Pace, Ipro 321 Report April 29th, 2005

Final Report

321 IPRO | Social Network Analysis for Pace Suburban Bus Stakeholders

Table of Contents

Executive Summary

Pace, a suburban Chicago bus company, asked the question: How can riders be retained? Undergraduate and graduate students at the Illinois Institute of Technology sought to answer this question through investigating two routes (213, 422), using the North Shore Division as their laboratory.

Original research was developed including: observation and visual documentation of these routes, 46 ride-along passenger interviews and 14 operator interviews. Existing Pace research was reviewed and compared to the new research. In large part, the interview analyses supported Pace research. Differences may be a result of interview media (telephone versus live) and the number of respondents and their selection.

The interviews covered much territory with regard to the riding (passenger) or driving (operator) experience of participants. Their responses covered system attributes including tangible and intangible aspects of the experience: delivery of service, fleet and infrastructure characteristics, communication use and need, and the relationship and expectation between passengers and operators.

Concepts for rider retention were drawn from both sets of research and analyses, they relate to 3 areas of concern: Communication, Service, and Large System Concepts. Under Communication, ideas were developed regarding kiosks and their functionality, route naming and bus identification, maps, passenger feedback, and advertising. Under Services, ideas were developed regarding promotions, visibility and fun, connections to local businesses, and route and scheduling notions, particularly with regard to night service. Under Large System Concepts, ideas were developed regarding bus-only lanes and shelters.

Based on research results, the ideas are sketched out as possibilities without regard to cost or time. A more detailed examination of these ideas is necessary, including an analysis of their viability, and the development of prototypes along with passenger and operator interaction from a multi-user perspective.

Pace is forward-looking in its delivery of service and use of technology. Its primary competitor, the car, is a formidable opponent. Challenges for Pace are integration of service and communication, expansion of system visibility and transparency, together with implementation of best practices from other transit systems. These actions will support rider retention and encourage new ridership as well.

Introduction

Pace is a successful and forward-looking bus company operating in the suburbs of Chicago. However, the company is facing an inability to retain riders, for reasons that are not currently clear. All that has been definitively established is that Pace is losing its ridership not to other public transportation systems, but to the automobile. Needless to say, Pace would like to determine the root cause or causes of the retention issue, as it is currently a major financial drain. Pace has existing in-depth research to share with us; we will extend and supplement this work through additional research and analysis. Based on research findings, we will develop and model concepts that address retention enhancement. Our goal is to develop an integrated system that supports passengers and successfully competes with cars. In order to accomplish this, we shall not only seek to identify areas in which Pace is currently deficient, but areas in which Pace is currently superior to the car – it is our hope that emphasizing or enhancing these points will provide Pace with the necessary competitive edge.

Project Background

The Pace bus system covers a 6 county market, roughly the size of Rhode Island. It is part of the Regional Transit Authority that also includes the Chicago Transit Authority (covering all public transportation within Chicago city limits) and Metra train service (a city-to-suburb service). The system is rather unstable, as public funds to support public transit are limited and various parts of the system are forced into major restructurings due to financial crisis. (At the time of this report, for example, CTA is preparing to make massive cuts to its service.) Pace loses about 15% of its riders annually, accounting for a 4 million dollar loss. While new riders offset the loss, Pace would like to increase rider retention to insure long-term fiscal solvency.

From a passenger perspective, rider retention involves developing loyalty to the service based on satisfaction. From the perspective of Pace, retention requires delivery of service that meets or exceeds passenger expectation.

The task of Pace is made more daunting by the particular characteristics of its suburban market, as opposed to the urban environment served by most public transit networks. Transit opportunities are less extensive in both time and space as the population is dispersed over a greater area. The car has been instrumental in fostering suburban growth, and thus, the design of most suburbs is auto-friendly at the expense of public, or even pedestrian, transit. Without a car, one is likely to become isolated or even stranded in the suburban landscape. Confusing the issue further is the changing nature of suburban growth. What were once simply bedroom communities now have substantial, large-scale business development. People now not only commute from suburbs to city, but from the city to the suburbs and between suburbs for work opportunities.

Aside from practical considerations, cars continue to be emblematic of freedom for many Americans. While Pace provides an essential service in its environment, it is not "cool." Riding Pace simply lacks status. Cars provide amenities Pace does not and they provide an indication of social status as well. However Pace also has some advantages – the passenger has time to read, listen to music or sleep during a commute, has no worries about vehicle maintenance, and he or she causes less road congestion or environmental pollution for everyone. (Although this last, altruistic motivation does not compel a great majority of people in the way we might wish it to.) Thus, Pace faces-off with the car not only on an economic level, but on a very personal level as well.

Project Purpose & Objectives

The purpose of this project is to develop ways to assess rider satisfaction and probe rider values and complaints with a view to suggesting systematic change. As Pace drivers are ultimately responsible for service delivery, their experience and observations are also solicited to help us understand needs and possibilities.

Because Pace's system is too extensive for us to examine completely, two North Shore Division routes, 213 and 422, were selected as the study sites in agreement with Pace. These two routes became our laboratory for investigation. Our project objectives were twofold: 1) original research and analysis and 2) development of systemic rider retention concepts based on this research.

Research Methodology

The IIT Institute of Design believes strongly in user-centered development of ideas. In this case, the users are Pace passengers and the drivers who deliver the service. What follows is a schematic overview of the research process.

Getting acquainted with Pace service:

Visual documentation of routes 213 and 422—are route elements, and/or the Pace brand, visible?
Ride-along observation—what are passengers doing?
Visual documentation of bus interiors and exteriors

Interviews with random passengers on the two routes:

46 Interviews tape-recorded and literally transcribed
Passenger answers coded and clustered according to grounded theory (Strauss & Corbin, 1998)
- Initial coding for concept, property, dimension
- Analysis of initial coding for redundancy
- Axial coding of remaining initial codes

Patterns from passenger concerns developed into concept maps
Causal relationships identified and mapped using Atlas TI (soft ware)
Yes/no responses quantified and graphed

Interviews with operators:

14 interviews tape-recorded and literally transcribed
Answers analyzed using grounded theory (see above)
Causal relationships identified and mapped using Atlas TI

Team Organization

The organization of this project required reconfiguring teams several times based on the projects task needs at the time. As a consequence, the list of teams and participants is rather extensive. To the extent possible, students' interests in specific parts of the project were respected; membership in a given team was almost entirely voluntary. The list below displays the teams and their members along with each team's tasks.

Initial teams

Conducted passenger interviews
Transcribed interviews
Performed initial coding

Members
Class

Team Local

Developed questionnaire for passengers
Organized logistics to cover two bus routes
Analyzed passenger responses and visualized
Developed questionnaire for drivers

Members
Alexis Dulinskas (leader)
Young ae Hahn (t.a.)
Joseph Hart
Griva Patel

Team Express

Developed identification badges for students for ride-along interviews
Created posters announcing driver interviews
Examined technology possibilities (GPS, Cellphones, etc.)
Provided visual documentation of bus equipment

Members
Geoff Colbath (leader)
Carmelina Piedra
Stacie Sabady
Papinya Thongsomjit

Team Owl

Examined other transit systems
Brainstormed ideas

Members
Rahul Dronamraju (leader)
Nivedita Basu
Nathanial Block
Lenka Cechova
Rinku Gajera
Hannah Schubert
Douglas van der Molen

Design Synthesis Teams

At the midpoint of the project, the initial teams dissolved and reformed into new task teams based on research and design synthesis activities.

Driver Transcriptions
Class

Driver Interviews
Nathanial Block
Geoff Colbath
Griva Patel
Stacie Sabady

Driver Interview Coding & Analysis
Nivedita Basu
Young as Hahn
Rinku Gajera
Stacie Sabady

Overall Coordination of Final Deliverables
Douglas van der Molen
Griva Patel

Deliverables
Website: Geoff Colbath
Poster: Geoff Colbath, Young ae Hahn
Project Report Editor: Joseph Hart
Project Report Design: Griva Patel
Presentation Director: Douglas van der Molen
Research Report: Nivedita Basu, Rinku Gajera, Young ae Hahn

Pace Promotion
Rahul Dronamraju
Alexis Dulinskas
Griva Patel

Information Management
Nathanial Block
Lenka Cechova
Stacie Sabady
Papinya Thongsomjit

Smart Route
Nivedita Basu
Joseph Hart

Shelters
Geoff Colbath
Hannah Schubert

Bus Only Lane
Carmelina Piedra
Douglas van der Molen

Project Barriers & Obstacles

Student Perspectives

The greatest external obstacle to our project was time. The extensive analysis on the interviews that was demanded of us would have been more useful for a project lasting a year or longer, as performing the analysis occupied most of our productive time. Many of the design team reports below refer to this problem when they recommend further research to properly implement their concepts – this IPRO simply cannot be completed, in the sense of producing a viable change, in a single semester.

Exacerbating the time issue was the sheer size of our group, which led to inevitable failures of communication between members. Some work was needlessly duplicated, while other work ultimately had to be cast aside because the parties thought to be responsible for it failed to deliver. This issue was most noticeable during the grounded theory coding stage of the project. Grounded theory is only valuable if the same basic coding criteria are applied through all the interviews being studied. However, as it was not feasible to have all members of the group code their ride-along interviews at the same time, each person coded his or her interviews in isolation, resulting in unacceptably divergent criteria. Ultimately the initial coding had to be scrapped entirely and redone by the four members of Team Local, which delayed our progress as the other members of the group were left largely idle, having nothing to do until the research results were in. It was partially because of this setback that the group reorganized itself after the midterm report into small design teams which could operate largely independent of each other – allowing the second portion of the project to run much more smoothly than the first.

Faculty Perspective

Pace has been a responsive and engaged sponsor for the project. One problem we faced was the time lag between requesting permission for access and getting the okay. This was not anticipated in scheduling the project. As a result we were not able to fulfill all the research we originally planned to do. Specifically, we did not get to perform the in-depth network analyses as the aforementioned delay only left us time for the interviews and their basic analysis.

We had also considered a before and after interview series with passengers as we knew, going into the project, that the routes under investigation would change. This change, however, happened too late for us to go back and do additional interviews.

Collectively doing original research posed another obstacle. I did not give sufficient attention to setting up systems for gathering and analyzing data. When constructing interview questions and performing the actual interview, students often depart from the structure provided and improvise based on the interviewee's response. This can result in a better, more informative interview, but it also results in more time spent organizing the information into the analysis structure. Simple things, like not numbering the questions in the transcriptions, lead to time needlessly spent fixing the omission, and collectively, this brings much frustration. I needed to provide simple, clear instructions and to emphasize over and over again that the system must be followed.

Along these same lines, when students failed to meet data delivery deadlines, it slowed the entire process down or we had to forget their data in order to move on. We did lose some data due to tardiness.

The last obstacle was time itself. Analysis of qualitative information is time consuming and continued almost up to the end of the project. This meant that design synthesis had to occur before all the research results were in. While one can get a feel for what the results might be, it is really better to have some firm conclusions and build an integrated solution from them. In our case, however, the retention ideas and research had to run in parallel. A way out of this dilemma would have been to focus only on research and its results. However, bringing research results without actionable ideas to accompany them would not be a satisfying result for this workshop.

Research Results

1. Overview

Collected data from both passengers and operator interviews were coded using the Grounded Theory process. Grounded Theory is a methodological approach that supports distillation of information and theory generation from qualitative data. The term "grounded" means a theory deductively emerges from collected data that are in general textual in format. There are three steps of coding in Grounded Theory: open coding, axial coding and selective coding. Among them, the first two process, open coding and axial coding were used to find major concepts expressed in interviews and the causal relationships between them. The codes were summarized using idea maps and causal network diagrams, generated by the software Atlas.ti in later steps of analysis.

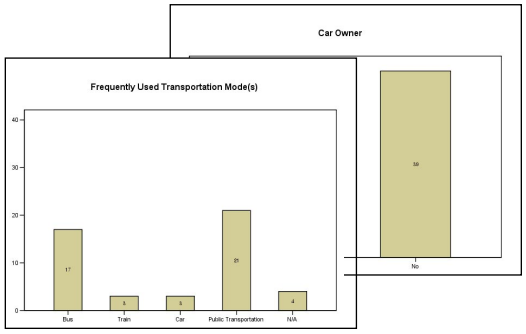
Open Coding of Interviews

Example #2: A property and its dimensions

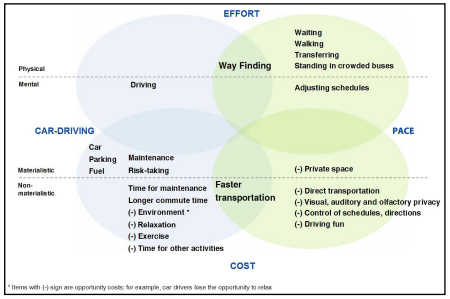
(Connectivity- Bus to Bus | Bus to Train)
Property Dimensions of the property

Example #3: A concept coded with a property and its dimensions

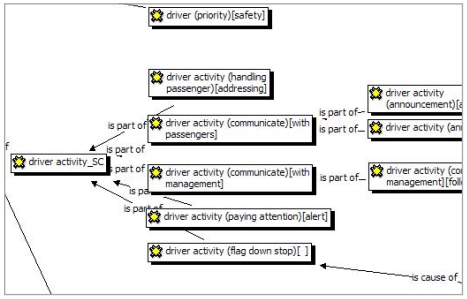
(Use of Pace Service: Frequency – Never | Rarely | Often | Frequently)
Concept Property Dimensions of the property



Frequency Analysis



Idea Mapping

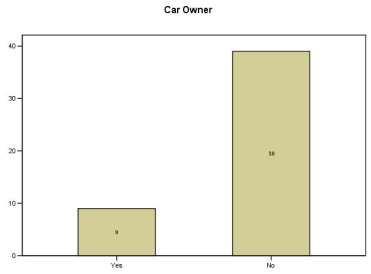


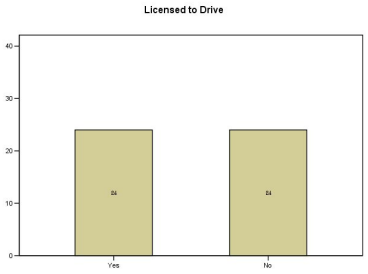
Causal Network Diagram

Research Results

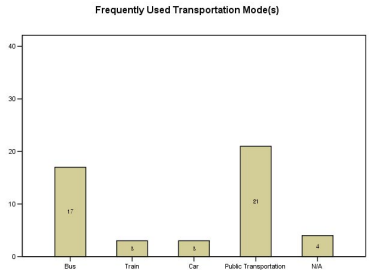
2. Frequency Analysis

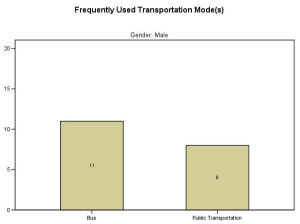
Part of the data collected from passengers interviews are answers to simple yes/no questions that are quantifiable. The answers are summarized through frequency analysis. This process helped the research team identify general characteristics of the interviewees in terms of their major means of transportations. Also their use of information technology was partly covered by looking at how many of them are internet users or cellphone users. Other questions are about their preferences on some aspect of Pace service, such as where they prefer to have time tables. For some of the answers, gender differences were observed.

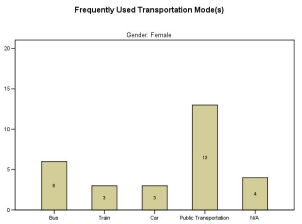




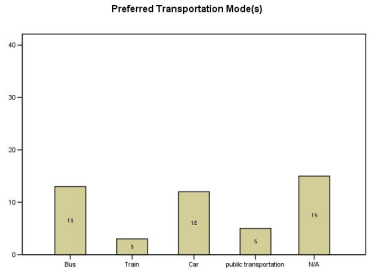
About 80% of the interviewees don't have a car and public transportation was their only mode of transportation for commuting.

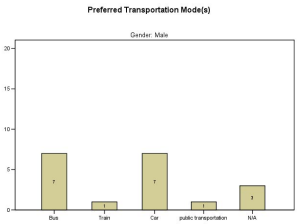


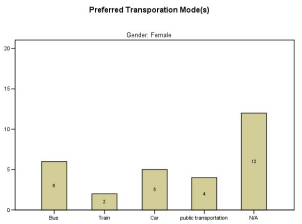




Public transportation was the most frequently used mode of transportation, with female interviewees answering in detail.

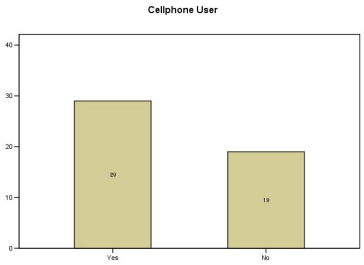




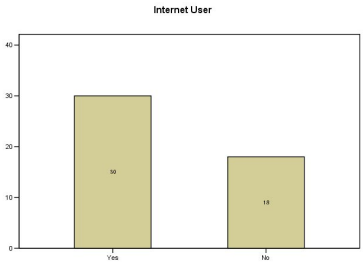


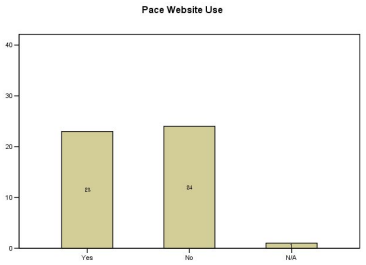
Car and bus were almost equally preferred, but relatively more male interviewees preferred the car.

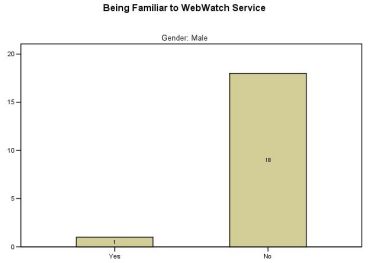
Research Results



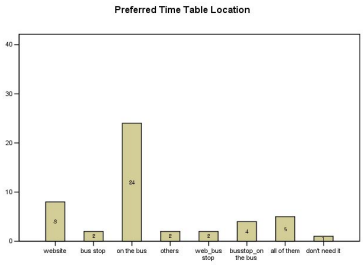
About 60% of the interviewees use cellphones.

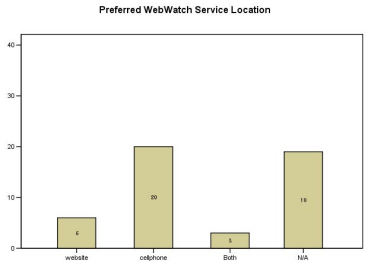






About 60% of them use the internet, but only half of the internet users had ever visited the Pace website. Webwatch service on the site was not well recognized by them either.





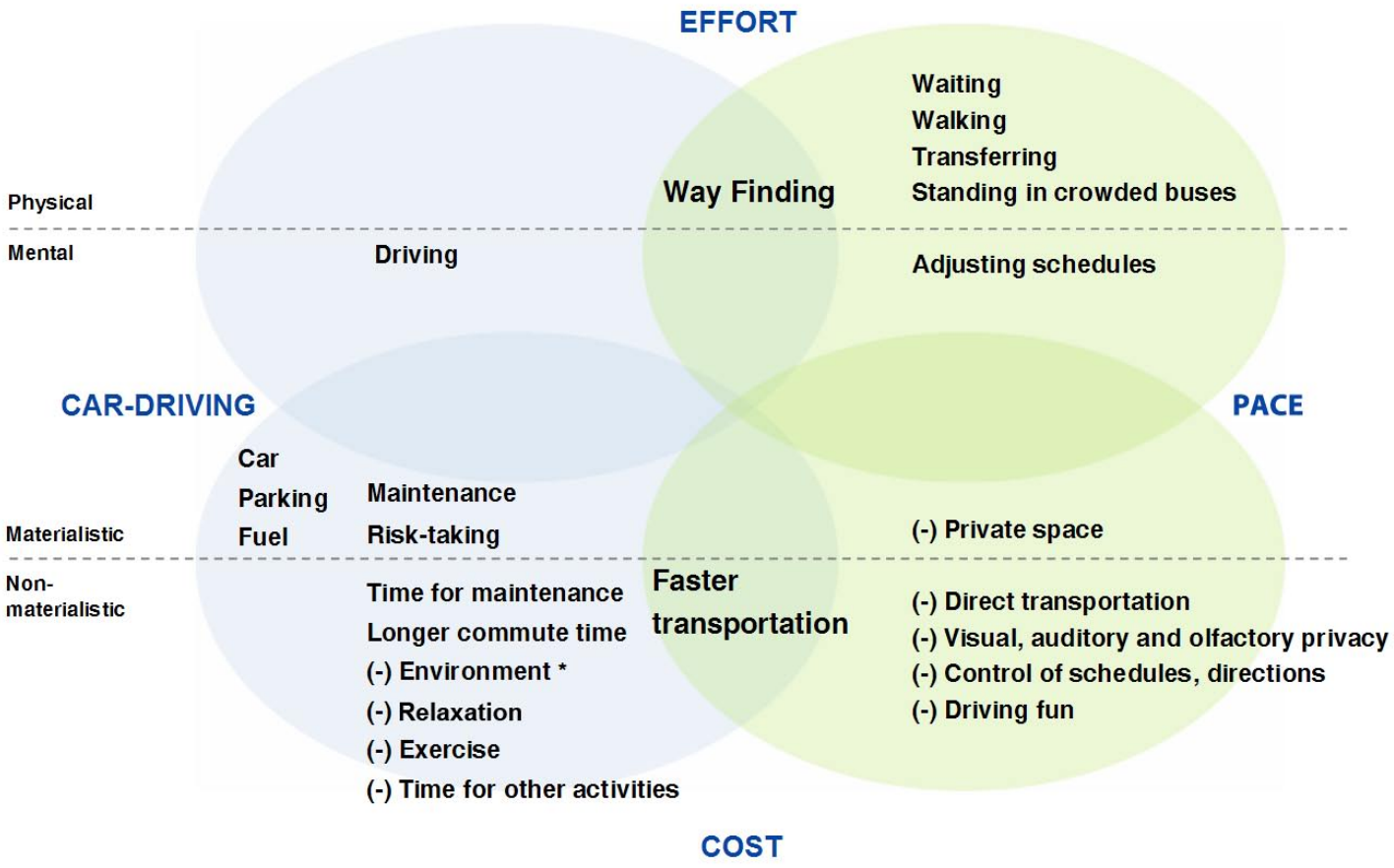
Preferred access to schedules is on the bus, and Webwatch service is preferred on the cellphones rather than through a website.

2. Idea Mapping

Qualitative data collected from both passenger and operator interviews were summarized using the idea mapping method (also called concept mapping), and the results were summarized into 8 maps. Major concepts described in the interviews were compared in each map.

Idea Map 1: Car - Pace Experience Comparison

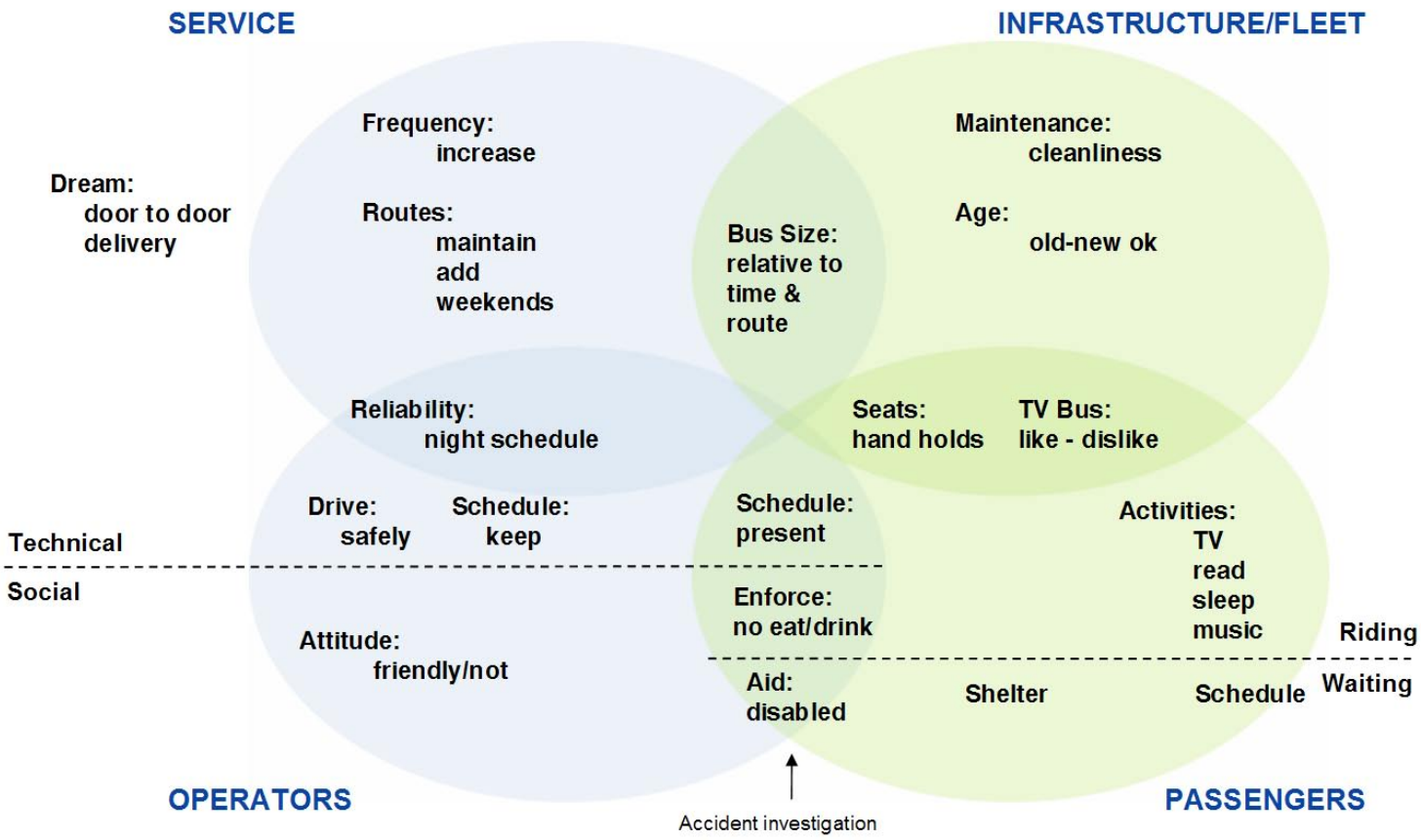
The experience of riding Pace and car driving is compared in terms of cost and effort for passengers and drivers.



* Items with (-) sign are opportunity costs; for example, car drivers lose the opportunity to relax

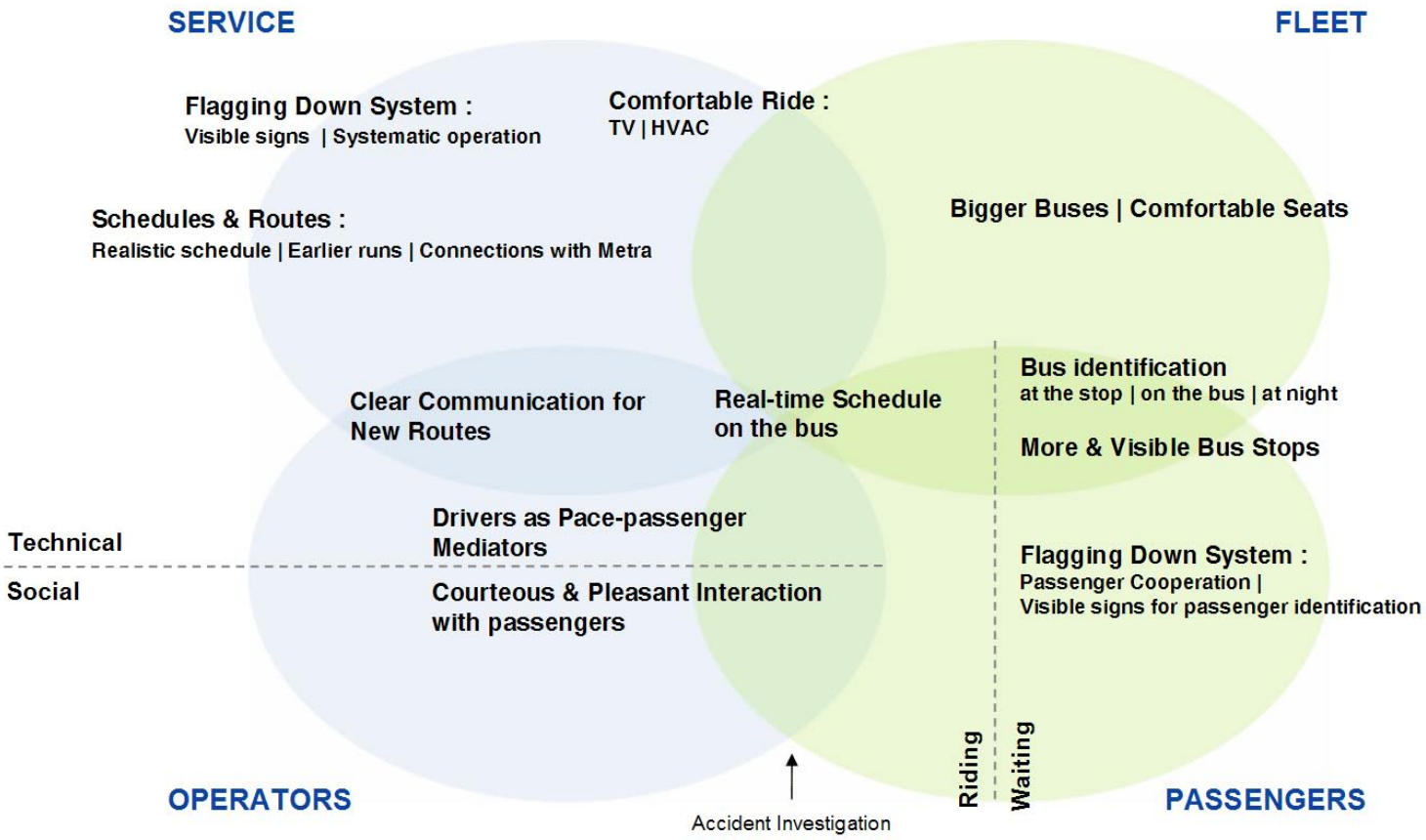
Idea Map 2: Service Improvability from Passengers' Interviews

Passengers' suggestions to Pace are categorized into 4 groups: service, infrastructure/fleet, operators, and passengers.



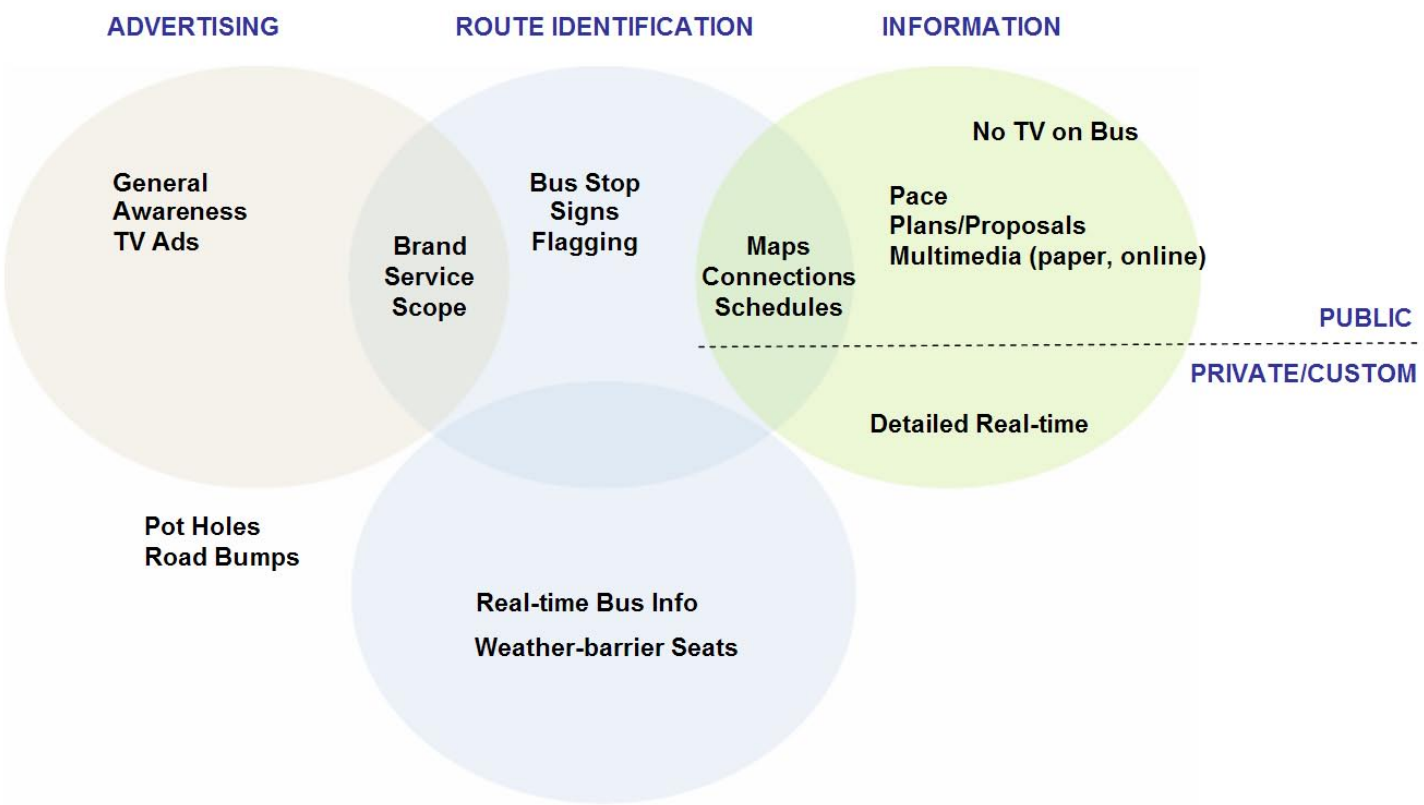
Idea Map 3: Service Improvability from Operator Interviews

Operators' suggestions to Pace are also categorized into 4 groups: service, infrastructure/fleet, operators, and passengers.



Idea Map 4: Information Gathering and Communication

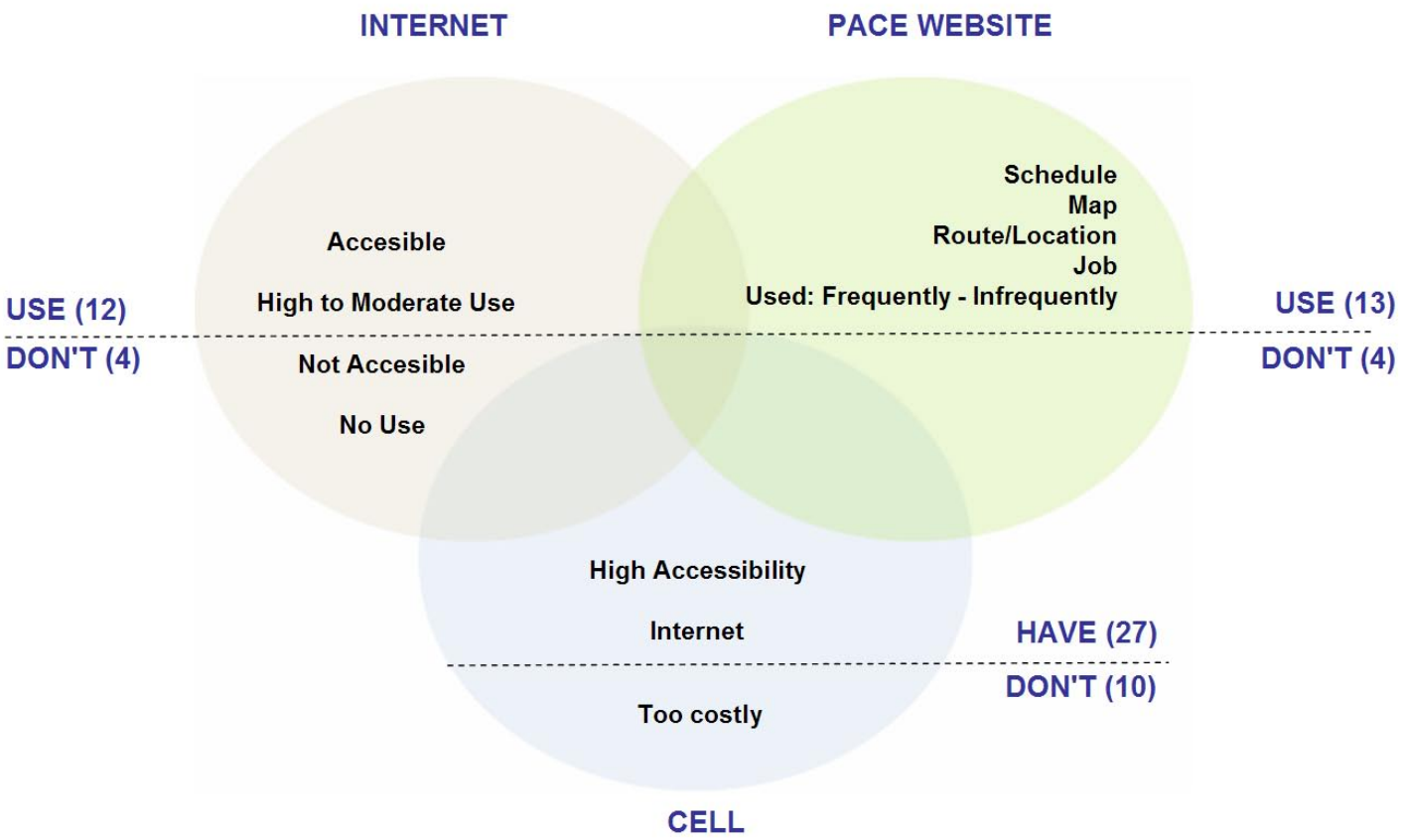
Current services for information and passenger communication were categorized.



Research Results

Idea Map 5: Sources for Pace Information

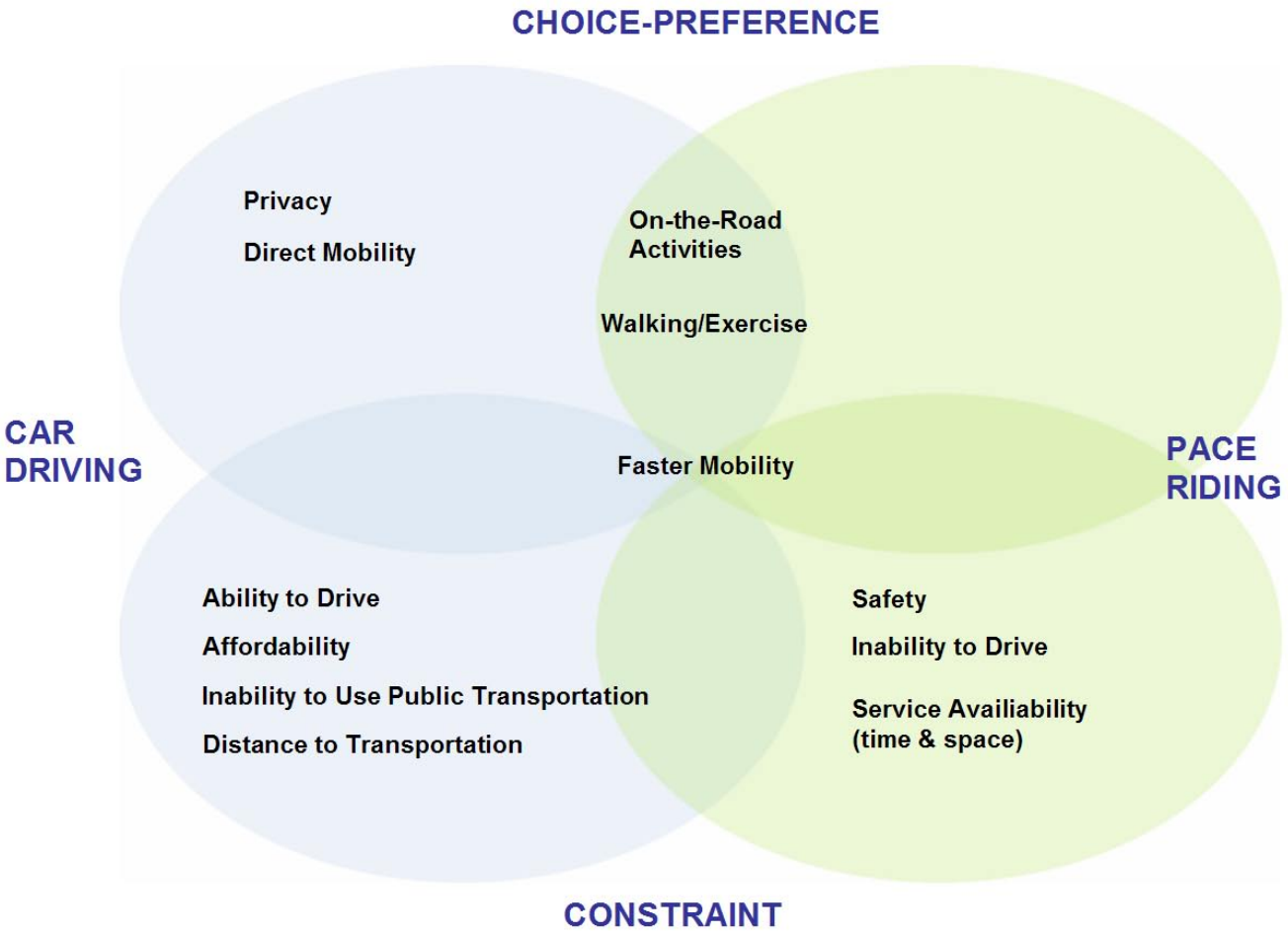
The passengers' usage of different sources of Pace information was analyzed.



Research Results

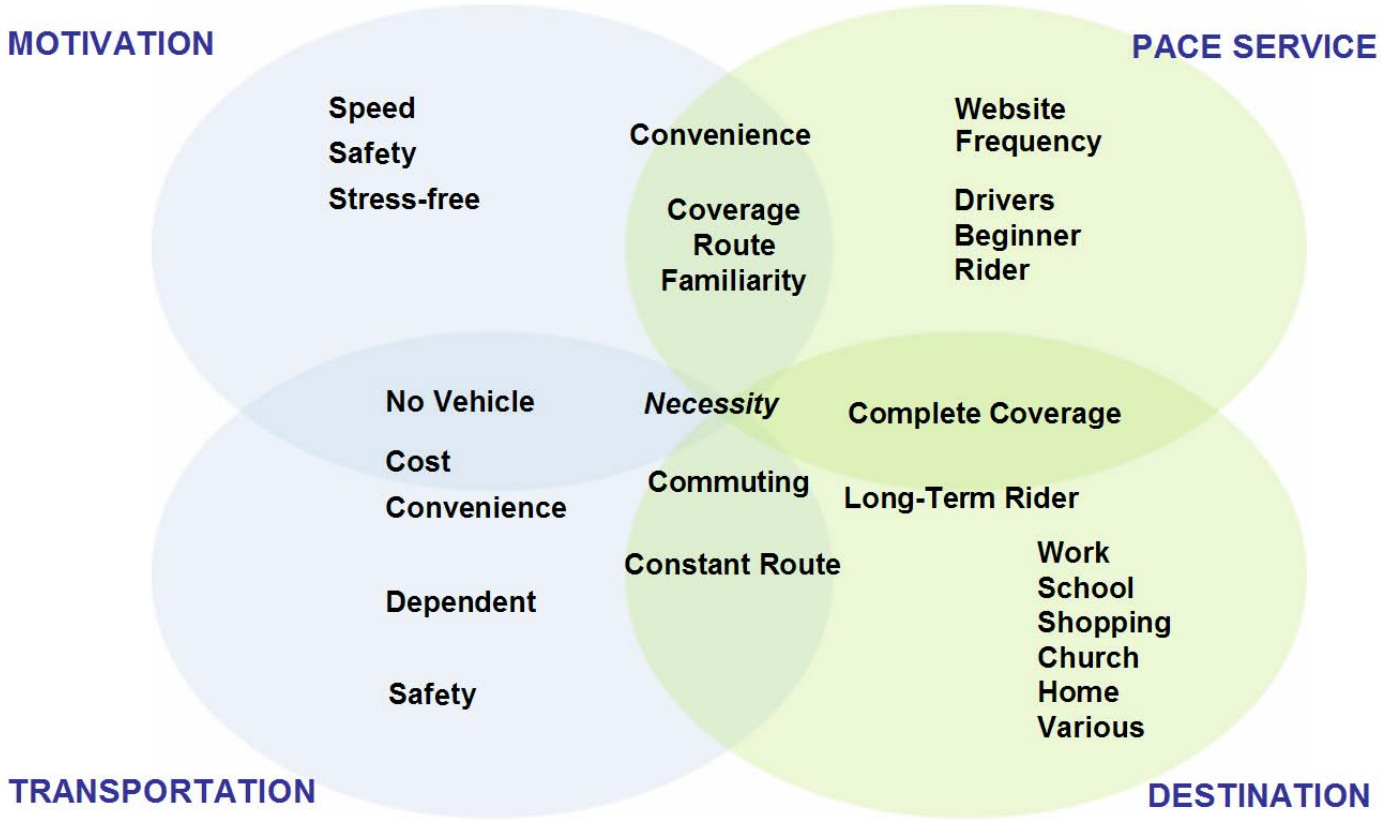
Idea Map 6: Preferences and Constraints in Choice of Transportation

Passengers' choice of transportation were analyzed with constraint and preference factors.



Idea Map 7: Ride Pace

Passengers' motivation behind riding Pace was analyzed.



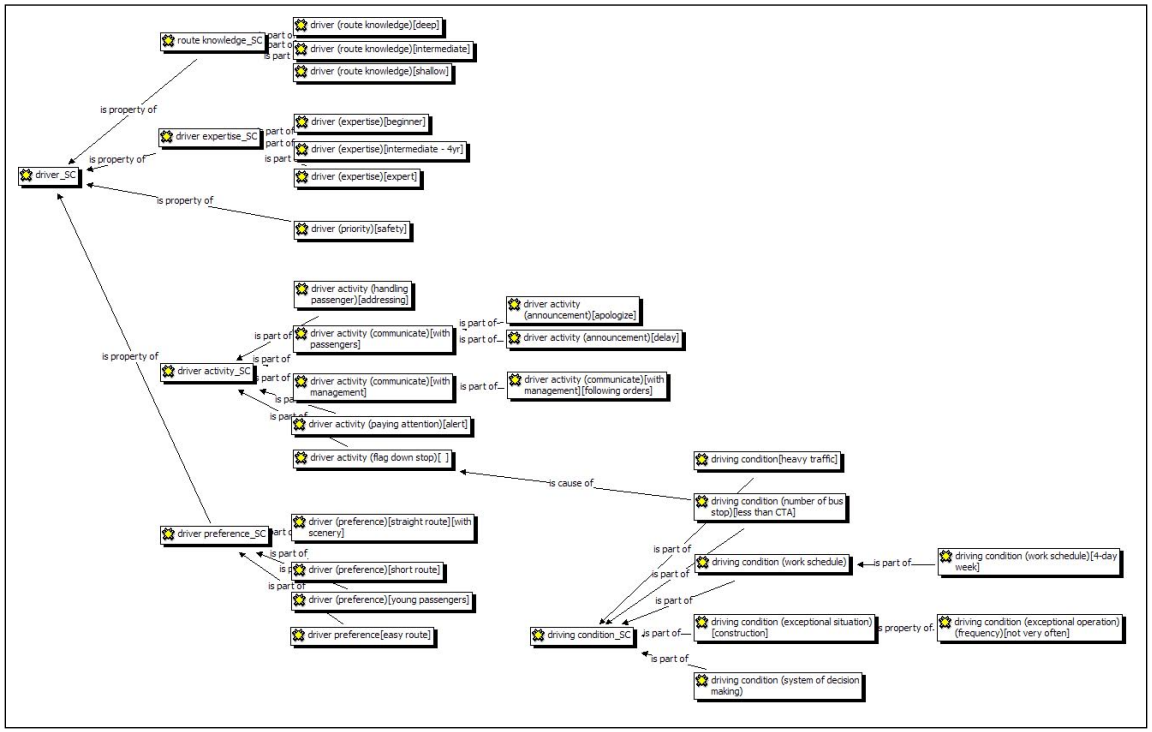
Research Results

3. Causal Network Diagram

Causal network diagrams are the visualization of the axial coding process. The purpose of causal network diagrams is to describe the causal relations between phenomena that are often hidden or incompletely perceived.

Causal Network Diagram 1: Operators' Activities and Preferences

Operators develop their own preferences for passengers and routes. They prefer straight, short routes with scenery. They also prefer young and sociable passengers, and are willing to have a more positive relationship with them. Certain driving conditions lead operators to adjust performances; traffic congestion prompts operators to communicate with dispatch to decide on deviation from normal route. Operators' main activities are driving, communicating with passengers and dispatch, and regulating passenger activities in some cases.



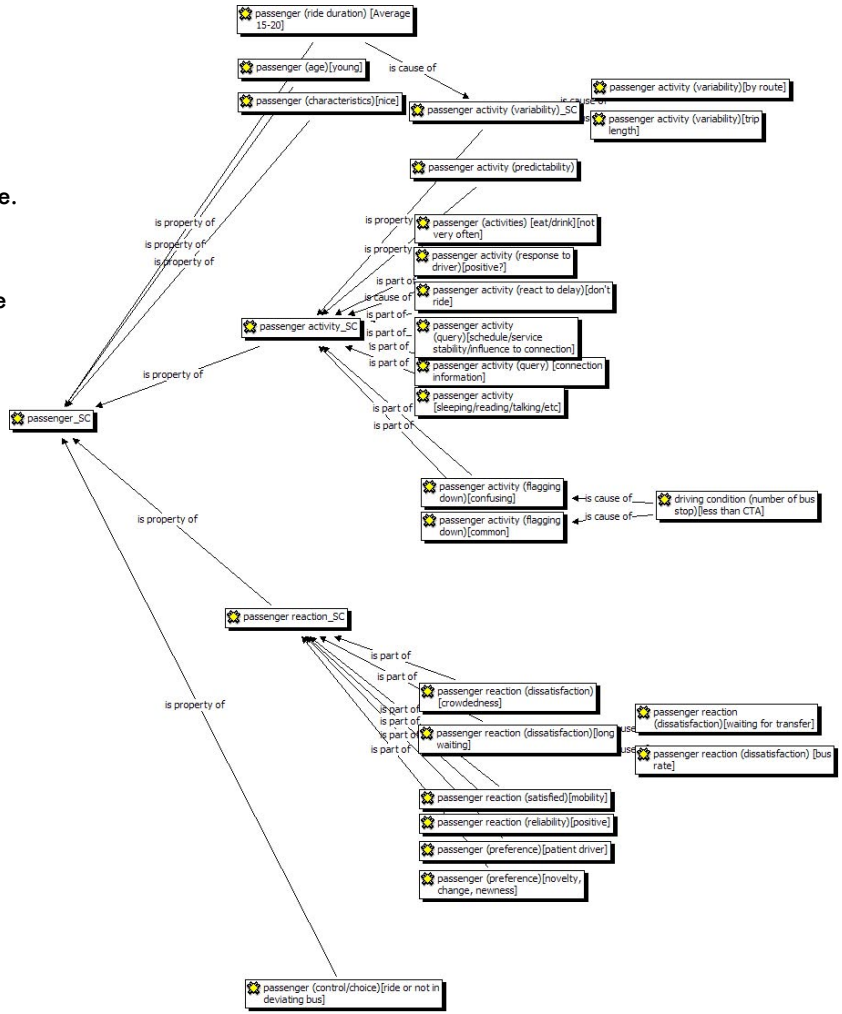
Research Results

Causal Network Diagram 2: Passengers' Activities and Preferences

Passengers are satisfied with operators' service and some features of new buses, such as comfortable seats. They are, however, dissatisfied with unreliable schedules and long waits - especially between Pace and Metra riding. Improved connectivity between Pace and Metra is needed.

Passengers engage in various on-the-bus activities, and some of them cause privacy issues. For example, eating and drinking food on the bus makes other passengers uncomfortable when it is too smelly and messy. For that reason, some passenger activities are regulated by drivers, with most passengers being very cooperative.

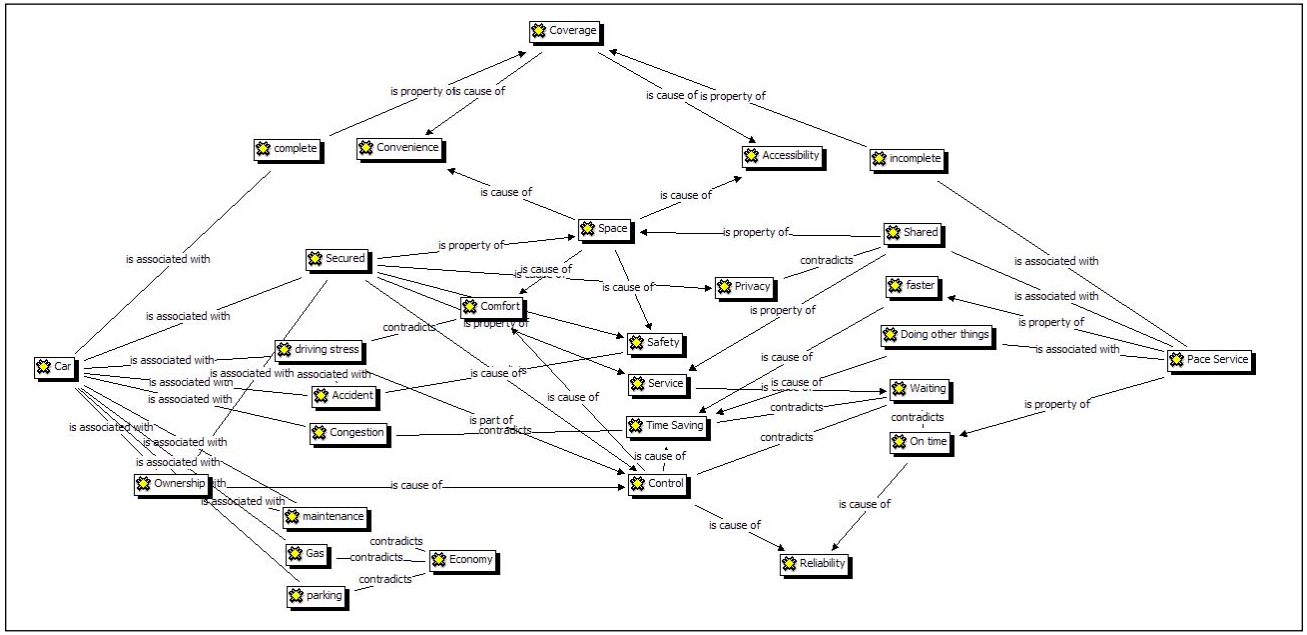
Passenger activities vary by route and trip length. In some cases, passenger demographic characteristics are predictable for a route and the time of day regarding students or commuters.

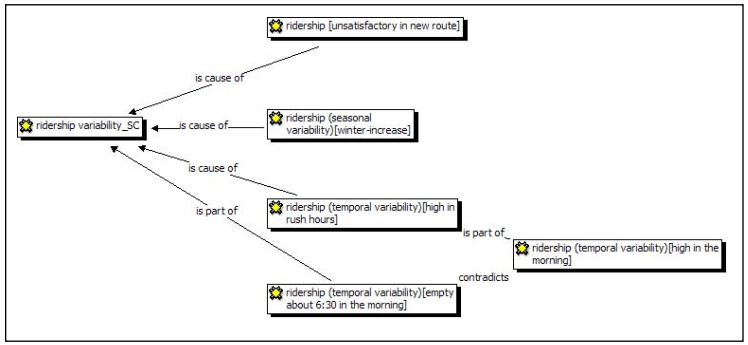


Research Results

Causal Network Diagram 3: Choice in Modes of Transportation

Ridership varies by season, day of the week, and time of the day. The underlying cause of the ridership variability is socio-economic factors such as vacation for students or the ups and downs of the regional ecomony. From the micro point of view, when people have a choice between Pace and car, they consider factors such as cost, safety, service reliability, convenience and comfort .





Concepts & Next Steps

1

2

3

4

Concepts emerged from the various research activities and results. This section is organized by design team, as each team focused on a separate potential aspect of Pace improvement. Each team reports its findings and proposed resolutions below.

Information Management

Through our research we found that passengers were occasionally confused by the way Pace publicizes its routes and brand. To develop a better visual communication of Pace to the customer, we are suggesting the following strategies of improvement.

1 Informational management kiosks: These kiosks, located at major transfer points, would be designed to help the Pace passenger gather needed information about Pace services quickly and efficiently. The kiosks would hold necessary information about the Pace system, offering schedules and maps with emphasized landmarks and events on relevant routes. The maps and schedules could be printed directly at the kiosks with a selection of different languages. Furthermore, kiosks could function as a trip planner, employing RFID enabled smart cards that would remember passenger route preferences and double as transit cards.

Next Steps: To develop well functioning kiosks, currently available technologies need in depth examination. Kiosks need to be prototyped and tested by a variety of users. Subsequent improvements need to be made based on testing results.

2 LED Displays: LED displays would be located on the bus as well as at major bus stations. Pace passengers would benefit from these displays by receiving information about a current time, date, location, a current and next stop and landmarks that are closely located from the particular route. LED displays located at bus stations would contain a current time, date, arrivals, and departures.

3 Advertising: Pace may use the local media, such as newspaper, TV, radio, Internet, and locations on the route itself to advertise itself. Current Pace advertising can be extended into ads placed on ceiling panels, seat covers, shelters and print materials. To raise money for advertising, Pace can link with local business to increase revenue. This can be accomplished by placing more ads on Pace buses.

Next steps: Explore joint ventures with local businesses that benefit from Pace access. Consider trading advertising space.

4 Further exploration and identification of route names: Clearly stated route names can eliminate current confusion amongst passengers. To support a better communication between Pace and passengers, Pace should use numbers with name descriptions on buses and provide more details if necessary (i.e. from current 213 into 213a and 213b or 422 into 422 Lake). Using this renumbering and renaming strategy, the passenger can better identify where and which direction the bus is going. Additionally, a touch-screen electronic device could be placed on the bus behind the operator's seat providing an overview map of the bus routes.

Next steps: Identify the logic for numbers and names, identify landmarks, and prototype the scheme. Submit the prototype numbers, names and destinations to user testing.

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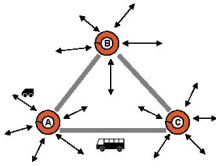

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5 Feedback boxes: A feedback box is a tool that would help Pace to better understand the needs of its passengers. The box would provide a double-sided card on which a passenger can fill in comments regarding Pace services. Additionally, by providing an address the passenger will be automatically included in the reward lottery (i.e. coupons to local business, free tickets), described in the reward teams report below. This feedback box would be placed on the bus, at bus stops and kiosks.

Next steps: See joint ventures with local businesses above.

Service

6 Smart Routes: The concept of Smart Routes as developed by our group stemmed from two observations made in the original research. The first was that many passengers cited a desire for more service on the weekends and late at night. Pace's lack of

service at these times is currently a major reason for its inability to compete with the car, as people who may have to travel at very late hours do not want to risk being stranded. The second observation came from one rider who idly pondered having door-to-door Pace service. This was initially dismissed as a dream, and indeed there would be little point or value in instructing Pace to transform itself into a taxi service. However, on further reflection, the door-to-door service could be applied to these late hours, when objectively it would be most valuable. "Smart Routes" is this concept. We believe that, instead of writing off the later hours of the day because so few people would take advantage of them, Pace can take advantage of low ridership at these times to provide more individualized service.

There are two proposals for implementation of this concept:

7 Variable Routes: Since all buses have a direct radio connection to a central dispatch office, it would be possible for late-night riders to call this office, informing them of where they are and where they need pick-up. Dispatch could then direct a bus to vary its usual route accordingly. Due to the expected sparse ridership, we believe it would be possible to send a single bus to cover what would be multiple routes during regular business hours. Thus, Pace could provide a valuable service for a fraction of the gasoline and labor costs of its normal service.

8 Hub and Spoke: The other possible implementation would take advantage of the existing Pace van fleet. In this model, only certain major bus routes would be kept in operation during late hours, to serve as trunks between Pace depots. A small fleet of vans would be in service at these depots, and they would be charged with picking up riders at their exact locations and taking them to the depot, or from the depot to their home.

In addition to extending service into areas where it does not currently exist, we propose that Pace should run smaller buses more frequently on its heaviest routes. We make this suggestion based on the ride-along interviews – nobody complained about the size of the buses, but many cited long waiting times as a complaint, and a major reason for switching to auto transport.

Concepts & Next Steps

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Nest steps: Should Pace choose to proceed with the Smart Routes concept, the next necessary step is self-evident. More research is needed to determine which routes are heavily traveled enough to benefit from more frequent service, or conversely which routes could be scaled back to offset the costs of Smart Routes. Furthermore, it should be determined in which times and areas Smart Route service would most likely be taken advantage of. For the former purpose, we suggest simply providing each Pace operator with a tally sheet to record how many passengers use his or her route each time. A similar method can also be used for the latter purpose, if Pace runs currently non-existent routes on an experimental basis, making sure to well-advertise the experiment beforehand, thus insuring an accurate count of how many people would make use of these routes and times. (Pace may even find that some currently unserved time slots would, in fact, warrant full service.) Once this rider density data is collected, the information forms a basis for a detailed implementation plan for Smart Routes.

Rewards

Our group considered what types of rewards Pace could provide their riders in order to help maintain retention. Several concepts were developed and more are possible.

Ticket machines: One possibility involves placing ticket machines directly on the bus. This way, if the passenger buys their bus fare directly on the bus, they can receive a special deal. For example, if a passenger buys six fares, they can receive their seventh fare free.

9 Local Businesses: Another possibility is incorporating local businesses into the Pace system. For example, a passenger could ride ten times and get a free cup of coffee. The hypothetical coffee shop would be one that is found along the bus route. Furthermore, Pace can incorporate local businesses into their route through special promotions. Pace could sponsor certain charity events or concerts by offering free fare or half-fare rides to that event.

10 Customer appreciation: Fliers could promote special events such as holidays, community events, or to celebrate Pace's anniversary. Finally, a "Fun Fair" could be held at Pace's office. The fun fair would provide entertainment for young riders, while providing their parents with information about Pace services, and perhaps helping passengers to become knowledgeable about different routes.

11 Rewards on the bus: A possibility in this regard is a "fortune cookie." The idea involves a machine placed at the back exit of the bus, where passengers could pull a piece of paper in order to receive their fortune. However, occasionally, a passenger could receive a free ride. In addition, the bus could support a 1000th customer reward. For every 1000th passenger, a coupon could print allowing for that passenger to receive a free ride. An expansion or variation on this idea would be to provide the 1000th customer with a small gift, such as a totebag, T-shirt, or hat. (The gifts, would, of course, bear the Pace logo to further spread and promote the brand.)

Next steps: These ideas need to be evaluated with regard to their cost and feasibility. Some would be easy to implement.

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Concepts & Next Steps

Large System

12 Bus–only: Transportation users feel most comfortable in their cars. Most do not feel the need to use public transportation because they have to abide by other someone else's schedule, which is inconvenient. They feel it is much faster to get where they need to go in their own vehicles. Our proposed solution would be to add bus lanes on roads that can accommodate them. Bus-only lanes are designed to give exclusive priority to buses, which improve bus services for passengers. They are used to keep unwanted traffic out of an area while allowing the operation of a bus service on a direct route that is attractive and faster for passengers.

Other benefits include:
Connectivity – Faster and better connections to other transit routes and regional service including Metra and the CTA
Accessibility – Faster travel times and better connections to destinations within the suburbs and improved access to downtown Chicago
Efficiency – Simplified routes with fewer stops and higher capacity vehicles with on board technology that allow the vehicles to travel faster and reduce waiting time at stops
Aesthetics – Landscape and urban design features designed to complement the transit features and connect the system to the surrounding communities

Bus only lanes can be used in a variety of different situations:

- To help restrict access for general traffic and allow buses to operate better on their routes
- To enable buses to bypass congested junctions
- To allow buses to get through residential areas, industrial areas, and business parks quickly and easily while preventing unwanted through traffic
- To maintain bus routes where a new road has been built or a traffic management plan has been proposed

Other states like California have been able to make bus only improvements using a four-phased improvement plan. Pace can and should use a similar plan. Cities using bus lanes include: Chicago (bus lanes on LaSalle during rush hours), Seattle, San Francisco, Sydney, and London to name a few.

Next steps: Investigate data from cities using bus-only lanes with regard to improved ridership, reduction in pollution, etc. Explore the possibility with local authorities.

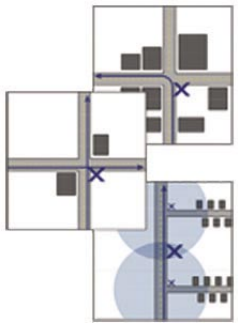
Shelters

Research and analysis of the Pace Bus System revealed grossly insufficient coverage of routes with bus shelters. The demand for shelters by the Pace passengers is great (as seen from the interviews). Bus shelters serve two functions: as a clearly visible, stop on the route and as a shelter to protect the waiting passenger from inclement weather. While some dedicated bus shelters currently exist, they do not exist in sufficient numbers to satisfy the demand by the passengers, nor do they display a coherent identity. Shelters

would provide a service that is in high demand by Pace's current passengers.

We propose to integrate the construction and maintenance of the bus shelters with local businesses. The shelter space would be offered in exchange for the chance to provide other services – coffee stands and newspaper vendors, for example. Pace could also partner with the school districts and the school bus system to plan locations of shelters based on population distribution. Therefore both Pace passengers as well as schoolchildren would benefit from a common effort.

Concepts & Next Steps



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13 As an implementation strategy, we suggest following a hierarchical structure of possible bus shelter locations: The town centers should be addressed first, as they are major community points, and thus the most crucial places to tie-in with. After that the major intersections, especially where a transfer option between two or more Pace routes exists, should be supplied. After these are appropriately covered, higher and lower density residential areas should be provided with at least one sheltered bus stop within a reasonable walking distance.

14 Our communications with Pace officials revealed that the largest obstacle in the construction of new bus shelters is the lack of cooperation by municipal authorities. Since Pace operates in the suburban area around Chicago, the company has to deal with numerous separate municipalities that have varying ideas and wishes. According to Pace, the municipalities often refuse the construction of a new shelter due to liability issues or because they are perceived as an eyesore. In order to change this mentality within the municipalities, we propose implementing "guerrilla" tactics to engage the community with the design of new bus shelters. Pace could put on shelter design competitions, and propose to implement the winning designs in each community. This process would strengthen Pace's ties with the communities and hopefully reduce opposition to the installation of shelters, as well as add to the identities of the communities themselves.

Next steps: In our research we focused on the passenger and operator side of the Pace bus service. In order to gain some insight into the issues concerning bus shelters, specifically the construction of new bus shelters and the obstacles created by the municipalities towards them, it is necessary to extend this analysis to the communities. Perhaps IPRO participants can facilitate communication between Pace and municipal governments as a "neutral party." This would involve two major tasks. The first would be to conduct research on the communities that have built shelters. Questions should be asked concerning the success of the implementation, the economic impact on the surrounding area, negative experiences and issues like increased crime, damage, or homeless occupation.

The potential of bus shelters as points of identification within the community and orientation for visitors should also be investigated. Meanwhile, a thorough analysis of the non-sheltered communities and reasons why municipalities have refused to give permission to the construction of new bus shelters is necessary. After this is done IPRO participants could assume a mediator position and offer insight on better communication and cooperation between Pace and the municipalities to offer a better public transportation service to the citizenry.

A different approach would be to select a study community and explore the idea of a community competition to design a shelter. Work with local designers and architects to establish the criteria for the competition. Explore shelter sites with community and business representatives. Based on findings of the previous steps, launch a small-scale experiment.

Conclusion

Translating research results into actionable ideas is always a challenge when the results deal with human action and satisfaction. Of the ideas presented that emerged from research four stand out: 1) the need for shelters to support passenger comfort and Pace identity; 2) the need to sort out and systematize communications, including numbering, naming, schedule listing, sign posting, some of these have technology implications and some require a clear logic and design; 3) the idea to integrate Pace with its communities through mutually beneficial business collaborations; and 4) service and large system ideas that make Pace more competitive with the car.

Any of these are a challenge. Some have overlapping domains and benefits, for example, shelters include communication and brand, possible community and local business collaboration, and extend a much desired service to the passengers. In other words, the four ideas listed above need to be considered as a system. The question is where would it be strategic for Pace to advance these ideas. Are shelters too big a step at this time? Could an experiment be run with a friendly community? The communication system is largely within Pace's control. Here the issue is the ripeness of technology in some cases, and the cost of implementation. Should shelters precede community/business collaboration or do they result from smaller but closer business ties and successes? These are the kinds of questions that only Pace can answer.

Given the price of gas and no projection that it will go down any time soon, and given the limited world supply of oil, estimated to last at the current consumption rate for 30-40 years, this seems to be a good time to plan for a future in which public transportation is ever more important to people's lives.

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