How Bike Lane Markings Shape Motorist Expectations of Cyclist Placement at Intersections

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ABSTRACT

Intersections are dangerous for cyclists; most accidents at intersections involve motor vehicles, which increases the odds of serious injury. There are many challenges to designing safer intersections for cyclists, and the variety of intersection types further complicates effective designs. We examined motorist interpretation of a traditional bike line compared to a novel merge bike lane at a four-way intersection. Motorists' interpretation of the bike lane was indexed by asking them to indicate where they would stop their bike to wait for the light to change. They were also asked to rate how difficult it was to make the position judgment and their associated feeling of safety at that position. The results indicate a strong tendency to position cyclists on the right side of the road. However, if a merge lane treatment was present, they were more likely to integrate the cyclist with motorized traffic. An examination of individual participant responses suggested some motorists adopt simple heuristics to determine bicycle position, such as *always staying right or staying in the bike lane*. Others adopted complex strategies such as using the bicycle lane or taking the lane unless motorized traffic was present. Motorists rated merge bike lane scenarios as less safe and more difficult to determine appropriate bicycle position. Overall, it appears motorists understand the proposed merge bike lane treatment but felt "taking the lane" was potentially hazardous.

Keywords: bicycle safety, driver behavior, bicycle lane markings

1 INTRODUCTION

Intersections represent dangerous situations for cyclists. There are a disproportionate number of accidents that occur at or around intersections compared to non-intersection portions of bicycle routes (c.f., Johnson et al., 2010). The majority of accidents involve motor vehicles, increasing the odds of serious injury (e.g., Beck et al., 2016; Dozza & Werneke, 2014; Meuleners et al., 2020). The risks posed by intersections can be mitigated by increasing cyclist visibility and by decreasing ambiguity about where to expect cyclists to be positioned in the lane. Encouraging cyclists to ride in a prominent lane position can increase visibility, but the effectiveness of this is partially constrained by motorists' expectations for cyclists to be in those positions. This study was designed to examine motorists' expectations regarding cyclist lane placement and how those expectations can be shaped using simple lane markings. In this case, the simple lane marking is a modified bike lane that appears to merge bicycle traffic with motorized traffic. We hypothesized that motorists expect cyclists to ride near the side of the road, but a "merge" lane treatment can lead them to expect cyclists to be in the middle of the lane.

The need for increased cycling safety cannot be understated. In addition to the risk of fatality, cyclists face the risk of severe injury. For example, in Beck et al.'s (2016) study of individuals who had been to the hospital as a result of a bicycle crash, 76% met the criteria for major trauma and while most were able to return to work within six months of the crash, "only a third of participants reported complete functional recovery" (p. 223). Dozza and Werneke's (2014) instrumented bicycle study highlights that cyclists were four times more likely to have an incident at or in an intersection. Further, occlusions near the intersection (e.g., buildings, bushes) increased risk twelvefold. Even an intersection that does not have fixed occluding structures can present visibility issues for cyclists. One of the most common types of crashes in Beck et al.'s (2016) study involved motor vehicles turning across the cyclist's path when the two were coming from opposite directions. Beck et al. hypothesized the cyclist was occluded by a vehicle they were following into the intersection in those situations. Thus, while the oncoming motorist believed they were turning into an opening in traffic, they were actually turning into a cyclist. Another common accident involved the motorist turning into a cyclist moving in the same direction. In this case, the cyclist may be in the motorist's blind spot.

One way to increase visibility on the road is to move toward the middle of the lane. However, many factors impact a cyclist's selection of lane position. Hatfield et al. (2018) found that while cyclists tend to ride in the lane position closest to the curb, they reported a preference to ride in the primary lane position. That is, they would prefer to take the lane. In practice, their decision to take the lane was impacted by numerous factors. For instance, the number of lanes traveling in the same direction, the presence of parked cars, the speed they were traveling compared to motorized traffic, the presence of motorized traffic in the oncoming lane, and lane width. Across a variety of scenarios, cyclists self-reported a desire to stay out of the way of motorized traffic.

Safe interactions with motor vehicles are the primary concern for cyclists of all types (Winters, et al., 2011). Safety plays a significant role in an individual's decision to ride a bicycle, where to ride, and how far to ride. Bicycle infrastructure, including bicycle lanes, can increase feelings of safety on the roads (see Buehler & Dill, 2016 for a review). Because bicycling is seen as a sustainable form of transportation and offers health benefits to regular riders (c.f., Rasmussen et al., 2016), communities and countries worldwide have examined ways to increase bicycle ridership. Buehler and Dill (2016) suggest that "virtually all cities and countries that have attempted to promote cycling have expanded their network of bicycle facilities, including bicycle lanes, cycle tracks, paths, traffic calming of neighborhood streets, and special accommodations for cyclists at intersections" (p. 9). It is presumed that bicycle facilities might increase bicycle commuting and, potentially, increase bicycling for other utilitarian and recreational purposes.

Given the goal to increase ridership, increase bicycle lane facilities, and the consistent growth in bicycling in the United States (Le et al., 2019), it is increasingly vital for cyclists and motorists to understand how to share the road. Although there is some evidence that motorists are not familiar with bicycle-related laws (c.f., Still & Still, 2019), simple painted markings on the road can help communicate safe interactions. For example, Hunter et al. (2010) suggest that sharrow (shared-use arrow) markings guide cyclists away from hazards like vehicle door zones and grates on the side of the road, and even bicycle lanes help communicate to motorists where to expect cyclists on the road (e.g., Pein et al., 1999). Similarly, Still and Still's (2020) stated-preference survey demonstrated that motorists are reactive to novel road markings and can interpret the markings in the intended fashion with no formal instruction. For instance, when presented with a scenario that included a painted hazard strip (dashed line) alongside a parking lane, participants were more likely to indicate that a cyclist should ride further away from the parking lane than when there was no hazard strip in the scenario. Road-sharing signifiers should be clear to both cyclists and motorists. While it is essential to know whether or not cyclists will use the signifiers and infrastructure as intended (i.e., will cyclists ride in a painted bike lane), it is also essential to understand how motorists interpret those signifiers. Knowing where to expect a cyclist on the road could increase motorist detection of cyclists and improve the subjective experience of interacting with cyclists. That is, the motorist knows the cyclist should be in that location on the road and it is not just a personal preference of the cyclist to "block traffic".

Bicycle positioning at intersections is even more complicated. Intersections are characterized by increased risk as vehicles and other road users can collide. They also contain various markings (stop lines, turn lanes, pedestrian crossings) and signs (stoplights, road signs, intersection-specific rules) that could make it difficult to incorporate additional bicycle signifiers. Because of this, effective bicycle signifiers at intersections should be easy to interpret. Bicycle intersection treatments should also be designed to mitigate specific risks for cyclists; that is, they are not merely a tool to indicate where a cyclist should ride.

In addition to risk incurred due to the complexity of intersections, is the risk of motorists turning across the path of a cyclist who is traveling straight (e.g., Beck et al., 2016). When traveling in the same direction, a motorist may turn and not see the cyclist to their side in the direction they intend to turn. Advanced stop lines and bike boxes have been used to increase cyclists' visibility at intersections and mitigate some of the risk of a vehicle turning into a cyclist or across the path of a cyclist at an intersection (e.g., Allen et al., 2005). This is accomplished by reserving space in front of the stop line stretching across the travel line for cyclists. The “box” allows cyclists to position themselves in front of stopped motorized traffic (i.e., they can travel up the bike lane or feeder lane past motor vehicles to the bike box) without blocking the crosswalk (NACTO, 2011). It also provides a space for cyclists to move to different lane positions to help facilitate turns across traffic at intersections (NACTO, 2011). The bike box is useful for areas with high numbers of cyclists as it provides enough space for multiple cyclists to position themselves in a high visibility location at the intersection compared to a traditional bike lane.

While bike boxes can be useful, they may not be well-suited for all situations. For instance, an individual cyclist who approaches the bicycle box is not directed to take the lane's prioritized position; they may remain near the curb, thereby underutilizing the bike box's functionality. Similarly, in situations where the bicycle lane does not continue on the other side of the intersection, the bike box may not facilitate cyclist integration into motorized traffic. In relation to motorists, the advanced stop line, bike boxes, and occasionally traditional curbside bike lanes, may be designed in a way that prohibits right turns on red. While the intention is to protect cyclists, a known challenge with advanced stop lines and bike boxes is vehicle encroachment into those spaces (e.g., Allen et al., 2005). Some may see the intersection treatment as a burden to motorists if it increases wait time to turn right.

The purpose of this study is to examine a novel intersection treatment, a merge bicycle lane, in comparison to a traditional bicycle lane. A merge lane positions the cyclist in a primary lane position (i.e., take the lane) at intersections. By taking the lane, the cyclist would have increased visibility for motor vehicle traffic in both directions. The merge lane position can also allow vehicles to continue to turn right at a stoplight while the cyclist waits for the light to change. In situations where a motor vehicle is already at the intersection when the cyclist approaches, the merge bike lane would serve as a visual indicator to integrate into traffic behind the motor vehicle instead of continuing to the stop line on the right side of the road. This type of behavior, integrating upon arrival at an intersection, might be an optimal practice when the bike lane does not continue. In addition to examining a novel intersection treatment, another unique aspect of this study is understanding the motorist's interpretation of bicycle intersection treatments. There is a trend in the existing literature to focus on cyclist use of novel intersection treatments and cyclist compliance with rules and laws. For instance, one might examine whether or not the treatment decreases the frequency of cyclists running red lights (c.f., Casello et al., 2017; Ohlms & Kweon, 2018). Although understanding cyclist compliance with the law is important, it is also essential to understand how motorists would interpret the bicycle lane treatment if they were to encounter it. Having a common understanding of how the road can be shared is a critical component in improving the safety and the subjective experience of motorist and cyclist interactions.

2 METHOD

Ninety-one university students participated in the study in exchange for course research participation credit. Of the sample, 14 were excluded because they were not licensed to operate a motor vehicle in Virginia (where the study was conducted), and four more were excluded because they did not complete the majority of the survey. The data from the remaining 73 participants were analyzed. The participants (57 female) were traditional university students (90% aged 18-23 years). Of the participants, 97% reported having ridden a bicycle before. However, the sample is best characterized as a group that does not cycle or rarely cycles: 83% report riding less than once a month, 11% ride once every couple of weeks, 2.8% ride 1-4 days a week, and 2.8% ride five or more days a week. Even the few cyclists in the sample fall below "expert level" with low yearly mileage (100 – 2000 miles) totals.

The survey data presented here were collected from a more extensive survey that included items measuring knowledge of bicycle law, opinions about safe passing distances, and bicycle placement in the lane associated with various contexts (e.g., parked cars, sharrow markings, *share the lane* signs; see Still & Still, 2020). Only the scenarios related to intersections are examined in this article. This paper and pencil survey was completed individually in a laboratory setting. A research assistant was available to answer questions during the session, but no participants asked for additional explanation.

Four intersection scenarios were tested with two factors manipulated within-subjects: bike lane design (traditional, merge) and vehicle (presence, absence). The scenarios were simplified top-down drawings of an intersection (see Figure 1); all scenarios depicted a four-way intersection governed by a stoplight with two lanes in each direction of travel. Because the survey was administered in the United States, it is implied that the traffic would flow on the right side of the road and the bicyclist would likely be in the right lane. Along these lines, the road markings also indicate that traffic flows on the right side. In the scenario, the participant is approaching a red stoplight and is planning to continue traveling straight through the intersection when the light changes. They should consider the road markings and obstacles that might be present and then respond to three questions.

Within each scenario, participants were asked "Where do you stop your bike to wait on the light to turn green?". They responded by selecting one of four predetermined locations (see Figure 1). One location was at the stop line in the right side of the left travel lane (atypical lane selection). Another location was at the stop line in the left side of the right lane; this position could be considered analogous to "taking the lane". The remaining two options were on the right side of the right travel lane with one option being positioned at the stop line (a traditional position) and the other option being a location a few feet behind the stop line (a recessed position). If a vehicle was also waiting at the stoplight, a cyclist might try to increase visibility to the driver by being in a recessed position. When a vehicle was present in the scenario, the participant was given the option to position the bicycle behind the vehicle; this was analogous to the "taking the lane" position but moved behind the vehicle, thereby integrating into traffic. After selecting bicycle placement, participants were asked to rate how much they agree with two statements: *It was difficult to determine the best bike position* and *I feel safe at this position*. The rating scale ranged from 1 – *Strongly Disagree* to 4 – *Strongly Agree*.

If participants feel it is difficult or dangerous to pass cyclists, it could impact where they say they would place their bicycle at an intersection. A subset of items related to passing cyclists was examined to provide more context for individual differences in the sample. Participants were asked about their general concern for the safety of cyclists when they pass them and they were asked about specific factors that might make passing a cyclist difficult these included: the lane is narrow, the cyclist moves side-to-side unpredictably, it's difficult to judge passing distance, acceleration to pass is too great. Agreement with each statement was rated on a scale that ranged from 1 – *Strongly Disagree* to 4 – *Strongly Agree*.

Figure 1. Two intersections from the survey. Participants were instructed to first refer to the intersection on the left which shows all road markings and obstacles. Then they were asked to indicate where they would stop their bicycle using the labels on the right.

3 RESULTS

All inferential statistics were conducted using two-tailed tests and an alpha level of 0.05 to determine statistical significance.

3.1 Bicycle placement

When asked where they would stop their bike to wait for the light to turn green, participants were most likely to report that they would stop in the bike lane (77.6%). In the traditional bike lane scenario, participants were more likely to place the bicycle in the bike lane (92.4%) than in merge bike lane scenario (62.8%). It is worth noting that two options in the traditional scenario included the bike lane, but only one option included the bike lane in the merge bike lane scenario, making the difference more apparent than real. When only the most common bike lane location in the traditional scenario is considered (far right, stop line condition), the percentage is comparable (60.3%) to the merge bike lane scenario

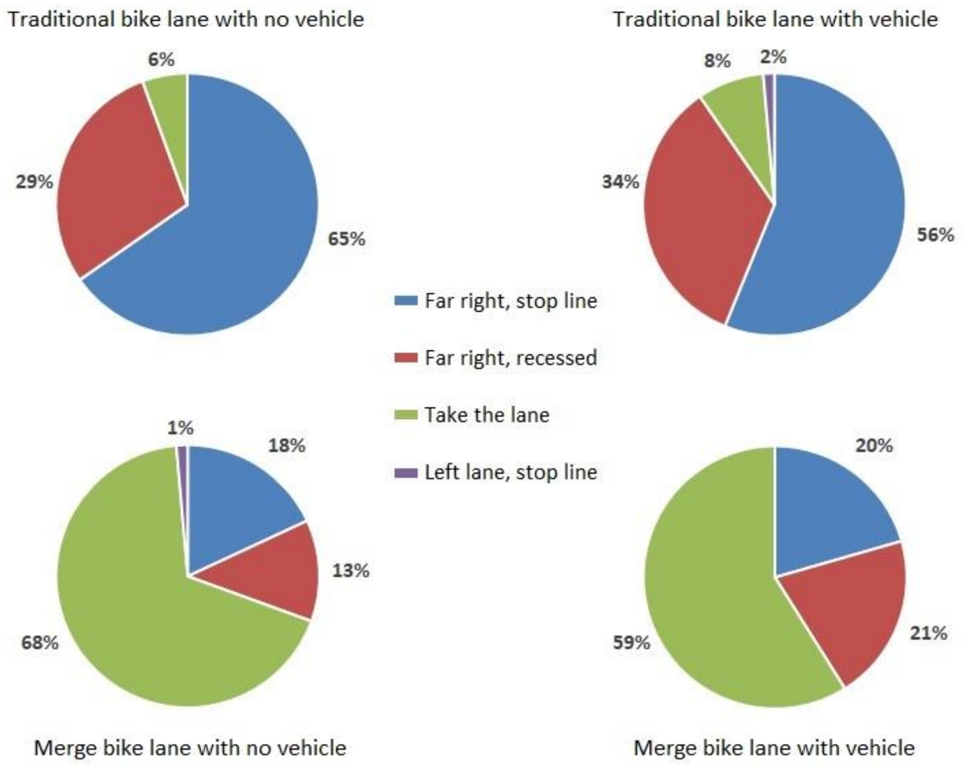

Figure 2. Bicycle placement at intersections and how it varies with bike lane type and vehicle presence. Values represent the percentage of participants selecting that position.

To further explore how participant responses varied across the scenarios, lane positions were recoded to reflect “change” across specific scenarios. This recoding facilitates a more nuanced measure of trends across changes in bike lane type and vehicle presence. Participants may adopt relatively fixed strategies where they provide the same response to two scenarios; these are depicted in Figure 3. When given the traditional bike lane scenario, 86.7% of participants place the bicycle in the far-right position whether or not a vehicle is present (i.e., they "Stay far right"). While many participants use the painted bike lane as a guide for bicycle placement (see "Stay in bike lane"), there is still a tendency to place the bicycle in a far-right position when

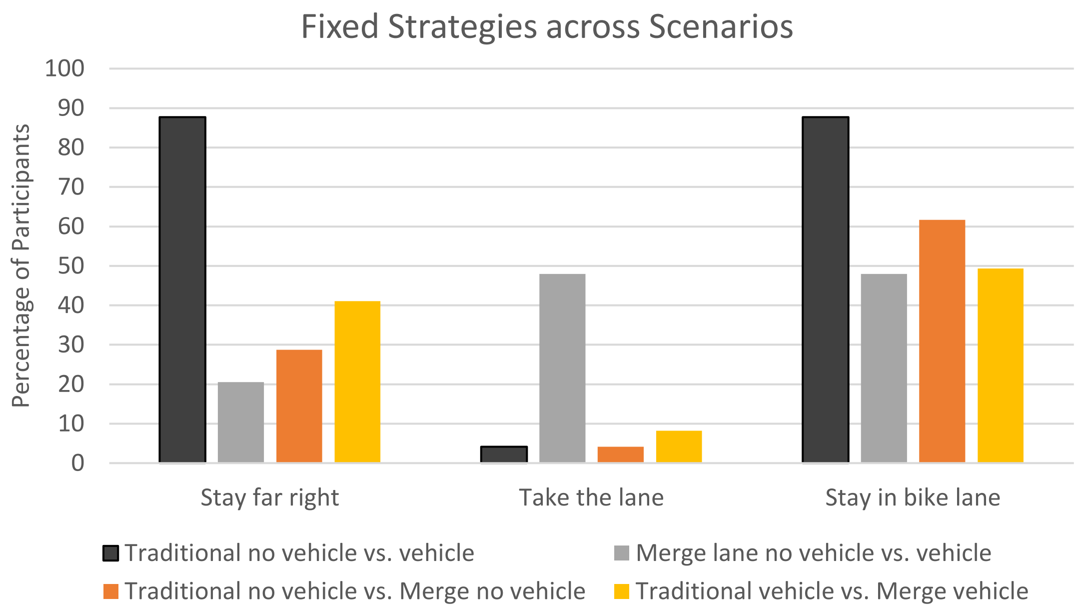

Figure 3. Percentage of participants who adopt the same strategy across scenarios.

motorized traffic is present. This is demonstrated by the lower percentage of participants who "Take the lane" and also by the difference in the percentage who "Stay in bike lane" when there is no vehicle compared to when there is a vehicle. Specifically, while 61.6% of participants stay in the bike lane across the two no vehicle conditions, only 49.3% remain in the bike lane across the two vehicle conditions.

In comparison, participants may demonstrate reactivity to bike lane type and vehicle presence; these are depicted in Figure 4. The "move right" response percentages reconfirm the tendency for participants to move right to avoid vehicles, even if that means moving out of the bike lane. A similar type of response is illustrated in the "move back" designation. The "move left" and “integrate with traffic” responses also show a trend whereby participants are more likely to place the bicycle in the middle of the right traffic lane (i.e., take the lane) when the merge bike lane is used compared to the traditional bike lane.

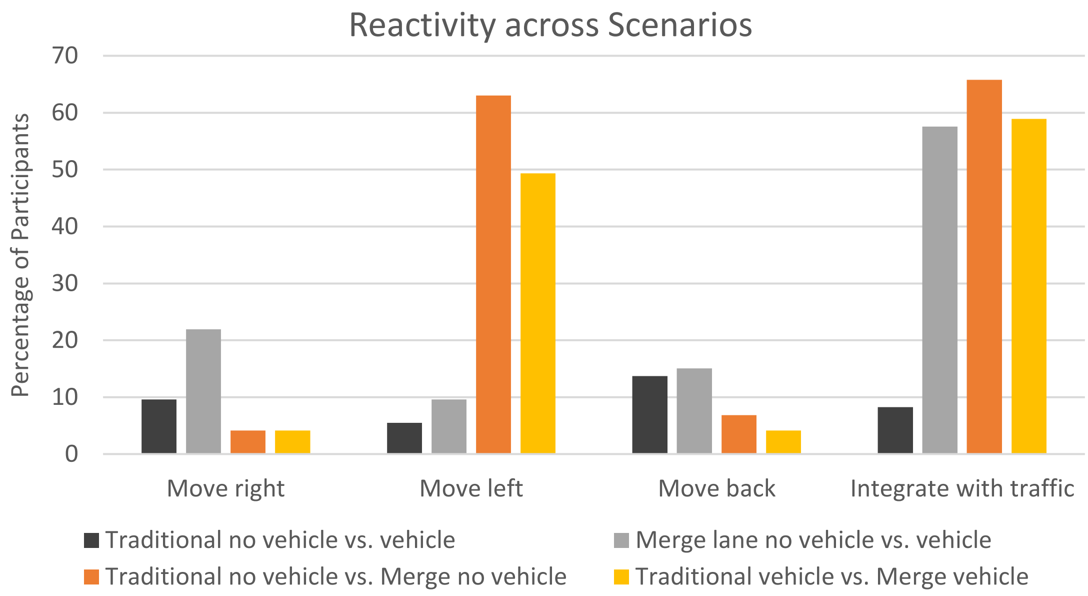

Figure 4. Percentage of participants whose bicycle placement varies across scenarios.

3.2 Difficulty rating

Across the four scenarios, the type of bicycle lane and a vehicle's presence impacted motorists' rating of how difficult it was to determine the best bike position at the intersection, Friedman's *Q* (3) = 9.56, *p* = .023 (see Table 1). Using Wilcoxon signed ranks test, planned comparisons revealed that participants rated the merge bike lane with vehicle scenario as being more challenging to determine the best bike position than the traditional bike lane with vehicle scenario (*p* = .025). The McNemar-Bowker test for consistency mirrored these findings. It demonstrated a general pattern whereby participants were more likely to rate the merge bike lane scenarios as more challenging to determine the best position. Difficulty ratings shifted from lower to higher when comparing the traditional scenario with a vehicle to the merge scenario with a vehicle, χ^2 (5) = 12.533, *p* = .028.

Table 1. Means and standard deviations of participant ratings of the scenarios.

Scenario	Difficulty Rating	Safety Rating
Traditional bike lane, no vehicle	2.40 (.70)	2.93 (.76)
Traditional bike lane, vehicle	2.38 (.70)	2.89 (.76)
Merge bike lane, no vehicle	2.53 (.87)	2.68 (.75)
Merge bike lane, vehicle	2.64 (.89)	2.58 (.82)

3.3 Safety rating

Across the four scenarios, the type of bicycle lane and the presence of a vehicle impacted motorists' rating of how safe they feel at the location they selected at the intersection, Friedman's Q (3) = 18.94, $p < .001$ (see Table 1). Using Wilcoxon signed ranks test, planned comparisons revealed that participants rated the traditional bike lane scenarios as feeling safer than the merge bike lane scenarios. This was true with no vehicle present ($p = .035$) and with a vehicle present ($p = .004$). The McNemar-Bowker test for consistency mirrored these findings with safety ratings tending to shift from higher to lower going from the traditional to merge bike lane when no vehicle was present, χ^2 (6) = 11.748, $p = .068$, and also when a vehicle was present, χ^2 (6) = 15.18, $p = .019$.

3.4 Participant characteristics

Overall, the data suggest that participants have concerns about passing cyclists. Eighty-nine percent *Agree* or *Strongly Agree* that "while passing a cyclist I worry about their safety". When asked to consider what factors make it difficult to pass a cyclist, 93% *Agree* or *Strongly Agree* that the narrow lane makes it difficult; 67% *Agree* or *Strongly Agree* that cyclists moving side-to-side in an unpredictable fashion makes it difficult; 86% *Agree* or *Strongly Agree* that judging the distance between their vehicle and the cyclists makes it difficult; and 44% *Agree* or *Strongly Agree* that passing quickly is difficult because they have to accelerate from such a slow speed to pass.

To further examine individual differences, participants were divided into groups based on their lane placement responses (see detailed descriptions in Table 2). Participants who always positioned the bicycle on the right side of the road were classified as *Conservative* (22%). Those who always positioned the bicycle in the bike lane were classified as *Bike Lane* (39%). Those who tended to ride in the bike lane except when motor traffic was present were classified as *Cautious* (22%). Those who typically take the lane were classified as *Confident* (4%). While those who responded both conservatively and assertively were classified as *Ambivalent* (11%).

Table 2. Participant types and ratings (mean and standard deviation) related to passing

Type	Description of Bicycle Placement	Cyclist weaving	Judging distance	Acceler-ation
Conservative	Always right in same the position (*n* = 10) Always right, recessed from stop line (*n* = 3) Always right, recessed with vehicles present (*n* = 3)	2.9 (0.9)	3.1 (0.7)	2.8 (0.8)
Bike lane	Always selects position in bike lane (*n* = 28)	2.5 (0.8)	2.5 (0.6)	2.3 (0.7)
Cautious	Uses bike lane except in merge scenario with vehicle (*n* = 14) Takes lane when there is no vehicle (*n* = 2)	3.2 (0.7)	2.9 (0.9)	2.8 (0.9)

Confident	Typically takes the lane (*n* = 1) Always takes the lane (*n* = 2)	2.3 (1.2)	2.3 (1.5)	2.0 (1.0)
Ambivalent	Avoids and takes lane in traffic (*n* = 8)	2.6 (0.5)	3.0 (0.9)	2.4 (0.9)
Unassigned	Failed to respond to all scenarios (*n* = 2)	3.0 (0.0)	2.0 (0.0)	2.0 (0.0)

To better understand if there are differences between the groups of participants identified in Table 2, the three largest groups (*Conservative*, *Bike Lane*, *Cautious*) were examined as quasi-independent variables. The *Confident*, *Ambivalent*, and *Unassigned* participants were excluded due to small sample sizes. One-way ANOVAs revealed no significant differences between the groups in terms of worry for the cyclists' safety, $F(2, 57) = 0.684$, $p = .509$, or difficulty passing due to narrow lanes, $F(2, 57) = 0.995$, $p = .376$. The three ratings listed in Table 2 (*cyclist weaving*, *judging distance*, and *acceleration*) were significantly different between groups. A one-way ANOVA revealed significant differences in rated concern about cyclists weaving unpredictably, $F(2, 57) = 4.665$, $p = .013$, $\eta^2 = .141$. The *Bike Lane* participants were less likely to think swerving cyclists would be a concern compared to the *Cautious* participants ($p = .013$). Ratings for how difficult it is to judge the distance between their vehicle and the cyclist also varied by participant group, $F(2, 57) = 3.923$, $p = .025$, $\eta^2 = .121$. *Conservative* participants were more likely to agree that judging distance made it difficult to pass cyclists than *Bike Lane* participants ($p = .031$). Similarly, ratings regarding how difficult it is to pass given the need to accelerate from such a low speed were significantly different between groups, $F(2, 57) = 3.488$, $p = .037$, $\eta^2 = .109$. Bonferroni post hoc analyses indicate a trend toward *Conservative* participants being more likely to agree acceleration was difficulty in passing cyclists compared to *Bike Lane* participants ($p = .075$).

4 DISCUSSION

Intersections are high-risk areas for cyclists (e.g., Beck et al., 2016; Dozza & Werneke, 2014; Meuleners et al., 2020), but there have been relatively few studies comparing bicycle-specific treatments at intersections (Buehler & Dill, 2016). The purpose of this study was to examine how motorists interpret bike lane markings at a signalized, four-way intersection. In this case, a traditional bike lane (green marked path on the right side of the right lane) was compared to a novel merge bike lane (green marked path that merges bicycle traffic into the middle of the lane). Participants' interpretation of the bike lane was indexed by asking them: where they would stop their bike to wait for the light to turn green, how difficult it was to figure out where to place the bicycle, and rate how safe they would feel. The bicycle placement results indicate strong tendencies to expect cyclists to be positioned on the right side of the road at an intersection. However, if a bike lane integrates into motorized traffic using the merge bike lane, participants expected the cyclist to be integrated with other traffic. After examining individual responses, it seemed some adopted simple heuristics to determine bicycle position (e.g., always stay right or always stay in the bike lane), while others adopted more complex strategies such as using the bicycle lane or taking the lane unless motor vehicles are present. A common theme in the more complex strategies was reactivity to the presence of a motor vehicle. For instance, participants might move right when a motor vehicle is present or move back from the stop line when a motor vehicle is present—this pattern of responding mimics the results Hatfield et al. (2018) obtained with Australian cyclists.

The results are clear regarding perceived safety and the difficulty in selecting the best location at an intersection. Participants rated the merge bike lane scenarios as less safe and as being more difficult to select the best lane position than traditional bike lane scenarios. While these ratings may reflect uncertainty because the merge bike lane is novel, the novelty did not impact their understanding of what the lane is intended for. Even with these lower ratings, many participants identified the position in the merge lane as the location where they would stop their bicycle if they were at the intersection. This suggests that while the merge lane markings convey the intended message (i.e., bicyclists should be here), this sample of participants find positioning that involves “taking the lane” worrisome.

Some of the mismatches between the safety and difficulty ratings and the lane placement task may stem from individual differences among participants in their expectations about interactions with cyclists. After dividing the participants into groups based on their lane placement results (*Conservative*, *Bike lane*, *Cautious*), some differences were revealed. Compared to those participants who always place the bicycle in the bike lane (*Bike Lane* group), those who always placed the bicycle on the far right side of the lane (*Conservative*) were more likely to indicate concern about their ability to judge the distance between their vehicle and cyclists when passing and concern about their ability to accelerate fast enough to pass a cyclist. The *Cautious* participants who tended to place the bicycle in the bike lane but move away from motor vehicles (i.e., move to the far right in the merge lane or to the recessed position in the traditional bike lane) expressed more concern about cyclists moving unpredictably from side to side compared to the *Bike Lane* participants. These differences could indicate varied motives among participants. Some motorists might think bicycles should be placed out of the way to avoid “inconvenience”, while others might be more concerned with mitigating risk of a collision, that is, provide a large buffer in case the cyclist must swerve unexpectedly. The results of this study cannot discriminate between participant motives.

It is also worth noting that *Conservative* and *Cautious* participants make up approximately half of the participants in this study. The bicycle placement data from both groups reflects a strong tendency to avoid motor vehicles much like data obtained from samples of regular cyclists (e.g., Hatfield et al., 2018). Thus, much like Winters et al. (2011), these data show that cyclists and non-cyclists are aligned in some of their perceptions regarding bicycle safety. This is important from a practical perspective. First, extensive bicycling experience is not required to understand basic pavement markings indicating how to share the road. And second, bicycle infrastructure improvements could serve to both increase bicycle safety and *perceived* safety, leading to a corresponding increase in willingness to try bicycling on the road.

In conclusion, beliefs about where cyclists should position themselves at an intersection can be shaped by simple lane markings. Notably, this was true even if the lane position is one that many would find uncomfortable (i.e., a motorist indicating the bicycle should go in the middle of the travel lane). There is no doubt that intersections present an enhanced risk for cyclists, but there is uncertainty about the best way to protect cyclists while also facilitating traffic flow for all. It is unlikely that one type of intersection treatment will be an effective solution for all situations. The results of this study provide a first step in investigating an intersection treatment that simply communicates that cyclists should take the lane.

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