CIE5050: Additional Graduation Work, Research Project

The Light-moped Impact on the Cyclists' Subjective Safety and Intended Behavior

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Date: **2023.1**

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1 Introduction

1.1 Background

With the popularity of the (light-)mopeds rises in the Netherlands, more and more mopeds appear on the roads, specifically the light-mopeds on the cyclists' paths. Meanwhile, there are increasing safety concerns towards the (light-)mopeds which deserves our attention. It is reported that (light-)moped riders have relatively high risk to be involved into an accident compared to other transport modes (SWOV, 2017b). Moreover, cyclists are the second highest in deaths and serious injuries in (light-)mopeds involved accidents, following the mopeds themselves(SWOV, 2017b). Since the cyclists are still the dominant users on the cyclists' path in the Netherlands, on average Dutch people owns 1.3 bicycle per capita (Bicycle Dutch, 2018), it is worthwhile to look into the feelings and reactions of the cyclists. And investigating the cyclists potentially brings more responses compared to the light-mopeds users. Hence, this research focuses on the interaction between the light-mopeds and the cyclists on the cyclists' path, and points to investigate the subjective safety and the intended behavior of the cyclists when encountering the light-mopeds.

As stated previously, the light-mopeds are sharing the cyclists' path which makes the interaction between them inevitable. But to what extent the influx of the light-moped may influence the cyclists' subjective safety remains unclear. This research uses the questionnaire to collect the participant's feeling on interaction with the light-mopeds as a cyclist, asking about their perceived safety and intended behavior towards given situations. By analyzing the responses, this research attempts to understand how safe the cyclists feel when interacting with the light-mopeds and what factors are explaining these feelings, and how they would behave towards their subjective safety. The results are also helpful for regulation development and infrastructure design of the light-mopeds and cyclists.

1.2 Literature Review

In the Netherlands, riding the light-mopeds, which are defined as two-wheel vehicles capable of a maximum speed of 25 km/h, requires a moped driving license (AM driving license) unless you have a valid car driving license (Ministerie van Algemene Zaken, 2013). Helmet is not necessary when you are using a light-moped. In general, the light-mopeds should use the cyclists' lane except for special indications.

The motorcycle, which includes the (light-)moped, is concerned as the least safe transport modes in Europe (Furian, G. et al., 2021). Moreover, cycling is another unsafe transport mode in Europe, and cycling is regarded as even unsafer in Netherlands than other European countries (Furian, G. et al., 2021;

Vias institute, 2021). Cyclists' safety has long been a critical concern in the Netherlands, as Netherlands has the largest number of cyclist among Europe and near 20% of the road death are cyclists (Vias institute, 2021). The influx of the light-mopeds, however, may increase the risk for the cyclists as the they are bigger and faster than the bicycles which can disturb the cycling flow and increase crashing casualties (SWOV, 2017a).

The subjective safety of the cyclists refers to the individual feeling and the perception of safety, i.e., how safe they feel to cycle with a light-moped in a given situation (Furian, G. et al., 2021). And based on different perceived safety level, cyclists react potentially different (von Stülpnagel et al., 2022), e.g., the cyclist may slow down if he/she feels unsafe otherwise he/she may speed up. Factors which may influence the safety of the cyclists when encountering the light-mopeds have been widely discussed in the past decades and the crucial factors are summaries as follow:

1. **Road layout, road type**. In general, the intersections are less safe compared to normal roads, in Dutch more than two third of the (light-)mopeds involved accidents occurred at intersections (*Studies on Moped and Motorcycle Accidents*, n.d.). And for the normal roads, the two-directional cycle path could make the situation more conflicting and unsafe (van der Horst et al., 2014). Moreover, the shared spaces, which was introduced to replacing the traffic controls and traffic signs with social rules, could bring more conflicts and reduces the users' perceived safety (Gerlach et al., 2010). It is safe to assume that the perceived safety are differences between different road type.

2. **Position of the light-mopeds.** The position of the light-mopeds on the cyclists' lane, which includes the distance and interaction type, is another common crash factors (Davidse et al., 2019; SWOV, 2017b). If the distance between the light-moped and the cyclist is too close, it may stress the cyclist and put he/she at the risk of being knocked off. Moreover, with different interaction type with the light-mopeds, e.g., following the light-moped or being followed, being overtaken, approaching the light-moped from side, etc., the cyclists may perceive the safety differently and behave differently.

3. **Right of way**. The confusion of the right of way is another common crash factors for the mopeds(SWOV, 2017b). Research mentioned that behavior such as not yielding or turning without indication is hazardous for the cyclist and the light-moped driver, which may impede them to give proper reaction based on the right of way in order to avoid a collision (Davidse et al., 2019). Hence it is essential to investigate the intended behavior of the cyclists under different interaction scenarios with the light-mopeds, so as to investigate how the cyclists interpret their right of way with the light-mopeds.

4. **Demographic factors**, including the age, the gender and riding experiences, etc. The young mopeds users (16-18) are potentially riskier (Møller & Haustein, 2016). The female cyclists are in general

feeling slightly more dangerous on the road than male cyclists (Achermann Stürmer, Y. et al., 2021; von Stülpnagel et al., 2022), and female cyclist are less intended to do risky behaviors (Useche et al., 2018). Moreover, though the discussion of cycling frequency and the riding experiences on the cyclists' subjective safety is limited, research shows that the frequency and experiences may influence ones cycling behavior(Achermann Stürmer, Y. et al., 2021).

Current researchers mainly focus on the safety of the regular mopeds: the moped-involved accidents, and the factors of these accidents are discussed. However, most analysis are based on the interactions between the regular mopeds and the vehicles, the interaction between the light-mopeds and the cyclists are rarely discussed. In the Netherlands, where considerable cyclists are on their way daily, the prevail of the light-mopeds have crowded out the cyclists' lane and added crashing risks and crashing severity to the cyclists. This makes it important to consider the safety of cyclists, as they became more vulnerable and have higher exposure in an accident with the light-mopeds. Therefore, this research conducted a survey to collect the cyclists' feeling of their subjective safety and their intended behavior when interacting with the light-mopeds. In the hope that this research could figure out what makes the cyclists feeling unsafe and how they would react, so as to provide guidance to the infrastructure design and regulation development for the light-mopeds.

1.3 Research Questions

The main research question of this research is: To what extent do the light-mopeds influence the cyclists' subjective safety and their intended behavior?

With the following sub-questions:

1) How does the subjective safety of cyclist vary across traffic situation, e.g., in the intersection, on the cycling lane, on the shared space?

2) What factors would the cyclists' concern more when evaluating their subjective safety? E.g., the distance between the cyclist and the light-moped, the movement of the light-moped, the facing directions etc.

3) How would the cyclist's intended behavior be influenced by a light-moped in given situations, e.g., being overtaken by, giving ways to the light-mopeds or not etc.?

4) To what extents are different participants (concerning with age, gender, and the cycling experiences etc.), evaluate their subjective safety differently and react to the light-mopeds differently.

2 Methodology

In this research, a questionnaire was developed to collect the feelings on safety and the intended behavior of the participants. The participants are asked to put themselves in the shoes of the cyclists, and make choices based the given scenarios. The scenarios are mainly developed based on the crashing factors mentioned in Chapter 1.3, and they are divided into seven scenario sets. In each scenario set, three or four scenarios are provided, and the participants may choose the most unsafe scenario or rank the safety of the scenarios. After the ranking, the participants are asked about the reasons that make them feel unsafe and how will they probably react to each given scenario.

2.1 Participants

The recruitment targeted the cyclists in the Netherlands, who should know about the light-moped. But they not necessarily need to be a light-moped user. The questionnaire was distributed by sending an link to access the questionnaire on social media, e.g., WhatsApp and WeChat. Specifically, the course groups and Transport & Planning program group in TU Delft. Due to time limit, in total 31 responses are collected, with 26 responses valid. According to the responses, 57.7% of participants are male (n=15), and 42.3% of participants are female (n=11). Since the majority of the participants are TU Delft students, 73.1% of the participants are 19-24 years old (n=19). Most of the participants cycle regularly, as 73.1% of the participants cycles more than once a week (n=19). About one-third of the participants have crash/nearly crash with a (light-)moped as a cyclist (n=6).

2.2 Description of the Questionnaire

The questionnaire includes three sections, and the full questionnaire is available in the Appendix:

(1) The first section is the introduction which includes basic information of the light-moped and asks the participants about their knowledge on the light-moped. If the participant has never heard about the light-moped, the questionnaire will automatically end.

(2) The second section asks the participants' feelings as a cyclist when encountering a light-moped. In this section, seven scenario sets are provided, and the participants are asked to rank the scenarios from the most safe to the most unsafe within each set. After ranking the safety, the participants are asked about the reasons for what makes them feel unsafe in the most dangerous scenario they just selected. The reasons include if the distance between the light-moped and the participant is too close, if the light-moped is turning or overtaking the cyclists, if the participant is uncertain about his/her right of way, etc. The reasons are summarized from the literatures mentioned in Chapter 1.3. Then the participants will be asked about how will they react to each given scenario. This includes the speed alteration (slowing down, speeding up or keeping the speed), and lateral movement (moving to the right or left, or not moving

laterally). The illustration of the scenarios is presented in Figure 1, which includes four types of roads: the one-way cyclists' lane, the two-way cyclists' lane, the intersection and the shared spaces. The scenarios are created based on literatures on crashing data of the bicycles, where the turning of the cyclists and conflicting with different road users are critically unsafe (Englund et al., 2019). Also as summarized previously, the two-way cyclists' lane, the intersection and the shared spaces are more common in a crashing scenario. Hence the scenario sets are developed to better depict the critical cyclists-involved crashes with the light-mopeds. In each different road type, the turning of the light-moped and the cyclist are delivered separately.

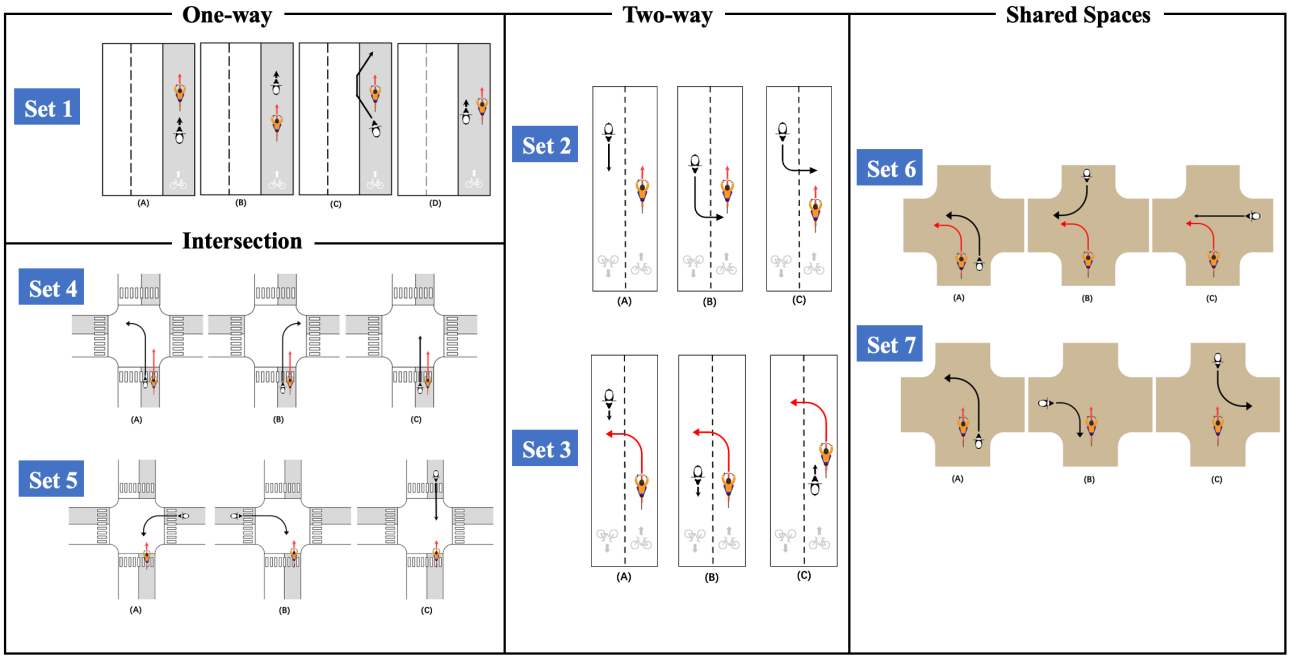


Figure 1 The Scenario Setting in the Questionnaire

(3) The last section collects the demographic information of the participants, including the age, the gender, the cycling frequency, the cycling experience, and the crashing experience with the light-mopeds.

In total there are 46 questions, which section one includes 5 questions, section two has 36 questions and section three has 5 questions.

2.3 Research Timeline

This research is conducted in TU Delft as a research project for the master student. The research is about 10 weeks long and the arrangement is presented in Table 1.

Table 1 The Research Timeline

Week	Date	Content	
1-2	10.10-10.23	Literature review, starting the survey draft	Intermediate Meeting Once a Week
3-5	10.24-11.18	Survey development	
6-8	11.19-11.27	Survey data collection	
9-10	11.28-12.16	Data analysis, report development	

3 Questionnaire Results

3.1 The Subjective Safety Ranking

Figure 2 presents the most unsafe scenario in each scenario set, from which we can generally conclude that situations are subjectively unsafe for the participants when: (1) they are in a conflicting direction with the light-moped, (2) the light-moped is in the back of them, (3) the light-moped is turning, (4) the light-moped is overtaking them. When looking into specific scenario, following a light-moped as a cyclist feels safer than being followed by a light-moped based on the results of Scenario Set 1. And when the cyclist is turning to a conflicting direction with the light-moped, participants feel more unsafe if the light-moped is following them than coming in front of them.

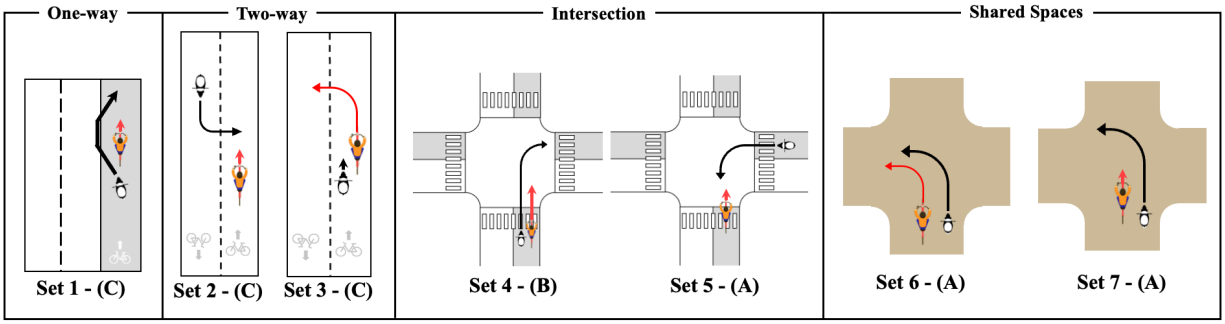


Figure 2 The Most Unsafe Scenario in Each Scenario Set

Additionally, for scenario sets on shared spaces, the ranking distributed more evenly, which means that the participants' feeling varies among scenarios. For scenario sets on one-way or two-way cyclists' lane, participants choices are more similar and have an agreement on what is unsafe. It is safe to assume that on shared spaces where the traffic controls and signs are removed, the road users may be uncertain about their right of way hence perceive the safety differently.

3.2 The Intended Behavior for Different Scenarios

The questionnaire collects the intended behavior of the participants for each of the scenario, i.e., 22 scenarios. The speed adaptation (speeding up, keeping the speed, and slowing down) and the lateral position adaptation (moving to the right, not moving and moving to the left) are separately collected and visualized. Figure 3 is a visualization example of Scenario Set 4, where the upper charts are the speed adaptation, and the lower charts are the position adaptation.

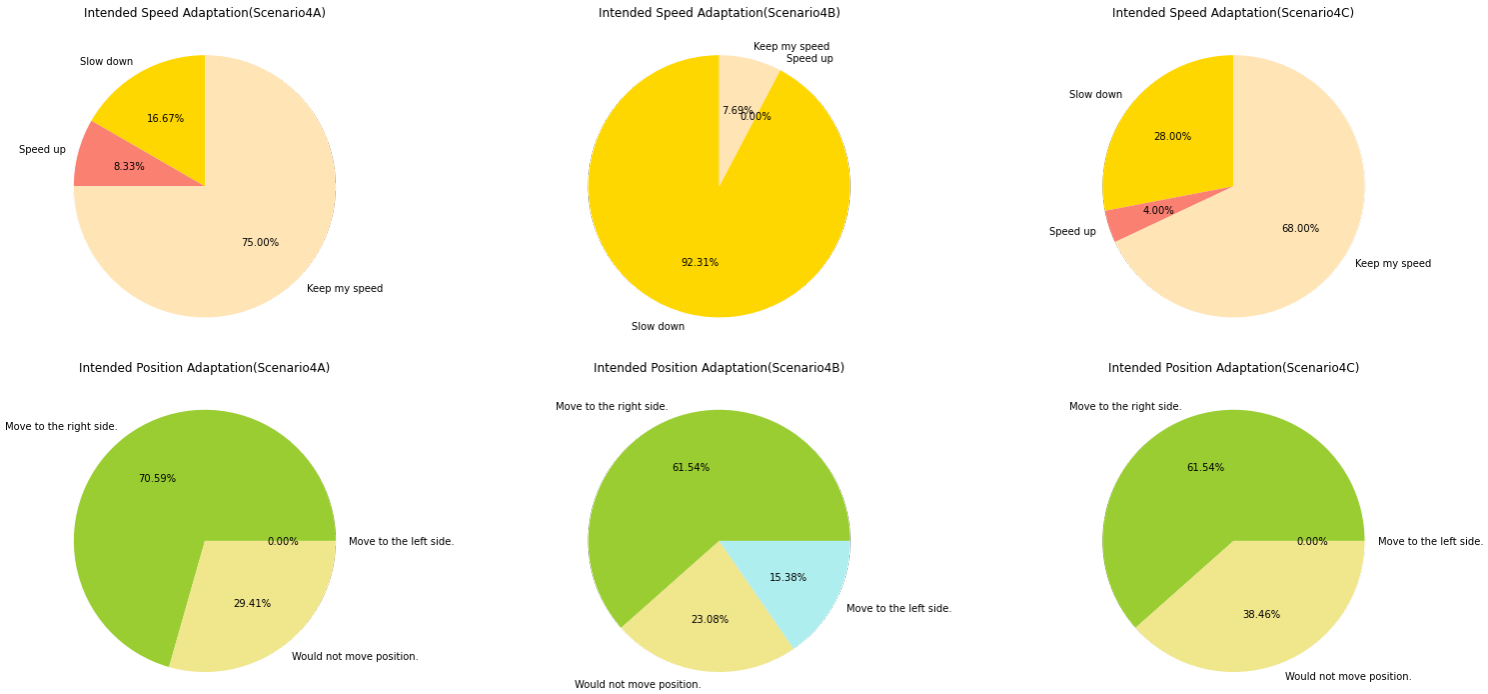
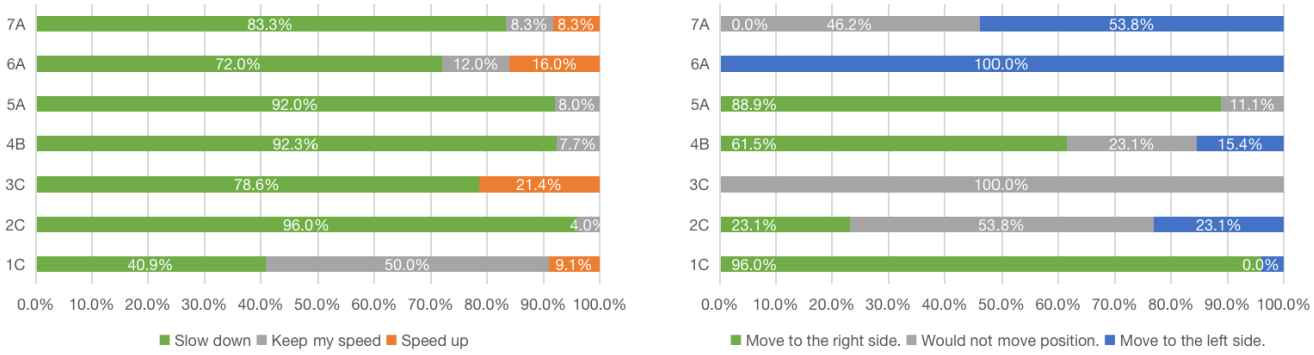


Figure 3 The Intended Behavior of the Participants for Scenario 4B

Figure 4 presents the participants' intended behavior in the most unsafe scenarios for each scenario set. Based on the result, more than half of the participants would slow down in these subjectively unsafe scenarios. Even in the situation that speeding up is also an option to avoid collision, most of the participants intend to slow down. From Figure 4(a) we can see that in intersection scenarios, the decelerating behaviors the most common where more than 90% of the participants choose to slow down. However, the lateral position adaptation is more complex, participants' choices are more diverse. Though majority of participants tend to move to the opposite side from the light-moped, there are part of participants would move to the light-moped. Overall, it can be concluded that in general cyclist would be more evasive, i.e., to slow down or moving away from the light-moped, when they feel subjectively unsafe.



(a) The Speed Adaptation **(b) The Position Adaptation**

Figure 4 The Intended Behavior Differences Between the Most Unsafe Scenario in Each Scenario Set

3.3 The Potential Reasons for Why the Cyclists are Feeling Unsafe

The reasons for what make the participants feeling unsafe are collected after the ranking of the scenarios, the overall result for the concerning reasons is presented in Figure 5. From which we can see that the concern about the light-moped is turning and might crash on the cyclist is the leading reason for feeling unsafe. Even the scenarios cannot present the speed of light-moped, the speeding behavior is also a critical factor for the participant to feel unsafe. The uncertainty of the right of way, the position of the light-moped (the light-moped is coming from the side, the distance is too close, or the light-moped is overtaking me) is also leading factors influencing the subjective safety of the participants.

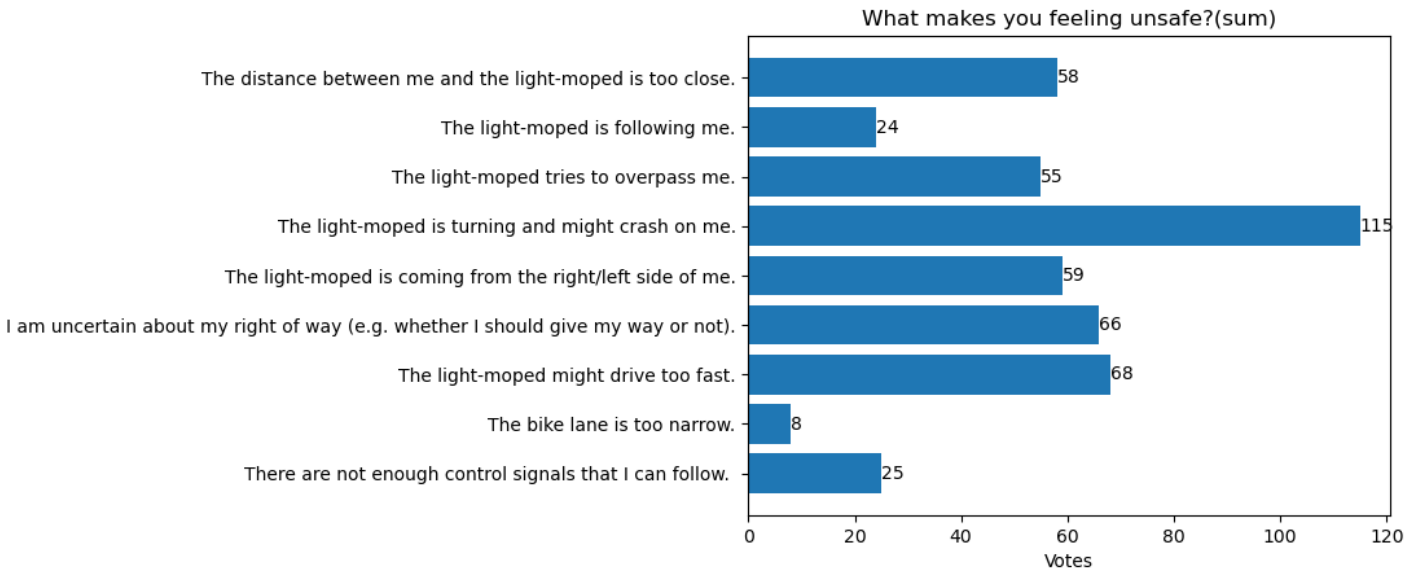


Figure 5 The Reason Distribution for All Scenarios (Unit: Votes)

Additionally, the reasons vary between different road section. Figure 6 presents the differences of the concerned reasons for the four types of road section. It shows that the overtaking behavior of the light-moped is the most critical reason on a one-way lane but the least critical on a two-way lane. It is explainable since a two-way lane has more space for the light-moped to overtake. Moreover, the close distance between the light-moped and the cyclist is more critical at a one-way or two-way road than intersections or shared spaces. For the shared spaces, the turning of the light-moped and the coming from the side of the light-moped are the leading factors. The potential speeding of the light-moped is the most concerned factor at the intersection.

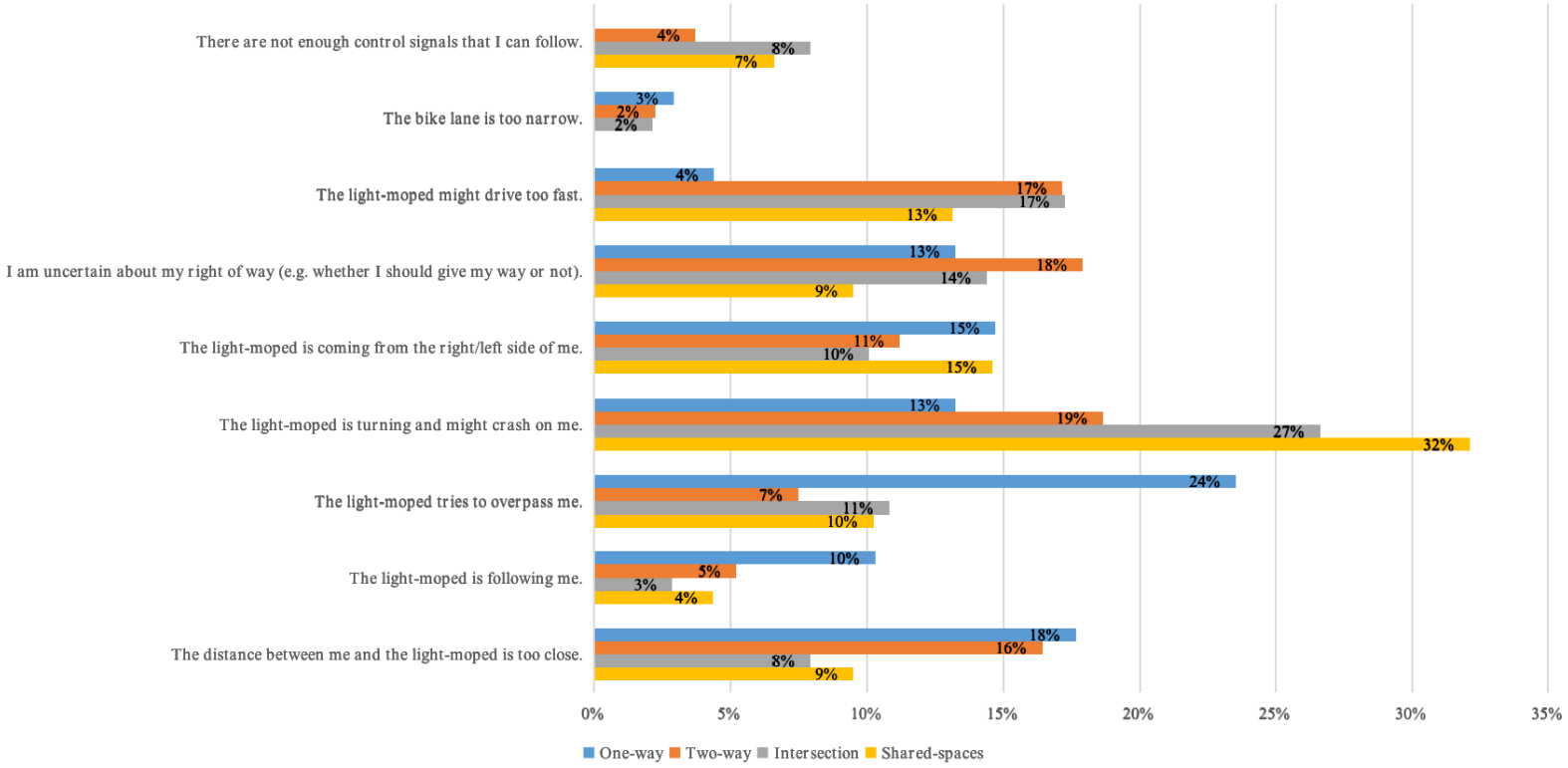


Figure 6 The Reasons Distribution for Different Road Sections

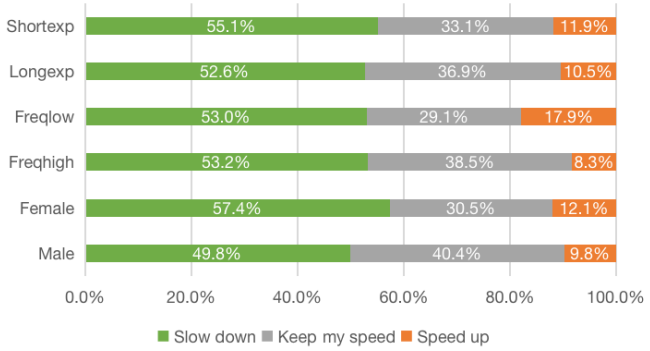
3.4 Demographic Differences

(Differences in ranking is little) (Differences in intended behavior is more observable: through gender, experiences and cycling frequency) (Not age at the majority are from the same age group)

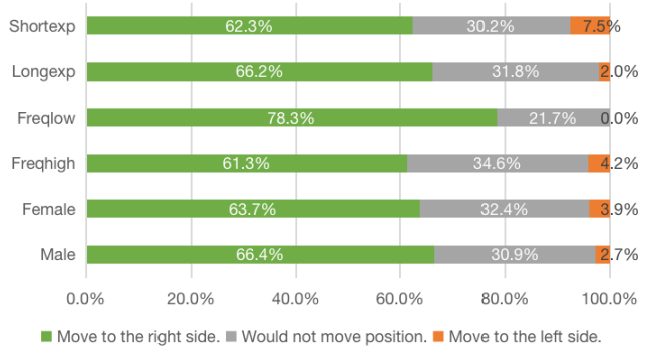
In this section, the differences between the gender, the cycling frequency and the cycling experiences are analyzed. According to the results, the differences between ranking the safety of the scenarios and the reasons for feeling unsafe are minor, while the differences between the intended behavior is more observable. Figure 7 presents the intended behavior differences among different groups.

From Figure 7(a) we can see that female would slow down more often than the male, while male tend to keep their speed. This is accord with previous research that female are less risky taking but male are more self-confident and sometimes risky (Useche et al., 2018). Moreover, those who cycle less frequently changes their speed more, whether speeding up or slowing down, while those who cycle frequently tend to keep their speed. And those who have longer cycling experiences also keep their speed more than those have shorter cycling experience. It is safe to assume that those who cycles more tend to be more assertive to themselves and change the speed or position less often.

When it comes to the position adaptation, i.e., Figure 7(b), the participants would hardly get closer to the light-moped. The difference between the cycling frequency is the most obvious, those who cycle less frequently would move to the right more, to get away from the light-moped. This is explainable since these participants maybe less conversant to the light-moped involved situation, and they may be more alert and careful.



(a) The Speed Adaptation Differences



(b) The Position Adaptation Differences

Figure 7 The Intended Behavior Differences Between Different Demographic Groups

4 Conclusion and Limitation

This research aims to investigate the light-mopeds influences on the cyclists' subjective safety and their intended behavior. Based on the questionnaire results, we can conclude that:

(1) Cyclists would feel unsafe when moving to a conflicting direction with a light-moped, especially when the light-moped is following them.

(2) On shared spaces, where the traffic control and signals are removed, the cyclists feel uncertain when interacting with the light-moped.

(3) The concern that the light-moped is turning and might crash on the cyclist is the most common reason for the cyclist to feel unsafe. For the one-way or two-way cyclists' lane, the close distance between the light-moped and the cyclist is the most common concern. For the shared spaces, the turning of the light-moped is the most common. And for the intersection, the potential speeding of the light-moped is the most concerned.

(4) When cyclists feel unsafe, they tend to be evasive towards the light-moped. Most of the cyclists would slow down or move to the opposite side. At the intersection, cyclists slow down even more often.

(5) Female cyclists slows down more often than the male cyclists. The cyclists who cycle frequently or have longer cycling experience, tend to keep their moving speed and position. But cyclists who cycle less or have shorter cycling experience, change their speed and position more often.

To summarize, this research successfully figured out the feeling of the cyclists when encountering a light-moped, and the reasons for why they are feeling unsafe. Moreover, the research analyzed the intended behavior of the cyclists and performed the disparity among different road sections and different demographic groups. The conclusions could provide guidance for the road infrastructure design and the regulation development about the light-mopeds.

However, this research still has some limitations and drawbacks. Due to time limit, less than 30 responses were collected, which is not enough to draw a generic conclusion. The conclusions are basically all descriptive, without statistical analysis. This is because the sample size is not enough for a statistic test and the answers are all descriptive ones which is hard for a statistical analysis. Moreover, the research did not distinct the influence of the light-moped among other transport modes, for example if the light-moped in the scenarios is replaced by a usual moped, or other cyclist, would the results be different? Though in the questionnaire, adequate instructions are given to the participants that they are the "cyclist" and they need to evaluate the interaction with the light-moped, it is still dubious if the participants can distinguish the light-moped and response correspondingly. Hence, further research could work on a wider scope to collect more responses, and the questions can be modified to quantitative ones so that statistic analysis could follow on to give more robust conclusion. Additionally, 3D modeling scenarios could be applied to improve the immersive experiences for the participants, which may help them to distinguish the light-moped from other transport modes. Questions to compare the differences between the transport modes, e.g., light-mopeds and the bicycles, could be added to bolster the impact of the light-mopeds.

5 Project Reflection

This project is an individual project of CIE5050-90 (10 CET) with the help from Dr. Sina Nordhoff and Dr. Haneen Farah. In this research project, I carried out an online questionnaire on the interaction between the light-mopeds and the cyclists. Specifically, I did the questionnaire design, delivered the questionnaires, collected and analyzed the data, and finished the report. The project work took ten weeks, excluding the assessing and uploading process.

The most challenging part of the project was the questionnaire development, as I have never designed a questionnaire before on my own. In the beginning I tried to make the scenarios as realistic as possible, but soon I found out that this 'realistic' scenarios too complicated with so many details which could increase the difficulty for the participants to understand the situation and give their thoughts. It is important to keep the participants informed about what really is the problem, otherwise the collected data may lose its credibility. After repeated discussions with Sina and Haneen and several revisions, the scenarios were improved to be more concise and more critical.

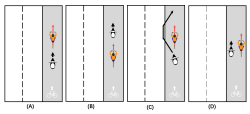
To be honest, the work plan of the project, which was made in the beginning stage, is bit imprecise which sometimes made me feel uncertain. For instance, I planned to read the literatures for two weeks, but when I really started the literature reviewing, I aimlessly browsing everything and felt unmotivated. Maybe it is a better idea to give more detailed planning like finding at least 10 literatures on the topic of cyclists' perceived safety, and light-mopeds' accidents analysis, etc. 10 week is quite short for a research project, which makes the planning more crucial. To better plan my next project, i.e., the master thesis, I will be more thoughtful and create a detailed project plan that outlines all the tasks that need to be completed, and the timeline for completion etc.

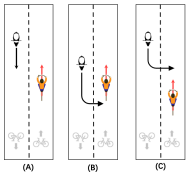
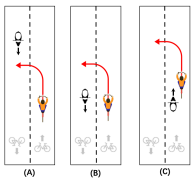
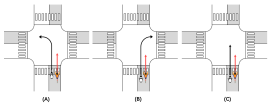
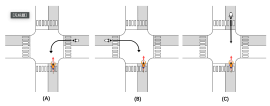
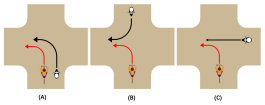
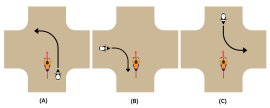
This was the first time I did a project on a master level individually and I indeed learned a lot. During during the process I have learnt how to deliberate my ideas. At first it started with only key words and vague conception, but I had to think critically and narrow the topic down to something worth investigating and interested me. Besides, I understand that I am the director of my project and I have to keep my pace. The communications with my supervisors are necessary and encouraging, but I am still the driving force for my process. Not to mention that the critical thinking ability, the communication skills, the report writing skills have been extensively practiced during the process.

Lastly I want to present my sincere thanks to Sina and Haneen, who are always ready to help me with my concerns and enlightened me with new thoughts. I cannot have these results without their guidance and suggestions.

Appendix 1: The Questionnaire

The full questionnaire is available through: https://forms.gle/hrwZjyXbckcCNt1e6. The questions and options in the questionnaire are presented as follow:

<table>
<tr><td colspan="3">Part 1: Introduction and basic information on the light-mopeds.</td></tr>
<tr><td colspan="3">1. Have you ever heard about light-mopeds? Yes/No.
2. How often do you read / watch / listen to information on light-mopeds? Frequently/Occasionally/Rarely/Never.
3. Do you own a light-moped in the Netherlands? Yes/No.
4. Did you use shared light-mopeds in the Netherlands? and if so from which company? Felyx/Go Sharing/CHECK/I never used a shared light-moped.
5. On average, how often do you use light-mopeds? (Nearly) every day/3-5 days per week/1-2 days per week/At least monthly/Less often or never.</td></tr>
<tr><td colspan="3">Part 2: Your feelings as a cyclist when encountering a light-moped.</td></tr>
<tr><td>Set1</td><td>1. Which two of the given scenarios are the least safe to you as a cyclist? (Select two scenarios) A/B/C/D
2. Now that you have selected two unsafe scenarios, what makes you feel unsafe as you selected in the last question? (Choose at most three reasons) The distance between me and the light-moped is too close./ The light-moped is following me./ The light-moped tries to overpass me./ The light-moped is turning and might crash on me./ The light-moped is coming from the right/left side of me./ I am uncertain about my right of way (e.g. whether I should give my way or not)./ The light-moped might drive too fast./ The bike lane is too narrow.
3. Based on the scenario (A)/(B)/(C)/(D) in the previous question, how would you possibly react to the light-moped? (Choose one or more) I would keep my speed./ I would speed up./ I would slow down./ I would move to the right side./ I would move to the left side./ I would not move my position.</td><td>  </td></tr>
</table>

Set2	1. How would you rank the safety of following scenarios? (Rank the three scenarios) 2. Now that you have ranked the situations above, what makes you feel unsafe in the most unsafe scenario you selected in the last question? (Choose at most three reasons) *The distance between me and the light-moped is too close./ The light-moped is following me./ The light-moped tries to overpass me./ The light-moped is turning and might crash on me./ The light-moped is coming from the right/left side of me./ I am uncertain about my right of way (e.g. whether I should give my way or not)./ The light-moped might drive too fast./ The bike lane is too narrow.* 3. Based on the scenario (A)/(B)/(C) in the previous question, how would you possibly react to the light-moped? (Choose one or more) *I would keep my speed./ I would speed up./ I would slow down./ I would move to the right side./ I would move to the left side./ I would not move my position.*	
Set3	The questions are the same as Set2	
Set4	The questions are the same as Set2	
Set5	The questions are the same as Set2	
Set6	The questions are the same as Set2	
Set7	The questions are the same as Set2	
Part 3: Basic information of the participants		
1. What is your gender? *Male/Female/Non-binary/Prefer not to disclose.*		

2. What is your age? *Under 18/Age between 18 to 24/Age between 25 to 30/Age between 31 to 45/Age between 45 to 60/Above 60/Prefer not to disclose.*
3. How often do you cycle? *Always (more than 7 times a week)/Often (4-6 times a week)/ Sometimes (1-3 times a week)/Occasionally(1-2 times a month)/ Rarely (less than monthly)/ Never/ Prefer not to disclose.*
4. How long have you been riding a bicycle? *More than 10 years/Between 5 to10 years/Between 1 to 4 years/Less than 1 year/Prefer not to disclose.*
5. How many times did you crash or nearly crash with (light-)mopeds as a cyclist? *Three or more times/ Twice/Once/Never.*

Appendix 2: The Results for Questionnaire

The safety ranking of each scenario:

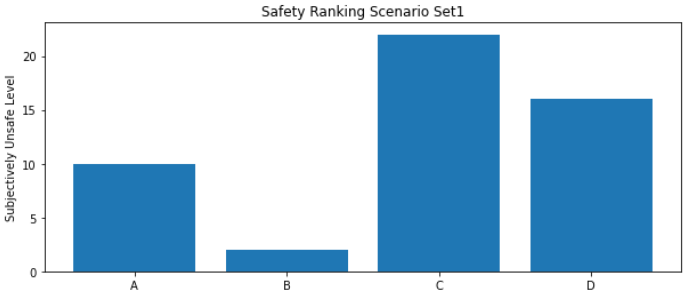


Figure 1: The Safety ranking of Set 1

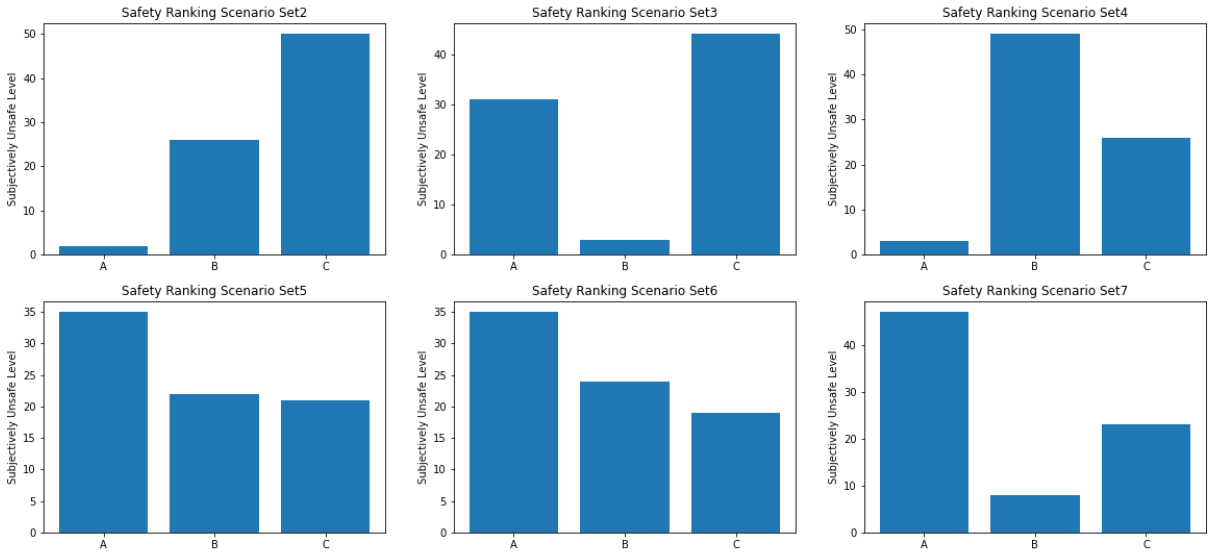


Figure 2: The Safety ranking of Set 2-7

The reasons for why the participants are feeling unsafe in each scenario:

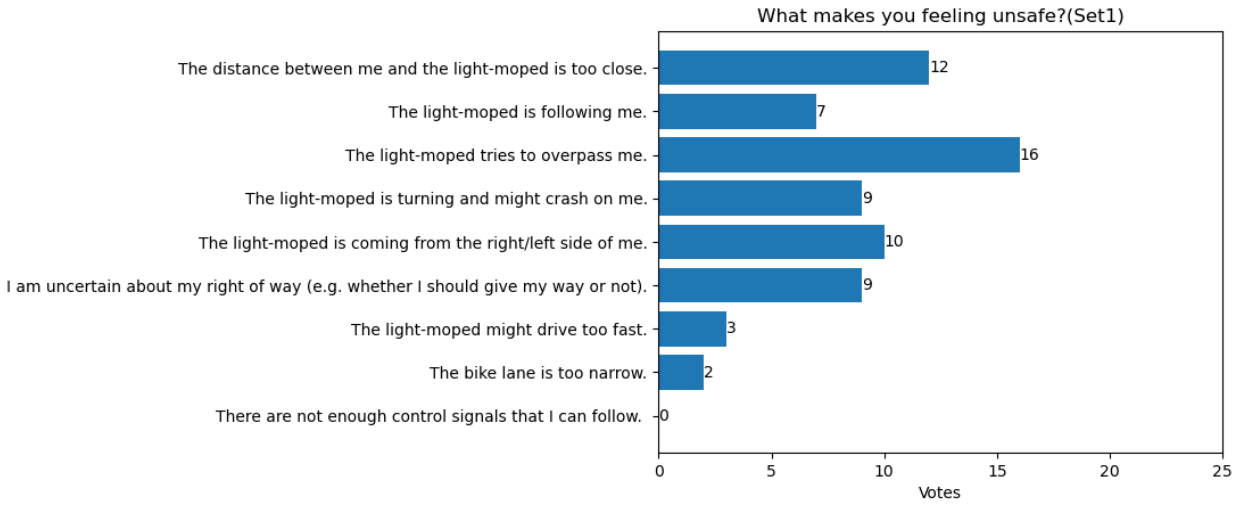


Figure 3: The Reasons for Set1

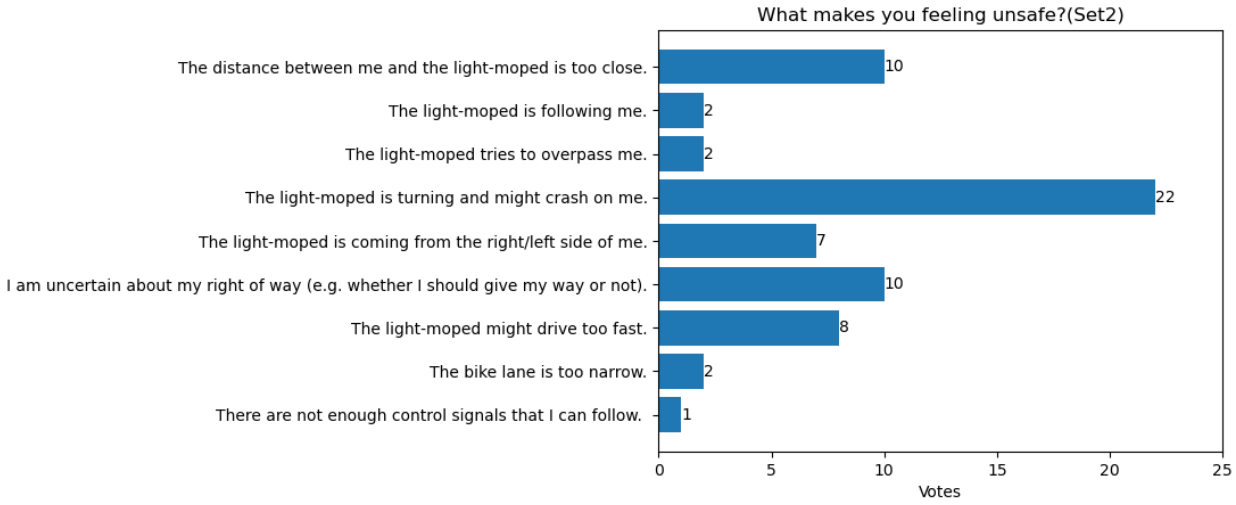


Figure 4: The Reasons for Set2

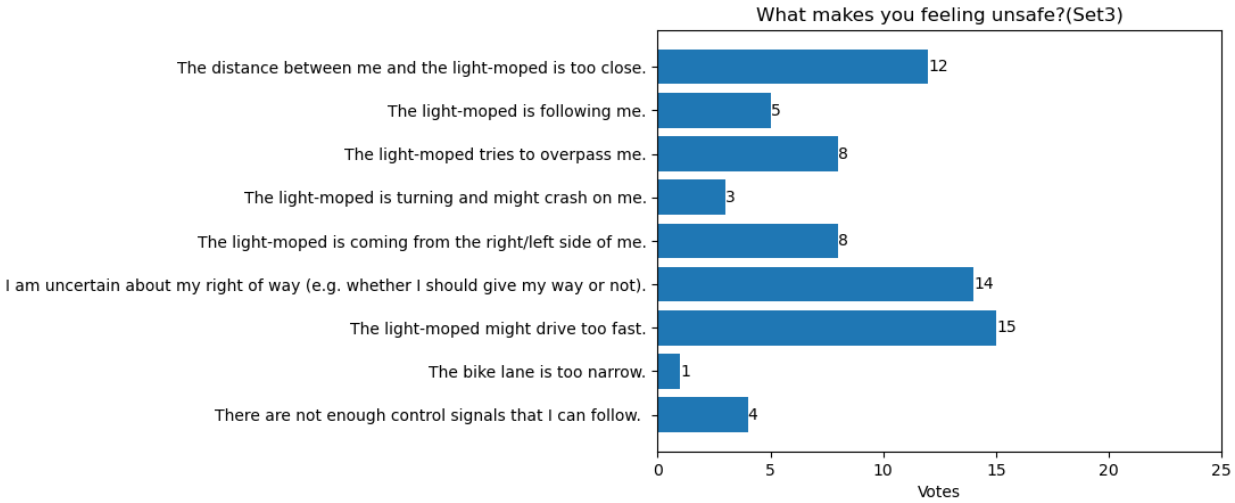


Figure 5: The Reasons for Set3

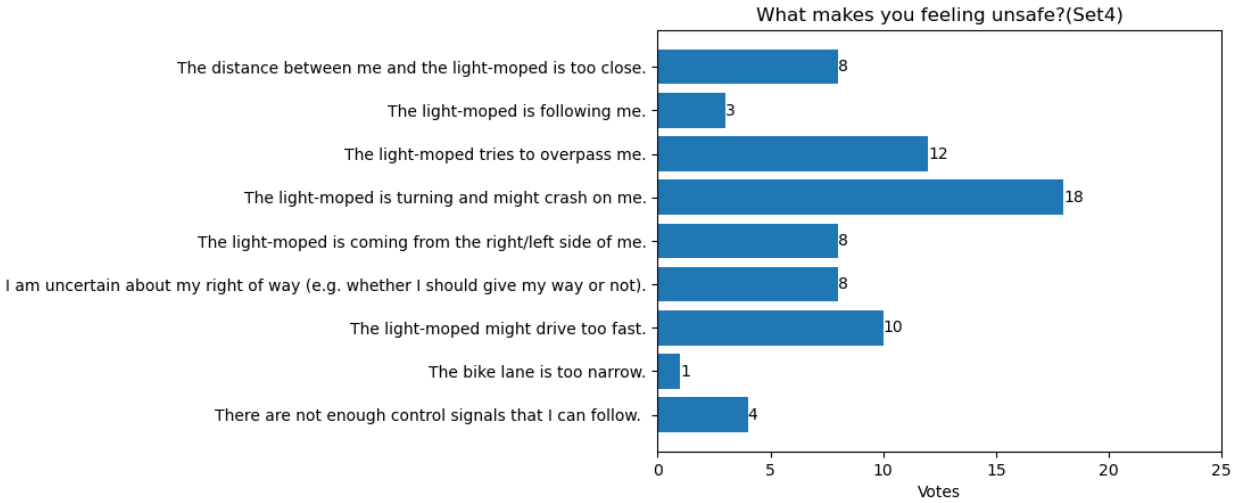


Figure 6: The Reasons for Set4

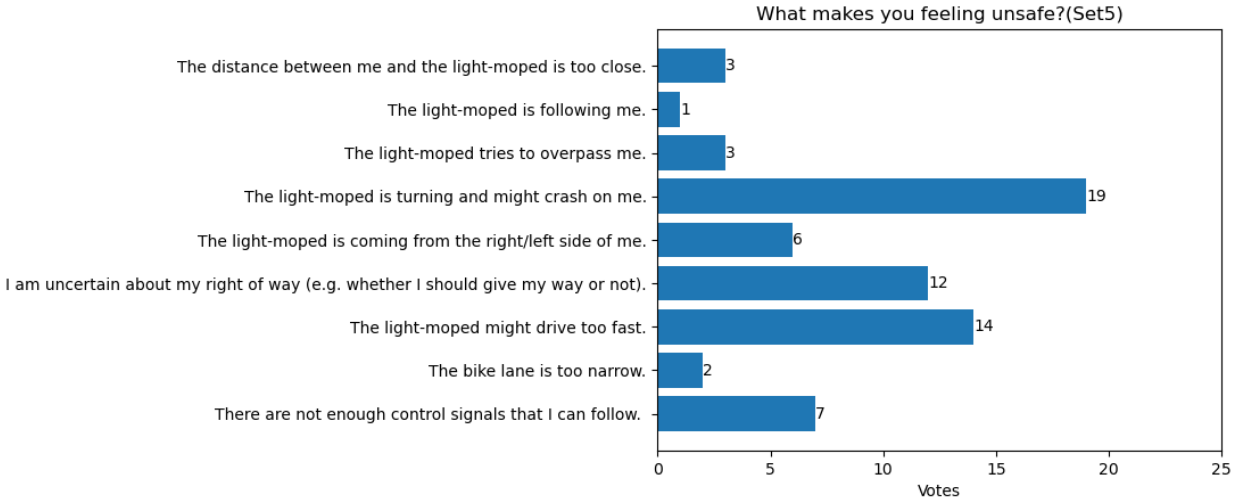


Figure 7: The Reasons for Set5

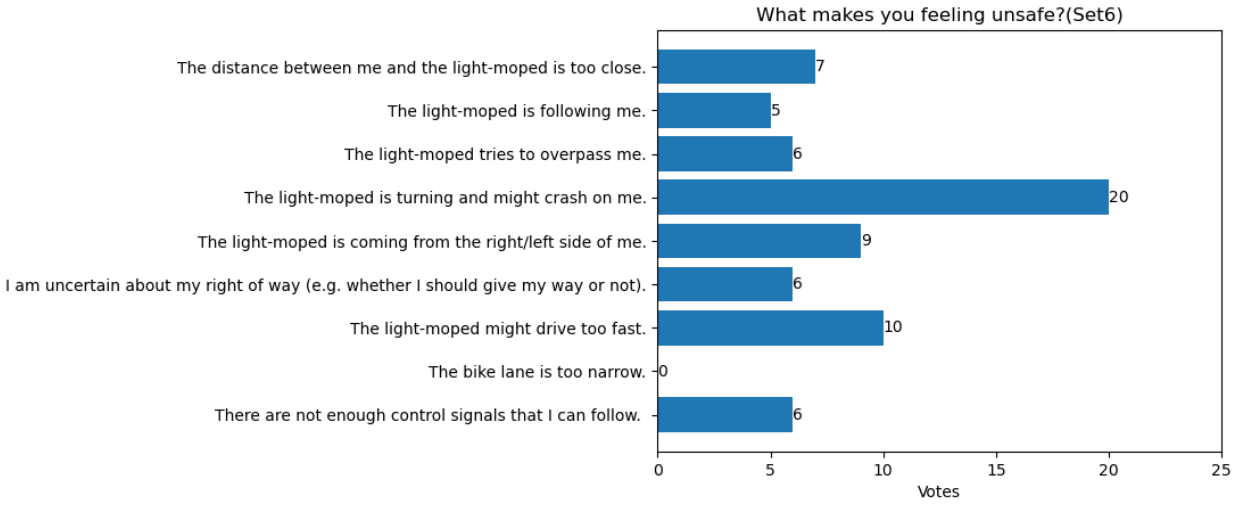


Figure 8: The Reasons for Set6

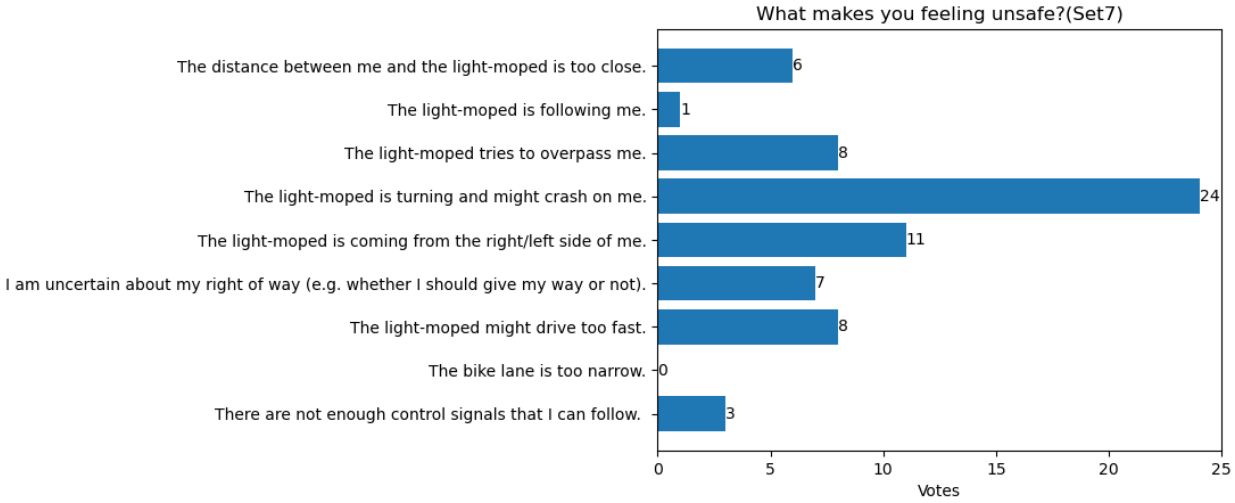


Figure 9: The Reasons for Set7

The intended behavior for each scenario:

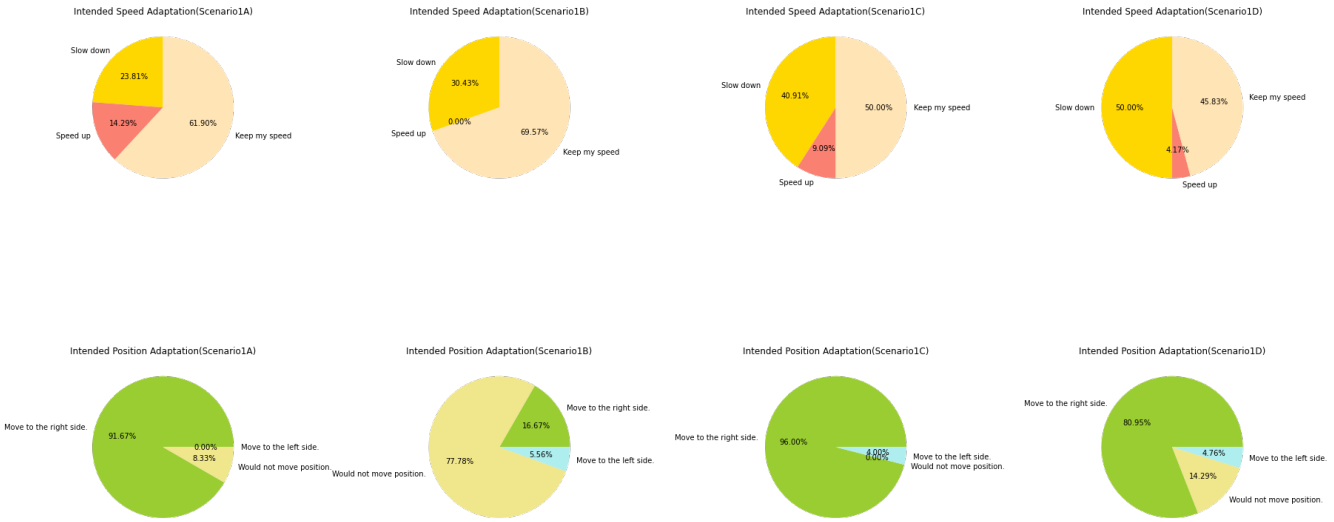


Figure 10: The Intended Behavior for Set1

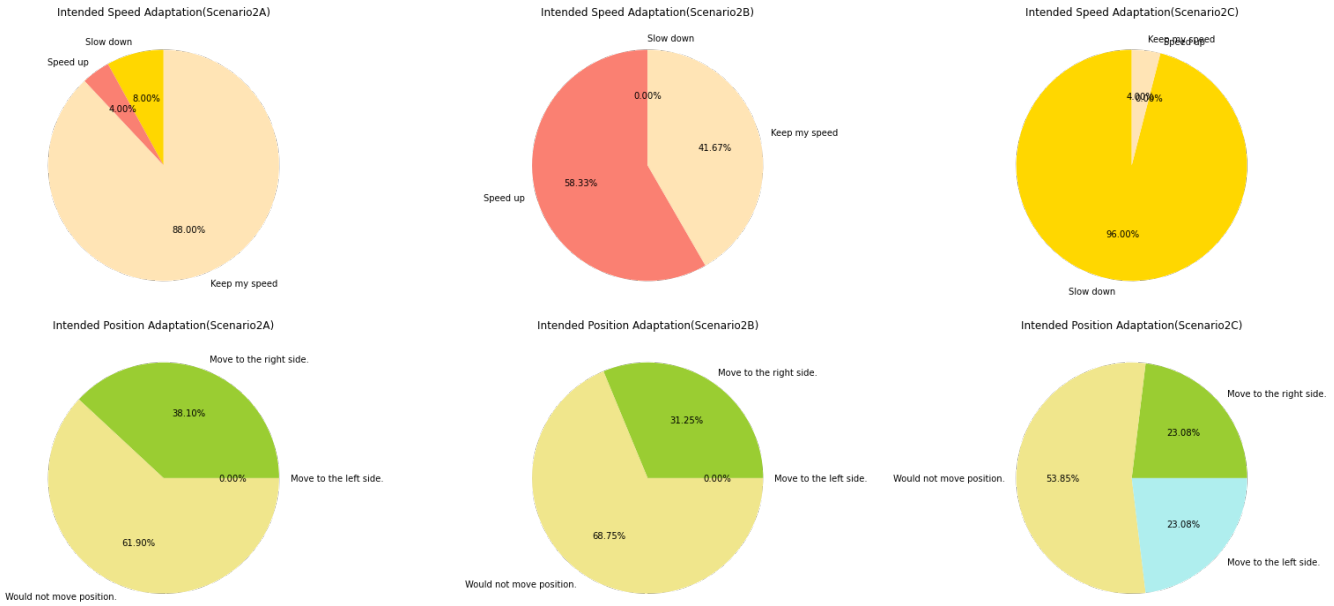


Figure 11: The Intended Behavior for Set2

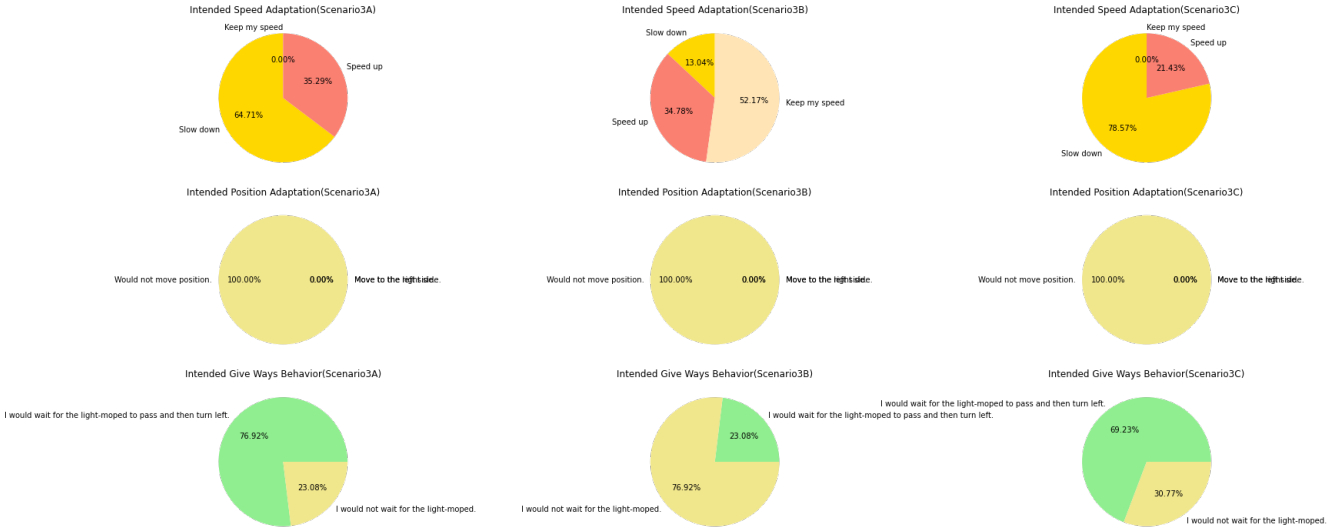


Figure 12: The Intended Behavior for Set3

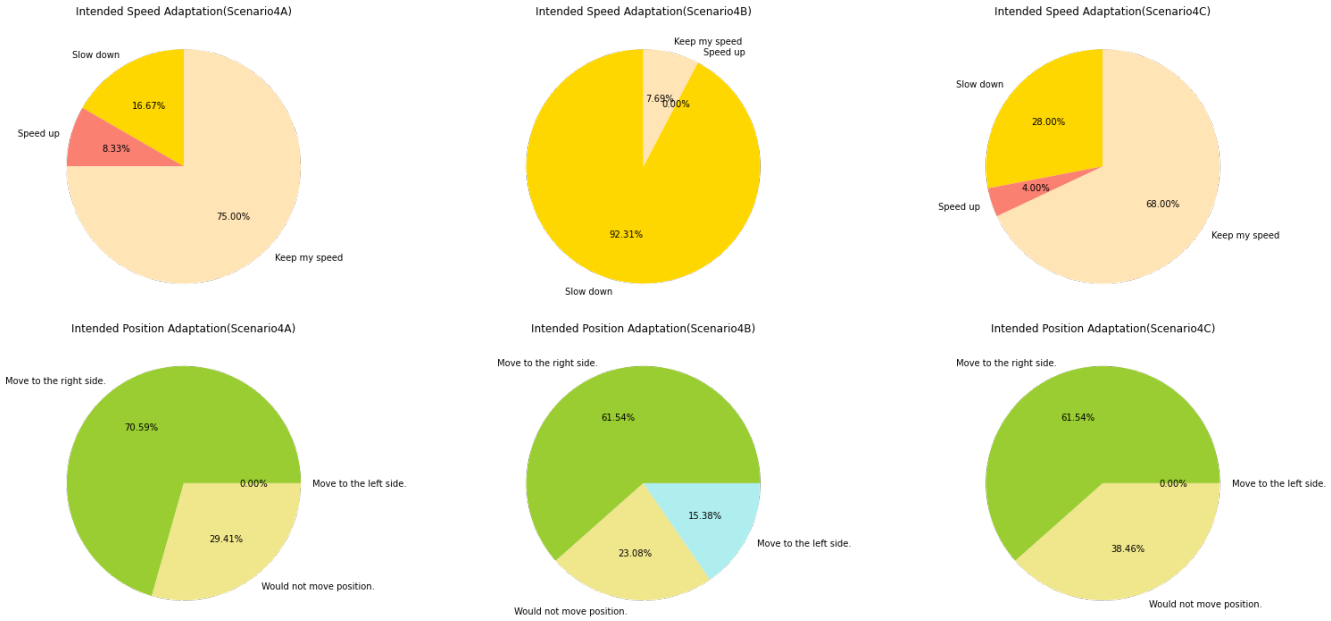


Figure 13: The Intended Behavior for Set4

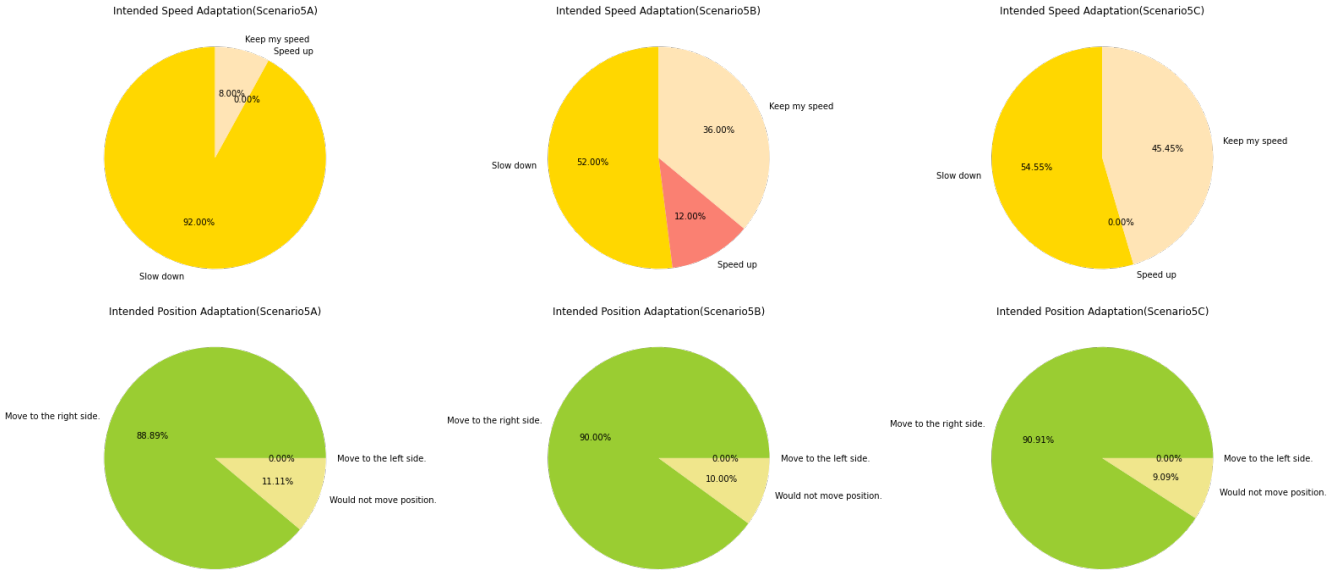


Figure 14: The Intended Behavior for Set5

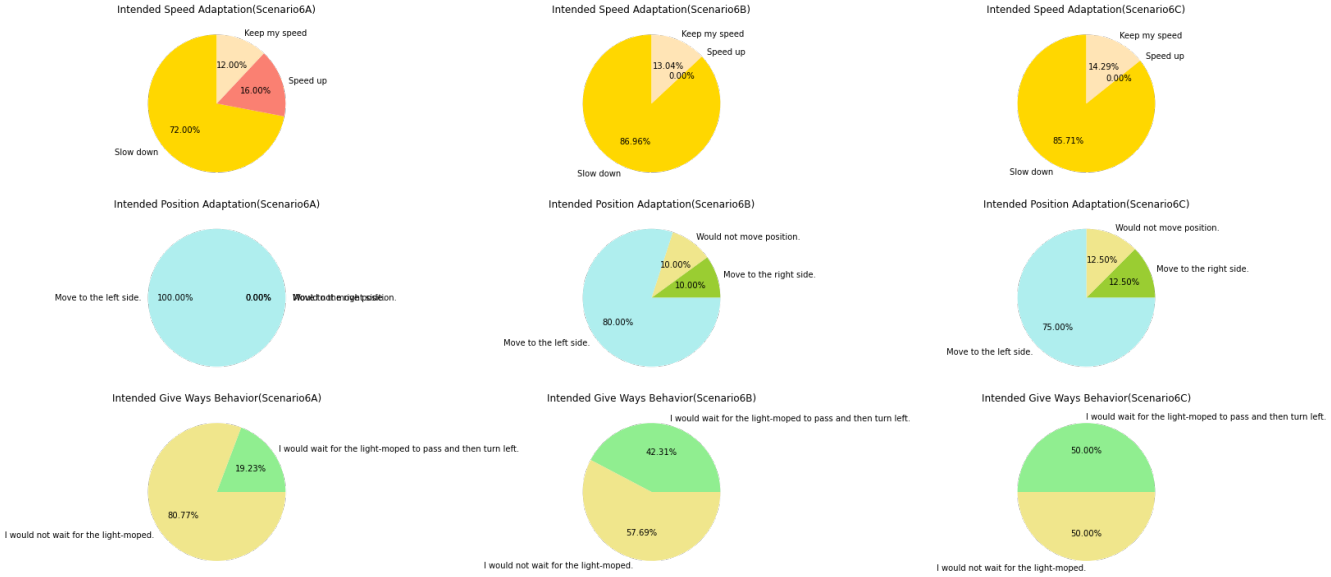


Figure 15: The Intended Behavior for Set6

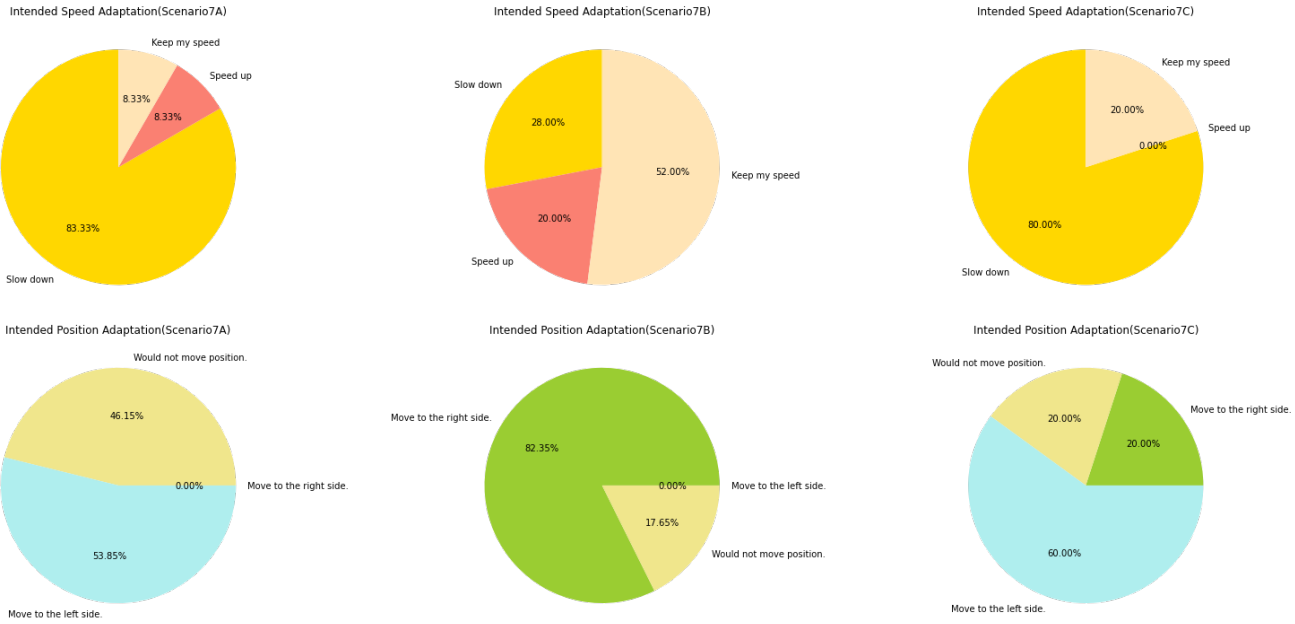


Figure 16: The Intended Behavior for Set7

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