the case in the previous system. George also observed that there was no formal method for entering and boarding the bus with the old system, explaining that: "I put my bus ticket in and I walk;" however, under the new system "You can't do that; you actually have to scan it every time. And if you just show [the driver], they just go 'okay, well that may not have rides on it'." Under the Go-Pass system, bus riders must individually scan their passes because the machine needs to recognize and collect the fares.

[8] The loss of communication and interaction between drivers and riders is explored in section 5.1.1.2 ("Automation and the Creation of a Passive Role for the Driver").

Participants argued that the specific ways in which they paid fares on the bus are shaped by the design of the Go-Pass technologies. For example, the process for obtaining a printed transfer requires riders to wait. Buck noticed that: "People follow that you know. They just stand there and wait until it comes out and then they pull it." At the same time, in order to avoid producing errors, some riders adjusted their actions to suit the technology when scanning their cards. Ben, explaining that he opens his wallet to scan his card in order to avoid producing an error, commented: "I knew a friend who would do that [keep his/her wallet closed] sometimes, I mean it beeps as if it's not working, so I do open it to avoid that." Similarly, Buck scans his card with the white side down because "it might beep the wrong kind of beep; the red light beep you know?" Buck felt that this scanning method worked best because it was least likely to produce the error tone and red light, which he refers to as the "red light beep."

Participants' attempts to avoid producing an error illustrate the error tone's significance, its potentially negative impacts on their experiences, and in turn shaping their actions in important ways; i.e., they find different methods to scan their Go-Pass in order to avoid causing an error. This finding is linked to an earlier theme, which found that the error tone conveys negative meanings such as putting the rider's character into question and was interpreted by the rider as having done something wrong[9].

Participants also felt that the technologies shape their experiences and use of the service in enabling or positive ways. For Melody, the Go-Pass smartcard provides financial anonymity through its universal appearance: "it looks as if I can afford a Go-Pass" since the "technology conceals the economic differences between me and people who can afford to pay [full price]." In Melody's experience, the appearance of being able to afford a regular priced Go-Pass reduces the

[9] The comments in this section connect back to the findings identified in the theme "socio-technical construction of the rider" where participants' interpreted the error tone as conveying negative meanings (see section 5.2.1.1 - neutral and non-neutral)

stresses associated with having her economic position known. Similarly, Dean explained that, for someone on social services: "there's no identifying component for that person… that Go-Pass looks just like every other Go-Pass." Due to its universal appearance, the Go-Pass smartcard is a technical/material artifact that (re)configures users' identities (i.e., their economic identities) by providing anonymity and privacy with respect to what type of card they are using. At the same time, as we saw in the second theme ("the social and technical construction of the rider"), non-use of the smartcard was experienced as having the reverse effect, exposing riders' economic identities.[10] Whether a bus rider uses the Go-Pass card or uses alternate fare options impacts on their experiences and interpretations.

Participants also indicated that the subsidized Go-Pass enabled them to use the service more freely. For example, Melody shared that the subsidized Go-Pass enables her to: "go where [she] want[s] to go without worrying about how much it's going to cost [her]," which was not the case when she had access to the month-based Go-Pass, and instead, had to use change and transfers. Since she could not afford to pay additional fare, Melody would often worry about the cost of each ride and organize her activities according to the timestamp on the transfer[11]. From Melody's perspective, the subsidized Go-Pass counteracts the mobility issues and stresses that she had experienced in the past with using change and transfers and the deepened marginalization she felt with respect to her financial situation. The enabling effects she experienced was, in part, due to the subsidy itself (i.e., the affordability of the month pass), and in part, the unrestrained use of the service which is provided by having a month pass (i.e., she did not need to keep track of change and transfers). The initiation of the low-income bus pass

[10] See section 5.2.3 "rider as eligible service recipient" for a full discussion on the ways in which the non-use of the Go-Pass exposes riders' economic positions.

[11] See also section 5.2.3.2 "social and technical consequences of ineligibility" for a discussion of the findings relating to participants' difficulties with using change and transfers.

program/subsidy that allowed Melody to use the monthly pass at a reduced price (and enabling her to "go where [she] want[s] to go") was motivated by the implementation of the Go-Pass system because the method to distribute the subsidy could be easily managed with the new technologies.[12] As a result, the Go-Pass has contributed to Melody's positive experiences, both directly and indirect, in important ways.

The physical durability of the Go-Pass card also was experienced as a benefit by participants in this study. For example, commenting on his experiences with using transit cards in other provinces, Eternal noted: "you could easily break them. Take scissors and chop them in half" because "the card wasn't thick like these ones […] it was a thin plastic." Since the Go-Pass is made of a thicker, more durable plastic, it might prevent damage to the card, offering more security or protection to the user. In addition, personalizing the Go-Pass offered another source of protection against ruined or broken cards.

The Go-Pass technologies were experienced as both constraining and enabling which shaped participants' actions in particular ways and use of the service. The technologies slowed down the stream of people getting onto the bus; each bus rider had to scan their Go-Pass card into the machine, and at the same time, the machines were slow in reading the cards. Frequently, the machines would malfunction, which resulted in riders adjusting how they scanned their cards into the machines to suit the system and to avoid errors. Alternatively, the Go-Pass smartcard's universal appearance and the physical durability of the cards provided riders with financial anonymity and security/protection. At the same time, the subsidized Go-Pass cards enabled low-income riders' to freely use the service because they did not need to deal with keeping track of change and transfers.

[12] The advantage of using the Go-Pass system to manage subsidized programs was confirmed during my meeting with Saskatoon Transit management staff on February 7, 2012. [Should I be including this here?]

#### 7.1.1.2 Adapting or Getting Used to the Technology

Participants frequently commented that they had to learn or get use to the technologies and adapt to the new system. Eternal, for example, explained that he "had to get used to the machine" and Jackal found that the new system "was easy to adapt [to]."Although she explained that the system was slower when it was first implemented, Mindy felt that bus riders simply got "used to it." Buck also commented that "[he] had to learn how to use [the Go-Pass] because when [he] first got it, and a lot of people [would do] the same, [he] would move [his card] on the scanner when you're supposed to just put it on there." Similarly, Dean suggested that the new system "has become the norm," "this is what people know," and "they're probably at the point where the cards have become habit." Using the Go-Pass system became a routine and everyday practice and riders simply had to adapt or get used to the technology in order to use the service, perceived as inevitable and necessary, suggesting that users are *configured* to suit the system (Woolgar, 1991).

### 7.1.2 Configuring the Technology

In contrast to the perceived requirement to adapt and get used to the new system, riders' employed "tinkering practices," or modifying and testing the technologies in order to configure the technology to better suit their needs. Tinkering practices were enacted by participants in response to the difficulties they encountered through re-configuring the Go-Pass card or their use of it.

#### 7.1.2.1 Users' Tinkering Practices

For participants, discovering alternative and more effective ways to scan the Go-Pass served to improve their use of the transit service; they found quicker and easier methods to scan their Go-Pass cards and reduce errors through testing different scanning methods. George, who experimented with the technology in order to increase the speed of his entry onto the bus,

commented that he was “just testing the technology” […] “To see if anything was quicker” and found that “if you hold it higher it will take longer to respond.” Similarly, Jackal commented that he tried a number of different scanning methods because he: “wanted to try them all” so that he could “get in [and] get off [the bus] quick.” From Jackal’s experience, the best method was to remove the card from his wallet and place it directly onto the scanner as opposed to keeping it in his wallet. He commented: “you see some of these people with thinner wallets than I have and it doesn't work.” Similarly, another participant (Jack) explained: “I got to flip this little piece of [my wallet] out to make it work. [...] It seems to be the best way to do it.”

Some participants observed that, in order for the machines to read the Go-Pass card properly it will depend on which side the card is facing or the particular scanning technique used. For example, Buck commented: “the white side down seems to work better. I notice other people do that too. So I just put it on there with the white side down length wise. [...] It doesn’t seem to always work if it’s upside down.” Barbara, who explained that she has had difficulties with setting the Go-Pass card down on the card reader, commented: “I’ve tried it, placing the card on there once and try pulling it off and I find that it, it has so much of a lip where the card sits that it’s hard for me to grasp the card back up. [...] Whereas if you just kind of wave it over you still got a good grasp of it, you’re not going to lose it somewhere.” She also found that setting the card down takes “an extra 3 to 5 seconds,” which might take too long if “you want to make sure your bus stays on time”; instead, waving the card over the scanner was both quicker and easier. In each example, the rider’s desire to enter the bus in the most efficient (i.e. less time consuming) way indicates the ways in which they are conscious of the transit system’s goal to keep the bus on schedule. These comments affirm the findings in section 5.1.1.2 that riders were concerned

about “hurrying up” in order to fit into the system and the perceived need to find quicker scanning methods.

Participants are not only actively testing the technology to find quicker and easier methods, but they also engage in making creative modifications to the way they use the technologies such as writing their name on the card or modifying the ways in which they use the card with a new card holder, case or lanyard. For example, Buck, who is partially blind, explained that he uses a special card holder: “I have a little button here and so I know that this is the blue side up.” In addition, he attaches his card holder to his backpack, and also thought of using a lanyard because he “wanted something where you would always have it around you; it would always be attached.” Melody also commented that a lanyard strap would be helpful, especially for people who have difficulties holding onto objects, she commented: “you could have a strap that maybe went around your wrist... and the pass dangling down [...] making it easier to [use].”

Some participants thought of creative ways to improve the security and protection of their Go-Pass cards. For example, Barbara stated that “I just stick [the card] in my cell phone here and I just place my cell phone on top [...] I feel… like it is more secure now. I don’t have to worry about losing it because it’s tucked in someplace safe.” For Barbara, the security of her card is important: “I have some personal attachment to it because it is my, pretty much only means of getting to work.” Libby also was concerned about the security of her card. Since all of the Go-Pass cards look the same, she writes her name on her Go-Pass card to prove that the card is hers; she commented: “I've had problems in the past because of it and [...] okay you put it down, they can see my name, see who I am. [...] because then that way it's easier for them to see [...] so I always show them that.” Libby felt obligated to clarify that the card was hers in order to avoid

potential accusations against her.[13] Although the act of writing her name on the Go-Pass demonstrates the ways in which the discourses about being qualified or eligible to use the bus service are deeply embedded and internalized, writing her name on the card served to reduce the stresses of having to provide proof. For Libby, writing her name on her Go-Pass symbolizes her status as a legitimate and eligible rider. [14]

#### 7.1.2.2 Re-Shaping the Design

The design of the Go-Pass system was also re-shaped by transit staff, community and non-profit organizations in response to bus riders' needs and their difficulties with using the system. Buck, for example, noted "they [the transit staff] did have to put little signs on there [...] like 'do not pull a transfer out' 'coins only' on the coin box and they had to put a sign 'scan here' for your transfer," in response to users' difficulties and confusion with using the new technologies. Kristina, one of the stakeholders, found that the removal of paper tickets created major challenges for community organizations, particularly in providing transportation to individuals who attend programs, she commented: "we wrote letters and the response they gave [was], 'okay we've developed a 2 pass card,' and they did ask us what would work." The two-ticket pass, however, was not created until the organization raised their concerns and complaints about the issues with the electronic ticket system, demonstrating how the technology had to be reconfigured to suit the needs of the organization and Go-Pass users.

The ongoing effort of the anti-poverty coalition, a non-profit organization, to provide transit to low income individuals was successful through motivating policy changes. This organization pushed for the subsidized bus pass program and has greatly improved the quality of

[13] This finding also was described in section 5.2.3.1 - proof of eligibility and stigmatization.

[14] The concern around providing additional proof connects with the themes *legitimate rider* and *rider as eligible service recipient* (see sections 5.2.1 and 5.2.3).

life for this group by having affordable and improved access to transportation; at the same time, the capacity for the Go-Pass technologies to be programmed and operate with various types of passes has enabled the implementation of the subsidized bus pass program. Melody, for example, commented that "having experienced the impact of that change, [...] it really showed me in terms of my personal experience...how changing a social policy can really affect people's lives and a lot of people's lives in a really positive way." This sub-theme demonstrates the ways in which social actors such as transit staff, community and non-profit organizations and the technical actors or features offered by the Go-Pass system that support the subsidized Go-Pass program, were influential in (re)shaping the technology, policies and use of the service for bus riders and the community.

### 7.1.3 Summary

For many of the study participants, the Go-Pass technologies play not only significant roles in shaping their identities, but also their actions. Overall, this theme demonstrates the ways in which technologies are not simply passive objects, but rather shape participants' practices and actions to suit the system; eventually, the technology became routine and inevitable once riders adapted to it. At the same time, bus riders are not simply passive actors to be configured to suit the system, but rather, they engage in (re)configuring and re-conceptualizing the Go-Pass to suit their needs and enhance their use of the system.

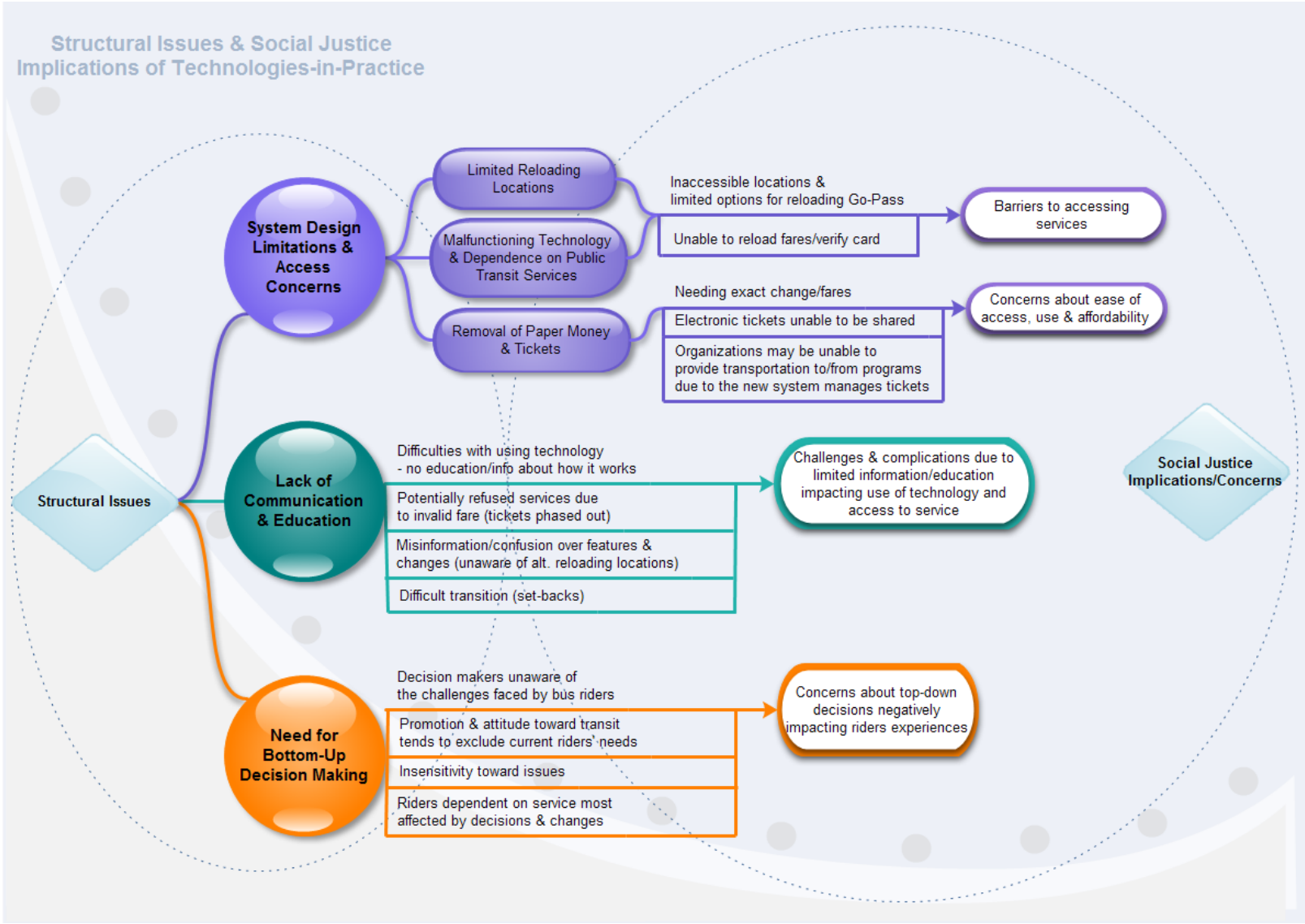
The findings suggest that users and technologies are *co-configured*. On the one hand, the technical features afford and prohibit use of the transit service in different ways, shaping users practices and the perceived need to adapt to the technology. On the other hand, users' *tinkering practices* (testing or modifying their use of the Go-Pass system) configures the ways in which the technologies are used, minimizing the constraining aspects and improving use. Both human actors (bus riders, transit staff and organizations) and non-human actors (Go-Pass smartcard and

electronic fare machines) co-constitute the way in which the system is used. Importantly, this theme demonstrates that, even after the technologies were designed and implemented, they needed to be configured further to suit bus riders' needs.

### 7.2 Structural Issues and Social Justice Implications of Technologies-In-Practice

Do mundane technologies have politics? That is, are there socio-political or ethical dimensions associated with the Go-Pass technologies as they are used by bus riders within the community? Using the Go-Pass system appears to be a relatively mundane activity used by bus riders' in their daily routines; however as this theme suggests (expressed by thirteen of the study participants), the Go-Pass technologies operate and are interwoven within the broader social context of public transportation services in Saskatoon. Participants' experiences with using the Go-Pass system connect to broader ethical implications of technologies-in-practice or technical use that have surfaced in relation to three overarching structural issues: 1) *system design limitations and access concerns*; 2) *the lack of communication and education*; and 3) *the need for bottom-up decision making*. The sub-themes *system design limitations and access concerns* and *lack of communication and education* directly relate to the impact that the Go-Pass system has on bus riders, while *the need for bottom-up decision-making* focuses on the ways in which decisions are made about the transit service and the Go-Pass system. The potential effects and impacts on bus riders' experiences and use of the transit service, through which the Go-Pass technologies are intertwined, are outlined in Figure 8 in relation to the structural issues identified by participants.

Figure 8: Thematic Map – Structural Issues and Social Justice Implications of Technologies-in-Practice



### 7.2.1 System Design Limitations and Access Concerns

Participants raised a number of access concerns with respect to the way the Go-Pass system is designed. They suggested that there are a number of design flaws and limitations which impact their access to the transit service, including the limited number of reloading locations, removal of paper money and tickets, and the malfunctioning of technology with respect to users' dependence on public transit services.

#### 7.2.1.1 Limited Reloading Locations

Participants expressed that, in order to reload their Go-Pass card they were often required to travel to a vendor, resulting in additional fare costs or, if they have access to a vehicle, mileage to drive to the location to get their card refilled. [15] They suggested that having more locations or alternative options to reload the Go-Pass would be beneficial for users. For example, Jack commented: "if you don't remember to renew it on time then you're in that situation every time," and felt that "being able to renew your card online, for instance, would help or if you could renew your card by phoning down to the transit center as opposed to actually physically having to be somewhere." Similarly, Jake suggested that having more options such as a subscription or automatic payment system would be beneficial, he commented:

> just having that be one less concern, one less...okay I'm going to miss my transfer because I'm out and I need to go refill it or you know, it's past 6 O'clock and the office downtown is closed […] So just being able to have more control over replenishment and making sure that your card is active is better for both security and convenience.

As Jake pointed out, giving the user more options and "control over replenishment" (i.e., "making sure that your card is active") would be "better for both security and convenience,"

[15] The Go-Pass is a reloadable smartcard which can be refilled with tickets or a monthly bus pass at the downtown customer service office and a number of vendors around Saskatoon including the Mac's and Safeway stores.

because it would mean users would have "one less concern" about whether they would miss their bus transfer due to an expired or invalid pass.

Participants using the low-income/social services subsidized Go-Pass expressed frustrations about having to go to the downtown customer service centre in order to renew and reload their Go-Pass cards. Libby, for instance, commented: "[if] your cheque is late and [the office is] closed, you can't use it at a Mac's store or Safeway," and she suggested that social services could "make it for other places [...] because then that way you know you're going to get [your pass]." Cory also felt that trustees should: "automatically say okay we need your bus pass to fill it up automatically, you know?" or alternatively "write on there, 'do not cash, only use for bus pass,'" in order for recipients to take their cheques to one of the alternative vendors. In order to increase the accessibility of the services, particularly for individuals on social assistance , Dean commented: "I would like to see social services have their own kiosk or refill station and maybe even a card swipe that the agents who are working with those recipients on social services are able to do it right there within their office."

The limited number of reloading locations is challenging for bus riders, especially those who are low-income and dependent on public transportation. Illustrating the ways in which the limited number of reloading locations acts as barriers for bus riders, Kristina commented:

> People just give up and they don't go anywhere... that's a challenge [...] And that's what a lot of people are faced with is 'okay I can't go there because I have no way to get there. I can't go to a job interview because I don't have any way to get there. I have a job but I can't get there.' You know, and even to get bus tickets to get to the job, how do I get down there to get the bus pass?

Kristina's observations demonstrate some riders, particularly those on low income, are totally dependent upon the bus transit system. Having only a few vendor stations affects riders' ability to get to where they need to go because they "have no way to get there," and as a result, they "just give up." Kristina felt that there are serious ethical concerns for individuals who are low-

income or depend on public transportation, she commented: “people in this area are the ones that use the buses the most. They don’t have cars. [...] So, the people it’s impacting the most, are the people that are suffering. You know, it’s almost like denial of services. [...] because they have no way to get there.”

The limited locations to reload the Go-Pass card impacts on riders’ access to transportation services, and further marginalizes those who are already marginalized as low-income, dependent bus riders. Barriers to accessing transportation impact on riders’ ability to get to where they need to go, including, but not limited, to grocery stores, hospitals, work or school.

#### 7.2.1.2 Removal of Paper Money and Tickets

The removal of paper money and tickets also was experienced as limiting or constraining riders’ access to the transit service, and raised many concerns for participants. Cory, who felt that the phasing out of paper money was inconvenient and limited his access to the service, commented: “I have a 5 dollar bill and we pretty much know that there’s nowhere close enough to be in time to change it [into coins]. That's kind of inconvenient right there.” Since the electronic fare machines only accept cash fares in the form of coins (and reject paper bills), Cory felt that the removal of paper money under the new system was inconvenient for some bus riders who may only be carrying paper money (i.e., such as the five dollar bill in his example), and as a result, some bus riders may be stuck in a situation where they do not have valid or accepted fare to board the bus and are unable to use the transit service. At the same time, the switch to electronic tickets was felt to be challenging for families and organizations who used to be able to divide and share a package of tickets; this option was considerably cheaper under the old system than the new Go-Pass system (i.e., riders must purchase a minimum of ten tickets on a single Go-Pass card). For example, Alfred suggested that the switch from paper to electronic tickets loaded onto a single card has the transit company: “operating on the assumption that one person uses the

bus […] rather than more sporadic users or families where you might have three people take it at once." As a result, the new system might present issues for low-income families who are unable to afford separate Go-Pass cards filled with tickets.[16]

The removal of paper tickets also has impacted community organizations' ability to provide transportation to clients coming to programs. For example, Kristina explained that the solution of the two-ticket Go-Pass in response to the removal of paper tickets was counter-productive: "I never know how many women are going to show up and so if all I had was 12 tickets and there are 24, I'm like "ah!" And now [...] I can't get those little 2 pass cards [because it] has to be downtown." Since she could only obtain the two-ticket passes at the downtown transit office, which has limited hours of operation, the organization often ran out of tickets, and as a result, was unable to provide transportation to individuals coming to and from programs. As a result, people are being denied those services because they are unable to get to and from the organization.

#### 7.2.1.3 Malfunctioning Technology and Dependence on Public Transit Services

Another major concern raised by participants was the malfunctioning of technology, particularly for those who are dependent on public transit services. Participants discussed the ways in which malfunctions or breakdowns can be stressful, especially when they have limited funds for alternative transportation. Since tickets and transfers are time-stamped, a malfunction can delay a rider, and as a result, the time-stamp can expire. Expressing her concerns with the technology malfunctioning, Libby asked: "what if the scanner is broken and you don't have a [monthly] bus pass, you have tickets on it... what are you going to do if you can't use it on your next bus?" From her experience, the machines sometimes fail, taking a ticket without leaving a

[16] There is an additional five dollar activation fee for each new Go-Pass card, adding to the expense of the purchase of tickets, which makes this option less affordable.

transfer fare on the card, which results in complications when transferring to another bus. Similarly, Cory felt that electronic payments cause "more worries," particularly with respect to the smartcard breaking or malfunctioning, outweighing some conveniences that the card provides. At the same time, the machines have problems with coin fares, as Cory pointed out: "what if it breaks and you put your $2.75 in, and that's all your money." The possibility that the Go-Pass might malfunction or break is stressful, especially for individuals who have limited means for alternative transportation.

The two-ticket Go-Passes that were created for organizations in response to the removal of paper tickets also were viewed as problematic because the cards frequently malfunctioned or broke. As Kristina suggested: "we're handing these people [cards] not knowing if it's going to work or not [...] and because of who they are, they are often stereotyped like 'well you probably stole it;' those assumptions happen all the time right, because we're dealing with people in poverty." Kristina's comment demonstrates that, when technologies break down or malfunction, they reinforce stereotypes about individuals who live in poverty (i.e., they are viewed as non-deserving riders who may be trying to scam the system).

### 7.2.2 Lack of Communication and Education

Participants felt that there was little communication and education surrounding the new system and suggested that it would have benefitted from more advertising prior to its implementation to ease the transition. Despite the efforts of the transit service to advertise the Go-Pass, many participants were unaware of the changes and new features provided by the system. For example, Jake noted that: "other than just advertisements on the bus and bus malls [...] [I] don't recall picking anything up to read about it." As Barbara expressed: "they could have advertised a little bit better," especially for those who did not ride the bus regularly. As a result, the participants pointed out that there were obvious set-backs and complications due to the

limited information and education surrounding the new system. For instance, Dean suggested that “people weren't necessarily aware [of] what day the cash was going to be gone.” At the same time, Kristina pointed out that: “the biggest issue was they did not give people notice that this was happening,” explaining that, after the Go-Pass was implemented, she continued to witness riders trying to get on the bus with paper tickets. She commented: “most of them senior, with their bus tickets and there was nowhere to put them anymore because they’re no good and the bus driver would say ‘I’m sorry, but you have to have a card now, those don’t work anymore.’”

For participants, more education and information around using the technologies could have been provided. Cory, for example, felt that “they could have educated the people a little bit more,” but instead, “they just said ‘hey, we're getting the new passes,’ they didn’t really tell you how to use it, you know?” For participants, one barrier was learning how to use the Go-Pass and electronic fare machines. Similarly, Kristina mentioned that, when the Go-Pass came in: “as organizations, we weren’t educated on what that meant for us. [...] they didn’t do any kind of consultation with us.” She suggested that more education and consultation would have allowed for the organization to raise their concerns from the start and develop solutions to help smooth the transition.

According to Saskatoon Transit, the Go-Pass allows them to offer more vendor locations to purchase and reload the cards, which was not an option in the previous system (Saskatoon Transit, personal communication, Feb 7, 2012). However, many of the participants in this study were unaware of the other vendor options or found out that they were unable to reload their cards because they were under a subsidized bus pass program. For example, Melody pointed out that for people on social assistance “the only place that you can get a subsidized bus pass, is at the

downtown terminal because it's... they have to program the computers in a particular way in order to serve that demographic after the 20th of every month." Similarly, George commented: "Instead of going to the Safeway or the Mac's you have to go downtown."[17] Buck believed that the lack of communication and information about the new system caused confusion and misinformation:

> I do live on welfare so right at the start I was going downtown to fill it out and they said 'oh you can go anywhere to get your pass done.' But I found out that wasn't true. You couldn't go to a Safeway or some other place to have it done because they didn't know how to do it if you're on welfare. [...] I even went to city hall once because I figured they would know how to do it for people on welfare and they didn't either. So I don't bother doing that anymore, I just go right downtown to the transit office.

The Go-Pass cards were designed to work with all of the reloading vendors, but as Buck experienced, some vendors "didn't know how to do it if you're on welfare."

Overall, the participants' comments suggest that some of the issues with developing and maintaining an efficient transit service resulted from the lack of communication and education provided to its users and vending partners. Providing more information and education could have prevented some of the challenges that bus riders faced, particularly during the initial transition phases.

### 7.2.3 Need for Bottom-up Decision Making

Participants expressed the need for bottom-up decision making with respect to the design, management and operation of the transit service and Go-Pass system. They felt that the decisions about the service are being made by individuals who have never used it. For example, Mindy commented: "people that don't take the bus are making decisions for us, you know? [...] they don't take the bus, so they don't know that I have to walk home every night because the bus, the

[17] Participants who receive a subsidized Go-Pass commented earlier that having to go to the downtown transit office was experienced as a barrier to accessing the service (see section 5.4.1.1 on limited reloading locations).

connections are never there you know? [...] It would be nice if they would, actually." Overall, Mindy was satisfied with the transit system and had very few complaints about the Go-Pass; however, she expressed concerns with the way decisions are made about the service, suggesting that decision makers do not have first-hand experience with using the service and she felt that "it would be nice if they would."

Participants also felt that the way in which the transit company promotes the transit service frequently excludes the needs of bus riders who are currently using the service and are most dependent on it. For instance, as Kristina argued, promoting public transit as "the transportation of choice" is an unrealistic view of public transit in Saskatoon because many bus riders are dependent on the service and do not have other options. She commented: "You can't tell that to a single mom with two kids and a stroller and one's balling, they got a food basket from the Food Bank [and] they're trying to haul and 3 bags of groceries or whatever. It doesn't work like that," she added "There is no choice!" The focus on increasing ridership by promoting the service as "the transportation of choice" to individuals who do not currently use the service (e.g., such as those who drive vehicles), means that resources are being allocated toward new users rather than those who currently use it. Kristina's comment makes an important link between decision-making and social justice issues. The reality, in many cases, is that riders of the system do not have a choice in their mode of transportation. In her view, the needs of this group of riders should be at the forefront of transit decision-making while those who are not dependent upon the bus should be secondary.[18]

[18] Similarly, Garrett and Taylor (1999) have argued that the promotion of "choice" riders tends to exclude and dismiss the realities of (usually lower income) dependent bus riders who use the service the most.

Participants explained that there are important differences between being dependent on the public transit service and not being dependent on it with respect to the challenges that bus riders face. They felt that decisions should be made with the realities of dependent users in mind.

> It's such a big difference between being dependent on public transit and not being dependent on it and […] the majority of the people who have the power to make decisions about how it works are not dependent on the system and they don't know what it feels like to be completely dependent on the public transit system. They don't know what it feels like to have to stand out at a bus stop at 35 degrees below zero and the bus goes by early and you don't know that it went by early. You just know it's not coming and it's too far to walk. Things like that, you just don't understand the realities of the system when you've never been dependent on one. (Melody)

Melody's comment demonstrates the ways in which the operation of the public transit service can significantly affect a person's quality of life and experiences (e.g., such as having "to stand out at a bus stop at 35 degrees below zero and the bus goes by early and you don't know that it went by early"). At the same time, her comment points to important power relations between service users and decision-makers; i.e., on the one hand, individuals who are affected most by transit decisions are dependent on the service, while on the other hand, "the majority of the people who have the power to make decisions about how it works are not dependent on the system" and consequently "don't know what it feels like to be completely dependent on the public transit system."

Bus riders who are dependent on public transit as their only source of transportation are especially affected by decisions and changes made to the service. From Cory's experience, some bus drivers give passengers a hard time when bringing groceries or other items onto the bus: "I feel like saying [...] 'Okay I'll trade you spots, you be in my situation where the only means of transportation is the bus and then tell me how the hell you're going to do your daily activities, especially in the winter time'... Let them walk a mile in our shoes." As Cory pointed out, there

needs to be more sensitivity and understanding with regards to the issues that riders face and to learn from their experiences and perspectives in order to improve the service.

According to participants, decisions tend to be made by individuals who do not use the public transit service resulting in a lack of awareness about the issues faced by bus riders. Participants comments suggests that it is important for individuals making decisions to understand the realities of bus riders who are dependent on public transit services in order to make appropriate decisions about the service. In order to better improve the service, decisions should be made by individuals who use public transit or through consultation with bus riders.

### 7.2.4 Summary

The Go-Pass technology is connected to and impacted by wider structural issues that present social justice and ethical concerns. Potential barriers to accessing the transit service include: 1) limited reloading locations/options; 2) removal of paper money and tickets; 3) malfunctioning technology. Barriers to accessing transportation, in turn, impacts riders' ability to get to where they need to go and access to other services and essential needs (e.g., such as getting to grocery stores, hospitals, as well as work, school and appointments). One important finding was that bus riders' who were most affected by these issues were those who had limited means for alternative transportation (i.e., who were dependent on public transit services) and who were low-income and/or social service recipients. The findings offer important insights into the ways in which the system's design presented limitations that impacted riders' access to public transportation, and in turn, affected their well-being and ability to access basic needs.

The participants felt that the transit system poorly communicated the changes to the riders during the transition to the new system; many participants were unaware when the changes were being made, what the changes could mean for their use of the service, and how the technologies were meant to be used. The participants argued that the transit system needed to

engage in bottom-up decision-making when it anticipates changes to the system. These findings illustrate the ways in which structural and technical issues are interwoven and linked to positions of power; those who had the power to make decisions about the transit service were not dependent on it. At the same time, poor decisions affect individuals who are most dependent on the service, which has the potential to be deeply immobilizing and discouraging.

# CHAPTER 8: DISCUSSION AND CONCLUSION

Although the Go-Pass represents a seemingly "mundane" technology, often taken-for-granted and made invisible in its daily and routine use, it has socially significant meanings for those who use it. By studying riders' perceptions of the Go-Pass system, the findings of this study suggest that, not only does the Go-Pass evoke different meanings, interpretations and emotions for differently situated users, but the bus also is experienced as a socio-technical space. That is, the bus is both a social and technical space, which is occupied by various human actors such as bus riders and drivers, and technological actors such as the Go-Pass smartcard and electronic fare machines.

Together these social and technical actors intra-act, and shape relations in such a way that constitutes the bus as a socio-technical space. Not only were the roles and relationships interpreted to be shifting between human and non-human actors—suggesting that the boundaries between them are malleable and fluid—but also the identities of bus riders were constructed and (re)negotiated in response to their social and technical environments whereby users and technologies co-configure meanings and actions. Moreover, technologies are not simply passive or neutral objects; rather, technologies are connected to wider social issues and power relations existing within society. There are non-neutral and socio-political dimensions of technical use that reinforce social problems, stigmas and inequalities, as well as foster social justice and ethical concerns; the use and non-use of the Go-Pass card, for instance, produces (un)intended social and technical consequences (i.e., the exposure of economic positions and difficulties using the technologies). A number of issues were raised in relation to the implementation of the Go-Pass system, such as the malfunctioning of the technologies, limited reloading locations or removal of paper tickets and money, affecting riders' use of the transit service, particularly for those most marginalized economically and dependent on the service.

Public transit in Saskatoon is strongly perceived as a transportation service associated with certain, often stigmatized and vulnerable social groups such as the poor, elderly, or disabled, but bus riders are not a homogeneous group. Participants' social positions, backgrounds and histories shaped their interpretations and experiences with using the Go-Pass system. The diversity and uniqueness of perspectives and backgrounds of bus riders have been an important and integral finding of this study; that is, within the bus rider community and space, class and other social divisions exist and help shape individuals experiences and perspectives. Unexpectedly there were connections between users' everyday situated uses and experiences of the Go-Pass technologies to wider social-political contexts. In particular, the new Go-Pass system often unintentionally reinforced negative stereotypes about economically marginalized or vulnerable groups—the poor, the elderly, or persons with a disability. At the same time, the changes to the transit system improved the quality of life for many riders.

The findings identified and presented in this thesis resulted from my thematic analysis of the qualitative interviews with bus riders (Go-Pass users) and community stakeholders. Bus riders and the community perceived that: 1) the roles and relationships of human and non-human actors are shifting; 2) the identities and meanings of bus riders are socially and technologically constructed; 3) users and technologies co-configure meanings and actions; 4) there are wider structural issues and social justice/ethical concerns connected to use of the Go-Pass system (see Appendix E for a summary of the themes and sub-themes).

In this final chapter I provide a theoretical discussion which summarizes the ways in which the mutual shaping framework was applied to the findings and the ways in which agency is re-conceptualized, which has its implications for understanding subjectivity and power. Next, I direct attention to the strengths and limitations of this study and future research directions. In the

third section, I reflect on the outcome of this study and make some recommendations. More specifically, I recommend that a bottom-up decision making approach would allow for bus riders' and the community's concerns to be addressed and potentially provide solutions for issues currently faced.

## 8.1 Theoretical Discussion and Summary

### 8.1.1 A Mutual Shaping Framework

The themes that emerged from this study provide evidence that socio-technical relations are mutually shaped. As discussed in the literature review (see Chapter 2), technological determinist and social constructivist/essentialist accounts capture only one side of a complex set of processes and interactions in user-technology relations. If we relied solely on either of these approaches, it would be difficult to explain the ways in which users and technologies co-configure one another or the shifting roles and relationships between human and non-human actors. Similarly, the influential role of both technical and social actors in the construction of bus riders' identities would be ignored; instead, there would be a tendency to overemphasize either the social or the technical influences on shaping bus riders' identities and meanings. Discussions surrounding the intertwining of the Go-Pass technologies with wider social and structural issues would potentially be limited to either social or technical factors, preventing a clear understanding of their mutually influential roles and interrelationships.

A mutual shaping lens offers an analytical framework to examine fully the reciprocal relationship between users and technologies and is the most instructive of the general approaches outlined for its ability to account for both social and technical influences. Table 5 below summarizes the themes that emerged from the mutual shaping framework. The first theme points to two related ideas: 1) social and technical aspects influence shifting roles and relationships; and 2) human and non-human actors are co-constituted. One key idea emerging from this theme was

that bus riders' interpreted and experienced the bus as a socio-technical space. The second theme focuses on the co-construction of meanings of the bus rider by social and technical aspects; the third theme directs attention to the co-configuring of users and technologies. The fourth theme outlines the mutual shaping of wider social/structural issues and technical limitations and their social justice/ethical implications of technologies-in-practice.

Table 5: Summary of Themes within a Mutual Shaping Framework

| Themes | Mutual Shaping Connections |
|---|---|
| 1. Shifting Human-Machine Roles and Relationships | • Social and technical aspects influence the shifting roles and relationships<br>• Both human and non-human actors are co-constituted and mutually shape socio-technical relations<br>➢ The bus is interpreted and experienced as a socio-technical space – social and technical aspects shape perceptions |
| 2. Socio-Technical Construction of the Rider | • The meaning of the bus rider is mutually shaped by social and technical aspects |
| 3. Configuring Users and Technologies | • Users and technologies co-configure each other |
| 4. Structural Issues and Social Justice Implications of Technologies-in-Practice | • Wider social/structural issues and technical limitations mutually shape social justice/ethical implications of technologies-in-practice<br>➢ impacts on participants' experiences and use of the transit service |

### 8.1.2 (Re)conceptualizing Agency, Subjectivity and Power

In order to uncover the complexities and implications of user-technology relations, this section explores the topics of agency, subjectivity and power. As examined in Chapter 2, a balanced approach between human-centered and techno-centered approaches for conceptualizing agency emphasizes the importance of both technical artifacts and users/social actors (Doherty, et al., 2006; Orlikowski & Iacono, 2001; Introna, 2007). Barad (2003, 1998, and 1999) proposes the concept of "intra-action" which takes into account the inseparability of social and material

influences by re-conceptualizing subjects' material character and the constructed (discursive) nature of objects as mutually constituted. Agency is theorized as productive, not possessed or static; it is "continually reconstituted through our material-discursive intra-actions" (Barad, 1998, p. 104). Material-discursive practices are "made up of specific intra-actions of humans and nonhumans, where the differential constitution of 'human' (or 'nonhuman') itself designates a particular phenomenon, and what gets defined as a 'subject' (or 'object')" (Barad, 1998, p.105). Moreover, intra-action is premised on the idea that action/agency is co-produced by specific and inseparable material-discursive or social-technical arrangements and practices.

From a similar perspective, Suchman's (2007, p. 268) concept of sociotechnical or "sociomaterial assemblages" describes the differential constitution ("diverse assemblages") that form in relation to particular practices or arrangements of social and technical actors. Suchman (2007, p.260) suggests that we need to "develop a discourse that recognizes the deeply mutual constitution of humans and artifacts, and the enacted nature of the boundaries between them, without at the same time losing distinguishing particularities within specific assemblages." The positions that Suchman (2007) and Barad (2003) advocate acknowledge the importance of the interrelationships between humans and machines while simultaneously making visible the differences between them.

The topic of agency is intertwined with the ideas of subjectivity and power. Growing interest in the topic of non-human agency, for instance, points to the blurring of human–machine boundaries and subjectivities through the creation of hybrid subjects (Haraway, 2000; Turkle, 1995; Suchman, 2005, 2007; Knorr-Cetina, 1999; and Mort, et al., 2005). Users' embodied interactions with technologies are conceptualized as extensions of their bodies and identities, and in turn, form new subjectivities or "assemblages" (Shah, 2008; Kruger, et al., 2008; Knorr-

Cetina, 1999; Suchman, 2007). Alternatively, technologies may inscribe new identities through configuration (Woolgar, 1991) or enable certain identities and constrain others (Oudshoorn, et al., 2004; Prus & Mitchell, 2009). The features that enable or constrain agency or identity/subjectivity point to power relations that form in relation to specific sociotechnical assemblages or practices. Socio-technical relations are interwoven within wider socio-political and cultural contexts.

If all actors are treated as equivalent or symmetrical, there would be little room to discuss the diverse and situated character of socio-technical relations, and therefore the ability to understand important differences between assemblages of humans and machines (Suchman, 1998, 2007; see also Introna, 2007). The power relations that emerge within specific assemblages may not be immediately visible and potentially taken for granted or overlooked. Barad (2003) suggests that one way to avoid this oversight is to enact "agential cuts" that temporarily separates the "subject" and "object." Similarly, Introna (2007) argues that in order to understand socio-technical agency, we must momentarily separate and expose the social and technical components or intra-actions. Following Introna's (2007, p. 16) model for exposing "co-constitutive intra-actional agencies", I outline the "material configurations", "identities", "practices" and "discourses" that emerged from this study in Table 6 below. These intersecting ideas also have been illustrated in the thematic maps presented in the previous chapters.

Users' and the community's experiences and interpretations of the Go-Pass system demonstrate the ways in which both social and technical actors intra-act; shaping relations and forming creative sociotechnical assemblages that are multiple, emergent, intra-acting and enacted by various social and technical actors. The concepts of intra-action and socio-technical assemblages are particularly useful for analyzing socio-technical relations by accounting for the

important role of both social and technical actors and are particularly informative for locating agency and its connections to subjectivity and power within the complex web of human-machine relationships. It provides a language to speak about human and non-human agency without assuming action is inherently a human quality. These concepts provide a way forward into examining diverse effects and arrangements, and their socio-political consequences and meanings, through the recognition of both the mutual constitution of humans and machines and the differences between specific assemblages.

Table 6: Co-Constitutive Intra-actional Agencies

| **Co-Constitutive Agencies** | **Examples** |
|---|---|
| **Material Configurations: Affordances/Constraints** | • Automated fare collection system: Go-Pass smartcards (contactless RFID technology), electronic fare machines (card readers, transfer scanners, coin mechanisms);<br>• Capacity to track & store data;<br>• Electronic verification & accuracy;<br>• Go-Pass vendors & reloading machines (locations/options);<br>• Transit computers and databases,<br>• Personalization feature;<br>• Electronic tickets (removal of paper tickets and money) |
| **Identities** | • Being a bus rider: legitimate rider, rider as data or eligible service recipient;<br>• Bus drivers' and electronic fare machines' identities as supervisors shifting |
| **Practices** | • Machines verifying and collecting fares (automatically scanning passes, coin fares, transfers);<br>• Drivers making decisions (waving riders on bus, problem solving or testing) and assisting bus riders;<br>• Detecting (in)valid fares & preventing fraud;<br>• Collection of transit use/ridership data;<br>• Supervising fare collection (passive or active roles), configuring practices of users and technologies;<br>• Automation functioning vs. malfunctions or technical breakdowns;<br>• Bus riders finding quicker methods to scan/deposit fares;<br>• Loss of communication & Interaction; |
| **Discourses** | • Scheduling demands & social pressures to hurry up;<br>• Goals to collect accurate transit use/ridership data;<br>• Meanings of legitimate use;<br>• Eligibility requirements;<br>• Adapting or getting used to new technologies as necessary; |

In building a deeper understanding of these intersecting topics, I draw attention to four main ideas associated with the concepts of intra-action and sociotechnical assemblages: multiplicity, temporal emergence, performativity, and socio-technical agency.[19] Table 8 summarizes how these four ideas intersect each of the themes.

[19] These four interrelated ideas are elaborated by Doolin and McLeod (2012) outlining the sociomaterial perspective.

Table 7: The Intersections between the Main Conceptual Ideas and Themes

| Themes | Multiplicity | Temporal Emergence | Performativity | Socio-technical Agency |
|---|---|---|---|---|
| **1. Shifting Human-Machine Roles and Relationships** | • Multiple performances of diverse and shifting socio-material assemblages<br>• Roles and relationships were interpreted as shifting between bus drivers or the electronic fare machines depending on particular socio-technical arrangements<br>- i.e., automation vs. breakdowns/ malfunctions in relation to scheduling demands or individuals' personalities | • The boundaries between humans and machines – bus drivers, riders and to Go-Pass technologies - are malleable and shifting rather than stable and fixed. | • The boundaries between human and non-human actors are enacted and performed shaping the ways in which the Go-Pass system is interpreted and used<br>• Whether bus drivers or machines play active or passive roles produces new meanings and shapes practices<br>- i.e., beeps taking over communications | • Agency is enacted simultaneously by both bus drivers and the electronic fare machines<br>• Their shifting roles enact different sociotechnical assemblages which enable certain practices and constrain others<br>- i.e., bus drivers may choose by-pass technologies when they malfunction or are too slow |
| **2. Socio-Technical Construction of the Rider** | • The meaning of the bus rider is multiple and fluid – multiple interpretations and the social and technical (material-discursive) construction of multiple identity positions.<br>- Multiplicity of identities: *legitimate rider, rider as data* and *rider as eligible service recipient* | • Meanings are shifting in time and space - interpreted differently by situated users, in particular contexts and spaces.<br>- i.e., diverse assemblages | • The effects of particular meanings or the formation of new identities are (re)constituted by social and technical factors<br>- i.e., identities shaped by social discourses and technical features | • Bus riders' identities/meanings are enacted - co-constructed by social and technical actors (social discourses and technical features) which produce different effects |
| **3. Configuring Users and Technologies** | • Multiple actors (users and technologies) are involved in shaping relations through configuration.<br>- i.e., relations as multiple and changing rather than static or fixed | • Users and technologies are configured and re-configured in practice – producing new and creative assemblages.<br>- i.e., technology modified to suit needs | • Co-configuration of users and technologies resulted in varied effects<br>- i.e., users' practices shaped in enabling or constraining ways or technologies shaped to improve use of services | • Users-technology agency is constituted through intra-action - afford or constrain practices<br>- i.e., users configure the Go-Pass and in turn shapes them |
| **4. Structural Issues and Social Justice Implications of Technologies-in-Practice** | • Technologies-in-practice produce multiple effects (intended/unintended consequences) which are influenced by wider social/structural issues and technical limitations.<br>- i.e., multiplicity of effects impacting participants' experiences and use of the transit service | • The consequences of social and technical issues are productive, ongoing and emerging; users interpreted that relations could be different and re-shaped to address, resist or solve issues. | • The effects of structural and technical issues are consequences produced by their co-constitution in different contexts, situated uses or for different participants/users.<br>- Go-Pass technologies not determinate or a-temporal but vary in their effects | • Consequences or effects are produced as a result of both social and technical practices.<br>- i.e., limited reloading locations, removal of paper money/tickets, malfunctioning machines, etc. |

*Multiplicity* relates to the idea that assemblages are multiple and diverse and that particular arrangements have multiple meanings for different people/contexts. Roles and relationships were interpreted as shifting between bus drivers or the electronic fare machines depending on particular socio-technical arrangements (i.e., automation vs. breakdowns/ malfunctions in relation to scheduling demands or individuals' personalities). The meaning of the bus rider is multiple and fluid; there were multiple interpretations and the social and technical (material-discursive) construction of multiple identity positions: legitimate rider, rider as data and rider as eligible service recipient. Multiple actors (users and technologies) are involved in shaping relations through configuration (i.e., relations were multiple and changing rather than static or fixed). The Go-Pass technologies-in-practice produce multiple effects (intended/unintended consequences) which are influenced by wider social/structural issues and technical limitations (i.e., there were multiple effects impacting participants' experiences and use of the transit service).

*Temporal emergence* refers to the way sociotechnical assemblages are neither stable nor fixed, but always in a state of "becoming" and are reconstituted across particular times and spaces. Assemblages of users and technologies and the boundaries between them are continually configured and re-configured in practice or through their intra-action; the boundaries between humans and machines (i.e., humans and machines, bus drivers, riders and the Go-Pass technologies) are malleable and shifting rather than stable and fixed. Meanings are shifting in time and space; that is, they are interpreted differently by uniquely situated users in particular contexts and spaces, and in different times (i.e., the formation of diverse assemblages). Users and technologies are configured and re-configured in practice, producing new and creative assemblages (i.e., the Go-Pass technologies are modified to suit particular needs). The

consequences of social and technical issues are productive, ongoing and emerging; users interpreted that relations could be different and re-shaped to address, resist or solve issues.

*Performativity* highlights the way assemblages are enacted or performed producing varied effects and intended/unintended consequences. The boundaries between human and non-human actors are enacted and performed shaping the ways in which the Go-Pass system is interpreted and used; that is, whether bus drivers or machines play active or passive roles, produces new meanings and shapes practices (i.e., beeps and sounds taking over communications). The effects of particular meanings or the formation of new identities are (re)constituted by social and technical factors (i.e., identities shaped by social discourses and technical features). Co-configuration of users and technologies resulted in varied effects; users' practices or actions were configured in enabling or constraining ways and the Go-Pass technologies were (re)configured to improve riders' use of the service. The effects of structural and technical issues are consequences that are produced by their co-constitution in different contexts, situated uses or for different participants/users; i.e., the Go-Pass technologies are not determinate or a-temporal but vary in their effects.

Finally, *socio-technical agency* refers to the way agency is co-constituted and enacted by various social and technical actors. Agency is enacted simultaneously by bus drivers, riders and the electronic fare machines; the shifting roles between bus drivers and the machines enact different sociotechnical assemblages that enable certain practices and constrain others (i.e., bus drivers may choose to by-pass the technologies when they malfunction or are too slow). Bus riders' identities are enacted—co-constructed by social and technical actors (social discourses and technical features)—which produce different effects on bus riders' experiences and interpretations. Users-technology agency is constituted through their specific intra-actions that

afford or constrain practices (i.e., users configure the Go-Pass technologies, and in turn, shapes them). Intended/unintended consequences and effects are produced as a result of socio-technical intra-actions and practices; that is, system design limitations such as the limited reloading locations, removal of paper tickets and money, malfunctioning technologies in connection to dependence on public transit services, as well as the lack of communication and education about the new system were identified as barriers that had particular effects on particular groups of bus riders. Overall, the ways in which decisions are made about the transit service by individuals who are not dependent on it serve to further embed social and technical issues.

The four related ideas of "multiplicity," "temporal emergence," "performativity" and "sociotechnical agency" provide insight into the intricacies of sociotechnical assemblages which align with the major themes identified in my analysis. In the context of this study, users and the Go-Pass technologies form specific sociotechnical assemblages that are diverse, multiply interpreted, situated, temporally emergent, and enacted by various social and technical actors that co-constitute socio-technical agency. In other words, socio-technical relations are mutually shaped and produced through the intra-actions of social and technical actors.

### 8.2 Limitations, Strengths and Future Directions

Although the study was aimed at including the perspectives of all riders' who use Public Transit Services with the Go-Pass system, this research falls short in capturing those perspectives of individuals involved in the operation, design, development and implementation of this system. In particular, the perspectives of bus drivers who operate and use the Go-Pass system on a daily basis would have greatly benefitted the analysis. Drivers' perspectives potentially would shed new light on user-technology relations offering insights into their experiences and use of the Go-Pass technologies and the fare collection process more generally. It is possible that the bus riders' participating in this study perceived the fare collection processes and interactions with the

Go-Pass technologies in radically different ways than bus drivers. The perceptions of transit management, front-line staff, Go-Pass designers, planners and developers would similarly assist my analysis and understanding of the broader social and political nature of the technologies.

Although participant recruitment was open to all individuals who use public transit and the Go-Pass system either presently or in the past, not all perspectives could be explored. For instance, all of the participants in the study were current users and the perspectives of past users (i.e. non-users) were not represented. As a result of the relatively unknown and dispersed population of past Go-Pass users, it was difficult to assess the best locations to post advertisements where they would be able to view them. Advertisements were posted in typical locations such as bus terminals and stops, which meant that current users of the service were more likely to see them than those who are not. Future studies could benefit from the inclusion of past or non-users as well as bus drivers, management, planners and designers.

The focus on public transit use in Saskatoon was both a conscious decision to examine local perspectives of technology, as well as a practicality based on limited resources and time. Focusing on a particular phenomenon occurring in a specific time and place has enhanced the depth and understanding of the local and situated context. The inability to generalize the findings beyond local contexts, however, presents a challenge and is a weakness of this work. This research serves as a starting point for conducting similar research initiatives with a broader focus. A cross-national or international study of bus riders/users and transit fare technologies would be particularly beneficial in uncovering this socio-technical phenomenon in the wider context.

Although the qualitative approach used for this research study allowed me to explore individuals' perspectives in depth, a full range of perspectives could not be discussed in the

scope of this Master's thesis. One example was the connection between gender and technology. For instance, one of the stakeholders in the study was concerned that the switch from paper tickets to the plastic Go-Pass card presented concerns for the women, who are in violent relationships, with whom she works in the community. Since the Go-Pass card cannot be as easily concealed or hidden on the body in the same way that paper tickets were due to its size, she felt that some women may end up in violent situations with no way to get out because their partners may find their bus passes. This connection was particularly important because it makes visible the ways in which the Go-Pass technologies, although seemingly mundane in their everyday use, have gendered dimensions that could produce serious issues for women. The gender connections of technology and the body present an avenue to examine in future research.

The findings of this study indicated that bus riders represented a diverse group of individuals, but it did not examine in any great detail the experiences of differently abled bus riders. For instance, the beeps and sounds produced by the electronic fare machines were interpreted by participants who were fully able to hear them. The meanings and interpretations of persons with hearing disabilities may have been much different from those of participants who took part in this study. This research also did not examine the perspectives of bus riders who use the Access Transit Service, which prevented discussions surrounding disability and technology. As discussed in Chapter 3, this choice was viewed as a strategic move to narrow the already wide-ranging scope of the research topic. In order to better represent their voices, an entire study of Access Transit users' perspectives of the Go-Pass should be conducted.

This thesis contributes to STS and the sociology of technology theory and research on mundane technologies by broadening the understanding of socio-technical relations and human-machine interactions through examining users' interpretations, experiences and use of the Go-

Pass system. I have identified some of the deficiencies with using determinist or essentialist approaches to studying technology-society connections and have illustrated the need to incorporate a critical theory of technology which takes into account the effects of technologies in their socio-political contexts. The strengths of this research lie in expanding upon the insights of the mutual shaping framework, as it applies to bus riders. This research confirms previous research that demonstrates the importance of a socio-technical approach that recognizes the mutual constitution of humans and machines as well as their differences and situated contexts and was highlighted by applying the concepts of "intra-action" and "sociotechnical assemblages." By weaving the theoretical framework of mutual shaping with the concepts of "sociotechnical assemblages" and "intra-action," I was able to develop key conceptual terms such as "the legitimate rider", "rider as data" and "eligible service recipient," which assisted in understanding transit users' experiences and interpretations of their use of the technologies. The concepts derived from my analysis may be transferable to other kinds of transit systems or the broader context of public transit use more generally. Methodologically I have contributed to the field by providing a detailed description of my data analysis and procedures, particularly with respect to using NVivo as a methodological tool. The thematic maps aided in developing a theoretical model for understanding the phenomena under study and were also strength of this work.

### 8.3 Reflections and Recommendations

While the transit system improved the quality of bus riders' lives, it also, as we have seen presented many barriers, especially for those groups who are socially and economically marginalized. The results of this study show, however, that participants were keenly interested in the transit system and they had many insights into the ways in which it could be improved. As suggested by the participants, a bottom-up decision making strategy is one way forward. There is

the need for consultation with bus riders and community members who currently use and depend on the service. Other strategies might include city-wide discussions or surveys that allow individuals to voice their concerns and opinions around transit matters. While there are public forums to discuss issues such as writing letters to city council or contacting transit directly through their complaints system (Saskatoon Transit, 2010), many individuals may not be aware of these options or be able to take advantage of them. Using community forums, extensive advertising and other knowledge translation activities, bus riders and the community should be consulted about improvements to the system and informed about the implementation of new transit technologies To this end, the recent hiring of a long term bus driver as the new manager of Saskatoon Transit, whose experience within the community and first-hand knowledge, may represent an important step in promoting potential improvements that could impact bus riders positively (Hutton, 2012).

As a whole, the outcome of this research study confirmed the importance of researching individual experiences as a way to better understand socio-technical relations. More specifically, using a qualitative approach allowed me to explore what the implementation of the Go-Pass system has meant for bus riders in Saskatoon. It was evident that each participant had a unique perspective to contribute to the study. Their stories indicate that there are both similarities and differences in perceptions of technologies and that user-technology relations are multiple and diverse. Studying the lived experiences of participants and the meanings they attach to the Go-Pass technologies provided deeper understanding of socio-technical relations and human-machine interaction (Schwandt, 1994). Following an interpretive-constructivist methodological perspective has contributed to my understanding of the way technologies are multiply experienced, interpreted and made meaningful in their situated use. This study highlights the

ways in which both social and technical factors are considered important and mutually shaped—an insight that is crucial for exploring user-technology relations. In particular, addressing current issues with the Go-Pass system requires examining both social and technical features which make up this space.

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## TABLE OF ABBREVIATIONS AND TERMS

| | |
|---|---|
| **Go-Pass System** | An electronic fare collection system used for paying fare via the public transit service in Saskatoon, SK. This includes the use of all fare types used with the electronic fare boxes on-board the buses. |
| **Stakeholder(s)** | A stakeholder refers to the community members in Saskatoon who are closely connected to the bus riding community. |
| **STS** | Science and Technology Studies |
| **User(s)** | A user refers to bus riders of the Saskatoon public transit system. |

APPENDIX A
USERS - INTERVIEW GUIDE

Intro: The purpose of this interview is to talk about your current or past experiences with using the Public Transit Go-Pass Smartcard. The aim of this study is to understand the social impacts of technology, in particular, how technology shapes society and the interactions between people and those technologies. Through our meeting today I hope to learn about your experiences, perspectives and the meanings you attach to the Go-Pass.

- Before we get started, are there any questions you have about the interview process or research project?
- Do you have a preferred pseudonym (false name) you would like to use? This name will take the place of your own when the interview is transcribed (the recorded interview is typed) and you will have access to this - so you may review your transcript when it is ready.
- I want to thank you for agreeing to participate. We'll begin. [Interview Start]

1. I have some specific questions to help guide our interview but to start would you like to share anything about yourself or general thoughts about the Go-Pass?
2. How long have you used the Go-Pass smartcard system?
    - Probe: (If since beginning): Have you noticed any changes since the beginning?
    - Probe: Were you a rider of the Public Transit system before the recent changes?
    - Probe: (If yes) - for how long?

3. What would you say is your main reason for using the Public Transit system? For instance, is public transit your primary mode/means of transportation?
    - Probe: (If no reason) – would you say you are more likely to use it for getting to work, school or other places?
    - Probe: How often do you use transit?
4. Has using the Go-Pass smartcard changed your experience or use of the public transit system?
    - Probe: How so? Or to what degree would you say? (Not at all, somewhat, very much so, etc)
5. What were your thoughts when you first heard of the new Go-Pass system?
    - Probe: Were you enthused, opposed, impartial, etc?
    - Probe: What were your expectations and were these expectations met?
    - Probe: (Yes/no): Why do you think that is?
6. In your experience, what were some of the barriers (limitations) you encountered with the Go-Pass system? And what were some of the enabling features or benefits?
    - Probe: (Barriers): Do you think these barriers limit your use?
        - Probe: How so?
        - Probe: In terms of barriers/enablers, do you feel there are specific social impacts with people using this technology? How so?
        - Probe: (Benefits): Do you think this has enabled you to more efficiently use the system? In what ways?
7. Are you familiar with the type of technology being used? (smartcard/electronic faire box)
    - Probe: (If yes): Do you think this technology is useful for transit use?

- Probe: (If no): Do you think information about the technology would be important for users to have access to? Where would this information be most easily accessible for you?

8. Did you find the Go-Pass easily accessible and user-friendly?
    - Probe: How would you rate this on a scale from 1-10 (1 being not at all user friendly to 10 being very user friendly)?
    - Probe: (If no) - Do you find/consider other technologies easier to use? Or are you consider yourself knowledgeable/savvy with technology?
    - Probe: what could transit do to make it easier?
9. This question is to get a sense of how you actually use the card when you scan it. Could you describe or demonstrate how you would normally scan or use the Go-Pass card on the bus? I have seen people scan their cards in different ways, such as taking the card out of their wallet and placing it directly on the surface of the card reader, others keep their cards in their wallets, and some just hover the card above the scanner. How do you use it, or what is your preferred technique?

    (*This question is to elicit their experience with the card in more detail in hopes of understanding how they physically engage with the card and how this interaction shapes their identity or behaviour – i.e. placing the card down on the scanner and moving your hand away while it scans might indicate a "hands off" interpretation of the technology*).
    - Probe: Do you think that you scan your card this way out of habit or is there a particular reason for doing it this way?
    - (If not sure) – Do you think scanning your card this way as opposed to another way would affect the process or not really?

- Probe: (For long term transit users): Reflecting back on this process of scanning your Go-Pass card and your experiences with riding the bus prior to the Go-Pass – is there anything you notice that has changed about the nature of riding the bus? Such as the relationship between the rider and bus-driver or the old coin mechanism compared to the new electronic fare box/smartcard?
    - (If yes): How so? How has this changed?

10. From your experience did you find or feel that using the Go-Pass smartcard changed how you see yourself or how you see/identify with others or the technology?
    - Probe: (yes): In what ways?
    - Probe: (not sure): Do you think the card changed anything about how you do things or see yourself as a person/rider of the bus? For example, you may find that it has changed how you think about yourself or as a transit user/rider.
11. How do you feel about personalizing the Go-Pass with your name and contact information?
    - Probe: (Doesn't mind): Do you find there are added benefits with having it personalized?
    - Probe: (Finds it a problem): Do you want to expand on this? How so?
    - Probe: How do you think this information is used?
12. In general, how concerned are you about privacy? (i.e. Not at all, moderately concerned or very concerned, etc.)
    - Probe: Do you think the personalization of the smartcard affects privacy?
        - (If yes): In what ways? (if no): So you would find this beneficial for the user?

13. This is just a hypothetical situation, how would you feel if retina or fingerprint scans were used in the future? (Biometrics)
    - Probe: In your opinion do you see this technology as plausible or being used in the future?
    - Probe: What is your impression of this type of technology?
    - Probe: What else might we see in the future?
14. If you could describe the Go-Pass smartcard in 3 words what would they be?
    - Probe: Could you reflect on what these words mean to you and how it relates to the smartcard?
15. Do you find the Go-Pass technology different than other technologies you use on a daily basis such as bank or credit cards, cells phones or other digital devices you carry on your person?
    - Probe: (Finds it different): In what ways do you find this technology different than others?
    - Probe: Do you feel personal attachment to the card or identify with the technology?
    - Probe: (If yes): How so? Did you want to describe this?
16. How do you feel about using "digital currency" with the Go-Pass instead of "physical currency"?
    - Probe: How do you feel this has affected your understanding of payments or the transaction?
    - Probe: Can you connect this to any other experiences or other technologies you've used?

- Probe: In your opinion, is the move toward “card” usage with the Go-Pas card a necessary thing, good, or bad, etc?

a. Probe: (Not sure) – Do you think using cards change peoples’ interactions?

17. Who do you think benefits the most from the new system? (Saskatoon Transit, the users, etc).
    - Probe: How so?
    - Probe: Would you characterize the design of the system as people-centered or oriented?
    - Probe: Do you think there are people that do not benefit from these changes to transit?
        - Who do you think that is? (Is it certain groups or people?)
        - What could be done to change this to make the system more equal?
18. From your perspective and based on your experience with the Go-Pass, what could be done to improve the new system? Or do you think there are some necessary changes to be made?
    - Probe: (If yes) - In what way?
19. How would you like information from this study to be presented to the public or Saskatoon Transit?
    - Probe: What forms would be best? (example: posters, websites, workshops, news articles, etc?)
    - Probe: What would be the best way to get the information out?
20. Is there anything I have not asked you in the interview that you would like to add?

- Probe: Any last thoughts, impressions, experiences or stories you would like to share?

- Just a few quick questions to wrap up the interview: I am curious, how did you find the interview process? Is there anyone else you know that might be interested in participating?
- Would you be interested in a follow up interview in the future?
- Thank you, those are all the questions I have. You will have access to the interview transcript for your own review as soon as it is transcribed. What is the best way to contact you to send the transcript? I will also send along a transcript release form in order to get your permission to use the transcript in my research. (For instance, I might use quotations from our interview).
- Do you have any questions or concerns before we strop the recording?
- I want to thank you for taking time out of your schedule to do this interview and for participating in this study, it is very much appreciated. Thanks. [END]

APPENDIX B
STAKEHOLDERS - INTERVIEW GUIDE

Intro: The purpose of this interview is to talk about your current or past experiences with the Saskatoon Public Transit Go-Pass Smartcard as a community stakeholder and program coordinator for your organization. The aim of this research study is to explore the social impacts of technology, in particular, how technology shapes society and the interactions between people and those technologies. Through our meeting today I hope to learn about your experiences and perspectives with the Go-Pass and how it is affecting your organization and its members. I have identified you as a stakeholder participant because of your involvement and role in the community; is this appropriate?

Interview information: Some general information about the interview process - it will be open-ended, meaning you can talk about whatever you would like to share. You may pick a pseudo name that will take the place of your real name so that when the interview is transcribed we can ensure anonymity and confidentiality. Your name will not be used in the research findings or published. I will be recording this interview with a digital audio recorder and I will send you a copy of the transcript so that you can make corrections and identify any parts that you would not like to be included in the study. Please remember if you feel uncomfortable answering any of the questions I ask, you may choose to not respond. We can end the interview at any time and stop the recording. The interview is 16 questions long and will take approximately 30-60 minutes.

- Before we get started, are there any questions you have about the interview process or research project in general?

- Do you have a preferred pseudonym you would like to use? (For you own name and the organization).
- I want to thank you for agreeing to participate. We'll begin. [Interview Start]

1. To start off the interview would you like to speak a little bit about yourself, your organization or your role in the community?
2. Did you want to describe your experiences with the Go-Pass as it is used or distributed by your organization? I am interested in learning about the reasons for the use of the Go-Pass by the organization and the process of distribution to member of the community.

- Probe: (Issues w/ Go-Pass) - Okay, so you have found some issues using/distributing the Go-Pass within the organization you work for. Were there any issues providing transit for members prior to the introduction of the Go-Pass?
- Probe: Has the city or Saskatoon Transit responded to this issue in any way?
- Probe: Considering those issues, from your perspective and understanding, why do you think Saskatoon Transit decided to implement the Go-Pass? There must have been some foreseeable benefits for them, but do you think they ignored how these changes might affect community organizations and programs?
- Probe: Did you want to explain how you've worked around this issue?

3. Did you find this an effective solution or do you think there still needs to be something done? (Based on previous knowledge: You mentioned that one of the solutions was to purchase 150 Go-Pass cards with 2 tickets each for the members).

- Probe: (If not effective solution) - What would you say would provide a reasonable solution?
- Probe: In what way might Saskatoon Transit make distributing transit passes/fares easier now that the Go-Pass is here to stay?
- Probe: How has this affected or shaped the nature of operations for your organization to deliver transit to its members?

4. Would you say that the public transit system is the primary source of transportation for the majority of the people your organization works with? (How many passes are supplied on average/how often?)
- Probe: (Main source for most) - So you would say this affects almost everyone involved in the programs at your organization? (Public transportation as a main source of transportation is used as an indicator for lower socio-economic status.)
- Probe: (For some) - So not all but some use public transit as their primary means of transportation.

5. This question relates to the last one. Overall, who do you think benefits from these changes? Who loses? How would you characterize the design of the transit system?
- Probe: (Identifies those that benefit/lose out) - What do you think is the social cost?
- Probe: In your opinion, do you think certain groups/organizations, etc were targeted (unintentionally or not) by the transit changes?
- Probe: (if yes) - How might this be prevented in the future?

6. Has your experience with the Go-Pass changed your perception of the public transit system or of smartcard technology in general?
- Probe: (yes) - How so?

- Probe: If you could describe the Go-Pass smartcard in 3 words what would they be?
    - Could you reflect on what these words mean to you?

7. Back tracking a little bit - Prior to the implementation of the Go-Pass what were your initial thoughts when you first heard of the new system?

- Probe: Were you enthused, opposed, impartial, etc?
- Probe: What were your expectations?
- Probe: Were these expectations met? (May have already answered this)
- Probe: (Yes/no): Why do you think that is? (")

8. In your experience, what were some of the barriers (limitations) you encountered with the Go-Pass system? And what were some of the enabling features or benefits? Pros/cons.

- Probe: (Barriers): Do you think these barriers limit your use? How so?
- Probe: (Benefits): Do you think this has enabled you to more efficiently use/distribute the Go-Pass? In what ways?

9. You have described your experience with the Go-Pass very clearly and have pinpointed a number of issues surrounding its use and distribution. What would you say are some of the (if any) benefits of the new system or potential benefits?

- Probe: Is there potential to be more user-friendly?

10. What is your perception or understanding of the changes to transit and the technology being used?

- Probe: (Not sure) - Do you find it a useful technology, not so useful, useful but the way it was implemented to be counter-intuitive or not so user-friendly? How so?

11. This is just a general question but I thought I would include this - what is your take on smartcard technology in general? What about the way in which technology is headed?

- Probe: What are your thoughts on "digital currency" for transit use?
- Probe: In your opinion, is the move toward “card” usage with the Go-Pas card a necessary thing, good, or bad, etc?
- Probe: What other technologies would you compare the Go-Pass to? (say a credit or debit card) and how do you think card usage impacts people's lives?
    - Probe: How do you think this changes the nature of money or of the interaction between people? – Do you think the use of plastic cards change peoples’ interactions?

12. From your perspective as a community programming coordinator, can you identify other social issues surrounding the use of the Go-Pass?

- Probe: Do you think the technology was designed for use by specific groups/users? (SES/class/employment status, race, gender, age, etc)
- Probe: (if yes) - In the same way, would you say its design ignores certain groups/users?

13. This question revolves around the personalization of the Go-Pass card - which is an option that Saskatoon Transit gives Go-Pass users to link their cards to their personal contact information in the case of a lost or stolen card. What are your thoughts on personalization of the Go-Pass?

- Probe: Do you think there are potential privacy or surveillance issues with this option? How do you think this information is used?

- Probe: Do those you provide transit passes for have the option to personalize the cards? Or would they have any need to personalize the cards? [Looking at the process - do the users give the cards back to be refilled?]
- Probe: In general, how concerned are you or your members about privacy? (i.e. Not at all, concerned, very concerned, etc.)

14. This is just a hypothetical situation, how would you feel if retina or fingerprint scans were used in the future? (Biometrics)

- Probe: In your opinion do you see this technology as plausible or being used in the future?
- Probe: What is your impression of this type of technology?
- Probe: Do you think this would change the nature of transit in another way?
    - (if yes) - In what ways?

15. How would you like information from this study to be presented to the public or Saskatoon Transit staff?

- Probe: What forms would be best? I.e. Videos, posters, websites, workshops, news articles, etc?
- Probe: What would be the best way to get the information out?

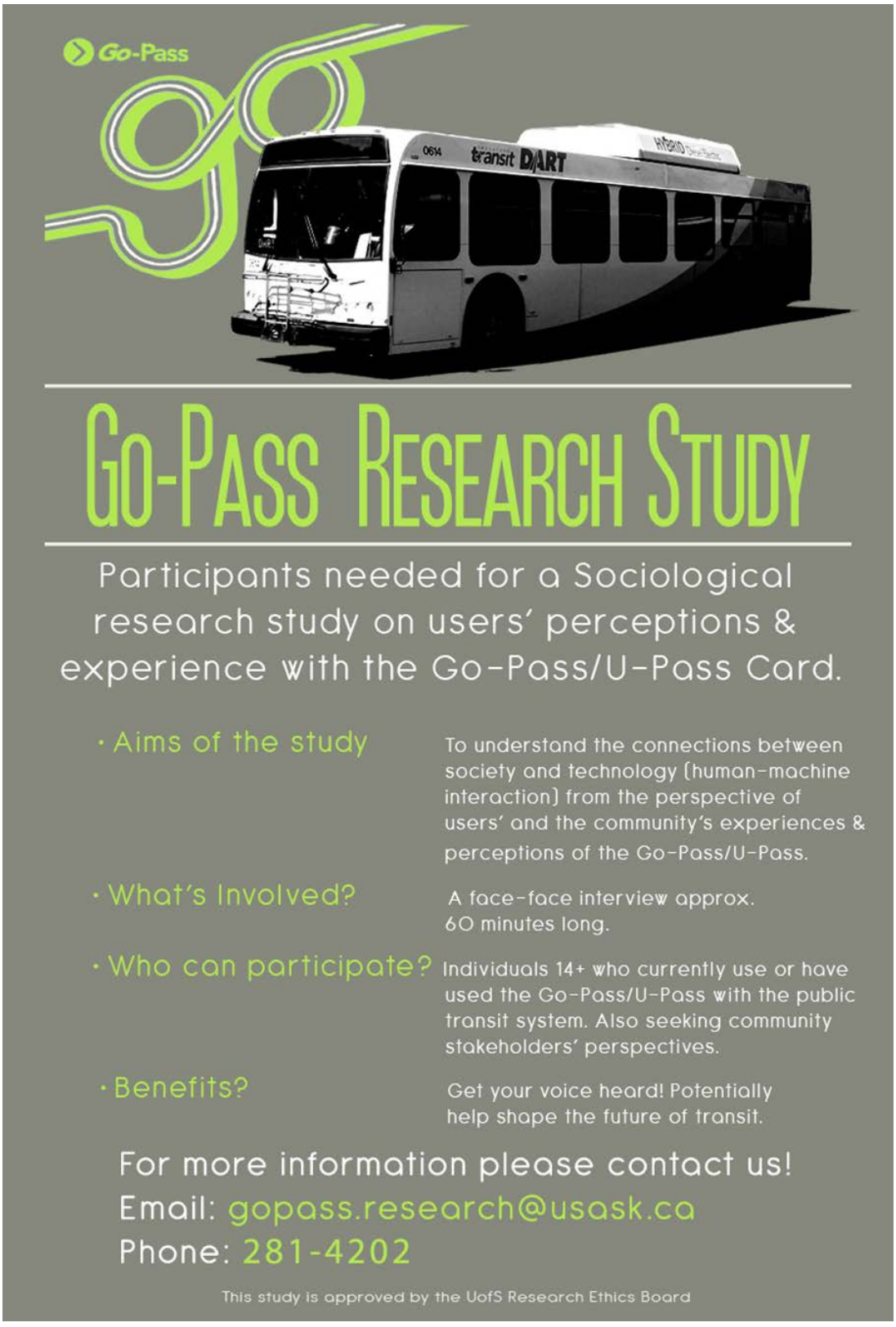
16. Before we end, is there anything I have not asked you in the interview that you would like to add?

- Probe: Any last thoughts, impressions, experiences, concerns, recommendations or stories you would like to share?

Just a few quick questions to wrap up the interview:

- Would you be interested in a follow up interview in the future?
- Do you think members that take part in your organization's programs would be interested in this project or participating? You had mentioned that other organizations might be interested in this project as well - could you identify specific ones that might want to be a part of this study?
- Thank you, those are all the questions I have. You will have access to the interview transcript for your own review as soon as it is transcribed along with a transcript release form. What is the best way to contact you and send the transcript?
- Do you have any questions or concerns before we strop the recording?
- I want to thank you for taking time out of your schedule to do this interview and for participating in this study, it is very much appreciated.

APPENDIX C
RECRUITMENT - POSTER ADVERTISEMENT



## APPENDIX D
## LETTER OF INVITATION

Dear potential participant,

I am Joelena Leader, a M.A. graduate student in Sociology supervised by Dr. Jennifer Poudrier at the University of Saskatchewan. I would like to invite you to participate in a research project entitled "Human-Machine Interaction: Perceptions of Saskatoon's Go-Pass Smartcard and Electronic Fare System". This study focuses on the interconnections between technology and society through investigating the experiences, perceptions and use of the Go-Pass smartcard technology used by Saskatoon Transit. The perceptions and experiences of Saskatoon Transit staff or personnel will be an important component to this research project that will assist in understanding the perspectives around the design, implementation and use of the new system. As an identified stakeholder your participation is viewed as a key resource that will help to identify enabling and constraining aspects with the use of technology for public transit, how this technology impacts the use of transit and would provide insight into the perceptions of those managing, using or working with the technology on a daily basis.

This research project involves a face-to-face qualitative interview that will take approximately 30 to 60 minutes to complete. Interviews will be conducted at a location preferred by the participant. The Qualitative Research Centre room at the University of Saskatchewan is available for conducting interviews if needed. The interview questions asked will relate to your own perspective and experience as a key stakeholder or representative of Saskatoon Transit. Your participation is voluntary and information shared in the interview will be kept confidential;

individual's names will be used in the analysis or results. You will have access to both your interview transcript and the final results upon completion.

If you are interested in learning more about this study, please contact me for more details by email at gopass-research@usask.ca. If you have any questions or would like to participate in this research project please feel free to contact me.

This research project has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on July 14, 2011. Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (966-2084). Out of town participants may call collect.

Kind Regards,

Joelena Leader

APPENDIX E
SUMMARY OF THEMES AND SUB-THEMES

| Major Themes | Sub-Themes | 1st level | 2nd level |
|---|---|---|---|
| **5.1. Shifting Human-Machine Roles & Relationships** | 5.1.1 Supervisory Machine & Passive Driver | 5.1.1.1 Machine as Active Authority: Beeps & Sounds of the Machines | *I) Slow Machines, Scheduling Pressures & Tensions* |
| | | 5.1.1.2 Automation & Passive Role of the Driver | *II) Loss of Communication & Interaction* |
| | | 5.1.2.1 Supervising Fare Collection & Making Decisions | *I) Scheduling Pressures & By-Passing Tech* |
| | 5.1.2 Re-establishing Supervisory Role of Driver | 1.2.2 Assisting Bus Riders | *II) Problem Solving & Testing Tech* |
| **5.2. Socio-Technical Construction of the Bus Rider** | 5.2.1 Legitimate Rider | 5.2.1.1 Verification Processes & Accuracy | *I) Neutrality & Non-Neutrality of the Go-Pass System* |
| | | 5.2.1.2 Fraud Prevention | |
| | | 5.2.1.3 Self-Surveillance | |
| | 5.2.2 Rider as Data | 5.2.2.1 Creating Digital Data Bodies | *I) Accurate Ridership Counts and Improving Services* |
| | | 5.2.2.2 Tracking & Storing Data as a Benefit and Concern | *II) Privacy Concerns* |
| | 5.2.3 Rider as Eligible Service Recipient | 5.2.3.1 Proof of Eligibility & Stigmatization | |
| | | 5.2.3.2 The Social &Technical Consequences of Ineligibility | |
| | | 5.2.3.3 Personalization as a Right to Service | |
| **3. Configuring Users & Technologies** | 5.3.1 Configuring the User | 5.3.1.1 Shaping Users' Practices | *I) Constraining Aspects* |
| | | 5.3.1.2 Adapting or Getting Used to the Technology | *II) Enabling Aspects* |
| | | 5.3.2.1 Users' Tinkering Practices | *I) Testing the Tech* |
| | 5.3.2 Configuring the Technology | 5.3.2.2 Re-shaping the Design | *II) Modifying the Tech* |
| **4. Structural Issues & Social Justice Implications of Technologies-in-Practice** | 5.4.1 System Design Limitations & Access Concerns | 5.4.1.1 Limited Reloading Locations | |
| | | 5.4.1.2 Removal of Paper Money & Tickets | |
| | | 5.4.1.3 Malfunctioning Technology & Dependence on Public Transit Services | |
| | 5.4.2 Lack of Communication & Education | | |
| | 5.4.3 Need for Bottom-Up Decision Making | | |