Where and how Tucsonans ride and implications for cycling infrastructure

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Abstract: Transportation planning focuses on access to destinations, getting from point A to B. Yet, cycling does more and creates a connection between the cyclist and movements during the journey. Drawing from cycling ethnographic work, I use video recordings of three groups of cyclists, commuter, recreational, and athletic, in Tucson, AZ, to contextualize their movements and interactions with the built environment, drivers, and other cyclists. Cycling can be utilitarian for commuters and a social, leisure, and athletic activity for recreational and athletic riders. Depending on their reason for riding, cyclists utilize infrastructure to suit their needs and protect themselves from drivers. Confidence levels also influence where and how people ride. Commuters rode defensively and sought out less-trafficked facilities. Recreational riders rode solo on paths and in groups on open roads. Athletic riders claimed space from drivers by riding in packs while being mindful of group safety. Video ethnography helps improve the understanding of the different reasons for cycling and those experiences. With this information, planners can provide more accurate maps and overcome pushback from some cyclists by designing infrastructure accordingly—such as providing both a path and bicycle lane along the same corridor to serve various cycling needs.

Subjects: Ethnography & Methodology; Transport Planning; Planning - Human Geography; Transport Geography

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PUBLIC INTEREST STATEMENT

Increasing the number of people cycling is one of the best ways to lower emissions and help people live a healthy life. However, what do cyclists experience while out riding alone or in groups? This study recorded the rides of six cyclists (3 who commute, 2 who ride for recreational purposes, and 1 athlete) to understand the day-to-day experiences of riding in Tucson, Arizona. Cyclists rode various roads, streets, and paths during the study to provide data across a large part of the region and on different infrastructure. The videos demonstrated some of the hostility cyclists face from drivers, how cyclists select routes, and social interactions on group rides. This information can inform planners and decision-makers on how to better design our bicycle maps, roads and paths, and policies to support all cyclists—regardless of the reason for riding or experience.

Where and How Tucsonans Ride and Implications for Cycling Infrastructure
Keywords: cycling; transportation planning; built environment; video ethnography; bicycle planning

1. Introduction

Transportation researchers often look at why and how a person moves. Cycling research focuses on understanding how and where people ride to help practitioners plan and design infrastructure (Broach et al., 2012; Dill & Carr, 2003; Lawrence & Oxley, 2019; Mekuria et al., 2012; Spinney, 2008, 2009). Additionally, some research looks at behavior and risk while riding (Dozza & Werneke, 2014; Gustafsson & Archer, 2013; Johnson et al. 2010). Transportation researchers often do not consider what makes riding meaningful for the rider. Spinney (2009) describes it as “what cycling could be instead of what it should be.” Cycling creates a connection between place and movement during the journey (Spinney, 2009). The non-places between point A and point B, such as road gradients, the connection between effort and motion, and interactions with other road users, become part of our kinesthetic sense while completing a ride (Spinney, 2006, 2009). Cycling can be more than transportation or leisure. It can be a way for people to explore and understand their community, the environment, and themselves.

For many people, cycling represents freedom to see and feel the city and landscapes outside the confines of a car. In a transportation sense, cyclists are free from congested travel lanes, and, unlike driving, the journey is door-to-door—no searching for parking, just a secure place to lock the bicycle. Cycling saves time by combining transportation and exercise into one activity. A 15-minute commute doubles as a workout to help reduce cardiovascular disease, obesity, and other health concerns (Fishman, 2016; Sevick et al., 2000). Freedom from driving also decreases emissions by removing vehicles from the road (Ekblad et al., 2016; Lin & Fan, 2020; Pucher & Buehler, 2012). In short, cycling saves time and money, improves health, and reduces greenhouse gas emissions from vehicles.

For these reasons, many cities have focused on increasing ridership. In Tucson, AZ, the local governments embraced cycling infrastructure starting with the 1970s bicycle boom (Seper, 1974; Stiles, 1976) and rose to one of the top communities for cycling commuting in the nation at 3% of trips in the 1980s (Anderson, 2017; Dames & Moore, 1989, pp. 2–2). Thanks to the terrain, weather, El Tour de Tucson, and other major cycling events, the city cemented its reputation as a top cycling destination for winter training among amateurs and professionals (Ferguson, 2013; Levine, 2015). However, bicycle lanes only go so far. Commuting rates have stalled at 1.69% (LAB 2021), with six fatalities (1.1 per 100,000 residents) in Tucson city limits in 2021 (Tucson Police Department, 2022). The city is playing catch-up to peers such as Portland, OR, where commuting rates stand at 6.4% (LAB 2017) with zero cycling fatalities in 2021 (Bike Portland, 2021), and all-ages cycling infrastructure is the default (Anderson, 2017).

In 2013, Tucson residents and leaders adopted the Plan Tucson comprehensive plan, which outlines goals to place the city on a more sustainable path to address climate change and expressly incorporates cycling infrastructure (“Plan Tucson” 2013, p. 3.141). In September 2020, the Tucson Mayor and Council declared a climate emergency to spur efforts to reduce greenhouse gas emissions (Tucson Mayor and Council, 2020). One effort to address greenhouse gas emissions is the 311 kilometers of planned low-stress bicycle boulevards (Tucson Bicycle and Pedestrian Program, 2017). Another effort is the city’s first mobility master plan that considers how and why people move about the region (City of Tucson Department of Transportation, 2021). These efforts shift transportation away from a means from A to B and towards mobility as a culture by understanding “routines, norms, and structures” involved in movement through our spaces (Tschoerener-Budde, 2020).

If Tucson is to fully embrace a “mobility culture” (Tschoerener-Budde, 2020), planners and engineers need to understand “the line between A and B” (Spinney, 2009). I embarked on this research because
my experience as a cyclist spans multiple cycling communities. I have raced road cycling at an elite level for sixteen years and commute most places on a bicycle. I have become familiar with Tucson’s commuting and training routes through a decade of riding in the area. During this time, I have noticed how my perceptions of safety on the road have evolved, from relatively fearless to not trusting drivers. I wanted to know what the daily experiences were like—that “line between A and B”—for other riders to help practitioners better understand and improve mobility for cyclists.

This paper explores differences and commonalities in the lived day-to-day experiences of commuting cyclists, recreational riders, and athletes and how the experiences relate to the built environment in Tucson, AZ. I use video ethnography to explore these aspects with six riders. Commuters use bicycles as their primary mode of transportation. Recreational riders use bicycles for exercise, social interaction, and enjoyment. Athletic riders use bicycles as a means for sport, competition, and social interaction. Different reasons for riding provide distinct experiences. Learning from these experiences can help practitioners and elected officials see how riders use their bicycles, bodies, and space in the city. This understanding can result in better support for the cycling community regarding information, policies, and infrastructure.

First, the paper reviews video ethnography and previous studies to ground the current methodology and show the field’s evolution. Then, it draws upon previous cycling studies from Albert (1991), Eichler (2017), and Palmer (1996), Pink et al. (2017), and Spinney (2006, 2008, 2009, 2011) in analyzing the choreographed dance of rider movements with other riders, traffic, and the built environment from the collected video footage to understand these behaviors. The analysis of rider behavior and experiences are used to discuss the value of understanding differences for riding and how they relate to policy recommendations such as improving mapping information and infrastructure improvements.

2. Literature Review: Cycling and Ethnography Overview
One way to understand lived experiences is through ethnography. Ethnography typically relies on the researcher being present in the field; however, this is difficult to do with cycling as the field is often a moving location (Palmer, 1996). Previous works have drawn upon personal knowledge and embedding in the study group. For example, Albert (1991), a former racer, and Palmer’s (1996) work focused on understanding the road racing community’s culture and norms. They explored the movements and expectations from riding and racing in a group (Albert, 1991; Palmer, 1996) and how cycling can become an immersive culture and lifestyle (Palmer, 1996). Eichler (2017) focused on the community and culture within fixed-gear riders, a countercultural group that uses riding as a form of protest against the dominant car culture.

Outside of embedded work, auto-ethnography can be used to explore the act and sensations of cycling. For example, Spinney (2006) explored the kinesthetic experience of space in professional and recreational cycling on the iconic climb up Mont Ventoux in France by documenting his training and riding the mountain on multiple occasions. Spinney’s work demonstrated how cyclists create meaning, the melding of mind, body, and machine, through landscapes and shared experiences with other riders.

Beyond these forms of ethnography, mounting cameras on bicycles have opened ways to explore how cyclists create space in the city through interactions with road infrastructure (Pink et al., 2017; Spinney, 2008, 2009, 2011). These works demonstrated how riders try to maintain speed by weaving between traffic or use benches, curbs, and walls for tricks (Spinney, 2008, 2009, 2011). These motions become a part of the rider’s kinesthetic experience in the city. Using cameras to record rides can provide an avenue to collect this information without the researcher being present. While it is feasible to ride along and record interviews with participants, it requires the researcher to be in shape to do so (Spinney, 2009). However, it is not safe or plausible to record interviews in an urban environment when riders need to remain in a state of heightened awareness to stay safe. Additionally, a growing number of riders are interested in recording rides to
document “cool” tricks (Spinney, 2011), share insight on social media into races and the racer's embodied experiences (Myerson, 2019), or capture and share experiences in the city ((Pink et al., 2017 or see Uprise.cc).

While video allows researchers to ride along from their computers, it is crucial to acknowledge that it is a proxy for in-person observations. Video provides an avenue to see what participants observe; however, it leaves out other contextual information that may impact behavior and limits our ability to co-construct understanding (Spinney, 2009). The camera serves as the researcher's “disembodied eye” on the subject, a way of “seeing there without being there” (Laurier, 2010; Spinney, 2011). However, the camera cannot capture smells, the feeling of wind, and other occurrences outside the frame. The camera preserves information for review and what is seen and interpreted is dependent on the observer (Pink, 2007a, 2007b; Spinney, 2011).

Being an insider- a member of the group studied- brings up an important tension between insider/outside positions within qualitative research. In some ways, understanding riders' small movements and decisions in the videos is easier for a researcher who rides—similar to how an experienced dancer can interpret the expression in moves better than a lay observer (See: Jorvinen 2006 in Spinney, 2011). Of course, my experiences are heavily influenced by years of commuting and racing, which provide the inside perspective on cycling behavior and culture. Additionally, my training as a geographer and urban planner shape how I see the city and its potential for change. I agree with Dwyer and Buckle (2009) in that it is impossible to occupy only an inside or outside position, “We may be closer to the insider position or closer to the outsider position, but because our perspective is shaped by our position as a researcher (which includes having read much literature on the research topic), we cannot fully occupy one or the other of those positions.”

However, interpreting video with an insider perspective requires the researcher to participate in the riding types recorded due to differences in movement and behavior. In this case, I do not participate in all types of cycling, such as fixed-gear riding, providing an outsider perspective in the analysis. As a remedy, Pink (2007b) says interpreting videos requires “learning to see” through the participants’ eyes to extract meaning. Patience is critical, especially with hours of footage collected, much of it unremarkable; however, a careful review can reveal nuanced information (Laurier, 2010).

3. Methodology

This study expands on Spinney’s (2008, 2009, 2011) work by purposely recruiting riders with three different reasons for riding: commuting, recreational, and athletic to show their lived experiences in Tucson, AZ. After approval by the University of Arizona IRB (project 1,904,499,197), I recruited participants within the cycling community through e-mail and group rides. Participants were eligible if they were over 18, rode primarily on paved surfaces, owned a GPS recording device (such as a cycling computer), and fit one of the categories. The requirements did limit participation, and future work that targets riders in marginalized communities and provides GPS devices could give additional insight into experiences, especially those on the other side of the digital divide. Three commuters (2 males, 1 female), two recreational riders (1 male, 1 female), and one athlete (1 male) signed consent forms and participated. Participants ranged in experience from five years of riding up to sixteen years. I gave pseudonyms to all participants in the discussion (Table 1). I embedded myself as a commuter in the pilot portion of the study to help the analysis come from a place of embodied experience (Lorimer & Lund, 2003). These reasons for riding are not mutually exclusive, and some riders partake in multiple forms of cycling. The five participants ride for multiple reasons; however, they participated in only one type for this study.

While I could ride with the participants, I agreed with Spinney in this being dangerous in urban spaces and sometimes outside of my comfort zone. Additionally, my presence and focusing cameras on them could impact their behaviors. Even with cameras mounted on their bicycles, there is a concern that cameras may alter the narrative provided by participants by changing their
behavior (Pink, 2007b). For example, a rider may not yell at drivers if they are aware of the camera. However, using the cameras passively for entire rides may help them forget about the camera presence. Additionally, looking for trends in behavior during the analysis could identify if riders remained consistent in actions.

I collected video, audio, and GPS data from participants. A Cycliq Fly12 front and Fly6 rear camera were used for video and audio recording, and I installed them on participants’ bicycles on the University of Arizona campus. The Cycliq’s built-in lights, small size, 8-hour battery, and 256 GB storage removed restrictions on frame material, size, time of day, and ride length. I showed participants how to use the cameras, charge them, remove them to prevent theft, and reminded them to ride normally for their two weeks of recording. After two weeks, participants returned the units for data extraction and for the next rider to use. Recording took place over fifteen weeks due to only two sets of cameras and participant availability. Finally, participants shared the GPS files via e-mail or Strava download, a social media website where riders share and track rides.

Thirty-seven hours of video footage was collected (Table 1). Video footage provided a rolling log of each rider’s entire ride and captured interactions with drivers, other cyclists, and the participants’ behaviors. Camera audio captured their reactions to drivers, their thoughts on the day, and even the roughness of the pavement. To review the footage, I turned to Gustafsson and Archer (2013) and Dozza and Werneke’s (2014) research for a framework to focus the video review and categorize events into groups for analysis. For example, Dozza and Werneke noted where their participant events occurred, such as in the travel lane, the bike lane or intersection, and divided their video analysis into critical events, where the rider was hit or crashes, and baseline events, which included threats from vehicle trajectory (i.e., turning across their path). Gustafsson and Archer segmented their events into conflict events, such as a driver stopping or turning in front of a rider, and mobility issues, such as a blocked bicycle lane or the lane ending. Based on these works, I chose similar categories for events, such as slow-rolling stop signs, drivers turning in front of riders, track standing at lights, and noting issues with infrastructure and mobility. Additionally, my experiences from sixteen years of commuting and racing helped me understand the movements participants made to stay safe, such as riding to the front of a line of stop cars to increase visibility at the light or riding in a peloton to lower odds of a close pass. Overall, the video analysis of these behaviors helps explain bodies in motion and how they utilize space while riding through the city (Pink et al., 2017; Spinney, 2011).

Beyond analyzing the video recordings, I rode some of my participants’ routes to place myself in their mindset; however, I did not feel comfortable riding all routes, such as arterial roads without a bicycle lane. Perceptions of safety vary from person to person. Even with my experiences and skills as a cyclist, riding these congested arterial roads seemed especially risky given the hostility some drivers show towards cyclists. I have noticed myself riding fewer and fewer routes I used to
enjoy due to negative interactions with drivers. Countless close passes (less than 1 meter), objects thrown, and angry honks over the last sixteen years have caused me to opt for quieter routes when possible. However, these busy roads are sometimes the fastest route for some participants, so I understand why they took the risk and rode on them. Replicating their routes helped narrow, but does not eliminate, the gap between “seeing there and being there” (Laurier, 2010; Spinney, 2011). Riding the routes also ensured a similar embodied experience, which helps with the video interpretation process and “learning to see” (Pink, 2007b; Spinney, 2009). Finally, as a male rider, I cannot experience the same conditions as female riders in this study in how they view space and safety. It is also impossible to forget my learned skills from sixteen years of riding and racing and experience the city as a newer rider. Audio from the cameras can help address these concerns by allowing the riders to provide additional context in the moment.

4. Results: Lived Experiences

Overall, the video footage demonstrated using space on roads and paths for utilitarian trips, social camaraderie, and physical challenges, but often with an eye towards potential harm from drivers. All the participants are experienced riders, and this experience of riding in traffic and learning driver behaviors, such as making eye contact at intersections, helped them avoid injury from errant drivers. Reviewing the rides allowed me to pause, re-watch, and reflect on events that placed riders close to harm and consider how such an event would impact a newer rider. In their study, Pink et al. (2017) found reviewing the riders’ footage an immersive experience with the sounds of passing cars, the rushing wind, and the rattling of the cameras on the rough roads. These sights and sounds meshed with my embodied experiences dealing with drivers, potholes, and other issues. While I entered the analysis with some expectations of what I would see based on frequently riding many of the routes, I still felt my body tense and a sense of concern and fear when watching a rider weave between traffic or select a route with no bicycle lane. The following sections discuss and analyze the riders’ experiences to improve policy and infrastructure.

4.1. Commuters

The commuting group consisted of three participants. There are two subgroups: Susan and myself, who used road or modified mountain bicycles, and Mick, a fixed-gear commuter. This distinction is important because fixed-gear riding is a countercultural group within cycling (Eichler, 2017). These bicycles lack a freehub and cannot coast—the rear gear is “fixed” on the hub, and most riders opt to remove brakes and use reverse pedaling to slow the bicycle. The focus on a fixed-gear bicycle is efficiency, both for power transfer and maintaining speed (Eichler, 2017).

Mick purposely selected a route through downtown, with only shared lane, or sharrow, markings rather than a lower-stress alternative. Comments during the video alluded to doing so for the rush, but it is also a form of tactical riding by “invading the car-zone” to remind drivers they “own a car and not the road” (Eichler, 2017). Spinney (2011) noted that riders often track stand—or come to a near stop at lights—to maintain a sense of movement. Conserving momentum pushed Mick to create space with his body and bicycle where other riders may not see any, such as between cars at stops and lights, rather than queue behind cars (Figure 1, top photos). Creating space in this manner, by avoiding behaving like a vehicle, is a way of asserting rights to the city and urban spaces (Eichler, 2017). However, this behavior places immense trust in the surrounding drivers to not merge or exit their vehicles. Skill and experience on the rider’s part can mitigate these dangers by looking for driver head movements or vehicle movements.

Unfortunately, lane splitting, or riding between stopped cars, does not always go according to plan. In Figure 1 (bottom), Mick attempted to maintain his speed, or state of flow (Eichler, 2017; Spinney, 2011), to catch the green light. Mick’s experience allowed him to notice the door cracking open, and he could maneuver quickly around. This action sometimes included a “Hey!” or “Woah!” to catch the driver’s attention. In this case, Mick is consistently looking for exits in the event of an errant driver or passenger. I often ride Mick’s routes, and I practice a heightened sense of awareness, scan for outs, and anticipate driver behavior. I did not perform lane-splitting due to
my distrust of drivers, and new riders may find his routes nerve-wracking due to the lack of infrastructure.

The other commuters dealt with day-to-day hassles of aggressive or inattentive drivers around the midtown area. Susan commuted most days using the same route to the medical campus at the University of Arizona. Her daily route consisted of navigating through residential streets and a construction zone on campus using the sidewalk. She selected this route because she felt safer than dealing with speeding campus work trucks on the alternative back road. The residential street provided a few close passes near stop signs (Figure 2, bottom). While low speed, these close passes can be unnerving to experience regardless of how long you have been riding.

Susan’s route also involved riding on the failing pavement on the hospital’s east side—the pavement’s roughness rattled the cameras. The road passes the hospital’s main entrance, which drivers occasionally blocked in the afternoon. On January 24, Susan entered the entrance intersection only to be cut off by a driver (Figure 2, top left). Exasperated, she exclaimed, “Really! Unreal!” while waiting until the intersection cleared. Other videos show these types of interactions with cars are not uncommon. A few days earlier, Susan had another interaction with an inattentive driver. In this case, the driver (Figure 2, top right, white car) stopped and then swung left into Susan, who yelled, “HELLO!” and braked hard to avoid a collision. While Susan used roads with low-speed limits and moderate traffic, she experienced close passes or other poor behavior from drivers almost daily. Other video footage showed Susan riding in a defensive position away from the edge of the road, a tactic used to force drivers to slow down and give space when passing, demonstrating her distrust for drivers even on slow residential streets. Even with defensive riding, the negative experiences are heard in her voice when she yells at drivers, not in fear but anger and disbelief that she is still at risk when doing everything right.

My experience and footage detailed similar interactions. In one case (Figure 3, left), a driver blocked the travel lane. As our small group went to pass, another driver honked at us, resulting in me yelling, “What did you want us to do!? There was a car there!” At another intersection (Figure 3, right), a driver barely stopped in time, causing another rider to stick their arm out in a stopping motion to catch the driver’s attention. An intersection north of campus proved particularly
troublesome during my afternoon commutes due to rush hour traffic. Left turns can be challenging to make, and in two cases, an oncoming driver turned in front of me, narrowly missing me. These two events were a few in a long string of such interactions at this intersection, which prompted me to select a longer route through campus to avoid it altogether. This longer route exposed me to two streetcar track crossings and several additional paths crowded with pedestrians; however, it was still safer and worth the risk compared to turning drivers. Such behavior from drivers is a constant reminder of the precariousness of riding with traffic and the ends some riders will go to avoid it if possible.

While the city often provides bicycle lanes, paint cannot stop a distracted driver. In these encounters, riders protect the space provided rather than creating space, as shown by the fixed-gear commuter. Whereas Mick created space by invading the car domain (Eichler, 2017), in my and Susan’s cases, the cars were the invaders, unwelcome and dangerous guests whose presence reminds us of how quickly a ride can end. Their aggressive actions undermine confidence, frustrate riders, and instill a sense of hostility. The cameras caught Susan and me yelling at drivers to vent our frustration when we felt threatened by their behaviors. A separate protected space in dense urban areas would provide a welcome reprieve from this daily grind, although they may not attract riders like Mick.


4.2. Recreational Riders

The two recreational riders, Vinny and Sara, often sought safety and companionship in numbers and used less-trafficked roads or The Chuck Huckelberry Loop path system. The path system is completely separated from the roads and provides a safe space to ride with friends without the constant threat from drivers. However, when venturing out to the open road, the recreational riders’ experiences with drivers were similar to the commuters and the athlete, with errant drivers invading bicycle lanes or turning without looking. In one example riding through campus on the weekend, a car stopped abruptly in front of Vinny, causing him to brake hard, yell, “Woah!” and swerve, almost crashing into the car and others in the process. Recreational riders attempt to protect their space from drivers by grouping up, alerting others to approaching cars, and yelling at errant drivers.

A notable difference from commuters is that recreational riders navigate the urban space while also creating and maintaining space within the group for themselves (Figure 4, top left). Cycling as a group activity has social norms and queues that dictate riders’ interactions, such as speed, handling, and communicating dangers (Albert, 1991; Palmer, 1996). Riding with others requires trusting them to ride in a smooth, steady, and predictable manner. The group’s safety and returning home injury-free requires adhering to these norms (Albert, 1991). Failure to do so, and presenting a danger to others, results in being ostracized from the group. Video from Vinny’s front camera captured a rider dropping a bottle in the middle of a group, which caused swerving and yelling, “Woah, hey, bottle!” and the rider to be placed near the back. Another rider increased the group’s speed unexpectedly. Sarcastic commentary such as “And we’re going to do 400 watts now!” and jeering from others showed their displeasure with the offending rider for disrupting the smooth pace.

There is often a mix of recreational riders and athletes on these group rides. Recreational riders straddle a line between cycling as the priority in life and having a life outside of the sport—although embracing the cycling culture can be just as strong (Palmer, 1996). Vinny straddles this line by riding sparingly during the week due to work and family, but long on the weekends—the classic “weekend warrior.” Sara uses riding for errands, a break from work, catching up with friends, and fitness for weekend adventures. Peak fitness is not always their goal; however, building social comradery or relaxing alone is often motivating.

Figure 4. Vinny’s Recreational Rides.
Top left: Vinny “taking pace” in the group and making his usual rounds conversing with riders.
Top right: Others stop to help him with his flat—his second for the day (rider is behind the camera repairing the flat).
Center bottom: On a separate, smaller ride, the group stops to help someone who broke their rear derailleur on a hill.
In this way, riders are creating physical space in the group and social space. Regardless of group size, there is a hierarchy based on years of riding and seniority. The senior riders are responsible for ensuring the ride proceeds safely and helping others if needed. In Figure 4 (top right), riders stopped to help Vinny, who had a flat, and later Vinny stopped to help others on a smaller weekday ride (Figure 4, bottom center). Vinny ended his ride early on the smaller weekday ride to help the rider with a broken bicycle get home safely. Stopping for others is a way to build relationships and support within the community.

The social comradery of cycling, which I have experienced on the same routes as Vinny and Sara, can be one of the strongest pulls into the sport and may be something cyclists who only commute solo miss out on. Most weekend rides saw Vinny chatting with numerous riders in the group and then stopping at a local bakery and café to swap stories with other riders. Weeknight sunset rides saw Sara sharing stories and views with a friend. The shared experiences of enjoying a sunset, a coffee, or conquering a hill with friends through a common interest create deep social bonds. It makes sense these riders seek out paths, low-stress streets, wide bicycle lanes, access to rural roads, and access to destinations such as cafés or pubs to enjoy both exercise and friendships.

4.3. Athlete

There is substantial overlap between the experiences of Rob, the athlete, and the recreational riders. The larger group rides are a mix of both, and riders follow the same norms and expectations to earn a place within the group. There is a subtle difference for athletes because rides serve a purpose beyond social comradery—they are training for competitions. Here, life is the bicycle, both on and off it (Palmer, 1996). This emphasis on training comes with a focus on selecting routes suited for the day’s training. A bicycle lane is not needed but is welcomed, and similar to fixed-gear riders, athletes often create space in the car’s domain.

On group rides, some groups’ size may crowd riders out of bicycle lanes on rural roads. The riders will bunch up in a peloton, or a pack of riders (Figure 5, top), for riding efficiency and safety (Albert, 1991; Palmer, 1996). The peloton makes passing quicker and easier for drivers rather than following the expected norms and laws of riding two abreast, which would create a long line of riders

Figure 5. Examples of Group Rides. Top left: An example of a peloton on a training ride. Top right: Riders pushed into the oncoming traffic lane. Center bottom: Norms, and expectations, such as holding a straight line (Albert, 1991), can break during critical points on hills as riders struggle to stay in contact.
nearly impossible to pass on some roads safely. It also forces drivers to wait for a safer moment and give more space instead of trying to squeeze by. However, riders often get pushed over into the oncoming traffic lane during the group’s constant motion (Figure 5, upper right), leading to dangerous moments with oncoming cars. These riders often position their bicycle and body close to others in the group to make their desire to merge back into the pack known. It is incumbent upon everyone in the group to understand the meaning behind this body language and create a small space for merging safely. Watching the “washing-machine effect” of the peloton’s movements can seem chaotic to the outsider, but the movements become clear once experiencing it or observing it over a long period (Palmer, 1996, p. 135).

While there is safety in numbers on training rides, there are risks of group norms and expectations breaking down, especially when the pace is elevated on hills on challenging rides. On these hills, riders struggle to stay in the group; their heart rate is near the max, and tunnel vision may set in. They are in an immense struggle between their physical limits and mental determination, and they take risks such as cutting off other riders to close gaps. Rob experienced this on a ride with another rider darting in front of his wheel (Figure 5, bottom). The struggle to stay in the group is multiphase: to win the battle of mind over body, to show your ability to your peers, to push to a new level of suffering, and to stay safe from drivers in the group. Interpreting these moments can be difficult for the non-cyclist and can appear more dangerous than they are. Only by experiencing and performing these painful practices, which I have, can one understand what is occurring in the rider’s mind (Palmer, 1996, p. 105).

Group rides provide an opportunity to push your limits; however, solo rides allow athletes to complete precise workouts without other riders interfering. Most athletes opt for a mix of group and solo training rides to maximize their fitness. Outside of the group ride, Rob selected routes to meet his training needs on solo rides. These routes often took him through downtown on the way to less trafficked roads. In doing so, Rob faced buses cutting him off, passenger doors opening, and unkept bicycle lanes (Figure 6). These experiences were similar for commuters and recreational riders. Other days saw Rob select routes without bicycle lanes and minimal shoulders. A wider shoulder would provide a safer environment, and enhanced infrastructure such as protected bicycle lanes could provide additional safety for other riders. However, as noted with the fixed-gear rider, these riders may not use those protected facilities because speed is an incentive,
and they are comfortable riding near traffic. Riding behind and around slower riders may not be desirable and could be a danger to both user groups due to speed differentials depending on the amount of space provided. Planners may need to offer both painted lanes and protected infrastructure to accommodate all users.

5. Discussion: Applications for Information Sharing and Planning
Understanding riders’ experiences provide opportunities for planners to develop better information and infrastructure that suits their needs. One outcome could be better maps. Special purpose cycling maps highlight low-stress streets, parks, libraries, and other destinations and are a crucial source of guidance for cyclists to know where to ride. However, maps are a social construct, and the final product depends on what the cartographer wants to show (Crampton, 2001; Crampton & Krygier, 2006; Monmonier, 2018; Pinder, 1996). Creating a map involves striking a balance between information overload and too little information (Macey et al., 1988).

For riders, selecting a route is a complex process, which includes the reason for riding, traffic, the presence of bicycle infrastructure, type of infrastructure provided, pavement conditions, gradients, parked cars, driveways, ease of turns, and route directness (Bíl et al., 2015; Broach et al., 2012; Hood et al., 2011; Lawrence & Oxley, 2019; Mekuria et al., 2012). The rider’s confidence and experience with cycling are also factors. As Dill and McNeil (2013, 2016) describe through surveys of 3,000 residents in 50 large Metropolitan Statistical Areas (MSAs) in the U.S., strong and fearless riders (7% of a population) are comfortable on a nonresidential street without a bicycle lane; enthused and confident riders (5%) are comfortable on nonresidential streets with a bicycle lane; and interested but concerned riders (51%) are comfortable riding on residential streets. The remaining (37%) are not interested in riding. Depending on what maps display, interested but concerned riders may find it challenging to create routes that suit their comfort level.

The bicycle map for Tucson shows various types of cycling facilities available, but the map does not differentiate between some road types (Figure 7). Arterials, which carry significant traffic and connect to major commercial centers, and collector roads, which connect neighborhoods to arterials (Forbes, 2000), are both described as a “painted lane on higher traffic streets with higher speeds.” These two roads have very different riding conditions (Figure 8). In general, the participants in this study avoided riding on arterial streets except for short periods to connect to other facilities. Unfortunately, the map could lead some to believe the roads are the same; however,
collector streets could be a lower-stress option for some riders. Revising the map to show colors based on traffic volume and speed may provide additional context for riders.

To fill this gap in cycling information, a local Tucson cartographer, Dylan Scott, developed a map showing lower stress facilities—predominantly residential streets and light-controlled crosswalks (Figure 9). Instead of a dense network, the city becomes almost unrecognizable without the prominent arterials and superblock grid. This map shows the city from the viewpoint of a cautious rider, not a place of unlimited options, but rather limitations determined by their location. For some, the current road conditions and infrastructure may not allow them to ride to their destinations safely or comfortably.

Comparing the low-stress routes to the standard bicycle map highlights Pinder’s (1996) description of constructing reality. In one map, we see a city that meets the League of American Bicyclists (LAB) Gold level ranking on their Bicycle Friendly Communities scoring system, with ample lanes and facilities (LAB, 2021). On the other, we see conditions for those less comfortable riding with traffic. If the goal is to increase ridership, we need to provide accurate information on cycling conditions. The information displayed on maps can impact how and where cyclists ride, impacting their lived experiences.
Increasing ridership requires more than good maps—better and more infrastructure is required. A small bicycle lane is not enough. Not only is paint a poor form of protection from errant drivers, but riders’ utilization of infrastructure differ, ranging from a competitive ride to a spin to work. Asking this wide range of use, abilities, and experiences to share one space may lead to conflict. For example, San Diego recently constructed over 96 kilometers of protected bicycle lanes (Smith & Joshua, 2021). The San Diego Union-Tribune detailed pushback on the projects from recreational and athletic riders, who felt forced into the protected lanes. They saw the lanes as dangerous because their speeds carry them into intersections faster than drivers can react, and slow-moving riders may block the path (Smith & Joshua, 2021).

The pushback against protected infrastructure is rooted in John Forester’s vehicular cyclist doctrine that all cyclists are the safest riding in traffic, and bicycle lanes and paths pose a danger (Flax, 2019; Pucher, 2001). Forester’s views stem from his defense of riding on the road in the 1970s when city governments in California attempted to ban riding on roads in favor of paths, which he found “1,000 times” more dangerous (Flax, 2019; Pucher, 2001). His work resulted in cities allowing cyclists on the roads; however, it squashed attempts to build cycle paths, and some advocates argue it set the U.S. back decades compared to Europe (Flax, 2019). Forester’s views on cycle paths do not consider today’s design standards or how these facilities increase ridership (Pucher, 2001). Instead, groups such as Cycling Savvy, which carry on Forester’s work, advocate teaching cyclists how to command and create space in travel lanes as the best way to increase ridership (Flax, 2019). Teaching cyclists how to create space around vehicles is not bad, and several riders in this study rode confidently in traffic. However, we need to move beyond the views of vehicular cyclists to create spaces that support all types of riders.

A similar conflict may play out in Tucson, as planners explore adding protected bicycle lanes along two bicycle-heavy utilized streets west of campus to improve commuters’ safety and experiences. Both streets are part of routes used by athletes and recreational riders. Like the pushback in San Diego, a group of recreational and athletic riders opposed the idea because it was unclear if they would be forced to use the facilities, impeding their group rides. However, lane markings could be used with the protected lanes on both streets. Doing so provides space for these riders during the group rides, which occur early in the morning when traffic is light and provides better connectivity for other riders seeking protected spaces.

Other cities have successfully provided more and better infrastructure by listening to riders’ concerns. In Paris, France, cycling rates increased modestly from 1.6% (650,000 trips a day) in 2010 to 1.9% (840,000 trips a day) in 2019 (Île-de-France, 2020). The onset of the 2019 transit winter transit strike, followed by the COVID-19 pandemic, spurred a flurry of activity on separated cycle paths in May 2020. 50 K.M. were constructed after ten days (11 May 2020) and 140 KM four months later (Île-de-France, 2020). Ridership rates effectively doubled post-lockdown in 2020. A survey of 600 riders found that 44% started riding after the lockdown, 41% were women, and 87% wanted to see the paths remain and made permanent (Île-de-France, 2020). The investment shows that new riders and commuters want and utilize protected cycling facilities. As shown by this study’s participants, commuters avoid the day-to-day struggle of fighting drivers for space.

By understanding different riders’ experiences and needs, planners can identify conflicts in facility use and carefully design our streets to meet the diverse reasons to cycle in the city. As shown in San Diego and Tucson, we cannot allow a small number of strong and fearless riders to dictate infrastructure design. These riders raise a valid concern if cities force them to use the protected lanes. These lanes can be hazardous if faster, more confident riders try to maintain their speed and group size. Protected bicycle lanes and separated paths better serve riders whose goals are lower-stress routes. The solution is not to remove the protected lane; instead, planners should provide additional space within protected lanes and paths, or provide a painted lane for more...
confident riders. Offering multiple types of cycling infrastructure on the same road may increase ridership and justify the investment.

6. Conclusion
This paper presents the differences in lived experiences between commuting cyclists, recreational riders, and athletes and the insights on infrastructure and policy using video ethnography. Since cycling requires studying participants in motion, being there may not be physically possible or dangerous. Using video ethnography provides researchers a way of “seeing there without being there” (Laurier, 2010; Spinney, 2011). Additionally, the videos capture events that may be forgotten or overlooked in journals or interviews. This methodology provides an excellent avenue to understand riders’ cycling experiences in the city.

Experiencing the city includes maps showing cycling infrastructure. Maps should show differences between roads based on ground conditions, such as the number of lanes and speed, not just the bicycle infrastructure present. Maps can influence where people ride; however, videos show the riders experienced the city differently. For commuters, cycling is often solo and utilitarian. For recreational riders and athletes, cycling is both an individual, relaxing activity, and social activity with norms that regulate behavior in a group. The social value was evident through interactions during and after group rides. The fixed-gear commuter, recreational riders, and the athlete often broke away from expected norms and infrastructure designed for them to take space from drivers. The fixed-gear commuter regularly shifted between cycling and vehicle space to maintain momentum and assert control. Athletes and recreational riders sometimes formed a group or peloton on the road for safety and social aspects. The other commuters were less likely to leave the space dedicated for them and rode defensively to protect it from errant drivers through quick motions, yelling, and gestures.

All participants experienced negative interactions with drivers during their rides and expressed anger in the moment. As evidenced by the audible frustrations, the daily grind of constant intrusions from drivers builds a sense of anger and mistrust towards both drivers and the city for not doing enough. Cyclists may feel vulnerable, forgotten, and marginalized as the incremental planning and construction process drags on for cycling infrastructure, while news reports cover rising injuries and fatalities (Conover, 2020; O’Gara, 2019). Locations that invest in quick build infrastructure projects have seen dramatic increases in ridership (Île-de-France, 2020), and it can show that decision-makers are listening to concerns.

However, decision-makers must balance various demands for cycling: people looking for safe routes to work/school, safe places to ride with friends, and places to train. Studies that explore the daily experiences and the social underpinnings of riding can help planners position cities to develop better maps, infrastructure, and policies. Planners should not design infrastructure to satisfy the behavior and demands of just the bold cyclists. As shown by the wide variety of experiences and behavior, bicycle infrastructure should match by providing various options to meet riders’ needs. Doing so creates spaces that encourage more people to ride by allowing them to select the facility they are most comfortable with for experiencing the city.

Acknowledgements
This work is the result of my dissertation project, and I am deeply thankful for the edits, comments, and feedback from my dissertation committee, family, and friends.

Funding
This work was supported by the National Institute for Transportation and Communities (NIITC), Grant 1276.

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Disclosure statement
In accordance with Taylor & Francis policy and my ethical obligation as a researcher, I am reporting that I serve on the Tucson-Pima County Bicycle Advisory Committee, an organization that may be affected by the research reported in the enclosed paper. I have disclosed those interests fully to Taylor & Francis, and I have in place an approved plan for managing any potential conflicts arising from that involvement.
Data Availability

Data is available for review through the University of Arizona ReDATA repository at: https://doi.org/10.25422/azu.data.148/9762v1

Citation information

Cite this article as: Where and how Tucsonans ride and implications for cycling infrastructure, Joseph Edward Iuliano,Cogent Social Sciences (2022), 8: 2054127.

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