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Affective components in training to ride safely using a moped simulator

Mariaelena Tagliabue *, Michela Sarlo

Department of General Psychology, University of Padua, Italy

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ABSTRACT

The aim of the present research was to compare different methods of training for safe moped use, especially focusing on physiological reactions during risky experiences. By recording skin conductance response (SCR), we investigated whether training that requires active riding behavior in different risky situations through the use of the Honda Riding Training (HRT) simulator leads to different physiological reactivity, which, in turn, might lead to better learning outcomes. Results indicated that participants who rode actively through the HRT showed higher percentages of SCRs than participants who simply observed risky road scenes to spot hazards. SCR percentage was higher in scenes with no accident. Overall, SCR amplitude was greater when accidents occurred than in scenes with no accidents. Implications for the effectiveness of inexperienced riders training with riding simulators were also discussed.

1. Introduction

Learning to drive safely is a crucial ability for people who drive a car or ride a moped daily. Thus, great efforts have been devoted to investigating the variables that influence safe driving and the conditions that might reduce driving risks. Many studies have been devoted to investigating which learning procedures and protocols help develop drivers who are less prone to the types of errors that lead to road accidents.

In recent years, the literature has increasingly focused on motorcycle riding because the higher vulnerability of motorcyclists when compared to car drivers. Indeed, the World Health Organization (WHO, 2013) demonstrated that in European regions, 43% of deaths in road accidents are pedestrians, cyclists, or users of motorized two- and three-wheeled vehicles (hereafter "riding users"); pedestrians and riding users have similar percentages of fatal outcomes (respectively, 20% and 18%). From 2007 to 2011, deaths among motorcyclists increased from 12% to 18%, which is worrying considering the efforts devoted to reducing road mortality. The trend is confirmed in the United States as well, where fatal motorcycle crashes increased by more than 70% between 1997 and 2003 (Baldi, Bear, & Cook, 2005). As mentioned by Shahar, Poulter, Clarke, and Crundall (2010), motorcycle crashes often are caused by other road users. It is thus even more crucial that road users gain practice with motorcycles' many hazards before they ride on a real road.

Baldi et al. (2005) argued that, to remedy this situation, motorcycle education and licensing programs should adopt best practice measures. Indeed, despite the fact that the literature provides controversial data concerning the efficacy of educational programs and licensure laws (Lin & Kraus, 2009), Baldi et al. (2005) demonstrated that the U.S. states that adopt best

* Corresponding author at: Department of General Psychology, University of Padua, via Venezia 8, 35131 Padua, Italy. Tel.: +39 049 8276598.
E-mail address: mariaelena.tagliabue@unipd.it (M. Tagliabue).

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practice measures concerning efficiency, coordination between different agencies, effectiveness of rider education delivery, and adequacy of licensing testing show lower rates of motorcycle accidents.

Training programs could be improved by taking into account the psychological mechanisms used in riding. Indeed, in the last two decades, evidence has been collected that one of the underlying processes crucial to safe driving is the ability to quickly detect potential hazards (often provoked by other road users) so that the rider can react promptly and effectively to prevent crashes (Deery, 1999; Rosenbloom, Perlman, & Pereg, 2011; Vidotto, Bastianelli, Spoto, & Sergeys, 2011).

In the context of risk factors for motorcyclists, Lin and Kraus (2009) referred to inexperience, risk-taking behavior, and excessive speed, among others, as human factors that increase the risk of accidents, particularly those with high-severity injury outcomes. Considering that inexperience can be reduced only with practice—and that practicing on the road without experience might lead to a higher risk of accident or injury—it follows that today, much research is focused on demonstrating the efficacy of other modalities for gaining experience, such videotapes and driving/riding simulators (Isler, Starkey, & Sheppard, 2011; Vidotto et al., 2011). Both these interventions are aimed at improving risk perception abilities through exposure to situations similar to those in real life, which should lead to fewer risky behaviors and safer responses to risky conditions caused by other road users. Isler et al. (2011) demonstrated that off-road training is effective if it improves the higher-order abilities involved in real driving.

Regarding the use of simulators, Meuleners and Fraser (2015) demonstrated the relative validity of a driving simulator by showing that on-road behavior does not differ significantly from simulator performance for several driving variables, such as space inspections (left, right, and forward observation), speed at intersections, speed maintenance, mirror checks, and attention to traffic lights and stop signals. Thus, despite some skepticism about the effectiveness and generalizability (transfer) of simulator-based skills to the road, Goode, Salmon, and Lenné (2013) provided encouraging conclusions; indeed, they stated that with reference to procedural skill (such as vehicle control and gear shifting), there is evidence that simulators enable learning transfer to on-road performance. The evidence concerning the effectiveness of simulator training for higher-order cognitive skills is even stronger, especially regarding visual scanning and hazard perception and reaction (Goode et al., 2013). In other words, the effectiveness of a learning system depends on the degree to which it simulates the cognitive and psychomotor processes involved in the learning task (Goode et al., 2013).

Thus, to investigate the on-road effectiveness of simulator training, it is important to understand the wide variety of underlying processes used in driving/riding. All the studies previously cited focused on cognitive or psychomotor aspects, but emotional aspects are also involved in all learning processes.

A recent contribution to the study of how affective variables are linked to risk perception is provided by Kinnear, Kelly, Stradling, and Thomson (2013), who investigated psychophysiological changes, comparing groups with different driving experience. The rationale was that psychophysiological measures, such as skin conductance response (SCR), reflect an implicit, automated way of detecting hazards that parallels cognitive hazard recognition—risk as feeling versus risk as analysis (see Slovic & Peters, 2006). According to this framework, risk as analysis is the rational (cognitive) way to face risks, and risk as feeling is an intuitive and quicker way to react to uncertain and perhaps dangerous situations to ensure a better chance of survival. Applying this perspective to driving education, it can be hypothesized that traditional learning programs train the analytic modality and that simulated hazard experience trains the affective modality.

Based on this perspective, Kinnear et al. (2013) compared the SCRs for groups of drivers with different degrees of driving experience while they watched clips of typical dangerous on-road situations, with and without the occurrence of an accident. Kinnear et al. demonstrated that driving experience plays a role in determining the number of SCRs, in that experienced drivers show SCR in a higher percentage of clips than do either inexperienced or learner drivers. Moreover, Kinnear et al. showed that anticipatory SCR scores (i.e., SCR in the period in the clips in which the potential hazard can be identified but before a hazard-avoiding maneuvers occurs) increase as a function of experience, defined in terms of miles driven in the previous year. On the contrary, no differences in terms of experience were evident in the level-of-risk ratings, which are mediated by the analytic system (Kinnear et al., 2013). The authors explained these results as a confirmation of the existence of the affective mode for detecting hazards, which depends on on-road experience and helps to immediately signal the approach of a potential danger (Kinnear et al., 2013). This mode is independent of the analytic/cognitive mode of hazard detection, as indicated by the absence of differences between groups in the conscious rating of the level of risk.

As stated above, previous attempts have been made to investigate this topic in ecological conditions—that is, on the road. Among others, Taylor (1964) observed SCRs (formerly known as GSRs) for participants driving under different real road conditions, but he failed to find consistent relations between those SCRs and road traffic conditions. However, the procedure used did not allow for the isolation of specific risky events. On the other hand, the recent findings of Kinnear et al. (2013) clearly show that a fine-grained analysis of risky points (from the moment when the hazard starts to a certain time after an action is taken to avoid the hazard) allows the SCR to be interpreted as a specific response to the perceived hazard, which, in turn, is modulated by driving experience.

Starting from these considerations, in the present research, we studied the performance of young adults riding a moped simulator (Honda Riding Trainer [HRT]) to investigate if a riding training simulator engages the implicit system of hazard appraisal. The reasoning is that an indirect way to assess the effectiveness of training with simulators is to demonstrate that it involves the mental processes that are crucial for hazard perception. Considering technical difficulties in measuring psychophysiological variables in on-road conditions, such evidence might provide useful information indicating the degree of this training simulator's effectiveness.