1681 E. 116th St.
Cleveland, OH 44106

December 10, 2012

Mary Assad
11112 Bellflower Road
Cleveland, Ohio 44106

Dear Mary:

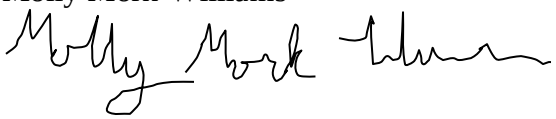
Attached to this letter is a research proposal, titled "Reducing Motorcycle Accident Rates via the Implementation of Simulators" and directed toward the Motorcycle Safety Foundation. Within the attached you will find a plan to implement simulators in a motorcycle safety course as well as a description of how crash statistic data will be analyzed to determine the effectiveness of the simulators on safety. The purpose of this formal proposal is to gather funding and assistance from the Motorcycle Safety Foundation to complete the research with a final goal of improving the curriculum of the motorcycle safety courses.

The proposal is written to appeal to the Motorcycle Safety Foundation and includes a detailed plan for the way that the simulations would be implemented, the follow up data collection, and the analysis of the data. The actual design of the simulators is only lightly discussed as this would be an area in which assistance would be requested from the Motorcycle Safety Foundation. For the benefit of a general audience, there is a large discussion of motorcycle crash statistics and the effectiveness of helmets; this section will be removed before submittal to the Motorcycle Safety Foundation as they are well versed in this information.

As much of the audience may not be familiar with the psychology behind the hypothesis, a section has been included giving background in this area. A budget has been excluded as the costs will differ greatly based on the willingness and ability of the Motorcycle Safety Foundation to provide access to advanced simulators. In addition to the main proposal, there is an appendix which includes the rough drafts of the surveys that would be given to participants.

Thank you for taking the time to read over this proposal, I hope that you find it informative and of interesting.

Sincerely,
Molly Mork-Williams



Molly Mork-Williams
12/10/12

Reducing Motorcycle Accident Rates via the Implementation of Simulators

Abstract

This proposal discusses research into the development of a new curriculum for the standardized motorcycle safety course (also known as the basic rider course). This course is provided by the Motorcycle Safety Foundation and is taken by motorcyclists in order to receive a waiver for the skills test required to receive a motorcycle license. The current class construct is similar to that of a driver's education course, in that it is split between classroom time, "on the bike" testing, a written exam and culminates in a final skills test. While this course may be effective in teaching people how to operate and maneuver a motorcycle, it does little to teach motorcyclists how to react in dangerous situations, or how to accurately assess risk based on their riding behavior and surroundings.

The goal of this research project is to determine if the addition of a realistic motorcycle simulation, similar to what is used in driver's education, would be an effective way of addressing the current weaknesses in the motorcycle safety course. If it can be shown that adding a simulation has an effect on the risks taken by and accident rates of graduated motorcyclists, then implementing these simulations permanently could drastically decrease motorcyclist mortality and injury. This proposal is directed toward the Motorcycle Safety Foundation and will cover the importance of this research in a description and literature review, followed by a detailed research plan, schedule, and discussion of researcher qualifications. It will conclude with a description of the anticipated involvement from and benefits to the Motorcycle Safety Foundation.

Introduction and Background

In 2010, motorcycle accidents accounted for over 4,000 fatalities and nearly 90,000 injuries across the United States. This represents a disproportionate increase in accidents compared to the number of registered motorcycles; a clear indication that current safety training has much to be desired. Currently motorcycle safety courses focus on learning the basic skills for riding using five hours of in class instruction and 10 hours of instruction on a motorcycle. The course ends in a skills test on a motorcycle as well as a written test in the classroom. The course does not include information on the limits of the rider's skills and has little instruction on reacting in dangerous situations [1]. It has been determined in past research that motorcycle riders often overestimate their skill and ability to deal with a hazard or they view a situation as being more hazardous to others but not as much to themselves; this is also known as an optimistic bias [2].

Optimistic bias is an innate trait of humans, dating back to early evolution. It is theorized to have originally benefited the individual by inducing overconfidence and thus increasing willingness of the individual to take risks. In the evolutionary context, risk taking is usually associated with a higher rate of positive benefits. The problem occurs when optimistic bias in today's individuals begins to encourage risk-taking in all areas of life, including motorcycling. Optimistic bias is the basis for inaccurate risk assessment and does much to explain low rates of protective gear use as well as the lack of defensive driving techniques.

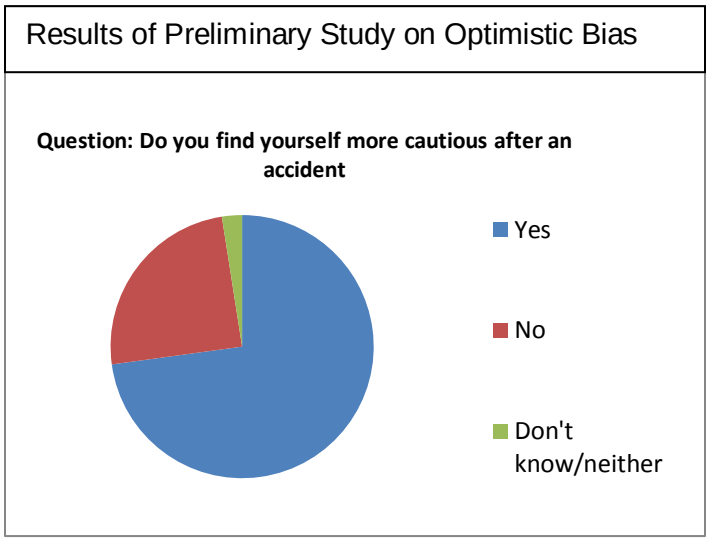


Figure 1

The proposed research is based in psychology and aims to reduce optimistic bias by demonstrating to the individual their true skill level in the safety of a simulation. In preliminary study of motorcyclists, it was shown that 75% of participants noted a decrease in risk taking after an accident or close call on a motorcycle. Some participants noted that they bought safety gear after an accident, reduced speed, or were more wary of passenger vehicles.

This is significant because it demonstrates that a situation which makes a motorcyclist more aware of the limitation of their skills and the riskiness of their surroundings can cause a decrease in optimistic bias. The issue with this is that many motorcyclists do not make it through these situations to become more cautious. If it can be shown with this research that realistic simulations of high risk situations provide the same benefits of real-world crashes or close calls, then permanently implementing simulators into motorcycle safety courses has the potential to significantly reduce crashes.

Literature Review

Within the following literature review, the reader will find a discussion of current motorcycle crash statistics and the monetary impact of motorcycle accidents on society. In addition, there is a brief discussion of the benefits of safety gear in decreasing mortality and injury. There is also a discussion of the success of simulator use in driver's education courses as well as some information discussing a past study of simulator use in motorcycle training. Overall, the literature review is meant to define the current problem and discuss past research.

Effects of Safety Precautions

It is well documented that the use of safety gear, helmets in particular but also such things as chest and back protectors, have a significant effect on the mortality and morbidity of motorcycle accidents. Although there are other factors that came into play such as speed and conditions, riders who wear helmets are 72% less likely to suffer life-threatening injuries [3]. Suffering fewer and less serious injuries is not just an improvement for the safety of the rider; it also alleviates some costs of motorcycle crashes. States with universal helmet laws see approximately

50% more riders wearing helmets than states with partial or no helmet laws; in states with universal helmet laws the costs of each registered motorcycle is $198, whereas in other states the cost rises to $725 [4]. These numbers arise from an estimated $32.5 million in health care costs from ICU patients who would have avoided injury with helmet use. In addition, the lost money from a death, including their taxes and lifetime earnings, is an estimated $370,000 [5]. When Florida repealed its universal helmet law, it saw an increase of 21% in deaths per 10000 motorcycles, yet more states continue repeal their laws because of pressures to not regulate what people do with their own bodies; Michigan repealed their helmet law in April 2012 and can be expected to see similar results [4]. It is apparent that the use of safety gear has highly positive effects, both for riders and the economy, but because universal helmet laws continue to be repealed people need to be motivated to wear gear even if they are not ordered to by law. The theory behind the research is that understanding the risks associated with riding will encourage motorcyclists to take less risks and willingly wear safety gear even in the absence of laws.

Current Simulator Use in Driver's and Motorcyclist's Training

Currently, simulators are not used in motorcycle safety courses; however they have been found to be effective in driving courses. Allen et al did a study on the effect of driving simulators on crash rates of novice drivers. They let novice drivers use advanced simulators, computer simulators, and no simulators and then studied the number of crashes the participants had a few months later. Crashes in the advanced simulator group were low and then increased as the quality of the simulation decreased. There were 500 participants involved in the study, with 3 different configurations of simulators. All of the simulators involved high rates of critical driving situations [6]. Just like driving courses, motorcycle safety courses are required for minors to get their motorcycle license and are taken by most adult riders to pass their skills test for their license. Both classes have skills sections that include time either on a motorcycle or in a car and classroom sessions.

Figure 2

The general skills taught are how to operate the respective vehicle, both of which involve a certain level of risk to operate. Therefore, it is reasonable to assume that studies involving driver risk taking can be applied to motorcyclists as well. A study on motorcyclists had similar results. Forty nine riders, divided into four groups, ranging from novice to experienced, used participated in simulations of dangerous situations. The experienced motorcyclists had less crashes because they approached the situations at slower speeds, indicating a more accurate perception of their own abilities [7]. This is important because it shows that there is a connection between having experience in dangerous situation and

a higher risk perception, resulting in more caution (lower speed in this example). Poor risk perception and overconfidence in skill are features of optimistic bias. All humans are theorized to have an optimistic bias, making them likely to believe that they are more likely to experience a positive outcome than their peers. The presence of optimistic bias is an evolutionary trait to encourage an individual to take risks. In order for the individual to go into a risky situation with confidence, the accuracy of risk assessment is depleted and an individual's assessment of their skills is overinflated [8]. The proposed research theorizes that if an individual is put into a dangerous situation and has a negative outcome because the individual is unable to react with the skill they believe themselves to have, optimistic bias will be lowered and more caution will be taken in later situations.

Research Methodology

The following details the procedure that the research will follow. There are three main stages to this research: participant selection and intake survey completion, simulator testing, and post-simulator data collection and analysis. The exact situations included in the simulation as well as precise details of the data analysis have been left out; these are details which require advising from experts in the field. A brief discussion of the expected results and future research completes this section.

Participants and Pre-test Data Collection

Participants selected will all be enrolled in a motorcycle safety course. These courses are standardized nationwide so location is not important. The intended sample size is 100 people in each group, control and test. All participants will be compensated for their time and will be informed of the 6 month commitment to the study.

Each participant will be given a brief intake survey about their experience as a driver or as a passenger on a motorcycle; questions will also be asked about experience with dirt bikes, ATVs and quad racers. Participants will be asked to disclose additional information such as age and gender as well.

Testing Period

After the initial intake, all participants will complete the motorcycle safety course in which they are enrolled. Half of the classes will spend half an hour, in addition to the normal class time, discussing how a motorcyclist should assess risk, average time needed to react to a hazard, and common hazards encountered. The other half will skip this discussion and instead each participant will spend half an hour on a simulator. All simulators come pre-programmed with 150 scenarios and over 38 crash avoidance scenarios; choosing which to incorporate into the test will require the expertise of those at the Motorcycle Safety Foundation. Participants will not be allowed to view the simulations as they are completed by classmates. This structure ensures that all participants receive an identical length of instruction, the only true variable being whether participants are told about risks or whether they experience them on a simulation.

Simulators will use a configuration comparable with a real motorcycle which lean with weight shifting (also known as counterbalancing) and put the participant in the exact physical position he or she would be in on a motorcycle. All controls are present on the simulator and the entire system is made to be adjusted to accurately depict the handling of a real motorcycle. Braking power and speed are correct for the weight of the bike and rider and an OEM instrument panel indicates speed, rpm, and other information. In order to make the simulation more realistic, participants will wear helmets, gloves, and boots. These three elements are important because they change the physical experience of riding a motorcycle; making the simulation as realistic as possible will insure that participants take the experiment seriously and will create more accurate feedback data.

Data Collection and Analysis

After all participants have completed the course, they will be asked to complete a survey every month for six months about their riding experiences. A rough draft of the survey is found in Index B. The information from these surveys will be tabulated and plotted based on various factors including age, gender, and previous experience; all of this information is gathered in the intake survey.

Although there is not yet a completely defined analysis methodology, the data should give a clear indication that more precaution is taken and fewer accidents occur in the group which completed the simulation. It is expected that those with previous riding experience and especially those with previous accidents will be less affected by the simulations, as their optimistic bias has already been partially depleted. It is also expected that there will be a slight gender and age divide as females and older adults tend to take less physical risks. However, based on the studies discussed in the literature review, these divides should be nearly negligible on a large scale. If at the completion of this research it is found that the hypothesis is supported, it would be beneficial to analyze the results of a larger scale implementation of simulators. In addition, it would be worthwhile to look at the longer-term effects of the simulators, past the six months that this study covers. Even if the hypothesis is not supported, this research could act as a base for new research to be done on improving the motorcycle safety course curriculum.

Researcher Qualifications

I am a junior studying mechanical engineering at Case Western Reserve University. In addition, I am a motorcyclist with a combined 25,000 miles of experience on standard and sport motorcycles. In addition, I have completed the motorcycle safety course and will be completing the advanced rider safety course before the end of this study. Due to coursework in human behavior, including Evolution of Human Behavior, and previous research into optimistic bias, I also have a strong understanding of the psychology behind the overconfidence that often leads to accidents. In addition, my engineering coursework has given me the skills needed for the data analysis required in this research.

Schedule

Participant Interaction:

Weeks 1-2: Gather participants; complete all simulator use with random observation.

Weeks 3-4: Conduct confidence surveys of all participants.

Weeks 4-24: Each month, contact all participants and gather data about accidents, traffic violations, and safety gear use.

Data Analysis:

Weeks 1-2: Record all test conditions and any anomalies in the use of the simulators. Prepare confidence surveys for administration.

Weeks 3-4: Compile data from surveys, analyze data according to any varying factor including but not limited to simulator use, age, experience, and gender. Do error analysis.

Weeks 4-24: Each month when information is received from participants, complete analysis of the data.

Requested Involvement:

This proposal is directed to the Motorcycle Safety Foundation. Assistance is requested from the Motorcycle Safety Foundation in the procurement of the motorcycle simulators and the structure of the scenarios within the simulator software. As the Motorcycle Safety Foundation is well versed in the collection of data on motorcycles and motorcyclists, some guidance is requested in the development of the finalized surveys. This project depends upon the reporting of data from the participants; in the case of a fatal accident, the relationship between the Motorcycle Safety Foundation and the Department of Transportation could be very helpful in completing data collection. Research in this area is beneficial to motorcyclists, the Motorcycle Safety Foundation, and society as a whole. In conclusion, I hope that the Motorcycle Safety Foundation recognizes the value of this research and will provide the assistance and funding necessary for its completion.

Appendix A

Intake Survey

- *What is your age?*
- *What is your gender?*
- *Please estimate your years of experience on a street motorcycle*
- *Please estimate your years of experience on an off-road vehicle*
- *Please specify the type of off road vehicle if applicable (dirt bike, ATV, etc.)*
- *Please describe any and all accidents on a vehicle (not including passenger vehicles)*
- *Please describe any previous formal safety training you have had for a motorcycle or off road vehicle*

Follow-up Survey (completed each month for 6 months)

- *Please estimate the amount of time you spend motorcycling each week*
- *Please describe any motorcycle accidents in the past month*
- *Please disclose any traffic violations (only include those for motorcycling)*
- *Please describe the average mph you drive under or over the speed limit*
- *Please list all of the safety gear you typically wear when motorcycling*

Bibliography

[1] *"MSF Curriculum Listing 2011"* [Online]. Available: http://msf-usa.org.

[2] M. J. White et al., "Young Drivers' Optimism Bias for Accident Risk and Driving Skill: Accountability and Insight Experience Manipulations," *Accident Analysis and Prevention,* vol. 43, p. 1309-1315, 2011.

[3] B. C. Liu et al., "Helmets for Preventing Injury in Motorcycle Riders," *Cochrane Database of Systematic Reviews*, vol. 1, no. 4, 2008.

[4] R. B. Naumann, "Helmet Use Among Motorcyclists Who Died in Crashes and Economic Cost Savings Associated with State Motorcycle Helmet Laws," *Morbidity and Mortality Weekly Report,* vol. 61, no. 23, pp. 425-430, 2012.

[5] M. A. Croce et al., "Impact of Motorcycle Helmets and State Laws on Society's Burden" *Annals of Surgery,* vol. 250, no. 3, pp. 390-394, 2009.

[6] R. W. Allen et al., "Simulator Training of Novice Drivers: A Longitudinal Study," *Advances in Transport. Studies,* pp. 51-68, 2011.

[7] C. C. Liu et al., "Hazard perception abilities of experienced and novice motorcyclists: An interactive simulator experiment," *Transportation Research,* vol. 12, no. 4, pp. 325-334, 2009.

[8] J. H. Fowler "Evolution of Overconfidence" *Nature,* vol. 477, pp. 317-320, 2011.

[9] *EF-Bike MotorCycle Simulator*. Retrieved from http://livbit.com/article/2008/12/19/ef-bike-motorcycle-simulator/