A Proposal for Defining, Measuring, and Documenting the Effects of "Safety Renewal": A Concept Whose Time Has Come.

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Tim Buche, President

Sherry Williams, Ph.D., Research Director

Allison Tyra, Research Associate

Motorcycle Safety Foundation

Irvine, CA, United States

Abstract

Research findings in the areas of driver and rider education as reported in the literature over the past twenty years are summarized. Based on previous decades of research conducted in traffic and motorcycle safety, an original idea for rider education is introduced: safety renewal. The concept of safety renewal is discussed as an integral part of a comprehensive rider education and training system that is distinguished by multiple training courses with multiple entry points that meet the lifelong learning needs of current and prospective motorcyclists. Safety renewal is hypothesized to be correlated with significant positive outcomes. This concept is contrasted with the previous measures of static results tied to a single rider education course. In addition, this paper reviews a proposal for a longitudinal research study that will seek to define, measure and document the effects of safety renewal on trained motorcyclists contrasted to results from untrained riders and riders trained through a single novice course.

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Research into the topic of motor vehicle safety has grown exponentially over the years. Specifically, research about motorcycle safety as a unique category of motor vehicles is of particular value. This paper will provide an historical view of the research in motorcycle safety. This overview will show that the main purposes of recent psychological and sociological research concerning motorcycle safety have been to explain casualty statistics and then to use this knowledge to develop effective countermeasures. With this historical view as a basis, the concept of "safety renewal" will be identified and defined as a promising new approach to conceptualizing the effect of motorcycle skills training and other mediating factors on rider-based outcomes.

As the number of fatalities has risen, the search for appropriate countermeasures has grown concurrently. In order to better understand the experience of motorcycling, we need to understand the rider. Therefore, one avenue of empirical investigation pursued has been to decipher the characteristics of the motorcyclist. These characteristics often include the rider's perception of risk, age, experience, skill level, and training. With these descriptive studies as a basis, theorists and researchers can develop hypotheses and design proper methodological studies to understand what rider characteristics may predict motorcycle accidents and fatalities. Substantial research has been conducted using these predictors to develop educational programs to help combat the accident and fatality statistics. The current zeitgeist for motorcycle accident prevention is exploring the benefits of multiple training and lifelong education based on previous empirical findings.

The cultural changes that occurred during the 1960s and 1970s included a substantial increase in the number of people riding motorcycles in most of the Western world. With this growth came an increase in motorcyclist injuries and deaths. In fact, from 1950 to 1974, the number of registered motorcycles increased by 1000% in the United States, which corresponded to the increase in the crude death rate (Kraus, Franti, Johnson, & Riggins; 1976). Pressure grew for changes in safety policy that would, in theory, quickly reduce the number of motorcycle casualties. Changes came in the form of a plethora of legislation that included stricter proficiency tests, a reduction in the time a provisional license could be held, and restrictions of engine capacity for learners. It was this early impetus that established the research agenda for the 1970s. During this time, the emphasis in motorcycle safety research was on accident analysis. Research focused on the characteristics of motorcycling accidents and the contributory factors which led to accidents and injuries (Chesham, Rutter, & Quine, 1993; Hurt, Ouellet, & Thom, 1981). Examples of related research topics included use of safety gear, use of daytime headlamps, the rider's age, and the influence of alcohol on motorcycle injuries and fatalities.

In the 1980s, the focus of motorcycle safety research shifted to investigating why the rider had chosen to comply with existing laws, how training affected behavior, and how perceived risks contributed to safety issues. Instead of examining the factors involved in accidents, research analyzed the processes of riding. These processes included training, skills testing, evaluation, and perceived risk (Mortimer, 1984; Wilde, 1982). Overall, this line of questioning now acknowledged the motorcycle rider as the central influence in motorcycle safety. In general, with notable exceptions such as the methodologically-sound Hurt Report (Hurt, et al., 1981), research involving motorcycle safety in the 70s and 80s lacked a strong theoretical foundation and therefore, measurements of the variables were often faulty.

As the 1990s, dawned and the rider became viewed as an "active agent," the methodology of research became more stringent. Much of this new line of investigation was based in the social psychological literature and was focused on the function of beliefs and attitudes in human behavior. The two important theories that were utilized were the Theory of Reasoned Action (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980) and the Theory of Planned Behavior (Ajzen, 1988). The Theory of Reasoned Action states that the most direct determinant of a behavior is a person's intention to perform it. Similarly, the Theory of Planned Behavior suggests that the best predictor of how individuals act in a specific situation is the strength of their intentions. In other words, if a motorcycle rider strongly believes and intends to ride safely, the chances of the motorcyclist riding safely increases. Both models have been useful and have shown that beliefs and attitudes play a significant role in roadway behavior.

While the historical picture of motorcycle safety research is replete with topic-oriented research studies, the current trend in research surrounding motorcycle safety attempts to incorporate all of the previous decades' findings. Many of the variables included in past research are not mutually exclusive; but instead, are correlated to one another. For example, Rutter, Quine, and Chesham (1995) found that beliefs and attitudes serve as mediators between a rider's age and safe riding behaviors. The study isolated a significant relationship between the rider's age (young versus middle aged) and his or her beliefs about traffic violations (receiving a speeding ticket or not), which, in turn, influenced the individual riding behavior (risky versus non-risky).

Using the more recent research as a guide, including and analyzing multiple variables appears to be an essential element in understanding motorcycle safety outcomes. In deciphering the more important variables to include when studying motorcycle safety outcomes, several seem

especially important in the literature such as age, perceived risk, and training. The first variable, age of the rider has been studied extensively. For example, Rutter and Quine (1996) found that motorcycle accidents were three times more common when the rider was under 20 years of age. Other studies have found that if the rider is young and male, the chance of being involved in an accident increases (Lin, Chang, Pai, & Keyl, 2003). However, the age question cannot be based solely on the increased risk associated with being young. The average age of today's motorcyclist is increasing. According Motorcycle Industry Council (MIC) data (Motorcycle Industry Council, 2000), the typical U.S. motorcycle rider is 38 years of age compared with 24 years of age in 1980. A report from the National Highway Traffic Safety Administration (2001) noted that the fatality rate for riders over 40 years of age increased 38% from 1997 to 1999. In other words, the people riding motorcycles today tend to be older and are experiencing more accidents than ever before.

The second variable of interest is the level of risk perceived by the motorcycle rider. The idea of risk perception is grounded in the theory of "unrealistic optimism" (Weinstein, 1980). This theory states that people generally expect misfortunes to happen to others and that more good things are likely to happen to themselves. Since Weinstein's classic series of papers (Weinstein, 1982; 1983; 1984; 1987), considerable literature on unrealistic optimism has developed (see Hoorens, 1994; Weinstein & Klein, 1996). One important focus of this literature has been to examine whether the theory of unrealistic optimism predicts behavior; specifically, whether unrealistic optimism predicts motorcycling behavior. In a study by Rutter, Quine, and Albery (1998), motorcyclists who participated displayed unrealistic optimism but no direct relationship was found between unrealistic optimism and subsequent risky behavior. Similarly, Horswill and Helman (2003) found that motorcyclists and non-motorcycling car drivers did not

differ on risk-taking measures. While the theoretical basis of this research appears promising, to date this line of investigation has been plagued by methodological problems (Van der Pligt, 1994). One such problem is the method in which "risk" is defined or constructed.

Although motorcycling is commonly recognized as an activity that is more risky than other forms of transportation, surprisingly little has been investigated from the perspective of an actual motorcyclist. A large portion of the literature in this area has examined the automobile driver's perception of their own driving abilities and the likelihood of being involved in an accident (Mannering & Grodsky, 1995). Then, assumptions and generalizations are made from the non-motorcycle driver to motorcyclists' perception of risk due to the notion that the driving environments are similar. This is an oversimplification of the motorcycling experience that may render the research to be considered irrelevant. Also, there is a difference in the construct of risk itself between the "experts" and the people who ride. According to Bellaby and Lawrenson (2001), motorcyclists disagree with the expert's assessment of risk. Many motorcyclists stated, "we are not so much risk-takers" as the risky situation is often imposed upon the rider (e.g., environment, road hazards, unsafe drivers). Overall, future research involving risk perception and motorcyclists should utilize a prospective longitudinal design (Rutter, Quine, & Albery, 1998), with multiple measures of constructs such as risk and various motorcyclist's personal characteristics.

The third variable of interest in motorcycle safety research is training. In particular, training as a method of managing risk and preventing accidents. The results from examining the effects of a single skill training program have been mixed. Almost all of the early evaluations of rider training programs produced encouraging results. Multiple studies noted that formally trained riders had a lower incidence of accidents than riders who were untrained (McKnight,

1987; Rothe & Cooper, 1987). For example, McDavid, Lohrmann, and Lohrmann (1989) found a small and persistent but not significant difference in trained and untrained riders using a rigorous subject matching methodology. Another study found significant differences between formally trained riders and untrained riders at a 6-month follow up but not one or two years after the training program (Billheimer, 1996). However, according to Mayhew and Simpson (1996), all of these studies suffered from at least one serious methodological flaw. For example, the McDavid et al. (1989) study did not control for amount of exposure. Therefore, the positive results are questionable.

Other analyses, some better-designed and others not, generally produced disappointing results. For example, Jonah, Dawson, and Bragg (1982) found that after controlling for differences in exposure level, formally trained riders had the same number of accidents as riders who did not receive formal instruction. In several assessments of the Motorcycle Safety Foundation's Motorcycle RiderCourse: Riding and Street Skills (MRC:RSS) course, evaluators found no significant difference in crash rates (Osga, 1980), accident rates per miles ridden (Mortimer, 1984), or accident rate, violation rate, or motorcycle damage (Mortimer, 1988). Furthermore, Buchanan (1987) reported on a large-scale study in New York State, with a very large matched sample and a rigorous experimental design that confirmed the negative findings of previous studies. In summarizing the research into the effectiveness of a single training program, Mayhew and Simpson (1996) conclude that research conducted in three countries "provides no compelling evidence that rider training is associated with reductions in collisions." (p. 36)

These experts warn researchers of the pitfalls of evaluating the effectiveness of motorcycle rider training (Simpson & Mayhew, 1990). First, they noted that the evaluations have failed to address the issue of effectiveness adequately by considering only final outcomes.

Anecdotal evidence from Motorcycle Safety Foundation training course participants abounds that supports the effectiveness of the training in real-life scenarios. Yet, these countless anecdotes have not been represented in the study variables. Additionally, researchers should consider capturing measurements of variables that go beyond violation and crash statistics. Variables such as self-reported cases of utilizing crash avoidance skills, the severity of collisions, improvement of riding skills, using protective gear, rider motivation, and attitudes towards risk and safety may serve as important intermediate outcomes. Previous research has demonstrated conflicting results but has not generally considered these mediating factors. Therefore, future research should include an assessment of variables such as these.

Another criticism of previous evaluation research of motorcycle training programs is the fact that these programs have been a single formal training experience. While the Motorcycle Safety Foundation's MRC:RSS has consisted of two separate courses (a novice course and an experience rider course) since its development in 1986, nearly 90% of the students nationwide are trained only on the novice course according to MSF training statistics. As a result, what is pragmatically in place is a single-course training system. Overall, it is difficult to show any long-term effects from a single skills training program. According to Rothe and Cooper (1987), motorcycle operation requires excellent motor skills and physical coordination. In order to master these types of complicated skills, repetition is necessary. In addition, because safe motorcycle riding is dependent on realistic attitudes toward risk taking and mental alertness, frequent reinforcement of safety-oriented attitudes may be essential.

The Motorcycle Safety Foundation has coined a concept for this type of practice or learning experience and attitude reinforcement, "safety renewal". In other words, an individual should be exposed to multiple learning experiences about safe riding techniques, which will

affect a change in attitude or intention and, subsequently, behavior. If a motorcyclist is involved in a variety of learning experiences over time, with no artificially imposed breaks between beginning and experienced courses (required waiting period and/or miles ridden requirements), the likelihood of the individual mastering the various cognitive and motor skills necessary for accident prevention should increase. Furthermore, renewal training periodically reminds the rider of salient safety issues, which should increase a rider's level of safety awareness and risk assessment. The safety renewal concept encourages proponents of motorcycle safety programs to modify their approach to training. If safety renewal is the key, riders will benefit more from multiple training modules and lifelong education compared to a single safety training course. Instead of viewing motorcycle training as a one-time inoculation to accident prevention, safety training should be presented as a "booster" to prevent crashes over the rider's lifetime. In conjunction with this idea, the Motorcycle Safety Foundation has developed the comprehensive Motorcycle Rider Education and Training System (RETS).

In the mid-1990s, the MSF embarked on a significant endeavor to improve the education and training processes related to motorcyclists and its own certified instructors. Originally the MSF believed that revising its two existing *RiderCourses*[SM] would be benefit the rider education and training community. The MSF soon learned that revising the original curricula would not be adequate to meet the needs of today's motorcyclists. As a result, the MSF approached the project uniquely by establishing the *Rider Education and Training System Development and Oversight Team* (RETSDOT) who undertook a comprehensive, broad-reaching investigative approach to curricular improvement. The RETSDOT approach revealed that the original curricula content remained sound and effective as it was based on quality research, including the *Motorcycle Task Analysis* (Motorcycle Safety Foundation, 1974), *Motorcycle Curriculum*

Specifications (Motorcycle Safety Foundation, 1976), and *Hurt Report* (Hurt, et al., 1981). Also, by researching participant needs, as well program delivery partners, and other stakeholders, RETSDOT identified the inadequacy of a segmented course structure as it relates to student learning.

Thus, MSF created the concept for an entire system where the processes of education and training would form a lifelong learning continuum and would provide for continuous and real-time improvement. Gone was the assumption that a rider needed a waiting period between novice training and experienced rider training. The *MSF Rider Education and Training System* (MSF RETS) was developed over a period of several years and continually analyzed, improved and expanded. The system uses proven and cost-efficient approaches to promote motorcycle safety by addressing the false perception that rider training is only for novice riders and by encouraging motorcyclists to constantly improve their skills and safety attitudes. RETS is a fluid system that provides ongoing and developmental growth for all motorcyclists that is distinguished by multiple training courses with multiple entry points. In addition, the system represents a commitment to excellence in promoting positive learning experiences in support of safe, responsible motorcycling.

The MSF RETS has four goals set to aid it in achieving the MSF mission of improving the safety of our nation's streets and highways so that responsible motorcyclists can enjoy riding to the fullest. Two of the four MSF RETS goals that apply to safety renewal are:

1. *A Comprehensive Model:* The MSF RETS is a dynamic program that packages education and training courses into interconnecting building blocks, each containing a specific set of core skills and competencies. MSF RETS offers learning opportunities for a wide variety of riders; for the community that supports RiderCoaches[SM], policymakers, and

program administrators. Because of the building block approach, the rider will experience renewal of his/her focus on cognitive and motor skill development that is essential to safe motorcycling.

2. *Custom-Tailored for Riders:* The MSF RETS uses stand-alone yet interrelated modules so participants can select courses to create a personalized education and training program with instruction and coaching matched to particular needs, interests, and skill levels.

Several fields of study and disciplines were applied in the development of RETS. The *MSF Rider Education and Training System* was conceptualized and developed by considering several fields of study and disciplines. System underpinnings include motor skills development principles, traffic and motorcycle safety research and experience, contemporary principles of human learning and development, and human factors research related to the motorcycle rider task (Brookfield, 1986; Jensen, 1996; Schmidt & Wrisberg, 2000). Applicable motor skill development principles include proper application of whole-to-part training, speed versus accuracy, the distinguishing characteristics of kinesthetic and augmented feedback, and the effects of verbalization and visualization. Overall, the MSF RETS is designed to enhance crash avoidance skills and to continuously improve rider education and training curricula in the area of crash avoidance skills based upon tested and evaluated skills, both cognitive and motor skills essential to safely operating a motorcycle on the roadway.

In order to test the proposed hypothesis that the new RETS program will encourage safety renewal and thus, demonstrate long-term effectiveness in positive motorcycle safety outcomes, the Motorcycle Safety Foundation has entered into a cooperative agreement with the National Highway Traffic Safety Administration (NHSTA), the Discovery Project. The objective of the cooperative agreement is to conduct a series of longitudinal studies to measure the

knowledge, skills, attitudes, habits, and values important to safe motorcycle riding. Research has shown that multiple variable models are essential. Thus, multiple predictors and intermediate outcomes will be employed. Taking to heart the disappointing results from a single training program, the main distinction between this study and countless others is the inclusion of safety renewal as one of the main predictors. Other predictor variables will include rider demographics, rider-perceived risk, rider experience, and previous driving and/or riding history. Mediator outcome variables will include the development of cognitive and physical motorcycle skills that are essential to safe riding and the rider's experience and/or involvement in critical incidents and near misses. Other outcome variables will include traffic violations, crashes, and fatalities. It is hypothesized that a systems approach to safety renewal will produce the desired results in increasing crash avoidance skills and reducing traffic violations and crashes while increasing safety awareness and attitudes over time.

The MSF RETS Discovery Project will take place at several controlled training sites where MSF will seek the match riders on important characteristics and then randomly assign them to one of three conditions: no training, single-course training, and safety renewal. For the safety renewal condition, the MSF will use rider incentives to encourage this experimental group to become involved with the MSF RETS by enrolling in multiple courses, learning modules and other learning opportunities. All three groups will be followed over time to assess their progress on the intermediate and final outcomes identified. With the MSF's primary focus of safety training for current and prospective motorcyclists, the study design will not prevent a motorcyclist from enrolling in additional training if they have been assigned to the single course training condition. The sample size will be large enough to accommodate any such movement of participants between groups

Data collection efforts will involve both quantitative and qualitative measures. For example, crash avoidance skills will be operationalized as scores on a riding evaluation test, a quantitative measure. Traditional outcome measures such as violations and crashes will be counted and coded for severity. At the same time, to provide a more complete picture, mediating measures such as near misses or critical riding experience will be collected as qualitative recollections where research participants give full and complete narratives. Narratives can then be coded in various ways, depending on the nature of the stories. In this way, the MSF will attempt to understand the effects of training from multiple perspectives and through both quantitative and qualitative measures.

This paper has introduced the concept of safety renewal as an important advancement to understanding the effects of motorcycle safety training. Though previous research findings in the areas of driver education and rider education have shown only short-term and/or contradictory effects from a single training course, the MSF RETS is a system-based approach consisting of multiple courses and learning opportunities that honors a rider's needs for training when he/she needs it. By meeting the lifelong learning needs of current and prospective motorcyclists, and thereby, increasing a rider's attention to a safe attitude through safety renewal, RETS is hypothesized to produce more lasting and more significant positive outcomes over time. Through a cooperative agreement with NHTSA, the MSF will embark on a significant test of this hypothesis. The study will utilize rigorous research design and methods including matched subjects and multiple experimental manipulations achieved through rider incentives and random assignment. The study instrumentation will include multiple quantitative and qualitative indicators of intermediate and final outcomes such as increases in knowledge, crash avoidance

skills, number and severity of near misses, incidents or crashes, and various attitudinal measures. The MSF believes that a shift to the concept of safety renewal will prove fruitful in the area of positive safety outcomes from rider training.

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