Bicycle-Friendly Route Identification in Chicago: a Pilot Project

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HCI 445: Inquiry Methods and Use Analysis

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Executive Summary

The city of Chicago is putting tremendous resources into improving and expanding its bike lanes; the success of this effort hinges completely on cyclists knowing about and choosing to utilize these safer routes. Based on the results of field observations, interviews, and a survey we assessed how and why cyclists choose their routes.

We began with field observations of multiple varied biking environments in the city. Observations took place at roads and intersections that varied in their level of bike-friendliness. We took note of the interactions between cyclists and cars, busses, and pedestrians, and how the road and lane design affected those interactions. After the observations, we conducted one-on-one interviews. We spoke with four cyclists; our questions aimed to establish their typical biking habits, learn how much route planning they do, resources they consult for planning, and what makes a route ideal.

Through analysis of the results from our observations and interviews, we found that bike lanes are perceived positively; participants felt bike lanes increased safety for riders, cars, and pedestrians alike. When describing an ideal route, interviewees reported safety as their highest priority; bike lanes were the most influential factor when choosing a route. While safety was everyone's top priority for route choice, participants reported mixed behaviors related to bike safety. Whether cyclists wear helmets, use hand signals, stop at stop signs, or at traffic lights, depended on context. When riding somewhere new, Google Maps was the most commonly used resource to plan the route; however, all our participants mentioned that occasionally it recommends less safe roads. While other forums and apps exist, their use was much less widespread. We also learned that participants were flexible with their route choices; they sometimes explored new roads to find a better route or changed roads on the fly due to congestion or road construction.

Finally, we conducted an online survey of 51 urban cyclists to understand how these different factors come together to influence bike route planning and more clearly see the distinctions between the personas we're creating. Analyzing our survey showed that the most important distinctions to draw were frequency of riding and years of experience riding in an urban area. These factors associated positively with more frequent route planning, using more resources to plan, including less bike-friendly roads in their routes, wearing helmets, and using hand signals.

Introduction

Within the last decade, Chicago has made substantial investments in bicycle infrastructure; these improvements have led to consistent increases in use. Between 2000 and 2010, bicycle commuter rates more than doubled, increasing from 0.5% to 1.3% (Lubitow et al. 2015). The 2010 rate was higher than other big city counterparts like New York, New York (0.8%) and Los Angeles, California (0.9%), but lower than cities such as San Francisco, California (3.5%) and Portland, Oregon (6.0%). In 2012, Bicycling Magazine ranked Chicago the 5th most bicycle-friendly city in the USA. Concurrently, in 2012, the city announced a plan to grow its network of bicycle lanes to 645 miles by 2020, nearly tripling the size. Mayor Rahm Emanuel introduced the plan with the claim that his vision is "... to make Chicago the most bike-friendly city in the United States" (Lubitow et al. 2015).

However, to use these new safer routes, cyclists need to be made aware of the most "bicycle friendly" routes between two destinations. Several dynamic (e.g. traffic congestion and construction) and static (e.g. bike lanes and speed limits) factors can affect safety. Our aim in this project is to explore how to get this information to cyclists so they can choose the safest route to their destination. We are piloting this project in Chicago. However, our findings should generalize to other urban areas.

There are some online applications and printed maps that highlight bike routes. For example, Google Maps has a bicycling layer that highlights bike-friendly routes. While this is useful, Google uses their own algorithm for "bicycle friendly" route mapping and does not include specifics such as road structure composition (e.g. rough pavement). Additionally, the tool does not update for dynamic changes such as traffic congestion and road construction. MapMyRide is another useful tool that utilizes crowdsourcing; users create their own routes and post them to the app. Again, while useful, the app is more focused more on cycling fitness than on safety.

We began this project by observing cyclists at multiple intersections in Chicago. We used the AEIOU (Activities, Environment, Interactions, Objects, and Users) framework to guide our observations. Each of the team members observed an intersection that was considered 'safe' and one that was considered 'unsafe' based on road structure and traffic rates. Our goal in these observations was to contextualize factors that contributed to bike safety.

During the next phase we conducted interviews with 4 participants to explore attributes of bike safety that were not observable. Our questions were framed around existing route planning tools and gathering information about route planning habits. We were

able to create 2 strong personas from these interviews after coding our notes and formulating spectrums. Through further analysis of our interviews, we identified four main themes in how cyclists choose and plan their routes and what their priorities are in those routes.

Our final step was to conduct an online survey to get more detailed information on the themes that we discovered from our interviews and observations. We asked 25 questions around route planning, resource use, safety, and biking experience.

We formulated two hypotheses before creating the survey that could be statistically tested. These included: (1) Cyclists that fit our “Pro” persona (rides more often, has more years of urban riding experience) plan their routes ahead of time more frequently than casual riders, and (2) Cyclists that fit our “Pro” persona are more likely than casual riders to plan/use routes that include major roads with no bike lanes.

After the data was collected from the final 51 participants, we performed statistical tests with our acquired survey data on these hypotheses to draw our ultimate conclusions.

Methods

Observation Methods

Data collection
We conducted our observational study at eight intersections during high traffic hours (8:00am-9:00am and 4:00pm-5:00pm) at four we considered safe and four unsafe. We chose locations based on previous knowledge and accident data. Because our observations were ‘in the wild’, we did not collect informed consent.

Each team member observed two (one safe and one unsafe) intersections for thirty minutes, taking notes using the AEIOU framework. Details we noted included bike type, cycling apparel, biking behavior, and the interaction between cyclists and the surrounding environmental influences.

Data analysis
After our observations, we transferred our notes to the online program ‘Stormboard’. Stormboard is an online tool that supports collaborative affinity diagramming. See Appendix A for a screenshot of our analysis. As part of our analysis, we grouped

cyclists into two main groups: safe and unsafe riders. We then associated several observed attributes to cyclists in these two groups.

To report the different safe and unsafe environments and attributes, we visualized the data using four birds-eye view maps. We decided what to visualize by weighing what we assessed as major factors that define (a) safe and unsafe environments and (b) safe and unsafe biking behavior.

Interview Methods

We based interview questions from our observation findings. We wanted to verify what we had observed. We were also interested in exploring attributes of bike safety that were not observable.

Participants
We interviewed four cyclists who bike regularly in Chicago. We recruited participants by asking family members and friends as well as people in city bike groups/clubs. Prior to interviews, participants signed a consent form (see Appendix B.).

The participants were people who biked for commuting, exercising, and pleasure. Two participants were females, ages 25 and 35; two were males, ages 27 and 32. Two interviews were conducted at the participant's home and two were at the team member's home.

Data Collection
Our questions were framed around participants' route choices as well as safety considerations when biking. In the interviews, we asked six different groups of questions regarding their bike habits, reasons that they ride, experiences they've encountered, their safety habits, how they plan their routes if they do so, technologies that they use, and demographics. The interview consisted of 20 questions, with some containing follow-up questions.

Data analysis
Three team members took notes; one audio recorded the interview. We each then wrote summary versions of our interviews in order to make it easier to compare notes. In order for each of us to gain a better understanding of each of the four interviews, we individually open coded each interview. We also created spectrums to see how each interviewee compared to others, thus, playing a major role in helping us to determine our two different personas. After working individually, we regrouped via Google Hangouts

and Google Drive to discuss the common themes and recurring spectrums. After virtually collaborating together, we were able to create two strong personas.

Survey Methods

We created an online survey to get more detailed information on the themes that we discovered from our interviews and observations. We asked 25 questions around route planning, resource use, safety, and biking experience. We created our survey using https://surveyplanet.com.

Participants
Our first question was used to screen participants by how much biking they had done during the past summer. If they had ridden fewer than 10 times, they were disqualified from the survey. We posted our survey on Facebook and the DePaul participant pool, gathering a total of 51 participants. Our participants were a variety of ages and were made up of 18 females, 31 males, and two who preferred not to specify.

Data Collection and Analysis
We conducted Mann Whitney U tests and t-tests in IBM's SPSS software. We tested our data thoroughly to look for associations that could help us improve our personas and to test our hypotheses: (1) Cyclists that fit our "Pro" persona (rides more often, has more years of urban riding experience) plan their routes ahead of time more frequently than casual riders, and (2) Cyclists that fit our "Pro" persona are more likely than casual riders to plan/use routes that include major roads with no bike lanes.

Findings

Observation Findings

We observed characteristics that improved or reduced safety and categorized them as: (1) behavioral and (2) environmental.

The most important distinction between safe and less safe environments was the presence of bike lanes. The main benefit of bike lanes of any kind is that they keep cars farther away from the cyclists, reducing the chances of an incident. We observed bike lanes that ranged from painted bikes and arrows along the edge of the road ("sharrows") to separate lanes isolated from vehicles by a physical barrier of some sort (see Fig. 1). Isolated lanes had the additional benefit of forcing cyclists to ride single-file, preventing them from riding two abreast or moving into the flow of traffic in order to pass a slower biker (see Fig. 1). The less robust, shared bike lanes were better than nothing because they indicated to the drivers they needed to make room for cyclists. However, we did observe a pattern of the lanes being ignored by some vehicles, e.g., busses pulling into bike lanes and stopping to pick up and drop off passengers (see Fig. 4). Cyclists reacted to this by either waiting behind the bus (safer behavior) or trying to pass the busses inline with other vehicles (less safe behavior).

Roads without any bike lanes were much less safe for cyclists. The lack of a designated areas to ride, forced cyclists into the road among vehicles, and in turn, forcing drivers to pass by the cyclists in extremely tight proximity (see Fig. 2). We also saw that common factors like potholes or the opening of parked car doors were much more dangerous without the extra room provided by bike lanes. As an alternative to riding in a road without bike lanes, some cyclists rode up on the sidewalk instead, bothering and endangering pedestrians (see Fig. 2).

In sum, the majority of bikers we observed practiced largely safe behaviors. This was evidenced by the very widespread use of helmets, with other common safety paraphernalia including bike-appropriate footwear, reflective garments, and bells to notify others of their proximity. We also saw most bikers come to complete stops at traffic lights at intersections and occasional hand singles being used as well.

However, these safer behaviors were not universal. We observed a distinct minority engaging in a variety of behaviors that seemed to increase chances of an accident. For example, a common pattern was cyclists slowing down at an intersection, and instead of stopping, they would continuously inch forward towards the cross-traffic until there

was a break in the line of cars just long enough for them to slip through. We also saw that at three-way intersections, many cyclists would ride through adjacent crosswalks to avoid waiting a full light cycle (see Fig. 3). This was part of a larger problem of cyclists switching back and forth from following the rules of a vehicle (riding in traffic) to the rules of a pedestrian (riding in crosswalks or on the sidewalk. See Fig. 2).

Cyclists were not the only culprits of less safe behavior: drivers and pedestrians were also observed rushing through intersections instead of yielding at yellow lights, resulting in close calls, shouting, honking, etc. Pedestrians would also use crosswalks at incorrect times, interrupting the correct flow of traffic and causing more general mayhem in the intersection.

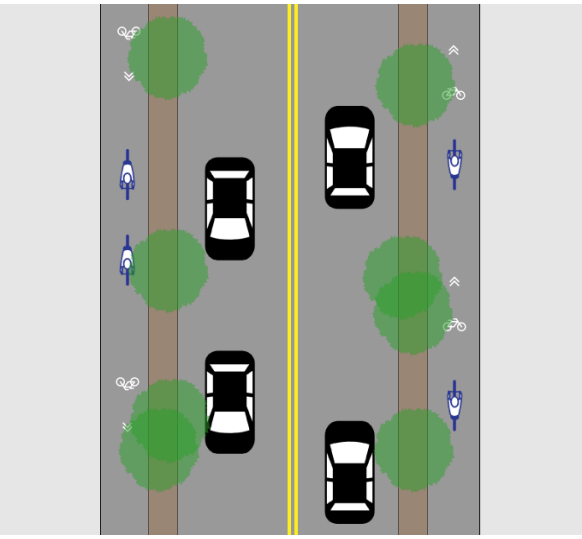


Fig. 1 - Isolated bike lanes protect cyclists

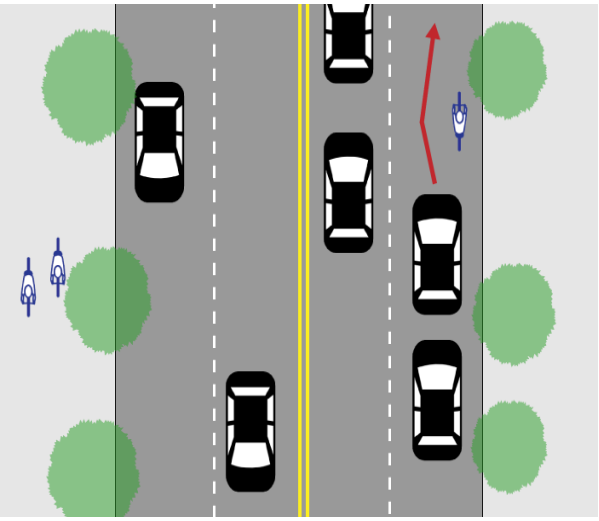


Fig. 2 - Some cyclists will ride on the sidewalk to avoid the dangerous proximity to cars in a road without bike lanes

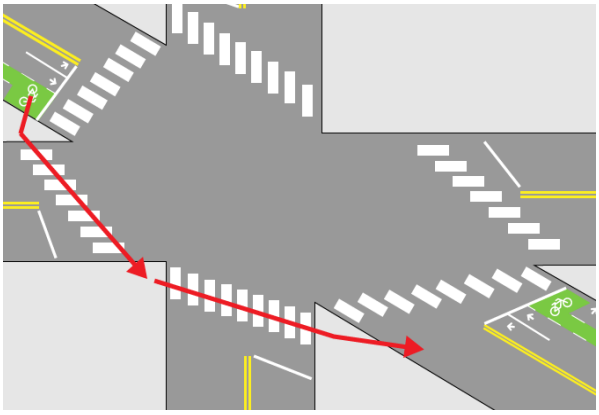


Fig. 3 - Cyclists biking through pedestrian crosswalks to get through a light cycle faster

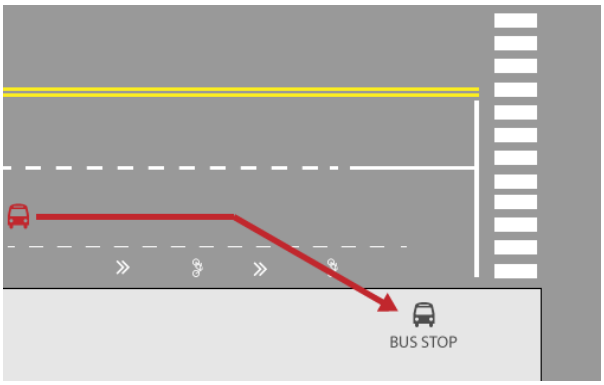


FIg. 4 - Busses pulling into non-protected bike lanes

Interview Findings

Through analysis of our interviews, we identified four main themes in how cyclists choose and plan their routes, and what their priorities are in those routes:

1. Riders want to maximize safety in their routes.
2. Riders find biking relaxing and want to minimize stressful riding.
3. Google Maps is the most widespread tool for planning a new route, but there is room for improvement.
4. Riders' routes are flexible and honed over time based on personal experience.

Riders want to maximize safety in their routes
From our four interviews, we found that safety was our interviewees' most important concern. Each interviewee stated specifically that safety is more important than taking the quickest, shortest, or most scenic route, noting that if they had to bike a couple blocks out of their way in order to take a route with protected bike lanes, they would do so. One interviewee told us his priorities are, in order of importance, "Safety, scenery, and then efficiency," adding "I'd happily add 5 minutes if it took me through a nice park."

Related, the majority of our interviewees enjoy the Lakeshore Path as an alternative to riding in busy streets. One interviewee stated, "Going to the lakefront is fine because the roads are not too crowded, but on the busy roads it sucks." However, another cyclist stated that sometimes riding on the lakeshore path can be as dangerous as overcrowding due to pedestrians, other bikers, skateboarders, and rollerbladers.

All interviewed cyclists strived to take all necessary safety precautions. They tried to take routes with bike lanes, that are less-traveled by motor vehicles, and less congested with pedestrians, noting that pedestrians can be as scary as vehicles since some jay walk or cross intersections at the wrong times. All of our interviewees wear helmets when they ride except for one cyclist who rides a Divvy bike for short errands and pleasure.

Most of the cyclists we interviewed said that they always wear helmets and sometimes use hand signals. Three out of four of them told us that they do not stop at stop signs, and instead simply slow down to see if anyone is coming, then proceed to ride through the intersection if deemed safe. One cyclist says that when he approaches stop signs, he asks himself, "Could I stop if I needed to?", and "... it's not efficient to stop **every** time." All our interviewees also said that they always stop at stop lights since these are typically busier intersections. To us, these behaviors seem generally in line with the

riders' stated number one priority of a safe trip.

Pleasure riding
We found that all of our participants ride for pleasure in order to escape the city environment. When pleasure riding, they do not want to deal with the everyday stresses of riding on the main roads. Riding in the streets is avoided because there is "a lot of traffic" as well as many pedestrians to watch for. They want to be able to take a break from all the stresses of cars and pedestrians, and enjoy the natural environment around them.

The most relaxing places are parks and by bodies of water (rivers and lakes). These areas are enjoyed the most because there is low pedestrian traffic and no cars. The lakefront is a favorite of some participants because they believe that is peaceful. One participant especially enjoys riding on the lakeshore path because "the view is nice and relaxing". However, another participant reported not enjoying the lakefront because they believed there is a high level of pedestrian traffic, including runners, dogs, and people that are stopped in the middle of the trail, making riding there a lot of work.

Google Maps and room for improvement
Our four interviews revealed that all of the participants used Google Maps to plan out their route on a bicycle trip, but all of them had issues with the service. One mentioned that it should show traffic patterns and bike lanes, another said there was a concern for displaying pedestrian or other bicycle traffic, and another identified that the service should be more "real time" updated. "Real time" to the participant meant that new construction on the streets was accounted for when displaying route information. One of the interviewees stated that they used the application in the beginning stages of their trip, but ultimately felt that Google was often wrong when safety was concerned; he only used Google Maps when he knew nothing about the route.

These discoveries indicated that Google Maps Cycling is successful for determining safe bicycle routes, but according to our interviews, it is lacking key bicycle safety information; this supports our motivation for this research. While Google Maps delivers tools for digital route-planning, it is not entirely comprehensive when considering safety.

Flexible Routes
Our interviewees preferred a familiar and memorized route that is safe and relaxing. However, this is not always possible, so riders needed to be flexible with their routes. This flexibility allows them to iterate and improve their routine routes, learn new road choices available to them in the future, and adjust their routes as necessary while in transit.

All of our participants reported that they change their return routes if the outgoing route was not ideal. Motivations for changing the route included too much foot traffic, too many cars, or a road not feeling safe enough. Two of our subjects also mentioned that they enjoyed the exploration aspects of taking different routes to get places. It's fun for them to try new roads and tweak their routes with "new discoveries or shortcuts" to find the best way to get somewhere. We also heard from two of our participants that poor road condition (eg, large potholes or road construction) is often unpredictable and caused them to change their routes "on the fly."

Through this trial and error process, cyclists hone in on their ideal route solution to their destinations. They also expand their own knowledge of routes they like and dislike in the city, giving them a greater personal knowledge of the best roads and possible alternatives when their usual routes aren't ideal for any reason.

Survey Findings

From the results of our survey we identified four major findings. These findings include:

1. More professional riders do more route planning than casual riders and use a wider array of resources to do so
2. More professional riders are more willing to include in their routes major roads that do not have bike lanes
3. Experienced, planning riders engage in safer behavior
4. Confirmation of interview findings and improvements to personas

More professional riders do more route planning than casual riders and use a wider array of resources to do so
One of our pre-survey hypotheses was that more professional riders are more robust route planners than casual riders. Our data showed this to be true with the following tests:

To gauge how "professional" a rider is, we looked at both riding frequency and the number of years they've been biking in an urban area. We compared these statistics against Likert answers to Question 11 (*"Not including riding just for leisure, how often do you typically plan which roads to bike on before your ride?"*).

We split up riding frequency into two groups (Group 1 = fewer than 3 rides / week; Group 2 = 3 or more riders / week), and ran a Mann-Whitney U test looking for significance in

the groups' Likert answers to how often they planned their routes (1 is never, 5 is always). Group 2 reported planning much more frequently than Group 1, with mean ranks of 28.80 and 18.61, respectively. We found the differences were statistically significant, $U_{(49)} = 155.5$, $p = .023$.

We also split years riding into two groups (Group 1 = riding for fewer than 4 years, Group 2 = riding for 4 or more years) and ran a Mann-Whitney U test looking for significance in how often they plan. Those in Group 2 were more likely than Group 1 to report planning their routes more often, with mean ranks of 30.02 and 21.82, respectively. The differences were significant, $U_{(49)} = 220.5$, $p = .041$.

To see if this extended to using a wider variety of resources as well, we created two groups that were low and high levels of planning frequency and ran a t-test for Equality of Means on the responses to Question 13 (*"Which of these resources do you use when planning a bike route? Please check all that apply"*). Group 1 (planning levels 1, 2, and 3) had a mean of 1.40 and Group 2 (planning levels 4 and 5) had a mean of 1.88. We found the differences were statistically significant, $t_{(49)} = -2.262$, $p = .028$.

These tests demonstrate that both riding more frequently and riding for more years associate positively with planning more frequently, and that the more frequently you plan, the more resources you'll consult to do so.

More professional riders are more willing to include in their routes major roads that do not have bike lanes

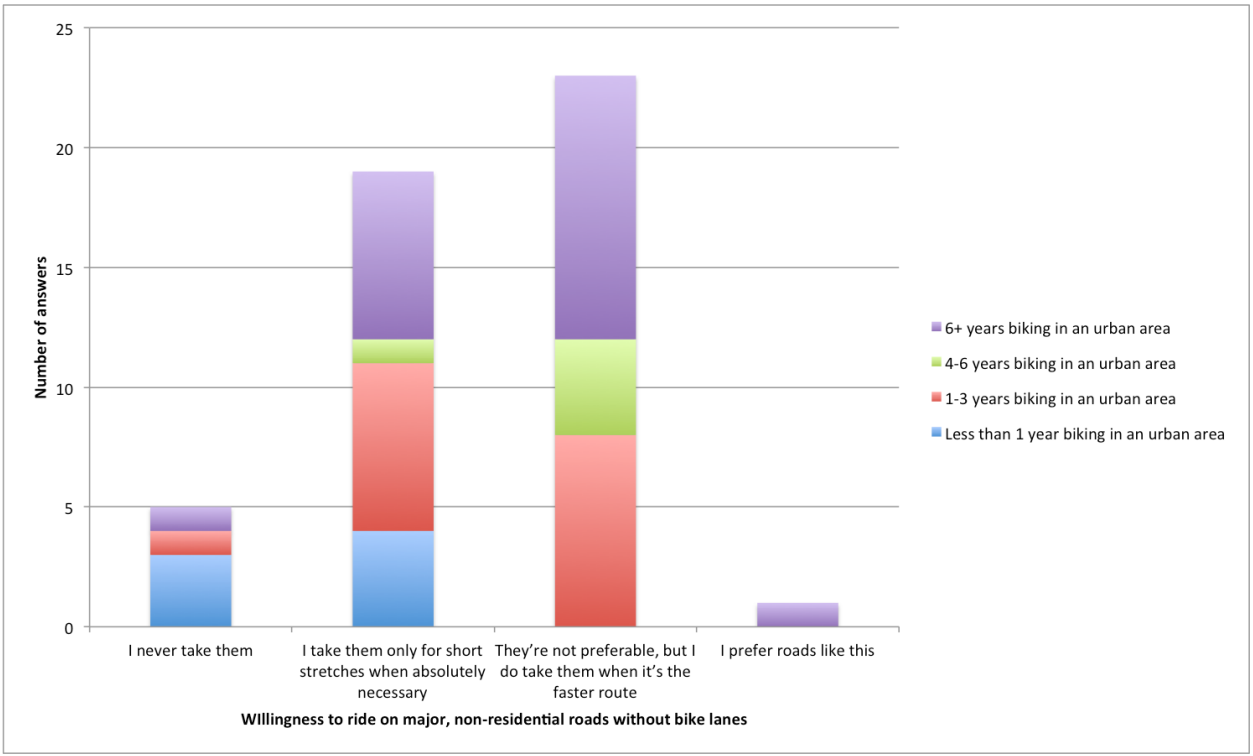
Our group was also seeking a more definitive answer to the question of who is biking on roads without bike lanes. Based on our field observations, we posited that cyclists on these roads were more likely to be professional and more experienced than casual riders. We found this hypothesis to be true, demonstrated by the following series of tests:

Question 17 on our survey asked "*Which of the following best describes your opinion regarding major, non-residential roads with no bike lanes?".* It was followed by four Likert-style responses gauging their willingness to use roads like this, ranging from *"I never take them"* to *"I prefer roads like this."*

We once again split riders up into two riding frequency groups (Group 1 = fewer than 3 rides / week; Group 2 = 3 or more rides / week) and ran a Mann-Whitney U test to look for significance. The more frequent riding group was much more willing to use these roads, with Group 1 having a mean rank of 17.08 and Group 2 a mean rank of 27.26. We found the difference was statistically significant, $U_{(46)} = 131.00$, $p = .014$.

We also ran a Mann-Whitney U test comparing years riding and willingness to use these roads. Group 1 contained riders that have been biking fewer than 4 years, and Group 2 was riders that have been biking for 4 or more years. Their mean ranks were 20.22 and 28.44, respectively, and the difference was significant, $U_{(46)} = 189.00$, $p = .025$.

Our observations and our interviews showed us that these environments are unquestionably viewed as less safe and less pleasant. However, this survey data reveals that more professional riders are willing to use them anyway.



Experienced, planning riders engage in safer behavior

In our survey we asked several questions to learn about the participant's safety habits. Analysis of our results showed that frequent route planning associated positively with consistent helmet use, and years riding associated very positively with hand signal use.

To compare route planning and helmet use, we created a low planning frequency group (1-3) and a high planning frequency group (4-5) based on the Likert responses to Question 11 and conducted a Mann-Whitney test against their reported 1-5 ordinal helmet wearing responses (1 is never, 5 is always). With a mean rank of 29.88, Group 2 reported that they wear helmets more often than Group 1, who's mean rank was 21.96. The difference was statistically significant, $U_{(49)} = 224.00$, $p = .040$.

We also saw that if you've been biking in an urban area for 4 or more years, you're much more likely to use hand signals. We again split up participants into two groups based on their years biking in an urban area. Group 1 had fewer than 4 years and Group 2 was 4 or more. Our less experienced group had a mean rank of 18.69 and the more experienced group had a mean rank of 31.06, showing very strong significance between biking longer and the use of hand signals, $U_{(47)} = 148.50$, $p = .001$.

Confirmation of interview findings and improvements to personas
In addition to the above findings, our survey also gave us the chance to ask questions that would confirm or deny what we learned in our interviews and help us to refine and validate our personas.

Amongst our four interviewees, Google Maps was the most commonly used route-planning resource. Question 14 in the survey definitely confirmed this with 39 out of 51 (76.4%) listing Google Maps as their primary resource, and the next most common resource being MapMyRide at 5 out of 51 (9.8%). We also learned from our interviewees that bike lanes were the most important factor for them when describing an ideal route, and the data from our survey confirmed this as well. Question 16 asked participants to rate the importance from 1 to 5 of several route factors such as the presence of bike lanes, car traffic volume, pedestrian traffic volume, etc. Bike lanes had the highest total score (164), with car traffic volume coming in second (159), and commute time in third (148).

We also found data in our survey that helped to refine our personas and make them more accurate. We saw that the most statistically defining way to describe our "pro" and "casual" continuum was through frequency of riding and through years of experience, and we discarded the number of bikes owned as a distinguishing feature. The statistically significant association between both riding frequency and years of experience with frequency of route planning validated our pro persona doing lots of planning and our casual persona doing less. We were also able to backup the inclusion of details such as what resources they use, what safety behavior they perform, and what types of roads they would use or avoid.

Discussion and Conclusions

We believe that cyclists would benefit from a clear understanding of the safest routes to their destination. While some tools exist, e.g. Google Maps and MapMyRide, there are no tools that consider the range of dynamic (e.g. congestion) and static (e.g., bike lanes) factors. Our aim in this project is to explore how to get this information to cyclists so they can choose the safest route to their destination.

To contextualize the problem, we observed cyclists in safe and unsafe intersections in Chicago. We found that cyclists at safe intersections exhibited more safe behaviors, for example, slowing down and stopping at yellow lights, as opposed to rushing through the intersection. This implied that well-designed intersections encouraged good behavior. We hypothesized that this was due to two interrelated factors: (1) everyone at the intersection (cars, bikes, pedestrians) had their own spaces so no one had the need to interact or invade the other's space, and (2) good behavior was contagious in these situations.

After conducting our interviews, creating spectrums and themes, we found that safety is everyone's main concern when riding. It was also evident that most participants felt that bike lanes increase their safety when riding with fellow riders, cars, and around pedestrians. However, even though safety was a number one priority when riding, actions taken to increase safety (such as wearing a helmet or using hand signals) often depended on the current environment. We also learned that some cyclists prefer to plan their routes when riding in new areas, where others simply prefer to explore new roads on the fly.

Because of our small sample size, we were not able to gather insights from serious cyclists who do bike during the winter in stressful conditions, cyclists who have been in a serious accident, or 'newbie' cyclists who haven't been riding in the city for very long, for example. Gaining more knowledge from a larger sample of users will provide insights in more specific situations.

In our survey research, were were able to analyze results from 51 urban cyclists submissions to obtain a broader understanding of why cyclists plan their routes and ride on roads that don't have bike lanes. Our two hypotheses for this survey, 1) Pro-ish riders will plan/use routes that include being on major roads with no bike lanes, and 2) Pro-ish riders are more into route planning than casual riders, held very true. Those that reported riding three or more times a week were more likely to plan routes ahead of time, use more resources to do so, include less bike-friendly roads in their routes, own multiple bikes, and wear a helmet.

Limitations and Future Work

While we were able to gain tremendous insights through our current research, if we were to continue this study, we recommend furthering research to other bicycle friendly urban areas across the country to cities such as San Francisco, CA and Portland, OR. By extending our research to US cities that are currently highly bicycle friendly, we would be able to study the different ways that these cities have implemented solutions to create a

safe bicycle cycling environment. We would also like to interview a larger sample of cyclists in these areas to cover a wider range of ages and cycling types. Exploring already-implemented solutions in other cities would provide us with the insights to see how their solutions might transfer to the Chicago area.

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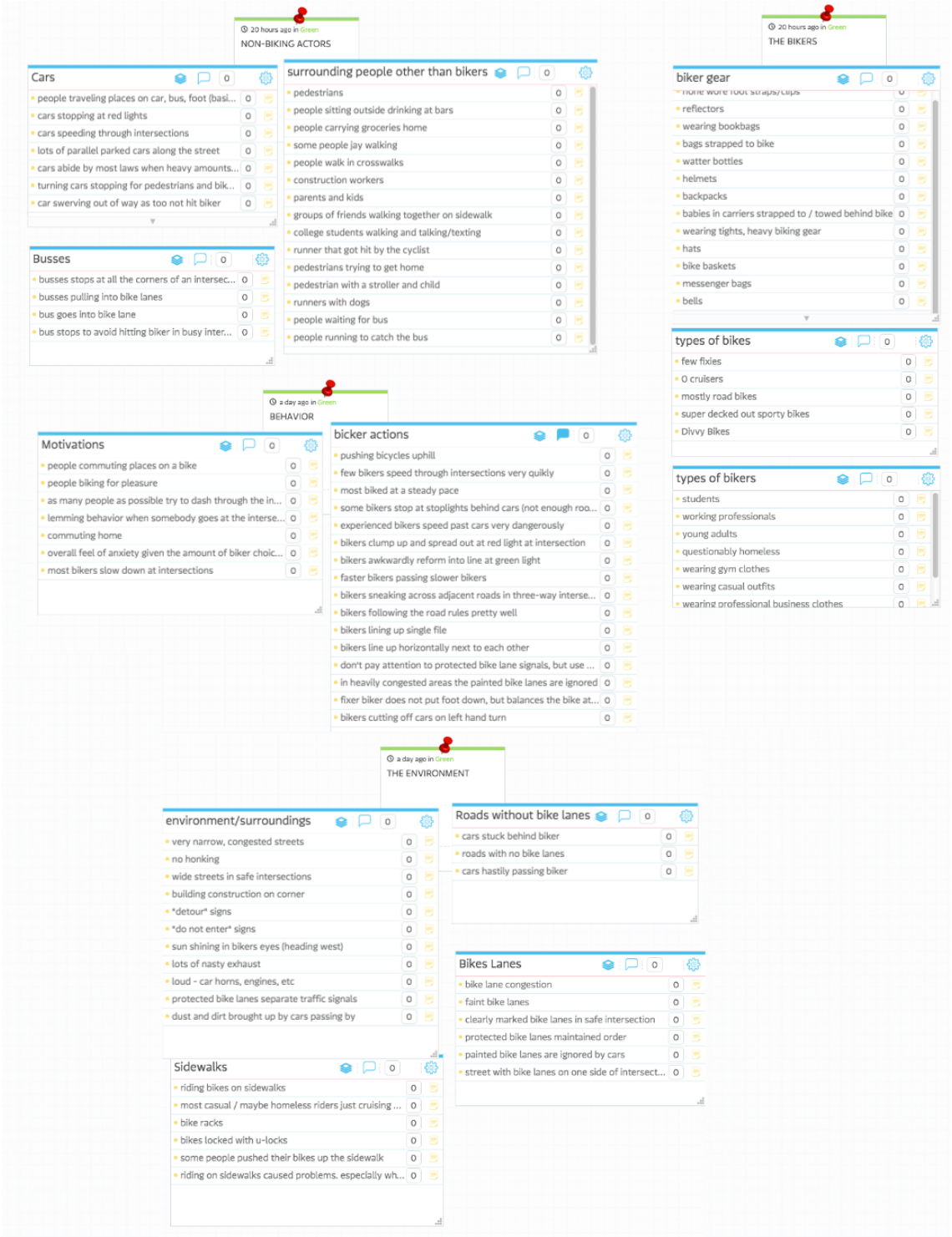
Appendix

a. Affinity Diagram



b. Interview Consent Form

ADULT CONSENT TO PARTICIPATE IN RESEARCH

Bicycle-Friendly Route Identification in Urban Areas

Principal Investigator:
Lauren Sprenger, Graduate Student
Jeff Forbes, Graduate Student
Carolina Barrios, Graduate Student
Luke Ramus, Graduate Student

Institution: *DePaul University, Chicago, Illinois, USA*

Department (School, College): DePaul University, College of Computing and Digital Media

Faculty Advisor: *Cynthia Putnam, DePaul University, College of Computing and Digital Media*

What is the purpose of this research?

We are asking you to be in a research study because we are trying to learn more about bike safety and bike friendly routes in urban areas. This study is being conducted by _____, a graduate student at DePaul University, as a requirement to obtain his Master's degree. This research is being supervised by his faculty advisor, Cynthia Putnam.

We hope to include about four people in the research.

Why are you being asked to be in the research?

You are invited to participate in this study because you are an adult cyclists who rides in Chicago. You must be age 18 or older to be in this study. This study is not approved for the enrollment of people under the age of 18.

What is involved in being in the research study?

If you agree to be in this study, being in the research involves participating in an interview. We are exploring how to get information to cyclists so they can choose the safest and most bicycle friendly routes to their destinations within Chicago. We will ask questions regarding your demographics, your cycling habits and safety habits, reasons why you ride, and how you plan your routes. The interview will occur at_____. The interview will be audio recorded and transcribed into written notes later in order to get an accurate record of what you said.

How much time will this take?

This interview will take about one hour to complete.

Are there any risks involved in participating in this study?

Being in this study does not involve any risks other than what you would encounter in daily life. You do not have to answer any question you do not want to. There is the possibility that others may find out what you have said, but we have put protections in place to prevent this from happening.

Are there any benefits to participating in this study?

You will not personally benefit from being in this study. We hope that what we learn will help other people in the future, a sub-group, a population, or society targeted by the research, contribute to the knowledge in the field for the topic being studied.

Are there any costs to me for being in the research?

You are responsible for any costs related to getting to and from the location where you will participate in the research.

Can you decide not to participate?

Your participation is voluntary, which means you can choose not to participate. There will be no

Who will see my study information and how will the confidentiality of the information collected for the research be protected?

The research records will be kept and stored securely. Your information will be combined with information from other people taking part in the study. When we write about the study or publish a paper to share the research with other researchers, we will write about the combined information we have gathered. We will not include your name or any information that will directly identify you. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. However, some people might review or copy our records that may identify you in order to make sure we are following the required rules, laws, and regulations.

The audio recordings will be kept until accurate written notes have been made, then they will be destroyed.

Who should be contacted for more information about the research?

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study or you want to get additional information or provide input about this research, you can contact the researcher, [insert your name and phone number, and email, and if appropriate the faculty sponsor's name and contact information].

This research has been reviewed and approved by the DePaul Institutional Review Board (IRB). If you have questions about your rights as a research subject you may contact Susan Loess-Perez, DePaul University's Director of Research Compliance, in the Office of Research Services at 312-362-7593 or by email at sloesspe@depaul.edu.

You may also contact DePaul's Office of Research Services if:

- *Your questions, concerns, or complaints are not being answered by the research team.*
- *You cannot reach the research team.*
- *You want to talk to someone besides the research team.*

You will be given a copy of this information to keep for your records.

Statement of Consent from the Subject:

I have read the above information. I have had all my questions and concerns answered. By signing below, I indicate my consent to be in the research.

*Signature:*_____

Printed name: _____

Date: _____

c. Interview Script

INTRODUCTION

I am conducting a research study with my team called “Bicycle-Friendly Route Identification in Chicago: a Pilot Project”. We are exploring how to get information to cyclists so they can choose the safest and most bicycle friendly routes to their destinations within Chicago.

The following questionnaire was designed to better understand the concerns of active cyclists within the Chicago area. There is no right or wrong answer to these questions; we are just trying to figure out what the cyclists in Chicago think about this issue.

We have a consent form for you to sign if you agree to this interview.

Thank you for agreeing to be a participant in this portion of our study today. Do you have any questions for me before we start?

QUESTIONS

Habits

1. **This last year, how often did you ride your bike in the the warmer months?**
    a. Is that typical for you?
    b. How about in winter?

Reasons to ride / experiences

2. **Would you describe yourself as a bike commuter?**
    a. **(If Yes) Tell me about that.**
        i. (Probe if needed) Is there a time in the day you typically commute? What is your typical commute route? Are their bike lanes available? Sharrows? (If asked for examples - “Like shared lanes, or protected by a physical barrier of some sort, etc”)

        ii. How does it make you feel on roads that do not have any bike lanes?
        iii. Tell me about your best commuting experience – Tell me about your worst.

    b. **(If No OR after the commute question) Do you ever ride your bike for pleasure?**

i. If Yes - Tell me about that (Probe for where they go if they do not include – ask if that is a common place(s)) - Why do you choose those/that place(s) – Is that on a road or path? - IF road – are their bike lanes available? If you did not ask above – ask about how they feel about riding on a road with no bike lanes here.

ii. (Probe if needed) Is there a time of the day you typically ride for fun? Time of week?

iii. Tell me about your best pleasure ride – tell me about your worst.

c. **(If No OR after the pleasure question) Do you ever ride your bike just for the exercise?**

i. If Yes – tell me about that (Probe for where they go if they do not include – ask if these are common place(s)) - Why do you choose those/that place? - Why do you choose those/that place(s) – Is that on a road or path? - IF road – are their bike lanes available? If you did not ask above – ask about how they feel about riding on a road with no bike lanes here.

ii. (Probe - if needed) Is there a time of the day you typically ride for exercise? Time of week?

d. **(If No OR after the exercise question) Are there any other reasons why you use a bike that doesn't fit into the categories above?**

i. If Yes – tell me about that (Probe for where they go if they do not include – ask if these are common place(s)) - Why do you choose those/that place? - Why do you choose those/that place(s) – Is that on a road or path? - IF road – are their bike lanes available? If you did not ask above – ask about how they feel about riding on a road with no bike lanes here.

ii. (Probe - if needed) Is there a time of the day you typically ride for exercise? Time of week?

If NEEDED - Among those reasons, commuting, fun and exercise (or which ever they said yes to) – do you have a primary reason for riding your bike?

Self assessment

3. **On a scale of very casual to very serious about cycling – how would you describe yourself? Why?**

4. **Can you describe your bike(s)?**
   a. If more than one – ask them which one they ride the most.
   b. Why did you choose that bike?
   c. Do you use any additional gear or paraphernalia with your bike, like lights, locks, clip-in shoes, etc?

5. **What clothing do you typically wear when you ride in the summer?**

Safety Habits

6. **On a scale from 1 to 5 where 1 is never and 5 is always, how often do you wear a helmet?**
    a. (Probe if less than always) How do you decide when to not use one?

7. **On a scale from 1 to 5 where 1 is never and 5 is always, how often do you use hand signals?**
    a. (Probe if less than always) How do you decide when to use them or not?

8. **On a scale from 1 to 5 where 1 is never and 5 is always, how often do you stop at stop signs?**
    a. (Probe if less than always) How do you decide when to stop?

9. **On a scale from 1 to 5 where 1 is never and 5 is always, how often do you stop at red lights?**
    a. (Probe if less than always) How do you decide when to stop?

10. **Have you ever had a car honk at you while biking? (If yes) - Tell me about that experience.**

11. **Have you ever been involved in any accidents while biking? (If yes) If you're comfortable talking about it, can you tell me about that experience?**

Route Planning (for their primary mode)

12. **When (commuting/pleasure riding/exercising), do you typically plan out your route ahead of time?**
    a. If they say no to the mode (e.g. commuting), ask if they ever plan ahead in any of the other modes.

13. **(If they plan ahead) - How do you typically choose what route to take?**

    a. Do you use any resources to help decide your route choice?

    b. If yes, ask what they are.

    c. Can you tell me about resources that have been particularly helpful?

    d. How about unhelpful?

14. **What are the most important factors that you take into consideration when choosing which route to take?**

15. **How important or unimportant is it for you to know the safest route available?**

16. **Have you ever changed your return route because you didn't like the route you took to get somewhere? If so, explain.**

Route Planning - Social

17. **Do you ever ride your bike with other fellow bikers (family, friends etc.)?**
    a. If yes, how does this affect your route choice?

Technologies

18. **In a perfect world, what kinds of technology-based route planning tools would you find helpful?**

Demographics

19. **What is your age?**

20. **What do you do for work?**

CONCLUSION

Thank you for your time today. The information that you have provided is critical to our study and I have enjoyed your valuable insight on this topic as we continue to explore this problem for Chicago cyclists.

Is there anything else that you would like to tell me?

d. Spectrums

C = Carolina's subject
L = Luke's subject
R = Lauren's subject
J = Jeff's subject

Route-planning Resources Consulted

Only Google Maps — More than just Google Maps

Casual or Serious Cyclist
(times typically ridden per week; number of bikes; paraphernalia owned)

Casual — Serious

Safety Behavior
(stopping at stop signs and traffic lights; using hand signals)

Minimal — Always

Helmet Wearing

Minimal — Always

e. Survey Consent Form

Survey Consent Form

You are being asked to participate in a research study being conducted by Lauren Sprenger, Daniel Ramus, Carolina Barrios, and Jeff Forbes at DePaul University. We are asking you because we are trying to learn more about bike safety and how people bike in urban areas. This study will take about 15 minutes of your time. You must be 18 years of age or older.

The survey will include questions about your biking habits. You can choose not to participate. There will be no negative consequences if you decide not to participate, or change your mind later. You can quit this study at any time by closing your browser. Your answers will be kept confidential.

If you have questions about this study, please contact Daniel Ramus, luke.ramus@gmail.com; Lauren Sprenger, laurensprenger@me.com; Jeff Forbes, forbes13@gmail.com; or Carolina Barrios, cbarrios@stetson.edu.

If you have questions about your rights as a research subject, you may contact Susan Loess-Perez, DePaul University's Director of Research Protections at 312-362-7593 or by email at sloesspe@depaul.edu.

By clicking Begin, you are agreeing to participate in this study.

f. Survey Grid

Survey Grid

#	Question	Instructions	Answers	Reasons
1	Thinking about this past summer, did you ride a bicycle in an urban area more than ten times?	None	Radio buttons Yes No	Inclusion/ exclusion criteria
2	How many years have you been biking in an urban area?	None	Radio buttons: less than 1 1-3 4-6 more than 6	To find out their experience level.
3	How many bikes do you own?	None	Radio buttons: 0 1 2-3 4-5 more than 5	To find out the different types of biking they like to partake in.
4	About how often do you typically use a Divvy bike?	None	Never 1 - 5 times a year 1 - 5 times a month 1 - 3 times a week More than 4 times a week	to find out how much the subject uses divvy bikes

5	How important to you is commuting on your bike?	None	Radio buttons: Not important Somewhat important Very important	To find out how much importance is placed on biking for commuting.
6	How important to you is riding your bike for exercise?	None	Radio buttons: Not important Somewhat important Very important	To find out how much importance is placed on biking for exercising.
7	How important to you is riding your bike for leisure?	None	Radio buttons: Not important Somewhat important Very important	To find out how much importance is placed on biking for leisure.
8	Thinking about the last two years during the spring, summer, and fall, about how many times per week did you bike (on average)?	None	Radio buttons: Fewer than once a week 1 - 2 times a week 3 - 4 times a week 4 - 5 times a week 5 - 6 times a week Every day	To find out how often they bike regularly in good weather and help gauge how pro vs casual rider is

9	Thinking about the last two years during the winter, about how many times per week did you ride your bike (on average)?	None	I did not ride during the winter. 1 - 2 times a week 3 - 4 times a week 4 - 5 times a week 5 - 6 times a week Every day	To find out how often they bike regularly in bad weather and help gauge how pro vs casual rider is
10	Not including riding just for leisure, how long is a typical ride for you?	None	Radio buttons: 1 - 30 minutes 30 - 60 minutes 1 - 2 hours More than 2 hours	To find out if they're biking long distances or short sprints.
11	Not including riding just for leisure, how often do you typically have your route planned out before your ride?	None	Radio buttons: 1 - Never 2 3 - Sometimes 4 5 - Always	To find out if they like to plan ahead of their routes or wing it.

12	Which one of these resources do you use if planning a bike route?	Please check all that apply.	Check boxes: Google Maps MapMyRide The Chainlink Ride the City Ask another cyclist Other _____ I do not use any resources	To find out how they prefer to receive information for planning trips.
13	If you do use one or more of these resources, which of them do you use the most? Please check one.	Please check one.	Google Maps MapMyRide The Chainlink Ride the City Ask another cyclist Other _____	To assess which resource is used the most
14	Please rate your level of satisfaction with the route planning resource you use the most	none	1 - Very dissatisfied 2 3 - Neutral 4 5 - Very satisfied No opinion	

15	If you do use one or more of these resources, in which scenarios are you likely to use them?	Please check all that apply	Check boxes: - When riding to a destination I've never ridden to before - When riding to a destination I've gone to before but haven't found a route I'm completely satisfied with yet - When riding to a destination I've gone to before and have my preferred route memorized -Other _____	To learn when they prefer to use a resource to plan their trips.

16	Please rank the following factors from 1 to 5 in order of importance for when you are planning a route for something other than leisure riding:	Rank the importance of these factors in order from 1 to 5 by entering the correspondi ng number in the blank.	Ranked Choices: _____ bike lanes _____ commute time _____ car traffic volume _____ pedestrian traffic volume _____ scenery	To learn what the most important factors are for riders when they are planning their routes
17	Which of the following best describes your preferences regarding major two-lane roads with no bike lanes?	None	Radio buttons: - I never take them. - I take them only for short stretches when absolutely necessary. - They're not preferable, but I do take them when it's the faster route. - I prefer roads like this. - I have no preference one way or the other.	To learn why these routes are still used by cyclists

18	On a scale of 1 to 5, where 1 is never and 5 is always, how often do you wear a helmet when riding?	Provide a number on a scale from 1 - 5.	Radio buttons: 1 2 3 4 5	To help establish a profile of a cyclist's safety behavior
19	On a scale of 1 to 5, where 1 is never and 5 is always, how often do you use hand signals when biking?	Provide a number on a scale from 1 - 5.	Radio buttons: 1 2 3 4 5	To help establish a profile of a cyclist's safety behavior
20	On a scale of 1 to 5, where 1 is never and 5 is always, how often do you come to a complete stop at red lights?	Provide a number on a scale from 1 - 5.	Radio buttons: 1 2 3 4 5	To help establish a profile of a cyclist's safety behavior
21	On a scale of 1 to 5, where 1 is never and 5 is always, how often do you come to a complete stop at stop signs?	Provide a number on a scale from 1 - 5.	Radio buttons: 1 2 3 4 5	To help establish a profile of a cyclist's safety behavior

22	Which of these best describe your preferences for riding when it's dark outside?	None	Radio buttons: - I never ride when it's dark - I avoid riding when it's dark if I can - I don't mind riding when it's dark - I like riding when it's dark	To find out how they feel about riding in the dark.
23	What is your age?	None	Radio buttons: 18-22 23-27 28-32 33-40 41-50 51-60 Over 60	To learn their demographics.
24	What is your gender?	None	Male Female Prefer not to say	demographics

25	What is your level of education?	None	Some high school High school graduate Some undergraduate Ungraduate degree Some graduate school Graduate degree Prefer not to say	demographics

g. Personas

Personas

Kevin Casual - *"I like to ride to nearby parks, markets, and friends' apartments…"*

Kevin is a full time Administrative Assistant and a part-time MBA student at the University of Chicago. He works a typical Monday - Friday work schedule and attends class for his MBA degree every Wednesday night. Kevin takes the CTA to and from work and rides his bike a couple times a week or less (he hasn't been riding in the city for very long- only a couple years). Since he lives in Lakeview, he likes to ride to the lake and on the lakefront for exercise where he feels safer than riding in the streets with motor vehicles. He also rides his bike for short errands during the week or to visit friends, going to the gym, and picking up a few groceries. Bike safety and planning routes ahead of time are important to Kevin so he uses Google Maps to occasionally plan his routes, but hasn't explored other resources. He doesn't mind taking a longer route if it means there are protected bike lanes or less car and foot traffic. He doesn't always wear a helmet, and doesn't use hand signals.

Age: 27
Occupation: Admin Assistant at the University of Chicago / part time MBA student
Location: Chicago, IL
Income: $37,000
Home life: lives in Lakeview with a roommate (26 years old)
Hobbies: reading, rock climbing, exercising (walking and riding his bike)
Personality: optimist, introvert, has a dry sense of humor

Experience Goals:

- Enjoys relaxing and taking calm, stress-free bike rides
- Bikes with the peace-of-mind that there are usually physical bike barriers

Life Goals:

- Graduate with his MBA
- Making time to exercise by biking daily
- To work in the communications department at the University of Chicago

End Goals:

- Find the safest routes to take when running errands
- Cycling on the least congested roads

Penelope Pro - *"I love using my bike for all my transportation in the city and when I am not working a nice casual ride is perfect to calm my nerves…"*

Age: 30
Occupation: Full- time Manager at an Accounting Firm
Location: Chicago, IL
Income: $65,000
Home life: Married, lives in Rogers Park with her husband
Hobbies: working out, riding throughout the city, movie fanatic, loves going to comedy shows, playing with her Pug
Personality: outgoing, fun, athletic, adventurous

Penelope is a commuter biker who owns several bikes and rides at least three times a week. She works downtown at an accounting firm and uses her bike to commute to and from work and has been riding in the city for over four years. Although she primarily uses her bike for commuting purposes, she will also ride for pleasure. She plans her routes frequently by using Google Maps and Chicago Bicycle forums, but feels the tools don't give her enough real time information about the current road conditions. Would typically choose the route that has bike lanes and the least amount of pedestrians, but is willing to ride on less bike-friendly roads if necessary to get to her destination. She always wears a helmet and uses hand signals.

Experience Goals:

- Use her bicycle in the most efficient way possible for commuting
- If riding for pleasure prefers the absence of pedestrians or other vehicles

Life Goals:

- Continue to use her bicycle not only for pleasure, but as her main form of transportation
- Maintain a healthy lifestyle through biking

End Goals:

- Must plan her routes based on real time conditions of the road for safety and efficiency
- Prefers the quickest and safest routes because biking is her main form of transportation

h. Scenarios

Scenarios

Penelope wakes up for work late one day and has to make up a for a little time that she missed on her daily commuted protected bike lane route. She knows a couple of faster routes, but has heard about construction going on in the area where her office is located. She still wants to consider safety such as painted bike lanes, but wants to take the fastest route on her bicycle with the lowest amount of construction to make up for her lost time. She plugs in the destination information on her new 'safe cycling application' with the quickest route option turned on and flips on filters for construction and bicycle lanes. She is able to zoom in on live updates on traffic for cars, bikes, and pedestrians, to see how much the traffic would affect her commute time. With these updates, the application gives her the safest and quickest route to her office. Penelope arrives at her work safe with a minute to spare.

Kevin is enjoying his scenic trip on the Chicago lakefront trail one day when his friend calls him. He decides he hasn't heard from this friend in a while so he pulls off to the side of the trail and answers the call. His friend turns out to have the day off and wants to meet up with Kevin for lunch in about an hour. He decides that since his friend is fairly close he will just meet him at the restaurant without going home first. The only problem is that Kevin has never ridden his bike around the area and it is close to downtown where he knows it is not as safe, especially when he isn't familiar with the area. Kevin realizes his new 'safe cycling application' that he recently downloaded would be perfect for such a situation because it can tell him the safest route with the least traffic and give him directional auditory updates through his headphones. Kevin plugs in the filters for traffic, protected bike lanes and construction into the application because he has plenty of time to get there, but wants the safest route available. Because the application uses live updates, he knows that the information he is given on his filters are up to date. It relays back his tailored route and he begins his cycling journey to meet his friend.

i. Task-user Matrix

Task-User Matrix

	Frequency		**Importance**	
	Penelope Pro	*Kevin Casual*	*Penelope Pro*	*Kevin Casual*
Route Planning				
Looks for bike lanes	Sometimes	Often	Medium	High
Finds routes where streets are not congested	Sometimes	Often	Medium	High
Finds fastest route	Often	Rarely	High	Low
Purpose of Biking				
Rides for Pleasure	Sometimes	Often	Medium	High
Rides for Exercise	Rarely	Often	Low	Medium
Rides to Commute	Often	Sometimes	High	Low