Simulator Emergency Police Vehicle Operation: Efficiencies and Skill Transfer

Gregory P. Krätzig M.A.
Royal Canadian Mounted Police
Regina, SK, Canada
gregory.kratzig@rcmp-grc.gc.ca

Dr. Garry Bell (ret.)
Royal Canadian Mounted Police
Regina, SK, Canada
g.b.consulting@accesscomm.ca

Cpl. Rae Groff
Royal Canadian Mounted Police
Regina, SK, Canada
Rae.Groff@rcmp-grc.gc.ca

Cpl. Cathy Ford
Royal Canadian Mounted Police
Regina, SK, Canada
Cathy.Ford@rcmp-grc.gc.ca

ABSTRACT

Each year hundreds of people die in collisions that are a direct result of emergency responder or military personnel driving; given this it has become increasingly important to mitigate these situations. One way to reduce these incidents is through simulator instruction. Although driving simulators have been used for several decades, we will address the absence of empirical evidence that systematically investigates how using this technology will not only enhance emergency response and military driver training programs, but will provide training opportunities not previously possible. We have optimized time on task by emphasizing the use of specific measurable scenarios significantly reducing the time needed to achieve intersection clearing proficiency in a simulator; however, until now evidence of the transferability of skills from a simulated driving environment to a real world setting has been missing. This paper will report on the results of Project Drive that is currently being conducted with over 1500 police cadets who train at the Royal Canadian Mounted Police Training Academy (RCMP). Through the use of only 7 scenarios, we have created instructional efficiencies resulting in cadets achieving maximum performance proficiency in a simulator. This instructional method has eliminated classroom sessions, and has permitted cadets to begin training in a police training vehicle at level that previously occurred in the field. We will discuss;

1). How our teaching methodology optimizes instruction time.
2). The extent that skills transfer between driving simulators to police vehicles during live problem-based scenario exposures.
3). We will also discuss the integration of this technology into a police driver training program that considers simulators as an enhancement of the training curriculum rather than treating simulator exercises as “bolt-on components.”

ABOUT THE AUTHORS

Mr. Krätzig joined the Royal Canadian Mounted Police (RCMP) Training Academy in 2009 and is responsible for investigating the most effective means of integrating simulator technology into training. During his tenure he has lead research projects investigating; 1) skills acquisition during simulator exercises measured against real world tests, 2) video-based use-of-force training, and 3) pistol skills acquisition on a virtual training range. His research has resulted in the integration of driving simulators into the Cadet Police Driver Training program. Other research interests include training factors influencing the degree to which skills are retained and identifying factors that protect skills from degrading. Mr. Krätzig was a successful senior manager in the private sector before receiving his Masters Degree in Experimental and Applied Psychology from the University of Regina where he is currently a PhD candidate.

Dr. Bell managed the Program Support and Evaluation Unit at the Training Academy in Regina, which is responsible for the curriculum, teaching methodologies, testing and evaluation procedures. In November 1999, Garry was named Cadet Training Program Officer. He was a guest lecturer at "Depot" from 1970 to 1983, during which time he participated in the creation of the Human Relations program and was instrumental in bringing "simulation training" with live actors to the area of conflict management in domestic violence. He has researched the effectiveness of various teaching methods and created a performance measurement tool for evaluating domestic abuse intervention performance. He has also conducted enforcement studies on "officer safety" and "use of force" for resource officers in Saskatchewan. Dr. Bell holds a Masters Degree in Social Work from the University of British Columbia and a Doctorate in Psychology from the University of Calgary. Dr. Bell retired from his position in Training Innovation & Research with the RCMP in April of 2010.

Rae Groff joined the Royal Canadian Mounted Police (RCMP) in 1990, and had 8 years of operational policing in British Columbia which included General Duty, General Investigation Section, Municipal Traffic and Highway Patrol, before being transferred to the Immigration and Passport Section in Ontario. In 2006 Rae joined the RCMP Training Academy as an instructor in the Police Driving Unit before moving to the Simulator Training Unit in 2009. In her current role she is responsible for conducting research, developing programs and integrating the driving simulators into the Cadet Training Program. Rae has completed 3 years of a 4 year degree program in Psychology from the University of Regina.

Catherine Ford joined the Royal Canadian Mounted Police (RCMP) as a Regular Member in 1993. Before coming to the RCMP Training Academy she spent 12 years in British Columbia working as a general duty police officer in various mid-sized detachments. In 2005, she transferred to the RCMP Training Academy in Regina, Saskatchewan where she spent 4 years in the Police Driving Unit as a Facilitator/Instructor, before becoming a Police Driving potential Instructor (train the trainer). In 2009, she transferred to the Simulator Training Unit, as part of the research team investigating cadets' performance during emergency vehicle intersection clearing responses. She is also part of the team that is developing the new training program for the Police Driving Unit, with a focus on the integration of the driving simulators into the Cadet Driving Program. Her education includes a certificate from the University of Regina in Adult Education.

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Cpl. Rae Groff
Royal Canadian Mounted Police
Regina, SK, Canada
Rae.Groff@rcmp-grc.gc.ca

Cpl. Cathy Ford
Royal Canadian Mounted Police
Regina, SK, Canada
Catherine.Ford@rcmp-grc.gc.ca

INTRODUCTION

For many people the decision to become a police officer is made with the knowledge of the many risks and rewards inherent with the job. Although risk reduction is continuously targeted throughout each agency's respective training programs, some situations cannot be properly trained for in situ. For example, the Royal Canadian Mounted Police (RCMP) had long ago incorporated city and rural driver training into the Cadet Training Program (CTP). However, exposing students to situations such as emergency vehicle response intersection clearing (EVRIC) in a public setting would be impossible. While this paper focuses on the field of law enforcement, it is clear that there are positive outcomes for not only emergency responders but military drivers as well. The goal of our research was to determine if driving simulator technology can be used to efficiently and safely train police cadets how to clear an intersection while in an emergency vehicle response situation. But more importantly would the lessons learned in a simulator be transferred effectively into a real-world setting?

Research has shown that people who are successful problem solvers have a flexible and organized knowledge base, and that instructional practices which allow a student to apply their knowledge, are more likely to produce better students (Mandle, Gruber, & Renkle (1996). In addition Barrows (1996) and Dochy, Segers, Van den Bossche, and Gijbels (2003) suggest that learning environments should be representative of real-life situations that offer opportunities to learn through interaction. While the RCMP instructs cadets how to drive in both urban and rural settings, doing EVRIC training in situ involves unacceptable risks, making training in this environment an unfeasible option. Unfortunately though, for most police organizations, acquiring EVRIC skills occurs "through osmosis" after the cadet or recruit has graduated, and often in less-than-ideal learning conditions, the exact opposite of what is prescribed by Barrows (1996) and Dochy et al, (2003). This last point is particularly relevant as most emergency vehicle collisions occur during EVRIC situations (Hunt, Brown, Cabinum, et al 1995; Pipes & Page, 2001), and collisions are a leading cause of death and disability among military personnel (Bell, Amoroso, Yore, Smith & Jones, 2000; Ward & Okpala, 2005). Therefore equipping vehicle operators with the skills needed to respond safely and quickly will ultimately save lives, reduce injuries, and save scarce financial resources.

Emergency responders, including the police, are not immune to the hazards that are present when crossing green or red light intersections. The amount of traffic on the roads is increasing, vehicles are better engineered to keep road noise out, and drivers are listening to mp3 players while simultaneously watching for the next turn on their GPS and attending to their kids, who are watching movies on portable DVD players. While many jurisdictions are trying to deal with distracted drivers by banning the use of handheld cell phones or text messaging while driving, this only addresses part of the problem. In addition to distracted drivers, emergency vehicle sirens used by most agencies typically use pure tones which are poorly localized by our brains, and by default are spatially ambiguous (Withington, 1996). Although this ambiguity is removed once a visual cue has been identified, the emergency vehicle is often traveling too fast to allow the public to maneuver their vehicles out of the way in time (Withington, 1998). Regardless of the factors that we can identify as hazards on the road, the question still remains as to why operators of emergency and military vehicles continue to be involved in an increasing number of vehicle collisions.

A study by Hunt, et al (1995) found that over 12,000 emergency vehicles are involved in lights and sirens collisions each year in Canada and the United States. In a separate study the National Fire Protection Association (NFPA) found that, in a 10-year period ending in 1999, thirteen percent (13%) of all firefighter deaths in the United States were a result of vehicle crashes (Frazer, 2000). In a 2005 follow-up report, researchers found that 17 firefighters were killed in on-duty crashes (Olson, 2006). When incidents involving the police were examined, it was estimated that, in the United States, just over forty percent (40%) of all police pursuits ended in collisions resulting in approximately 300 deaths per year (Pipes, & Page, 2001). Hill (2002); however, suggests that because of the lack of reporting, 300 deaths is a low estimate and suggests the real numbers may be closer to 500. Regardless of the numbers, these deaths are not just suspects who are fleeing apprehension; but also include police and innocent bystanders.

The National Highway Traffic Safety Administration (NHTSA) revealed that 314 people were killed during police pursuits in 1998, including 2 police officers and 114 innocent bystanders (Hill, 2002). Data collected more recently in the U.S. found that 37 of the 127 line-of-duty deaths in 2009 were the direct result of automobile collisions, whereas in Canada during the same year, 3 of the 4 line-of-duty deaths were the result of automobile collisions. Historical data suggests that in the U.S. roughly 33 percent of those people killed or injured as a result of police pursuits were innocent bystanders. Although Canadian statistics involving public injuries and or death were unavailable, a study by the Independent Police Complaints Commission (IPCC) in the UK (Docking, Bucke, Grace, & Dady, 2007), found that over a 2.5 year period between 2004-2007, police pursuit-related incidents involving death or serious injury totalled 275 people, of which 50 (5 deaths) were innocent bystanders.

This issue of vehicle collisions is not restricted to emergency vehicle operators. A study by Bell et al, (2000) found that 369 active duty U.S. Army personnel were injured in motor vehicle collisions between 1992 and 1998. While a more recent British study of active duty personnel stationed in Iraq, revealed that over a 6 month period in 2003 at total of 315 vehicle collisions occurred, of which 47 service personnel were hospitalized and 3 were killed (Ward & Okpala, 2005). Ward and Okpala go on to say that vehicle collisions are not restricted to a combat environment, but in fact between 2002 and 2003 vehicle collisions accounted for 40% of all service fatalities and 70 personnel were medically discharged due to their injuries.

Support for EVRIC-Based Simulation Instruction

Many jurisdictions and agencies have policies that provide emergency vehicle operators with exemptions to the rules-of-the-road; however, these exemptions do not release drivers from their legal responsibility if they are involved in a traffic accident (Berger, 1999, Florida Statutes, 2009; NCUTLO, 2000). The NFPA 1500 (i.e., Standard on Fire Department Occupational Safety and Health Program) requires that “emergency vehicle operators come to a complete stop when encountering hazards such as red lights, stop signs…or any time the driver cannot account for all lanes of traffic” (Frazier, 2000, pp 7), even if their emergency equipment (i.e., lights and sirens) is activated. More recently the 2009 Florida Statutes stated clearly that the driver of an emergency vehicle can be held liable in the event of an accident. Because EVRIC cannot be adequately trained for in situ, this type of driver training needs to occur on a closed driving track; however, this can be time consuming and staff-resource intensive, and consequently expensive (e.g., wear and tear on vehicles, fuel, etc). A solution to this training gap may come in the form of simulator training, modeled after the airline and medical industries (e.g., Ahlberg, Enochsson, Gallagher, et al, 2007; McDermot, 2006; Rantanen, & Talleur, 2005).

The airline industry has been using simulators to train novice and experienced pilots for decades, and more recently the medical profession has incorporated surgical simulators into many intern programs (Ahlberg, et al, 2007). Medical simulator training has been so effective that the Risk Management Foundation of Harvard Medical Institutions offers a lower premium for anesthesia staff who go through simulator training (Friedrich, 2002). While the evidence mounts supporting the use of simulators in the airline and medical professions, it is unclear why driving simulators are not more widely used in emergency vehicle driver training programs. A review of the literature reveals a paucity of evidence-based research investigating the effectiveness of driving simulator technology in the paradigm of EVRIC (i.e., police, fire, ambulance, etc.). Despite this, for any simulated environments to be useful for training purposes, any learning that occurs must generalize to comparable experiences in a real world setting, and performance data in both real and simulated environments must be analyzed in order to make any inferences regarding skills transferability (Rose, Attree, Brooks, et al., 2000).

The airline industry has recognized that flight simulators are a critical training component not only for new pilots, but also for extant pilots (Bürke-Cohen, Go, & Longridge, 2001). Additionally, anesthesiology residents learning endotracheal intubation using a simulator saw a reduction in training time, and a decrease in the number of errors committed (Abrahamson, Denson, & Wolf, 2004). While these two disciplines provide sound evidence that simulator technology has merit as an instructional tool, the literature, while scarce, is split on driving simulator training effectiveness. Whether it is a pilot carrying 400 passengers, an anesthesiologist intubating a patient, or a police officer responding with lights and sirens, simulators imitate the salient features of the real world while reducing physical risks, thus allowing for the user to learn from their mistakes without suffering the consequences of their actions or inactions (Schank, 2002). The RCMP recognized the potential of simulator technology and 2 years ago purchased 2 pods of 4 driving simulators (L-3 Communications); however, before this technology could be incorporated into the current CTP, a rigorous and methodical research protocol was established to assess if and how this technology could best be used for training. The following paper will discuss our findings, as well as future directions.

PILOT STUDY

Using driving simulators, members of the Utah Department of Public Safety (UDPS) were taught EVRIC using 16 pre-designed computer software scenarios (EVOC-101) over the course of 4 hours (Applied Simulations Technologies, 2006); however, before any time was spent in the simulator, each student needed to successfully complete a 2-hour, online pre-instruction course. Part of our investigation was to determine how critical the pre-instruction session was to the overall learning of the cadet. This course familiarizes the cadet with the rules-of-the-road for emergency vehicle operation and provides the student with baseline knowledge to complete the simulator scenarios. We manipulated how the pre-instruction was delivered and included a group of cadets who did not receive any pre-instruction, and found that cadets who did not receive any pre-instruction, significantly underperformed those cadets who did receive a pre-instruction session ($p < .05$).

After reviewing the data from the UDPS study we found that driving proficiency appeared to asymptote by about the seventh scenario, and following a review of our initial data we discovered similar results. We tested this assumption further using one troop of cadets ($N = 31$). Analyzing the data with a dependant t-test we found that there were no differences between scenario 7 and scenario 16 [$t(30) = -.38$, $p = .71$]. In fact there was only nominal improvement between scenario 1 ($M = 70.58$, $SD = 12.41$) and scenario 16 ($M = 75.00$, $SD = 14.75$) see Figure 1.

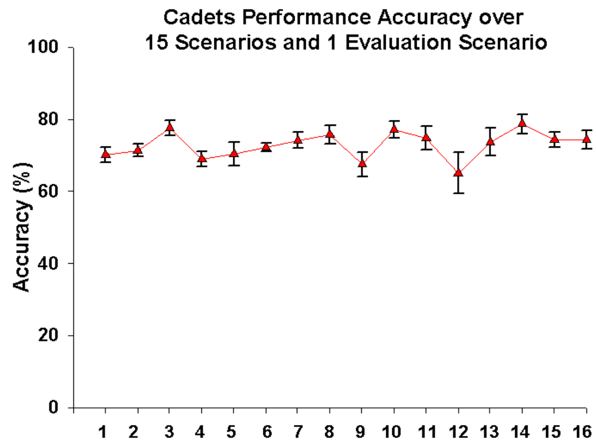

Figure 1. *Note*: Scenarios 1-15 = pre-evaluation scenarios; scenario 16 = evaluation scenario. Each scenario takes increasingly longer to complete and becomes incrementally more difficult.

The outcome of the preceding pilot study provided partial evidence regarding our belief that performance accuracy nominally improves after a seventh exposure in a driving simulator, and that any additional exposures after scenario 7 is negligible. Although cadets did not improve their performance after the seventh exposure, overall proficiency never exceeded 79%. In addition, we gave individual performance feedback to each cadet, a practice which exposed inefficiencies. For example, after one cadet received their performance feedback, the other three cadets passively waited for their feedback session. By administering feedback in this fashion we lost the opportunity to use the session for the group as a whole. Therefore we developed a method in which performance feedback for each cadet could be used as a learning opportunity simultaneously for all cadets within a pod (i.e., 4 cadets). We tested two different (Figure 2) medium in which performance feedback was delivered (i.e., paper feedback vs. computer screen-based visual feedback) and analyzed the results. There was no Scenario X Feedback type interaction $F(1,34) = 1.07$, $MSE = 191.99$, $p = .31$, and there was no main effect of feedback type $F(1,34) = .65$, $MSE = 997.86$, $p = .42$.

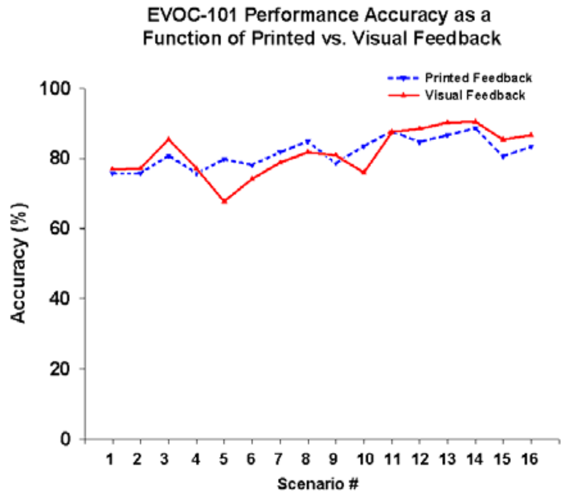

Figure 2. *Note*: Printed Feedback = after the scenario each cadet was given a printed copy of their performance. Visual Feedback = performance feedback is displayed on the forward facing monitor of the simulator; allowing all cadets to review each other's performance.

These data allowed us to use the visual feedback method, a technique which is more efficient and cost effective to deliver as an instructional tool. When we examined the performance differences with dependent *t*-tests, we found that there were performance differences between the 7th and the 16th scenarios $t(35) = -3.79$, $p = .001$ (M = 77.52 vs. 83.52); however, cadets did not improve their performance after the 8th scenario, $t(35) = .09$, $p = .93$ (M = scenario 8; 83.67 vs. scenario 16; 83.52). These findings are particularly important as they suggest that the 2.0 hours spent in the driving simulator after scenario 8 are of no apparent benefit to the cadet. Additional analysis of performance in each scenario allowed us to identify 6 scenarios plus the evaluation scenario (i.e., a total of 7 scenarios) that maximized performance.

Simulator Adaption Syndrome

An artifact of driving simulators is the potential impact that simulator adaption syndrome (SAS) may have on cadets. Although SAS is described as ill feelings similar to motion sickness (Mollenhauer, 2004), an important distinction between motion sickness and SAS is that the latter is due to the lack of physical movement. Although generally accepted that SAS decreases with time (Kennedy, Stanney, & Dunlap, 2000), it is important to acknowledge that SAS remains an issue when driving simulators are used in training. We considered this with each of our experiments, and collected SAS scores using the Simulator Sickness Questionnaire, (SSQ; Kennedy, & Lane, 1993). Our initial research tested cadets using only straight through intersections; however, we were concerned what effect introducing turn intersections into the scenario lesson plan would have on SAS reporting. While the evidence suggested that cadet performance would asymptote after completing the seventh scenario, we identified six pre-evaluation scenarios (plus the evaluation scenario), alternating between straight through and turn intersections. As noted earlier, that SAS decreases over time (Kennedy et al, 2000), something we observed when our cadets completed 16 scenarios; we were concerned that reducing the number of scenarios to seven would have a deleterious effect on our cadets and not allow enough time to realize SAS reduction. Four experimental conditions were analyzed and all conditions had one cadet per simulator unless otherwise specified: 1) ST16, (i.e., 16 scenarios alternating between straight through and turn intersections), 2) S16, (i.e., 16 scenarios all straight through intersections), 3) ST7, (i.e., 7 scenarios alternating between straight through and turn intersections), 4) ST [1], saw 2 cadets per simulator who alternated between completing a scenario and observing their partner complete the scenario. This condition was comprised of the same scenarios used in ST7. The data were analyzed using the One-way ANOVA (SAS X Lesson Plan). There was a significant effect of Lesson Plan $F(4,377) = 3.08$, $p = .012$, with SAS severity higher in ST7, (M = .093) than each of the three other lesson plans (M = .051-.065). Independent *t*-tests revealed that there were no differences between ST16, S16 and ST all $p > .05$ (Figure 3). Our belief was that cadets in ST would report lower SAS symptoms. Although this was not the case, we found that alternating cadets between driving and observing provided the best performance accuracy. Because there were no SAS differences between ST and ST7, we opted to use ST as our method of instruction.

The preceding pilot studies provided the empirical evidence that lesson plan ST optimized time on task while maximizing performance in a driving simulator. While these data indicate that cadets can perform quite well in a simulator, a critical question remained

[1] We had anecdotal evidence that frequent breaks and stretching resulted in a decrease in SAS severity. We had hypothesized that if two cadets were assigned to a simulator and alternated between driving and observing, that SAS severity would be mitigated.

unanswered: whether the skills learned in a driving simulator could be transferred into a real world setting. The following experiments were designed to answer this question.

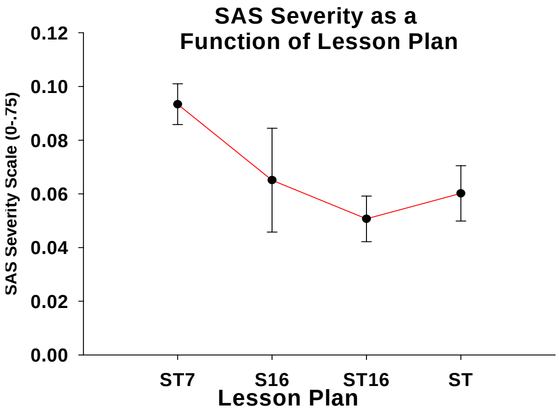

Figure 3. *Note*: S16 = 16 Scenarios all straight through intersections, ST16 = 16 Scenarios alternating between intersections, ST = 7 Scenarios with 2 cadets alternating between drives, ST7 = 7 Scenarios alternating between straight through and turn intersections.

EXPERIMENT 1

Participants

Forty-two cadets (37 male), average age 29.3 (SD = 6.7) participated in this experiment, and all had completed approximately 18 weeks of basic training.

Methods and Design

The experiment required cadet participants to complete lesson plan ST before they completed the intersection clearing (IC) scenarios on the RCMP's closed driver training track (see Illustration 1 for track configuration). Before the cadets completed the IC exercise, they had to complete the 7 scenario ST lesson plan, and the subsequent data collected were used to compare with their track performance. The three IC scenarios are modeled after the first (SC1), third (SC2) and sixth (SC3) ST scenarios, allowing for a direct comparison of performance in like situations. Cadets completed the IC scenarios in sequence (i.e., scenario1-2-3), with each scenario, as also evidenced with the ST scenarios, becoming increasingly complex.

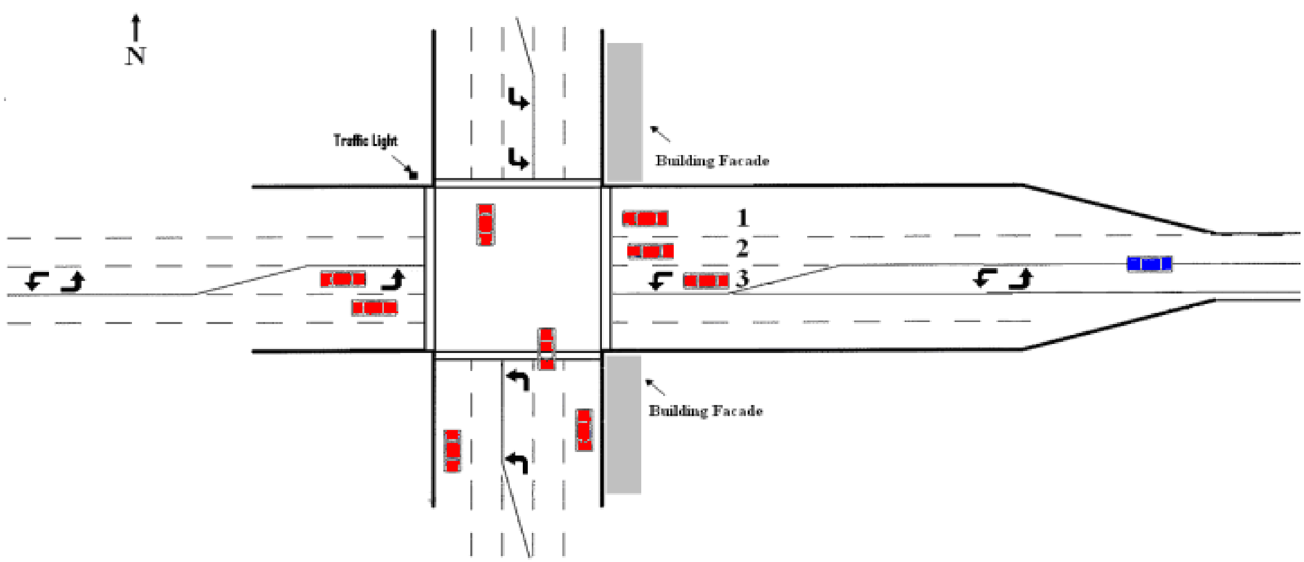

Illustration 1. *Note*. Civilian traffic and traffic light change depending on IC scenario (e.g., Red-light and lane 1, 2, 3 blocked with eastbound traffic)

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Each scenario took approximately 90 seconds to complete. Cadets were scored according to the same test items used during the ST sessions. Cadets completed their simulated scenarios in the L-3 driving simulators (MPRI) using EVOC-101 software (Applied Simulation Technologies, 2010). Ford Crown Victoria police training vehicles were used for all IC scenarios.

Results

The data (see Table 1 for means) were analyzed with a 2 (Lesson Plan; Simulator vs. Track) X 3 (Scenario; S1, S2, S3) repeated measures ANOVA. There was an effect of Lesson Plan $F(1,43) = 47.38$, $MSE = 165.37$, $p < .001$, with track performance better than simulator performance (88.29% vs. 75.18%). There was an effect of scenario $F(1,43) = 19.42$, $MSE = 165.37$, $p < .001$, with performance improving between S1 = 75.15% and S3 = 83.70%.

Table 1. Means by Scenario as a Function of Simulator and Track

Scenario	Mean	SE
SC1	69.25	2.08
SC2	80.76	1.84
SC3	75.54	3.90
IC1	81.06	1.83
IC2	91.96	1.06
IC3	91.86	1.26

There was no Lesson X Scenario interaction ($F = .744$); however, in order to determine whether performance improved over time, the data were analyzed using One-way repeated measures ANOVA. There was a significant improvement in accuracy with skill level increasing from SC1 to IC3, $F(1,43) = 103.49$, $MSE = 140.64$, $p < .001$, (S1= 69.25% vs. IC3 = 91.86%) see Figure 4.

DISCUSSION

These results suggest that skills taught and subsequently acquired in a simulator transfer into a real world setting. The data presented in Figure 4 indicate that learning continues with each of the first two IC scenarios before performance asymptotes. Although these results are encouraging, the cadets who participated in this experiment did not encounter a dynamic, (e.g., cars and pedestrians moving in the intersection) learning environment during the IC scenarios. Cadets were instructed to respond lights and sirens and successfully navigate an intersection containing *civilian* vehicles (i.e., actor vehicles); however, these vehicles, although positioned to

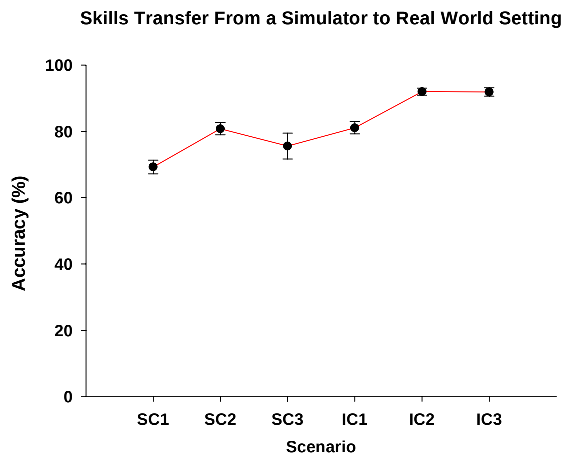

Figure 4. *Note*: SC1 = Simulator scenario straight through on green light, SC2 = Simulator scenario turn left on red light, SC3 = Simulator scenario straight through on red light, IC1 = Track scenario straight through on green light, IC2 = Track scenario turn left on red light, IC3 = Track scenario straight through on red light.

obstruct the intersection, remained static. While this approach addressed initial safety concerns that cadets may get into an accident during this training exercise, making comparisons between SC and IC scenarios were difficult because scenarios seen in the simulator incorporates traffic moving along the city streets. This point is particularly important when literature from the aviation and medical fields are examined. During a review of the literature a common theme emerged suggesting that in order to achieve the best training success, the simulated scenario must generalize in situ (Abrahamson, et al., 2004; Bürke-Cohen, et al., 2001). We, however, had the reverse problem. We were satisfied with our simulator scenarios but required our real world situations to incorporate additional elements (i.e., moving cars, and pedestrians in the intersection and crosswalk) that were not present in Experiment 1. In light of these findings, we developed a second experiment that addressed this issue.

EXPERIMENT 2

Participants

Forty-seven cadets (41 male), average age 29.71 (SD = 6.51) from the RCMP training academy participated.

Methods and Design

Two troops of cadets were recruited to complete this experiment. Troop 1 completed the SC and IC lesson plans as described in Experiment 1 (no actor vehicle movement); however, Troop 2 completed the IC scenarios with vehicles in the north and south bound lanes moving into the intersection. The actor vehicles were operated by RCMP instructor drivers who would drive partially into the intersection as the cadet approached LS in their vehicle.

Results

Data were analyzed (see Figure 5) using a 2 (Lesson Plan; SC, IC) X 3 (Scenario; 1, 2, 3) X 2 (Troop, 1, 2) repeated measures ANOVA, with Troop as the between subjects design. There was an effect of Lesson Plan $F(1,42) = 31.60$, $MSE = 190.87$, $p < .001$, with performance in IC better than SC (87.82% vs. 77.35%). There was an effect of Scenario $F(1,42) = 15.98$, $MSE = 169.30$, $p < .001$, with overall performance increasing from scenario 1 to scenario 3 (76.07% vs. 84.66%). There was a Troop X Lesson Plan interaction, $F(1,42) = 11.95$, $MSE = 190.87$, $p = .001$, with Troop 1 performing better than Troop 2 in the simulators (82.64% vs. 72.05%). There was no main effect of Troop; however, it was approaching significance $F(1, 42) = 3.03$, $MSE = 311.68$, $p = .089$, with Troop 1 performing marginally better than Troop 2 (84.66% vs. 80.51%). All other results ($p > .05$).

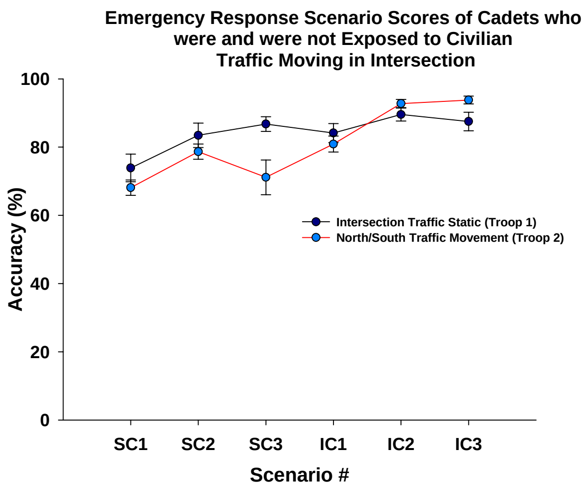

Figure 5. *Note*: SC1 = Simulator scenario straight through on green light, SC2 = Simulator scenario turn left on red light, SC3 = Simulator scenario straight through on red light, IC1 = Track scenario straight through on green light, IC2 = Track scenario turn left on red light, IC3 = Track scenario straight through on red light.

DISCUSSION

While the data for Troop 1 mirror the results of cadets in Experiment 1, the outcome for Troop 2 in the IC lesson plan warrants further investigation. Both Troop 1 and 2 were exposed to the same SC and IC scenarios; however, the variable being manipulated was whether the vehicles in the intersection were moving or not. We had expected that cadets who were exposed to traffic moving in the intersection would perform worse because vehicle movement added an additional level of complexity. This, however, was not the case. In fact, when vehicle movement was incorporated into the scenarios, it appears to have positively impacted performance. As each scenario became more complex and as more potential hazards presented themselves through movement, the better the performance. Through the creation of dynamic learning scenarios, we had the opportunity to demonstrate that not only do skills acquired in a simulator transfer in situ, but if you consider that cadet performance asymptotes by the 7^{th} scenario in lesson plan ST, we were able to extend learning to where the error rate for a real world scenario was below 10%, an improvement of over 50% from the error rate found with the cadets' performance in our Pilot Study mentioned previously.

CONCLUSION

The goal of Experiment 1 and Experiment 2 was to investigate whether skills acquired in a simulator were transferable to a real world setting. While research is still ongoing, our results clearly demonstrate that simulator training is an effective method in which to deliver instruction. When you consider traditional methods of training and tabulate the time spent explaining policy and technique in a classroom, coupled with the extra time required training cadets on proper EVRIC techniques, we calculated that it would take three 8-hour days to realize the same level of proficiency that our current 8-hour design provides. Additionally these efficiencies do not include the additional 160-hours of instructor time needed for a traditional training approach, wear and tear on training vehicles, fuel, etc. Another added benefit that cannot be recreated in situ, is collisions with motor vehicles and pedestrians. The simulator provides instances where a cadet’s decision may result in a collision which then becomes a valuable teaching point.

Even though newly engaged police officers are taught EVRIC skills in the field, the Fitts and Posner’s (1967) extant three-stage theory of motor skill acquisition demonstrates that traditional non-simulator training is not optimal. They propose the process of learning occurs through three specific stages or phases (i.e., cognitive stage, integrative stage, and autonomous stage). Their theory suggests there is a convergence of knowledge that results in task automaticity and that the learner no longer needs to think about task execution but can now incorporate other tasks that need attention. If you consider the cognitive stage, then initial performance is abrupt and the learner conceptualizes the task as a series of steps in which the goal can successfully be completed. By utilizing driving simulators and the supporting evidence that skills transfer into a real world setting, there will be a level of automaticity when the cadet or recruit is presented with their first EVRIC situation. When the police officer, or emergency responder, encounters their first EVRIC situation, their performance with that task will be fluid and less prone to error.

Our findings from Experiment 1 and Experiment 2 have led to the integration of driving simulators into the RCMP cadet police driving program. This technology not only allows for EVRIC training, but we have begun to use simulators as an instructional tool to develop safe radio communications skills, and to develop geographical spatial skills during EVRIC responses and be-on-the-look-out (B.O.L.O.) exercises.

We have also begun measuring cadet EVRIC performance during their final emergency vehicle operation (EVO) session. This session is a problem-based learning environment, using police cars in which the cadets use the road system located on the RCMP Training Academy grounds, including the track. During these scenarios, cadets are dispatched to a complaint, and using their knowledge accumulated during training, will attempt to apprehend the suspect. While the majority of scenarios do not involve a pursuit, there are instances in which the cadet will need to pursue the suspect vehicle. When this occurs, the scenario plays out on the track and will see both the suspect vehicle and cadet, encounter and cross the intersection. While the scenarios used in both the driving simulator and on the track provide valuable learning opportunities, our current research is designed to measure performance in high arousal settings. Although the cadets experience scenarios which tax cognitive, emotional systems and motor systems, it is hypothesized that previous EVRIC exposures will result in cadets using those skills to successfully complete the EVO exercise and safely clear and cross the intersection. While this study has only recently been initiated, preliminary data indicates that cadets are using previous experience, that the skills acquired during the ST and IC lesson plans are being maintained and used, and that cadets are successfully and safely clearing the intersection. An additional longitudinal study will measure the number of collisions, and costs incurred as a result of those collisions, and make comparisons between RCMP members who received training using the driving simulators with those who received the traditional training.

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