Summary and Supporting Documents for Eric Davidson’s Presentation at the 2014 College Town Summit

**What Works in Prevention** - Enclosed is a journal article highlighting the components of effective and successful prevention/education programming. If we are to develop programming, we should be including these components. If we are looking at adapting someone else's programs, we should be checking to see how these elements have been incorporated within the development and planning of the program.

**Effectiveness of Fatal Vision Goggles** - Please find enclosed the brief developed by Prevention First, Inc. that provides a great summary of the Fatal Vision Goggle Use. In it you will see that effectiveness has not been assessed with non-collegiate populations, so there is little if anything to validate its use with high school populations. As indicated, what research that has been done has found that use of the goggles creates a very short term change regarding beliefs, which appears different in those watching the goggle use with those wearing the goggles, and usually does not extend much after the program. This research is limited, and can only be found within 3 studies. As noted within this summary, there is little, if any behavior change observed in those participating in fatal vision goggle events. Although widely used, there is insufficient evidence to support this equipment's use as an evidence-based approach, especially if the use is by itself and isolated from other programs and interventions.

**Research Articles Highlighting Ineffectiveness of Drunk Driving Simulators** - Enclosed are three articles, in which different formats of drunk driving simulators were developed and used. While students viewed these as "fun" none of the three studies actually found any significant differences regarding beliefs, intentions, in driving under the influence, thus minimizing, if not negating their use as prevention tools, particularly when used alone.

**NIAAA Report** - The report, developed in 2002, resulted from a meta-analysis of studies looking at reducing/prevention alcohol use within college students. The report developed 4 tiers, with the first tier being effective with college students, and the last tier not effective at all. The following link highlights the 4 tiers with examples of programs and interventions for each tier: [www.collegedrinkingprevention.gov/niaacollegematerials/taskforce/CallToAction_02.aspx](http://www.collegedrinkingprevention.gov/niaacollegematerials/taskforce/CallToAction_02.aspx)

**The State of Prevention in Illinois Higher Ed** – The link at bottom will take you to a survey administered in 2011, with the report released in 2012 (the 2013 report is currently being written). It provides some great background on what is being done on Illinois college campuses. Pages 7-9 details the ineffectiveness of what many schools are currently doing, and how little institutions are doing in terms of effective prevention education programming. [http://www.eiu.edu/ihec/Needs_assessment_document-_esd_2-7-2012REVcm.pdf](http://www.eiu.edu/ihec/Needs_assessment_document-_esd_2-7-2012REVcm.pdf)
The high prevalence of drug abuse, delinquency, youth violence, and other youth problems creates a need to identify and disseminate effective prevention strategies. General principles gleaned from effective interventions may help prevention practitioners select, modify, or create more effective programs. Using a review-of-reviews approach across 4 areas (substance abuse, risky sexual behavior, school failure, and juvenile delinquency and violence), the authors identified 9 characteristics that were consistently associated with effective prevention programs: Programs were comprehensive, included varied teaching methods, provided sufficient dosage, were theory driven, provided opportunities for positive relationships, were appropriately timed, were socioculturally relevant, included outcome evaluation, and involved well-trained staff. This synthesis can inform the planning and implementation of problem-specific prevention interventions, provide a rationale for multiproblem prevention programs, and serve as a basis for further research.

Recent analyses concerning the status of American youth and families have concluded that the United States is a nation at risk in regard to many social indicators such as substance abuse, adolescent pregnancy, youth violence, and school dropouts (Bronfenbrenner, McClendon, Wethington, Moen, & Ceci, 1996; Weissberg, Walberg, O’Brien, & Kuster, 2003). In addition to the obvious public health concerns, the costs of the social, therapeutic, and rehabilitative services needed to address these problems has made the search for effective prevention programs essential.

Our work with community coalitions indicates that community-based preventionists and mental health practitioners are seeking to provide effective prevention programs. The science-based research and evaluation literature has consistently shown that a number of prevention programs are beneficial in helping youth to avoid numerous problems (Albee & Gullotta, 1997; Durlak & Wells, 1997; Price, Cowen, Lorion, & Ramos-Mckay, 1989; Weissberg & Greenberg, 1998). However, the difficulty in replicating expensive, science-based prevention models or proprietary commercial products has resulted in many local agencies creating or adapting their own prevention programs with marginal effects. Consequently, there is a gap between the science-based prevention programs and what is provided by practitioners to families and children in the United States (Morrissey et al., 1997). As private and public funders require greater accountability, practitioners are asking the question: What practical information does prevention research have to offer to improve the effectiveness of prevention practice? Furthermore, granting agencies and practitioners ask questions such as, What are the evidence-based programs that work? What is the essence of good prevention programs? and Whom should these programs target?

Reviews of prevention programs have provided some answers to these questions. Some reviews provide case studies of effective programs (Albee & Gullotta, 1997) or summarize the research within a particular content area such as substance abuse (Center for Substance Abuse Prevention [CSAP], 2001; Tobler & Stratton, 1997), teen pregnancy (Kirby, 1997), and HIV/AIDS (Choi & Coates, 1994). An advantage of these reviews is that they can bring prevention theory within a content area to bear in drawing conclusions about the effectiveness of programs. These reviews suggest that there are some principles that tran-
The first step of this process has been accomplished by reviews of prevention programs specific to one outcome area. By comparing findings across problem outcome areas, the usefulness of these studies can be strengthened. Dryfoos (1990) made a vital contribution toward this goal by reviewing over 100 prevention programs related to substance abuse, teen pregnancy, school dropout, and juvenile delinquency. Her review yielded several key characteristics associated with successful programs, such as the provision of intense individualized attention, intervention in several domains of the child’s life, early identification of and intervention in the development of problem behaviors, training in social skills, and engagement of peers and parents in the intervention. Similar reviews conducted on school-based curricula (Elias, Gager, & Leon, 1997) and programs focused on children and adolescents (Weissberg & Greenberg, 1998) continue to identify the types of interventions that work and to suggest general principles of effective prevention.

To complement earlier reviews, we used a review-of-reviews approach to identify general principles of effective prevention programs that might transcend specific content areas. At the start of this process, we placed some limits on the scope of the reviews. First, we limited our review to four content areas: (a) substance abuse—prevention of use/abuse of alcohol, tobacco, or other drugs; (b) risky sexual behavior—prevention of unwanted pregnancies and HIV/AIDS; (c) school failure—prevention of general academic problems and high school dropout; and (d) juvenile delinquency and violence—prevention of aggressive or antisocial behavior. Although this is not a comprehensive list of issues affecting young people, they are critical public health issues, and our work with community-based practitioners indicates these are priority areas.

A second important limit involved the types of prevention programs that would be included in our review of reviews. The Institute of Medicine (Mrazek & Haggerty, 1994) identified three categories of prevention that are appropriate for participants with different levels of risk factors: universal, selective, and indicated. A complete survey of all three types of preventive interventions was not attempted because the theory, goals, and structure of indicated interventions are significantly different from those of universal and selective interventions and therefore may limit the applicability of the results to any of the categories. Consequently, we limited the review for this special issue on primary prevention to reviews of universal and selective prevention programs.

**Search Method**

We conducted a literature search through PsycLIT and Criminal Justice Abstracts from 1990 to 1999 and consulted key informants (see acknowledgments) for journal articles and book chapters that reviewed the efficacy of prevention programs. Multiple selection criteria were required for inclusion of an article. First, the article had to be a narrative literature review that summarized the results of prevention research in one of our selected content areas. Second, the article had to go beyond lists of best practices or describing the status of research to provide an explicit discussion of the common features of effective program or recommendations (based on the review) for new content area–specific prevention programs. Articles that only discussed theoretical issues (e.g., reviews of etiological theories and implications for prevention) were excluded. Finally, the reviews were limited to one review per first author (unless it was clear the reviews used different data) to avoid including multiple reviews based on the same data. We identified 35 journal articles, books, or book chapters that fit our criteria (see Table 1). Although our search efforts may not have resulted in an exhaustive coverage of the field, there is a sufficient critical mass to provide practitioners and future reviews principles that merit consideration when designing and implementing effective prevention programming.

We reviewed the articles meeting the inclusion criteria to identify the characteristics of effective programs. Because all of the articles included in this review provided explicit lists or clear sections in which characteristics were discussed, this step involved merely writing down those characteristics identified in the list. This resulted in a listing of 252 characteristics from 35 articles. Next, two members of the research team independently coded the characteristics (based on their similarity) into categories, with 84% agreement. From this process, we constructed a list of characteristics that were important in addressing each problem behavior. From those characteristics, we looked for patterns that might indicate that certain characteristics were generalizable. Principles were chosen based on the percentage of reviews endorsing a characteristic. Support for the nine identified principles discussed in our review ranged from strong (80% of reviews indicating it was an important characteristic) to moderate (31% endorsement). Then there was a sharp drop off in endorsement of principles and therefore they were not further identified in this article. Table 2 provides the percentage of reviews endorsing each principle.

Our analysis yielded nine principles associated with effective prevention programs that were related to three broad areas of prevention programming: program characteristics, matching programs to target population, and implementing and evaluating prevention programs. There were five principles associated with program characteristics: Programs (a) were comprehensive, (b) included varied teaching methods, (c) provided sufficient dosage, (d) were theory driven, and (e) provided opportunities for positive relationships. Two principles were specifically related to matching programs to the target group: Programs (a) were appropriately timed and (b) were socioculturally relevant. Finally, there were two principles related to program implementation and evaluation: Programs (a) included outcome evaluation and (b) involved well-trained staff.
The review identified five program characteristics associated with effective prevention programs. These effective qualities of the interventions or curricula are presented in order of the strength of support for the principle.

**Comprehensive**

We define comprehensive as providing an array of interventions to address the salient precursors or mediators of the target problem. There are two important dimensions to consider for comprehensive programming: multiple interventions and multiple settings. *Multiple interventions* refers to the importance of having several interventions addressing the problem behavior. In the prevention of unwanted pregnancies, reviews indicated that successful programs incorporate a combination of interventions focused on increasing information and awareness, promoting skill development, and providing reproductive health services (Miller & Paikoff, 1992). Substance abuse prevention reviews also indicated that multimodal interventions that increased awareness and encouraged the development of specific skills were associated with positive outcomes.

*Multiple settings* refers to the need to engage the systems that have an impact on the development of the problem behavior. Several reviews indicated the need to address community or school norms related to the problem behaviors (Center for Substance Abuse Prevention, 1996; Janz, Zimmerman, Wren, & Israel, 1996). Other reviews suggested that combined parent, peer, and school interventions support positive outcomes (e.g., Sagrestano & Paikoff, 1997). Initial assessments that identify important risk and protective factors provide guidance about which systems to include in the program. For instance, Hawkins and Catalano (1992) argued that drug prevention programs should address risk and protective factors across domains or settings (e.g., community, family, school, peer group) that have primary influence on the participants (also see Kumpfer, 1997).

**Varied Teaching Methods**

The majority of characteristics coded under this principle emphasized the need for some type of active, skills-based component in preventive interventions. Effective prevention programs involve interactive instruction (Tobler & Stratton, 1997) and provide active, hands-on experiences that increase the participants’ skills (Dusenbury & Falco, 1995). Although there appeared to be consensus that skill development is important, the nature of the skills varied depending on the target behavior. The National Institute on Drug Abuse (NIDA, 1997) concluded that programs that prevent alcohol and drug use help participants develop resistance skills, including the ability to be assertive and effectively communicate around issues related to drug use. Similar recommendations were suggested for preventing problematic sexual behavior. Kirby (1997) reported that effective programs provided verbal or written practice in negotiating situations that might lead to sexual intercourse. However, for school failure, the skill focus was distinctly different. Slavin and colleagues (Slavin, Karweit, & Wasik, 1992/1993) emphasized the importance of facilitating the development of cognitive, language, and social skills as a way of ensuring success in school. Despite the differences

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### Table 1

**Articles Included in the Review of Reviews**

<table>
<thead>
<tr>
<th>Topic and Authors</th>
<th>No. of studies reviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Substance abuse</strong></td>
<td></td>
</tr>
<tr>
<td>Center for Substance Abuse Prevention (1996)</td>
<td>12</td>
</tr>
<tr>
<td>Center for Substance Abuse Prevention (1997)</td>
<td>More than 309</td>
</tr>
<tr>
<td>Durlak (1997)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>Dusenbury and Falco (1995)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>General Accounting Office (1992)</td>
<td>10</td>
</tr>
<tr>
<td>Hansen (1992)</td>
<td>12</td>
</tr>
<tr>
<td>Kumpfer and Alvarado (1995)</td>
<td>25</td>
</tr>
<tr>
<td>Lewis, Battistich, and Schaps (1990)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>May and Moran (1995)</td>
<td>29</td>
</tr>
<tr>
<td>National Institute on Drug Abuse (1997)</td>
<td>10</td>
</tr>
<tr>
<td>Norman and Turner (1993)</td>
<td>30</td>
</tr>
<tr>
<td>Paglia and Room (1999)</td>
<td>Unspecified</td>
</tr>
<tr>
<td><strong>Risk sexual behavior</strong></td>
<td></td>
</tr>
<tr>
<td>Choi and Coates (1994)</td>
<td>30</td>
</tr>
<tr>
<td>Fisher and Fisher (1992)</td>
<td>48</td>
</tr>
<tr>
<td>Frost and Forrest (1995)</td>
<td>5</td>
</tr>
<tr>
<td>Holtgrave et al. (1995)</td>
<td>23</td>
</tr>
<tr>
<td>Janz, Zimmerman, Wren, and Israel (1996)</td>
<td>37</td>
</tr>
<tr>
<td>Kirby (1997)</td>
<td>50</td>
</tr>
<tr>
<td>Miller and Paikoff (1992)</td>
<td>9</td>
</tr>
<tr>
<td>Nitz (1999)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>Sagrestano and Paikoff (1997)</td>
<td>4</td>
</tr>
<tr>
<td>White and White (1991)</td>
<td>24</td>
</tr>
<tr>
<td><strong>School failure/dropout</strong></td>
<td></td>
</tr>
<tr>
<td>Carnahan (1994)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>Carlton and Winsler (1999)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>Durlak (1997)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>Ramey and Ramey (1992)</td>
<td>Unspecified</td>
</tr>
<tr>
<td><strong>Delinquency and violence</strong></td>
<td></td>
</tr>
<tr>
<td>Catalano, Arthur, Hawkins, Berglund, and Olson (1998)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>Elliel (1998)</td>
<td>10</td>
</tr>
<tr>
<td>Tolan and Guerra (1994)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>U.S. Department of Justice (1995a)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>U.S. Department of Justice (1995b)</td>
<td>50</td>
</tr>
<tr>
<td>Zigler, Taussig, and Black (1992)</td>
<td>5</td>
</tr>
</tbody>
</table>

3 provides definitions of the principles. The remainder of this article describes these principles in more detail.

**Principles Related to Program Characteristics**

The review identified five program characteristics associated with effective prevention programs. These effective...
in the types of skills emphasized, there is general agreement that programs should be careful not to rely too much on knowledge, information, or group discussions as the major change mechanism (Durlak, 1997).

**Sufficient Dosage**

This principle refers to the need for participants to be exposed to enough of the intervention for it to have an effect. Dosage, or program intensity, may be measured in quantity and quality of contact hours. Aspects of dosage include the session length, number of sessions, spacing of sessions, and the duration of the total program. Whereas many reviews refer to this as a general principle with comments like “continue (intervention) over a long period of time,” other reviews make specific recommendations regarding the number and frequency of contacts (U.S. Department of Justice, 1995a). Also, some reviews indicated that intensity needs to be gauged to the risk faced by the individual: The greater the needs or deficits of the participants, the greater the dosage or intensity of the intervention (Carnahan, 1994).

In addition to initial exposure to the intervention, effective interventions generally include some type of follow-up or booster sessions to support durability of impact. In many cases, the long-term effects of preventive interventions remain unknown because of a lack of research data on long-term results (e.g., Frost & Forrest, 1995). In a meta-analytic study of school-based prevention programs with controlled outcome studies, Durlak and Wells (1997) found that few studies included follow-up assessments.

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**Table 2**

*Percentage of Reviews Endorsing Prevention Principles by Content Area*

<table>
<thead>
<tr>
<th>Principle</th>
<th>Substance abuse (n = 12)</th>
<th>Risky sexual behavior (n = 11)</th>
<th>Delinquency and violence (n = 7)</th>
<th>School failure (n = 5)</th>
<th>Total (N = 35)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive</td>
<td>83</td>
<td>73</td>
<td>100</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Varied teaching methods</td>
<td>83</td>
<td>82</td>
<td>57</td>
<td>20</td>
<td>69</td>
</tr>
<tr>
<td>Sufficient dosage</td>
<td>42</td>
<td>55</td>
<td>86</td>
<td>60</td>
<td>57</td>
</tr>
<tr>
<td>Theory driven</td>
<td>58</td>
<td>73</td>
<td>29</td>
<td>0</td>
<td>49</td>
</tr>
<tr>
<td>Positive relationships</td>
<td>33</td>
<td>0</td>
<td>57</td>
<td>80</td>
<td>34</td>
</tr>
<tr>
<td>Appropriately timed</td>
<td>67</td>
<td>73</td>
<td>57</td>
<td>60</td>
<td>66</td>
</tr>
<tr>
<td>Socioculturally relevant</td>
<td>67</td>
<td>82</td>
<td>29</td>
<td>0</td>
<td>54</td>
</tr>
<tr>
<td>Outcome evaluation</td>
<td>42</td>
<td>64</td>
<td>29</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Well-trained staff</td>
<td>33</td>
<td>27</td>
<td>29</td>
<td>40</td>
<td>31</td>
</tr>
</tbody>
</table>

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**Table 3**

*Definitions of the Principles of Effective Programs*

<table>
<thead>
<tr>
<th>Principle</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive</td>
<td>Multicomponent interventions that address critical domains (e.g., family, peers, community) that influence the development and perpetuation of the behaviors to be prevented</td>
</tr>
<tr>
<td>Varied teaching methods</td>
<td>Programs involve diverse teaching methods that focus on increasing awareness and understanding of the problem behaviors and on acquiring or enhancing skills</td>
</tr>
<tr>
<td>Sufficient dosage</td>
<td>Programs provide enough intervention to produce the desired effects and provide follow-up as necessary to maintain effects</td>
</tr>
<tr>
<td>Theory driven</td>
<td>Programs have a theoretical justification, are based on accurate information, and are supported by empirical research</td>
</tr>
<tr>
<td>Positive relationships</td>
<td>Programs provide exposure to adults and peers in a way that promotes strong relationships and supports positive outcomes</td>
</tr>
<tr>
<td>Appropriately timed</td>
<td>Programs are initiated early enough to have an impact on the development of the problem behavior and are sensitive to the developmental needs of participants</td>
</tr>
<tr>
<td>Socioculturally relevant</td>
<td>Programs are tailored to the community and cultural norms of the participants and make efforts to include the target group in program planning and implementation</td>
</tr>
<tr>
<td>Outcome evaluation</td>
<td>Programs have clear goals and objectives and make an effort to systematically document their results relative to the goals</td>
</tr>
<tr>
<td>Well-trained staff</td>
<td>Program staff support the program and are provided with training regarding the implementation of the intervention</td>
</tr>
</tbody>
</table>
When follow-up assessments were conducted, the studies indicated that the effects of many preventive interventions tend to gradually decay over time (Zigler, Taussig, & Black, 1992). This suggests that booster sessions focusing on prior skills learned or on new developmentally appropriate skills are needed to maintain positive outcomes.

**Theory Driven**

This principle refers to the need for scientific justification of a preventive intervention. Although this principle may seem basic, an examination of actual prevention programs used in many communities and schools indicates that it is sometimes overlooked. In the areas of risky sexual behavior, one study indicated that the majority of preventive interventions were based on a blend of logic and past experiences (Fisher & Fisher, 1992). Across multiple content areas, there was consistent emphasis on the importance of theory-based interventions that have a basis in research. Two types of theories that play a role in prevention programming are etiological theories and intervention theories. Etiological theories focus on the causes (e.g., risk or protective factors and processes) of the targeted problem (Kumpfer, 1997). Intervention theories are focused on the best methods for changing these etiological risks. Once the causes are identified, effective prevention programs are then based on empirically tested intervention theories shown to produce the desired changes in the causes and ultimately in the behavior being prevented.

**Positive Relationships**

Providing opportunities for children to develop strong, positive relationships was consistently associated with positive outcomes. Some reviews emphasized the importance of improving parent–child relationships and parenting skills (Kumpfer & Alvarado, 1995), whereas others focused on leveraging peer influences on preventing problem behavior (Mulvey, Arthur, & Reppucci, 1993). Reviews of substance abuse prevention emphasized the necessity to have strong connections between children and significant others (including peers, teachers, community members) as a way of preventing drug use (National Institute on Drug Abuse, 1997). The reviews supported the idea that it is critical for children to have a strong relationship with at least one adult. This was most evident in the areas of school failure and dropout, in which almost all the reviews highlighted the need for strong relationships with positive adult models. Several reviews endorsed the use of adult mentors to encourage the development of these relationships. Evaluation of quality mentoring programs like Big Brothers and Big Sisters suggests that it is a promising strategy (Grossman & Tierney, 1998).

However, individualized intervention was not uniformly endorsed as being essential. Tolan and Guerra (1994) suggested that intense individual intervention (e.g., therapy or case management) is not sufficient to prevent delinquency. In light of their findings, it seems important to study the source of the individualized attention. The impact of attention from a mentor or therapist may be qualitatively different from that of a probation officer or therapist, even if it occurs in equal amounts.

**Principles Related to Matching the Program With a Target Population**

A subset of the principles seemed specifically focused on selecting programs that are appropriate for the identified population. The reviews indicate that even programs that are of good quality need to be matched to the needs of the participants to maximize effectiveness.

**Appropriately Timed**

Interventions should be timed to occur in a child’s life when they will have maximal impact. Unfortunately, many programs tend to be implemented when children are already exhibiting the unwanted behavior or when the programs are developmentally less relevant to the participants. This led the Institute of Medicine to warn that “if the preventive intervention occurs too early, its positive effects may be washed out before onset; if it occurs too late, the disorder may have already had its onset” (Mrazek & Haggerty, 1994, p. 14).

Prevention programs should be timed to focus on changeable precursor behaviors prior to the full-blown problem behavior being prevented (Dryfoos, 1990). The importance of early intervention was demonstrated in the “Reducing the Risk” HIV/AIDS prevention program. The program was effective in reducing risky behavior among all adolescents except those who were sexually active prior to beginning the program (Kirby, Barth, Leland, & Petro, 1991). Early intervention allows programs to have a chance to affect the developmental trajectory of the problem behavior (National Institute on Drug Abuse, 1997). This suggests that the elementary school to middle school transition may be an important window for intervention.

Also coded under this principle were several characteristics related to the developmental appropriateness of the intervention. Several reviews indicated that programs needed to have materials that were tailored to the intellectual, cognitive, and social development of the participants (Zigler et al., 1992). The importance of the factor was most clearly indicated in studies of adolescent sexual behavior, in which changing the message of the intervention according to the developmental stage of the participants was associated with positive outcomes (Miller & Paikoff, 1992).

**Socioculturally Relevant**

The relevance of prevention programs to the participants appears to be a primary concern in producing positive outcomes. The concept of relevance spanned a variety of dimensions, including local community norms and cultural beliefs and practices (e.g., Ramey & Ramey, 1992). Designing a prevention program to be culturally appropriate is one recommendation for increasing relevance. Culturally tailoring prevention programs goes beyond surface structure language translation to deep structure modifications sensitive to cultural factors that influence development and...
receptiveness to the intervention (Resnicow, Solar, Braithwaite, Ahluwalia, & Butler, 2000). Cultural attitudes have been shown to be important factors in sexual behavior and aggressive/delinquent behavior. Kirby (1997), for example, reported that effective pregnancy prevention programs tailored statistics and example situations to the culture of the participants.

In addition, programs must address the individual needs of participants. Carnahan (1994) documented the importance of tailoring the intervention for preventing students from dropping out of school, citing that one-size-fits-all programs appear to work best for those who least need the intervention and may exacerbate the problem faced by those most in need. When a prevention program is not relevant, programs may have difficulty in recruiting and retaining high-risk participants (Kumpfer & Alvarado, 1995). To improve program and evaluation relevance, Dryfoos (1990) and Janz et al. (1996) suggested that the participants in the intervention be included in the program planning and implementation to ensure that their needs are recognized.

### Principles Related to Implementation and Evaluation of Prevention Programs

In addition to the intervention or curriculum itself, we found that characteristics related to implementation and evaluation also associate with effective prevention programming.

#### Outcome Evaluation

The evaluation of prevention programs is necessary to determine program effectiveness. Otherwise, practitioners may assume that a program is effective on the basis of anecdotal or case study evidence. As evaluation has become more common, the results indicate that many programs that are anecdotally believed to be successful may actually not be effective. For example, the most widely disseminated and commercially marketed drug prevention programs are not as effective as many of the research-based programs listed in NIDA’s review (National Institute on Drug Abuse, 1997) or in the CSAP National Registry of Effective Prevention Programs (see www.samhsa.gov/csap/modelprograms). Evaluation strategies that emphasize continuous quality improvement can be useful in feeding back information at several stages of the intervention (Wandersman et al., 1998). Reviews of HIV/AIDS and alcohol and drugs prevention programs indicate that this type of information may be very important for achieving positive outcomes for prevention programs (Dusenbury & Falco, 1995; Hansen, 2002).

#### Well-Trained Staff

A high-quality, research-based program can produce disappointing results in dissemination field trials if the program providers are poorly selected, trained, or supervised. The implementation of prevention programs is enhanced when the staff members are sensitive, are competent, and have received sufficient training, support, and supervision (Lewis, Battistich, & Schaps, 1990). Kirby’s (1997) review indicated that formalized training for effective unwanted pregnancy prevention programs ranged from six hours to three days. These training programs give teachers or staff practice in implementation and an opportunity to have their questions answered. Evaluations of alcohol and drug prevention programs also indicate that training of teachers enhanced the impact of school-based programs (Dusenbury & Falco, 1995). Even when staff members are sufficiently competent, their effectiveness can be limited by high rates of turnover, low morale, or a lack of “buy-in” (U.S. Department of Justice, 1995b).

### Discussion and Conclusions

Before drawing conclusions based on this review, we want to acknowledge some of its weaknesses. In addition to the fact that this is not an exhaustive list of reviews, the reviews that were included in this process clearly varied in rigor. Some provided documentation of all studies included in the review and only included studies that had published evaluations (e.g., Kirby, 1997). Other reviews appeared to have less documentation and included some community-based programs whose effectiveness were verified by evaluation reports (e.g., General Accounting Office, 1992). As illustrated in Table 1, for example, some reviews documented the number of programs included in the review and others did not. Also, the apparent lack of reviews of dropout and school failure prevention programs was troubling. This was likely the result of many of the review efforts related to school issues being focused on promoting academic success rather than preventing school failure (Ross, Powell, & Elias, 2002). The studies that do exist focus more on early intervention with children “at risk” rather than universal prevention.

Another issue affecting this review was the lack of uniform standards for determining effectiveness. Some reviews were explicit, whereas others provided minimal justification for their definition of effectiveness. In prevention of risky sexual behavior, for example, successful outcomes included appropriate use of contraception, delays in the initiation of sexual activity, and lower rates of pregnancy. Other areas were less explicit and in some cases included changes in attitudes and intentions in addition to behavior change.

Finally, there were some areas in which our review did not overlap with previous multiple content area reviews. For example, Dryfoos (1990) noted the importance of programs being connected to the work world or other opportunity structures. Likewise, we found some factors to be important (e.g., emphasis on the theoretical substrates of prevention programs) that were not cited in some of the other reviews. The differences in our conclusions may be an artifact of the differences in our methods. Dryfoos gathered her data through direct observation and reviews of primary documents of programs in four content areas. Durlak and Wells (1997) focused on examination of the published evaluations of prevention programs and included content areas not included in this review or in the Dryfoos...
study. It is likely that closer observation of individual programs made some meta-reviews more sensitive to the nuances of service delivery in prevention programs. In contrast, the review-of-reviews approach benefits from previous authors’ synthesis of content-specific prevention efforts. However, this approach is potentially vulnerable to the interpretive and conceptual biases of the previous and current reviewers.

Despite the limitations of this method, there are several general conclusions that can be drawn. First, this review adds to the mounting evidence that prevention programs that are carefully designed and implemented can be effective in preventing many of the problems facing children and adolescents. Programs that engage children and their environmental context are most likely to produce change. Similar to Dryfoos (1998), our analysis suggests there is substantial overlap in the principles of effective programs across prevention domains that allow us to identify general principles of effectiveness. In particular, program characteristics like comprehensiveness, sufficient dosage, skill development focus, and the importance of timing were identified as being important in both reviews. Given this convergent evidence, these common characteristics offer a benchmark for scientists and practitioners involved in designing and implementing problem-specific preventive interventions.

As we reflect on the gap between the science and practice of prevention, our review suggests the results may have several implications for the future of prevention research and practice. First, practitioners may not be getting up-to-date information on what works in prevention. These principles could serve as a guide to encourage practitioners to search deeper for prevention programs that reflect these principles. Second, many practitioners cannot afford to implement research-based programs that were developed on well-funded, university-based research grants. Efficacy trials offer a sharp contrast to most prevention programs, which are frequently conducted with small budgets and small staffs (Morrissey et al., 1997). These principles might assist researchers and practitioners in identifying cost-effective ways of implementing the essential elements of programs. Third, there is a call for more systematic prevention science research. While content areas differentially endorsed principles, this does not necessarily represent a differential in the importance of the principles. This review could serve as call for researchers to examine the relationships between previously ignored issues (e.g., staff training) and program outcomes.

Finally, this review offers a rationale for multiple-problem prevention programs because at-risk children tend to be at risk for multiple negative outcomes as a result of dysfunctional families, neighborhoods, schools, and peer relationships (Donovan, Jesser, & Costa, 1988). In fact, the most frequently endorsed principles (comprehensive, varied teaching methods, appropriately sized) support the call for policies that encourage multicomponent, coordinated preventive interventions (Elias, 1995) such as those advocated in the Safe Schools/Healthy Students initiative (see http://ojjdp.ncjrs.org/grants/safeschools.html). The growing consensus among meta-reviews suggests that these common characteristics of effective programs may offer guidelines for conceptualizing and developing these policies.

REFERENCES

*References marked with an asterisk indicate studies included in the review of reviews.


Effectiveness of Fatal Vision® Goggles in Youth Alcohol, Tobacco and Other Drug (ATOD) Prevention

August 2010

This document was developed to provide a summary of the research regarding the effectiveness of the use of Fatal Vision® Goggles in the substance abuse prevention field. Suggested citation: Prevention First (2010). Effectiveness of Fatal Vision® Goggles in Youth Alcohol, Tobacco and Other Drug (ATOD) Prevention. Springfield, IL: Prevention First.
**Executive Summary**

Fatal Vision® Goggles (FVG) are intended to educate participants about the consequences of alcohol impairment. The goggles are used as a preventative method to change attitudes and reduce drunk driving behavior. Fatal Vision® Goggles simulate alcohol impairment and the effects are usually demonstrated to a large audience while one or more audience members wear the goggles and perform tasks such as sobriety tests.

There is limited research and evidence of FVG effectiveness in changing attitudes or reducing drunk driving.

A review of the research shows:

- No evidence base supports Fatal Vision® Goggles’ effect on youth or adolescents. The three studies reviewed in this paper used college students and the findings cannot be generalized to the 10-17 age group.
- When used with most participants observing as part of an audience, FVG are no more effective than watching a five-minute anti-drunk driving video. (Jewell, Hupp and Luttrel, 2004) (Jewell & Hupp, 2005)
- While participants who wear the goggles report greater declines in accepting attitudes toward drinking and driving compared to the audience, these differences disappear within four weeks. (Jewell & Hupp, 2005)
- Evidence indicates that FVG has the potential to change drinking and driving attitudes only. (Hennessy, Lanni-Manley and Maiorana, 2006) Changes in attitude are not accompanied by a decrease in drunk driving. (Jewell & Hupp, 2005)
- One study (Hennessy, Lanni-Manley and Maiorana, 2006) examined how past experiences, personal attitudes, personality and future expectation influenced the effectiveness of FVG in reducing drinking and driving attitudes. The findings related to personal characteristics are:
  - FVG is more effective with those that consume more alcohol.
  - FVG is more effective with those that believe there is a greater risk of collision when drinking and driving.
  - FVG is less effective with those who gain a strong sense of identity from their driving.
- The effect of FVG on attitudes as shown in the three studies is minimal to moderate in the short term.

While prevention workers have focused their efforts on approaches with evidence of effectiveness, it sometimes remains difficult to explain to coworkers and community partners why the field of substance abuse prevention supports some tactics and discourages others. In responding to this need, this publication summarizes the research on the effectiveness of FVG.
**Fatal Vision® Goggles Product**

Fatal Vision® Goggles (FVG) are intended to educate participants in community prevention programs about the consequences of alcohol impairment. Law enforcement officers often facilitate Fatal Vision® Goggles activities with the intention of changing attitudes about drinking and driving, and therefore, reducing drunk driving behavior.

Fatal Vision® Goggles use lenses that give the wearer a simulation of impairment. Fatal Vision® Goggles are available in different impairment levels and are available in a clear or shaded version to simulate either daytime or nighttime conditions. One of the popular activities usually conducted with Fatal Vision® is to perform Standard Field Sobriety Tests such as walking a straight line. Because the goggles cause a loss of balance and equilibrium, the effect of wearing them mimics impairment due to alcohol and other drugs. (*Innocorp, Ltd., 2010*)

In addition to sobriety tests, other activities used in conjunction with impairment goggles include driving/traffic simulators and actual driving of battery or pedal-powered go-karts and golf carts. Battery powered karts may be equipped with remote kill switches to stop their operation and ensure the safety of participants operating them while simulating impairment.

“The Goggles are often used with large groups, the majority of students often only observe the effects of the Goggles on another student without actually wearing the Goggles themselves.” (*Jewell, Hupp and Luttrell, 2004*)

While Fatal Vision® Goggles may be the most well known brand, similar visual alcohol and drug impairment simulation devices are manufactured and marketed under other names, including:

- Drunk & Dangerous Glasses
- D.W. Eyes Goggles
- Drunk Busters Goggles
- Drunk & Disorderly Goggles (U.K.)

**Research Highlights**

Three studies provide the basis of research findings on the effectiveness of Fatal Vision® Goggles. The first study (*Jewell, Hupp and Luttrell, 2004*) documents immediate attitude change differences between participants who wore the goggles and performed sobriety tests, and those who only observed the wearers. The second study (*Jewell & Hupp 2005*) researched longer-term attitude and behavior change. The third study (*Hennessy, Lanni-Manley and Maiorana, 2006*) used the goggles, sobriety tests and a driving simulator with participants, and tested several hypotheses regarding participants’ attitudes, perceptions, typical drinking behavior and personality characteristics.
The body of evidence listed below includes research findings that are specific to the use of Fatal Vision® Goggles.

**Fatal Vision® Goggle Effects on Youth**

- No evidence base supports Fatal Vision® Goggles’ effect on youth or adolescents. The findings in these studies cannot be generalized to the 10-17 age group. However, “This prevention tool is often used with adolescents in high school and younger. Adolescents are unique... it is possible that the effect of this prevention tool would be different for this population.” *(Jewell, Hupp and Luttrell, 2004)*
- The three studies reviewed in this paper used college students in their research and the evidence of effectiveness is generally limited to young adults.
- Participants in the 2004 study had a mean age of 20.6 years and approximately half were college freshman. About one-fourth (22%) were at or above the legal age limit of the state in which the study was conducted (21).
- Participants in the 2005 study had a mean age of 19.5 years, and approximately half were college freshman. *(Jewell & Hupp, 2005)*
- Participants in the 2006 study were at least 18 years of age and their mean age was about 20.5 years. The age range in this study was 18-33 years. All participants held a valid license and drove on a daily basis. *(Hennessy, Lanni-Manley and Maiorana, 2006)*

**Participant vs. Observer Effects**

- “…Fatal Vision® Goggles are moderately effective at reducing favorable attitudes toward drinking and driving, at least in the short-term. However, there is an important caveat revealed in these results. Simply stated, this prevention tool is significantly more effective if it is actually experienced by the individual. As previously mentioned, many agencies using the Fatal Vision® Goggles select a few individuals to wear the goggles, while a large audience watches.” *(Jewell, Hupp and Luttrell, 2004)*
- “These results specify that the experiential effects of the goggles are significantly greater than the onlooker effects. In fact, onlooker effects were no different than if the participant had simply watched a short five-minute video. Those individuals and agencies that utilize this tool should consider allowing the full number of participants in these prevention programs to wear the goggles rather than simply watching a demonstration passively.” “…allowing more (or all) of prevention program participants to actually wear the goggles would cost agencies or school *(sic)* in terms of time and money.” “However it seems clear that using these goggles in front of a very large, and mostly passive, audience is not the most effective way to use this prevention program component.” *(Jewell, Hupp and Luttrell, 2004)*
Duration of Effects

- “... this study only measured the very short-term effects of this prevention tool. It is currently unknown whether these effects will be maintained.” (Jewell, Hupp and Luttrell, 2004)
- “...while the Fatal Vision® Goggles are effective in changing immediate attitudes when they are actually worn, this attitudinal change disappears within four weeks. (Jewell & Hupp, 2005)

Attitude and Personal Characteristics

- One study (Hennessy, Lanni-Manley and Maiorana, 2006) examined how past experiences, personal attitudes, personality and future expectation influenced the effectiveness of FVG in reducing drinking and driving attitudes. This study had all participants wear the FVG while performing field sobriety tests and driving in a traffic simulator; there were no ‘audience’ participants. Findings related to the personal characteristics examined in this study are noted below:
  - Participants that consume more alcohol during the average outing showed greater reduction in intentions to drink and drive following the use of FVG.
  - Participants that perceived a greater risk of getting caught by the police did not show greater reduction in drinking and driving intentions following the use of FVG.
  - Participants that perceived a greater risk of collision when drinking and driving showed greater reduction in drinking and driving intentions following the use of FVG.
  - Participants rated as ‘high identity drivers’ were impacted less by the use of FVG. In explanation, some drivers drive to express their persona and gain a sense of identity from driving. For ‘high identity drivers,’ driving demonstrates greater personal meaning and relevance. “Attempts to alter this freedom...may lead to resistance and oppositions because it would represent a threat to their underlying motive for driving.”

Attitude and Behavior Change

- While other research correlates attitude and actual behavior change in prevention programs, none of the studies reviewed provides direct evidence for this correlation specific to Fatal Vision® Goggles.
- “These results indicate that wearing the Fatal Vision® Goggles, or watching others wear the goggles, had no significant effect on actual drinking and driving behaviors in the four weeks after their implementation.” (Jewell & Hupp, 2005)
- “... this study measured the effects of the Fatal Vision® Goggles on attitudes toward drinking and driving, not drinking and driving behavior itself. With this being said, research has shown attitudes toward risky behavior are highly related to the behavior itself (Donavan, Marlatt & Salzberg, 1983) and that altering individual preferences toward drinking and driving have been found to be one of
the most effective strategies toward changing the actual behavior (Mannering, Bottiger & Black, 1987).” (Jewell, Hupp and Luttrell, 2004)

- “…the change in attitude was not accompanied by a similar decrease in drunk driving behaviors.” (Jewell & Hupp, 2005)
- “…evidence from the present study should be taken as an indication of the potential for FVG to change drinking and driving attitudes only.” (Hennessy, Lanni-Manley and Maiorana, 2006)

Conclusions

Given the increased amount of recent applicable theory and research in our field and limited resources, as prevention workers we have a responsibility to primarily use those prevention strategies that are proven to prevent and reduce youth alcohol use and related consequences, as well as other substance use. In order to create positive change within our communities, we must apply best practices and promote evidence-based prevention.

While FVG has shown some evidence of effectiveness in changing college students’ attitudes short term, no evidence exists for the 10-17 age group. There is no evidence of FVG leading to long-term attitude change beyond four weeks and no evidence of drinking and driving behavior change.

Further, many commercially available programs such as Fatal Vision are quite costly. For example, the price of a single Fatal Vision “starter kit,” which includes six types of goggles of varying strengths and tints, video and handouts, is currently $875. Therefore, it is critical for agencies and schools, which have limited budgets for such activities, to spend these funds wisely and in a way that will have the most benefit. (Jewell & Hupp, 2005) (Note: Starter Kit price as of July 2010 was $1,060.00. Source: Innocorp, Ltd., Spring 2010 Catalog.)

FVG does not meet the criteria to qualify as an evidence-based practice; however, it does not appear to violate the standards of best practices. FVG may be useful as one component of (or a supplement to) a comprehensive prevention program. It should not be used as a single prevention event that is not part of an ongoing prevention effort.
References


Use of a Virtual Reality Driving Simulator as an Alcohol Abuse Prevention Approach with College Students

Dear Editor:

A study by Hingson, Heeren, Zakocs, Kopstein and Wechsler (2002) reported alarming estimates of the number of U.S. college students in the age range 18-24 in 1998 who experienced alcohol-related problems: over 1400 students died (including motor vehicle accidents), over 2 million of 8 million college students drove under the influence, and over 3 million of 8 million college students rode with a drunk driver. A variety of approaches have been employed to try to reduce the risks associated with the consumption of alcohol among young people, including promising new approaches that include some type of experiential learning. An example of such an approach is the “Road Ready Teens” videogame developed by several groups (e.g., Mothers Against Drunk Driving; MADD, 2003) to increase teenagers’ awareness and understanding of driving risks, including driving while drunk. An evaluation of this game by The University of Michigan Transportation Institute showed that playing the game increased a group of twenty-five teenagers’ perceptions of personal driving risk (Bingham & Shope, 2003).

Researchers at the University of Missouri-Rolla (UMR) developed a personal computer (PC) based virtual reality (VR) driving simulator that included a simulation of the effects of driving while drunk. The “Road Ready Teens” video game also included a drunk driving component and participants in the evaluation study conducted by the University of Michigan Transportation Institute reported that the game was a more engaging mechanism in comparison to written materials for communicating with teenagers. However, some of the young people expressed the criticism that they thought video games were “for fun” and not “for education” (Bingham & Shope, 2003).
In contrast, the UMR driving stimulator was clearly designed and presented to participants as an educational tool and not as a game experience.

Our study attempted to evaluate the VR Driving Simulator in order to: (1) establish the internal validity of the drunk driving simulation by comparing participants' performances under a “sober” condition to a “driving drunk” condition; and (2) assess the external validity of the simulator by asking subjects about their future likelihood of engaging in drinking and driving and their general expectancies regarding the use of alcohol.

Participants in our study were 86 undergraduate students enrolled in Introductory Psychology classes at the University of Missouri-Rolla. They completed the study as part of their course requirements. Thirty-one students participated in the driving simulator condition and 55 students in a control group condition. Consistent with the campus composition, there were 51 males and 35 females and the average age was 20.9 years. On a background information sheet, students were asked the number of times in the past two weeks that they had four or more drinks (if female) or five drinks (if male) at a single setting. For purposes of analysis in our study, this provided an index of “binge drinking.”

The virtual reality driving simulator was restricted to a single desktop computer and screen to make it more portable and affordable in future research and educational endeavors. The plug and play capability of the hardware in this setup was also an important consideration in its creation. The virtual simulator consisted of two parts, the static world (scene data) and the moving entities. The scenario development was carried out using an event based triggering method. In the simulation, the image responded to input from the steering wheel, accelerator, and brake. There was also appropriate accompanying visual and sound feedback. The synchronization was provided by a vehicle dynamics model, the core component of the driving simulation system. The vehicle model implemented in this system consisted of different mathematical models for various parts of the vehicle such as steering, engine, driveline, differential, aerodynamics,
and tires. A scoring system constantly monitored the driver’s performance during the experiment.

To equate the drivers in their skill levels before beginning the experiment, participants in the VR simulator condition completed a driver training task. In the training task, participants completed a driving course that familiarized them with the apparatus and control devices. They had to complete the training course without losing more than a total of four points (using a scoring system to be described later) before they could start the actual driving tests. In the actual experiment, there were two driving tests: a “sober driving” task and a “drunk-driving” task where the controls were specifically modified to simulate the effects of driving while drunk. To control for order effects, the order of the drunk versus sober driving tests was decided randomly by a coin flip.

Moskowitz et al. (2000) also showed that longer reaction times are associated with consuming alcohol and are related to delays in the decision to act and uncertainty about what action to take. Based on this concept, it was possible to create a similar situation by implementing reaction time lags in the control devices of the simulator. This was achieved by creating a time lag between the moment of making a response using the hardware of the simulator and the corresponding change in the response of the simulator. Moskowitz et al. (2000) showed that the average increase in reaction time for individuals consuming alcohol in the age group 21-24 is 0.5 seconds. Thus a delay of 0.5 seconds was added to the controls of the simulator including steering, brake pedal, and accelerator pedal under the “drunk driving” condition.

A standardized set of instructions was read to all subjects. After completing the driving tests, subjects were shown bar graphs of their driving mistakes and their performance on the auditory shadowing task under the sober versus drunk conditions. Students in the no treatment control group filled out the same questionnaires that all other participants completed but did not experience any type of educational program.
In order to make the driving task as realistic as possible, different scenarios were designed to include day-to-day situations. To maintain similarity between the sober and drunk driving tests, the two testing tracks were essentially the same except that the time and location of events in the two tracks were different. The two testing scenarios were designed such that the driver could complete either one in about ten minutes.

A participant was told to obey a maximum speed limit of 35 miles per hour throughout the driving test. The student was able to view the surroundings in the same way that someone would be able to do if they were sitting in the driver's seat in a real car (e.g., they could see the car dashboard, speedometer, and what was behind them in a rear view mirror). The participant experienced a series of events (e.g., traffic lights, people crossing the street, cars passing by, etc.) while driving—events which were designed specifically as part of the testing scenario. The events involved a triggering method based on the position of the driver's vehicle in the virtual world. The participant was guided through the environment with visual cues. A red arrow appeared in the lower left or right side of the screen indicating which direction he/she should turn at the next intersection; and the arrow would go off when the turn was completed.

While completing these driving tasks, participants were also required to simultaneously perform an auditory shadowing task. Research (Moskowitz, Burns, Fiorentino, Smiley, & Zador, 2000) has shown that a major negative effect of alcohol on driving skills is a reduction in the driver's ability to divide his/her attention (e.g., converse on a cell phone while paying attention to driving cues). The auditory shadowing task was employed in our study because it involved the same type of response and has similar time and attentional demands as talking on a cell phone. It was run on a different computer system from the simulator.

The application consisted of two audio threads played in the two ears of a set of headphones that drivers wore while completing the simulator test drives. The pre-recorded audio threads were made
of different words that were spoken at random time intervals. The participant's task was to respond to the words that were spoken only in his/her right ear by repeating them aloud. Participants were told to ignore all words presented in the left ear. "White" noise was played in both ears continuously in order to avoid any interfering noise.

The performance measurements for the driving task involved keeping track of driving mistakes through the use of a continuously running performance measurement module in the background while a participant was performing one of the driving tests. The mistakes a driver could make included deviations in driving speed, number and type of collisions, failure to follow speed limits, failure to respond to traffic lights and traffic signs, and the driver's failure to keep their vehicle under control. At the end of their test drives, participants were shown two graphs. These graphs showed the total points lost in the two tests and the total time taken to complete the two tests.

The performance measurements for the auditory shadowing task also involved use of a performance measurement module that was continuously running in the background while a subject was performing one of the driving tests. The measurements taken included the response time for each word and the number of missed or wrongly responded to words. The performance measurement results on each of these tasks were also shown to the driver in terms of bar graphs.

As an initial step toward exploring the external validity of the VR simulator, two questionnaires were passed out to all participants, the Cognitive Appraisal of Risky Activities questionnaire (CARE; Fromme, Katz, & Rivet, 1997) and The Alcohol Expectancy Multi-Axial Assessment (AEMax; Goldman & Darkes, 2004). The CARE measures respondents' beliefs about the consequences of 30 risky activities with four subscales, i.e., possible negative consequences associated with each risky activity, possible positive consequences, expected involvement in these activities in the next six weeks, and actual involvement. However, in the current study, the 30 item subscale related to "actual involvement" was not used. Although all 30 items from each of three sub-scales of the CARE were given to
subjects, in the present investigation only the five items having to do with alcohol were used later in the analysis of results. Research by Fromme and colleagues has shown good test-retest reliability for the CARE with values of Pearson's $r$ that ranged from .51 to .79 and good criterion validity in terms of scores being significantly related to actual risk taking behaviors.

The AEMax is a recently developed comprehensive questionnaire that assesses subjects' global positive and negative expectancies associated with the use of alcohol (Goldman & Darkes, 2004). We used the 24-item short version of the AEMax (eight octants measured with three items per octant). Research indicates that the AEMax is predictive of concurrent and future drinking behavior among college students and that it also significantly correlates with other measures for expectancy of alcohol effects.

The results of the study showed that the VR simulator had very good internal validity: all of the comparisons with regard to the differences between how participants performed under the "driving sober" versus "driving drunk" conditions were significant. Students showed clear decrements under the drunk driving condition with regard to both their driving performance and their ability to perform the auditory shadowing task. Moreover, there were no order effects. A comparison of scores obtained by participants who experienced the "sober-driving" condition first and those who underwent the "drunk-driving" condition first showed no significant differences in their scores on any of the measures used in this study.

Drivers made a significantly [$F(1, 29) = 325.48, p < .0001$] greater number of driving errors in the "drunk" than in the "sober" condition. The number of errors in the drunk condition (mean = 93.81 points) was, in fact, more than three times greater than that of the sober condition (mean = 27.19 points). Additionally, it took drivers significantly [$F(1, 29) = 72.48, p < .0001$] longer to complete the driving simulation task under the "drunk" condition (mean = 621.11 seconds) than under the "sober" condition (mean = 511.30 seconds).
A similarly impressive set of differences was found with regard to how subjects performed on the auditory shadowing task. The average response time was significantly greater \([F(1, 29) = 6.57, \ p < .02]\) for the drunk condition (mean = 1.83 seconds) than for the sober condition (mean = 1.65 seconds) and the number of omitted words was also significantly \([F(1, 29) = 24.13, \ p < .001]\) greater when participants were “drunk” (mean = 3.8 words) than “sober” (mean = 1.9 words).

The CARE and AEMax questionnaires were used to address the issue of the external validity of the effects on people of the VR driving simulator. To remove individual differences regarding the drinking habits of subjects prior to the start of the study, frequency of “binge” drinking, i.e., the number of times in the past two weeks a subject had four or more drinks (if female) or five (if male) at a single sitting, was used as a covariate. Similarly, age of respondent was also used as a covariate.

CARE scores were analyzed by means of a 2 (treatment versus control) X 2 (male versus female) multivariate analyses of variance (MANOVA) using binge drinking and age as covariates. Only binge drinking was significant \([\Lambda, F(15, 66) = 5.73, \ p < .000]\). None of the other variables, i.e., treatment versus control \([\Lambda, F(15, 66) = 1.34, \ p < .20]\), male versus female \([\Lambda, F(15, 66) = 1.34, \ p < .20]\), treatment/control X male/female \([\Lambda, F(15, 66) = .75, \ p < .72]\) interaction, or age \([\Lambda, F(15, 66) = 1.37, \ p < .19]\) were significant. This indicated that participation in the virtual reality experiment had little effect on changing expectancies or attitudes regarding drinking alcohol.

AEMax scores were also analyzed by means of a 2 (treatment versus control) X 2 (male versus female) multivariate analysis of variance (MANOVA) with age and binge drinking serving as covariates. While the binge drinking variable was significant \([\Lambda, F(8, 73) = 4.63, \ p < .000]\), none of the others were, i.e., treatment versus control \([\Lambda, F(8,73) = 1.34, \ p < .20]\), male versus female \([\Lambda, F(8,73) = .69, \ p < .70]\), treatment/control X male/female \([\Lambda, F(8, 73) = .56, \ p < .70]\).
These results again indicated that participation in the virtual reality simulation, age of participant, and sex of participant had little impact on expectancies toward alcohol.

Results of this study with regard to the internal validity of the VR Driving Simulator were impressive: participants clearly committed more driving errors while under the "drunk driving" condition and also showed poorer performance on the divided attention task.

As a concept, the VR simulator has exciting possibilities as an experiential education tool. It clearly avoids the complex legal and ethical problems involved in actually giving alcohol to humans, and especially to young people.

With regard to our initial attempt to assess the external validity of the VR driving simulator, the results were disappointing as no significant differences were found with regard to the likelihood of students engaging in future drinking and driving behavior, or for any changes in their expectancies regarding the use of alcohol. This failure to find significant results for this aspect of the study is similar to the results reported by The University of Michigan Transportation Institute in their evaluation of the "Road Ready Teens" videogame (Bingham & Shope, 2003). The videogame, which also included a drunk driving experience, similarly did not impact subjects' intentions to avoid future risky driving behavior. Moreover, the participants in this study commented on the fact that the videogame lacked realistic feedback about the consequences of making "real life" driving mistakes, e.g., the degree of injury, possible repair costs, and damage from hitting obstacles.

Recent research in JADE evaluating another experiential approach to alcohol education by Jewell, Hupp, and Luttress (2004) has also raised this issue, i.e., the possible need for making explicit connections between a subject's experiences and the real life consequences of alcohol abuse (connections which were also lacking in our VR experiential approach). Jewell and colleagues examined the effectiveness of the "Fatal Vision Goggles" as a prevention tool for changing
attitudes toward drinking. The goggles are an eye glass device that simulates the effects of alcohol by distorting the wearer’s perception with respect to vision and sense of balance (Innocorp, LTD., 1997). In an experimental study comparing a control group, the group wearing the goggles, and a group of onlookers, Jewell and colleagues reported that participants in the goggles condition showing a significantly greater change in attitudes. However, before any post-treatment measures were taken, all participants in this study viewed a videotape “that is typically used during drinking and driving prevention programs, which recounts the story of a parent whose son died in a collision caused by a drunk driver (p. 71).” It may be that with experiential approaches, the connection between a participant’s experiences of disrupted functioning and the possible negative consequences of drinking and driving need to be explicitly made to the participants. Future research is needed to explore this possibility.

Overall, the present study’s results were positive in showing that the virtual reality simulator could be a safe, ethical and effective approach to educating young people about the dangers of drinking and driving. More work is needed, however, to demonstrate the impact of the VR simulator on expectancies and future behavior and the need to include more connections with realistic consequences associated with drunk driving.

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References


An Evaluation of the *Road Ready Teens* Video Game:
Final Report

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This study evaluated the effectiveness of the Road Ready Teens video game "Streetwise," in (1) raising teen awareness of key driving risks, (2) strengthening positive attitudes toward driving safety guidelines, and (3) emphasizing that the experience they get through practice-driving helps them become safe drivers. Twenty-four teens who were either within three months of beginning, or were currently taking but had not completed driver education, were evaluated before and after 50 minutes of playing Streetwise, and then participated in a focus group lasting one hour. Pre- and post-game comparisons indicated that playing Streetwise significantly increased perceptions of personal driving risk; however, intentions to avoid risky driving behaviors, attitudes toward driving guidelines, and acceptance of driving guidelines did not change significantly from pre- to post-test. Girls were more likely than boys to report increased awareness of driving risks, greater acceptance of driving guidelines, and clearer perceptions of personal driving risk. Prior driving experience, video game playing experience, risk-taking propensity, driving risk-taking, and living locale (i.e., rural vs. in-town) also related to game outcomes. Teens in the focus groups said the video game gave too little opportunity to make driving decisions and not enough vehicle control to practice safe driving. They recommended leaving more decisions up to the driver, such as choosing to use safety belts and turn signals; checking blind spots; choosing their own routes or following directions instead of following turn arrows; and controlling vehicle speed to follow posted speed limits. They also suggested adding life-like driving situations, such as realistic obstacles; oncoming traffic; opposing traffic at intersections; and executing left turns at intersections and navigating four-way stops with on-coming traffic. The teens also wanted realistic feedback about the consequences of their mistakes and choices, such as degree of injury, repair cost, damage from hitting obstacles, and consequences of their decisions about safety belt and turn signal use. They felt this type of information would help them learn safe driving skills and the benefits of safe driving habits. Overall, the teens enjoyed playing the video game and felt it was a good teaching tool for people their age.
The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Safety Council, DaimlerChrysler, or GMMB.

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Executive Summary

Topline Results

- Twenty-four teens participated in the evaluation; however, one individual did not provide any pre- or post-test data. Nineteen took part in the focus groups.

- Participants were 74% male (n = 17), 30% Asian American (n = 7), 70% White (n = 16), 13% freshmen (n = 3), 57% sophomores (n = 13), and 30% juniors (n = 7). They ranged in age from 15 to 17 years.

- All participants reported that their typical marks in school were C’s or higher, and 52% (n = 12) reported A’s as their typical mark.

- The majority (91%, n = 21) of the participants were in Level 1 (learner’s stage) of the Michigan Graduated Driver License program.

- Most participants lived in a town (83%, n = 19) as opposed to a rural area.

- Sixteen participants (70%) reported having driven prior to taking driver education. The vehicle most commonly driven was a passenger car.

- Most participants said they enjoyed the game some (39%, n = 9) or quite a bit (35%, n = 8).

- Sixty-one percent of the participants played video games several times or more a week.

- Mission 4 was the highest mission reached by most participants (48% n =11). Four reached Mission 5, and four reached Mission 6. Everyone made it at least to the second Mission.

- Participants reported liking the challenging scenarios most about the game, and maneuverability of the car was what they liked least.

- Thirty-six percent said they were likely to recommend the game to a friend, and 15% said they were unlikely or very unlikely to recommend the game to a friend.

- The mission most liked by the participants was Mission 3 (44%, n = 10), and 22% said they did not like any of the missions (n = 5).

- Thirty percent were neither likely nor unlikely to play the game more (n = 7), 40% reported being unlikely to play the game again (n = 9), and another 30% (n = 7) said they would be likely to play the game more.

- All participants reported that the game helped them at least “a little” to understand the driving risks that they face as new drivers, and 65% (n = 15) reported that it helped them quite a bit or a lot.

- When asked how much more aware of the risks they were after playing the game, 91% (n = 22) reported being at least “a little more” aware, and 22% (n = 5) reported being quite a bit more aware.
- Sixty-one percent (n = 14) said they were more likely to take steps to protect themselves from driving risks as a result of playing the game.

- Positive attitudes toward driving guidelines increased slightly from pre- to post-test.

- The likelihood of being involved in risky driving behaviors decreased slightly from pre- to post-test.

- The participants were quite risk averse, both in terms of general risk-taking and driving-specific risk-taking.

Specific Results

- *Streetwise* was generally positively received by the teen participants, as evidenced by both the quantitative and qualitative results. All participants said they enjoyed the video game at least "a little," and 43% indicated they enjoyed the game either "quite a bit" or "a lot."

- Perceptions of personal driving risk increased significantly from pre- to post-test. Intentions to avoid risky driving behaviors, attitudes toward driving guidelines, and acceptance of driving guidelines did not change significantly from pre- to post-test.

- Girls were more likely than boys to say that their awareness of driving risks had been increased by playing the video game.

- Girls in the sample were more likely to increase their acceptance of driving guidelines from pre- to post-test.

- Boys were more likely than girls to report an increase in their perception of personal driving risk from pre- to post-test.

- Asian-American teens had better perceptions of personal driving risk, greater acceptance of driving guidelines, more positive attitudes toward driving guidelines, and greater intentions to avoid risky driving behaviors than White teens at both pre- and post-test.

- White teens were more likely than Asian-American teens to increase their perceptions of personal driving risk, acceptance of driving guidelines, positive attitudes toward driving guidelines, and intentions to avoid risky driving behaviors from pre- to post-test.

- Teens living in town were more likely than teens living in rural areas to report that they were more likely to protect themselves from driving risks as a result of playing *Streetwise*, increase their perception of personal driving risk, and increase their positive attitudes toward driving guidelines from pre- to post-test.

- Teens living in rural areas were more likely than teens living in town to say their awareness of driving risks increased as a result of playing the video game.

- Participants who had driven before driver education were more likely to report an increase in their intentions to avoid risky driving behaviors and acceptance of driving guidelines from
pre- to post-test, and were more likely to report being more aware of driving risks as a result of playing the video game.

- Compared to the inexperienced video game players, experienced players were less likely to protect themselves from driving risks as a result of playing the video game and less likely to report that they enjoyed the game. However, they were more likely than inexperienced players to increase their intentions to avoid risky driving behaviors, increase their perception of personal driving risks, increase their acceptance of driving guidelines, and increase their positive attitudes toward driving guidelines from pre- to post-test.

- Teens in the high risk-taking propensity group were more likely than the low risk-taking propensity teens to intend to protect themselves from driving risks as a result of playing the video game, and less likely to improve their perception of personal driving risks from pre- to post-test.

- Compared to low-driving-risk-takers, teens with high-driving-risk-taking scores were less likely to increase their intentions to avoid risky driving behaviors; less likely to increase their acceptance of safe driving guidelines; and less likely to adopt more positive attitudes toward driving guidelines from pre- to post-test.

- Teens in the focus groups felt the increased driving risk associated with having teen passengers and eating or drinking while driving was made clear by the video game, but that other guidelines are not clearly addressed and should receive more attention.

- The message for safety belt use was clearly present in the game, but several teens in the focus groups felt the message was not very specific.

- The teens in the focus groups had hoped that the game would teach them more about driving safely but said there was too little opportunity to make driving decisions, and that too many things were under control of the game for them to practice driving safely. They thought this would include leaving more things up to driver discretion, such as using a safety belt or not; checking blind spots; choosing their own routes or following directions through town instead of having turn arrows; turning signals on and off; more control of vehicle speed with posted limits to follow; and having more realistic obstacles. They felt that life-like driving situations should be added, such as oncoming traffic; opposing traffic at intersections; driver choosing the right time to make a left turn at an intersection with oncoming traffic; and navigating four-way stops with traffic coming from the other directions.

- Teens in the focus groups also wanted more realistic feedback on the consequences of their mistakes, such as degree of injury, cost of repair, a flat tire after hitting a pothole, and information about what would have happened, based on the decisions made, such as differences in injury outcome because of not wearing a safety belt. They felt this type of information would help them learn more about being responsible drivers; and about potential consequences of their behavior.
Introduction

Data on the driving behavior of teens leaves little doubt that young drivers are at high risk of injury or death from motor vehicle crashes. Risk of death in a motor vehicle crash peaks at age 16, and remains elevated relative to other drivers through age 35. With the exception of the elderly, drivers in this age range are the most likely to be involved in, to be drivers in, and to lose their lives in a motor vehicle crash (National Center for Injury Prevention and Control [NCIPC], 2000). In 1999, teen drivers represented only 6.8% of all drivers, but accounted for 15% of all drivers involved in fatal crashes, and 18% of all drivers involved in police-reported crashes. Alcohol involvement was also related to crash severity in this age group. Among 15-20-year-old drivers in 2000, alcohol was a factor in 3% of crashes resulting only in property damage, 5% of crashes resulting in an injury, and in 22% of fatal crashes (National Highway Traffic Safety Administration (NHTSA), 2002).

High-risk driving behaviors and serious driving outcomes are associated with various driver characteristics, including inexperience, distraction, emotional states such as anger or depression (Donovan, Marlatt, Salzberg, 1983), high-risk driving practices and attitudes (Evans & Wasielewski, 1983; Jonah, 1990; Jonah & Dawson, 1987; Peck, 1985; Wasielewski, 1984; Yu & Williford, 1993), thrill seeking, various personality factors, and substance use. High-risk driving behaviors such as drinking and driving, tailgating, driving 20 miles per hour or more over the speed limit, traffic signal violations, and passing violations are common among young drivers and also contribute to crash-related injury and death (Centers for Disease Control (CDC), 1994; Insurance Institute for Highway Safety [IIHS], 1993).

These data document the danger faced by young drivers and the hazards they present to passengers and other drivers on the road. They also bring to the fore the importance of developing, evaluating, and refining programs that reduce the risk of motor vehicle injury or death for young drivers. Several such programs have been initiated; perhaps most recognized are the recently developed, administered, and evaluated graduated driver licensing (GDL) programs. While the general GDL approach has been shown to be an effective method of decreasing risk while improving the driving skills of young drivers, further enhancements are needed.

The Road Ready Teens video game, Streetwise, complements GDL and driver education in many ways, by adding other teaching tools, such as manuals, audiovisual presentations, structured instruction and guidance for parents of new drivers, and a video game designed to (1)
enhance the risk awareness of young drivers, and (2) help them adopt positive attitudes toward driving safety guidelines.

The purpose of this study was to evaluate the effectiveness of Streetwise in (1) raising teen awareness of key driving risks, (2) strengthening positive attitudes toward driving guidelines designed to keep them safe from driving risks, and (3) emphasizing that the experience they gain through practice-driving will help them become safe drivers.

The video game was a web-based computer game, controlled by the four arrow keys on the keyboard and the mouse. The game consisted of six missions that increased in difficulty from the first to the last, with each mission locked until the preceding mission had been successfully navigated. The missions represented six different driving scenarios. Obstacles in the road were presented in all six missions, and the game player must successfully navigate them. As the difficulty increased, so did the responsibilities for signaling turns and slowing down for stop signs. The first mission was called “Mom’s Gauntlet” and involved running errands with Mom while she gave directions. The second mission specifically focused on passenger distractions and was called “Driving with Friends.” The third mission was called “King of the Neighborhood” and involved driving around town with friends. The fourth mission was called “Night Driver” and simulated driving at night. The fifth mission was called “Bad Weather” and added the challenge of driving in the rain. Finally, the sixth mission was called “Drink Drivers” and involved the safe negotiation of hazards presented by drink driving.
Methods

Sample

Recruitment

Michigan uses a three-level graduated driver licensing program. The process begins with Segment 1 of driver education, which consists of 24 hours of class instruction, and six hours of on-road driving. Once Segment 1 is successfully completed, a Level 1 supervised learner’s license can be issued, which allows the holder to drive only with a licensed parent/guardian or designated adult age 21 or over in the front seat. Following completion of at least 30 hours of supervised driving, the holder of a Level 1 license can attend Segment 2 driver education which consists of six classroom hours where the students discuss and examine their driving experiences and share what they learned as supervised drivers. After successfully completing Segment 2 and a total 50 hours of supervised driving, including at least 10 hours of driving at night, Level 1 license holders can apply for a Level 2 license, which requires passing a road test.

To qualify for this study, participants had to be teenagers within three months of beginning their driver education classes, attending Segment 1 classes, driving with a Level 1 supervised license, or attending Segment 2 classes. To recruit eligible participants, project staff coordinated efforts with driving schools in the Ann Arbor Area, including the Sears Driving Schools, All Star Driver Education, Ann Arbor Driving School, and A-1 DiGregorio Adult and Teen School of Driving. Each driving school was contacted by a project staff person who made an appointment to recruit study participants from the school.

At the recruitment appointment, the staff member introduced themselves to the class, gave some background about the video game, and told the potential participants that their help was needed to evaluate the game. They were informed that they would receive a $15 Border’s gift certificate for playing the video game and completing two short surveys, and another $15 gift certificate for remaining an additional hour after the video game session to attend a discussion group to about their impressions of the game, what they liked and disliked, and how it could be improved. They were also told that the video game was not being developed for commercial purposes, but instead would be available to the public on the World Wide Web and that, by helping us with the evaluation, they would be performing a public service. Then informed consent forms and information about the evaluation were handed out and explained. The students were given time to complete their forms, and they gave them to the recruiter along with
contact information, so they could be scheduled for an evaluation time and reached with a reminder a day or two before the evaluation.

Because minors were being recruited, signed informed consent was needed from both the teen and his/her parent (i.e., teen assent and parental consent) in order for the teens to participate. Most of the driving schools offer a parent class so, to facilitate obtaining signed informed consent, recruitment was done at parent classes whenever possible.

All potential participants were given an information sheet describing the evaluation, giving directions to the evaluation site, and providing the e-mail address and phone number of the project’s Principal Investigator. They were invited to call or e-mail with any questions. Participants who were recruited from a regular (not parent) class, as well as any who chose not to hand in a teen assent form at recruitment, were encouraged to come on the day of the evaluation with the necessary forms completed. In addition, eligible participants were asked to invite friends to join them, and told to have their friends contact the Principal Investigator using the phone number or e-mail address on the information sheet, to obtain the consent and assent forms and to be scheduled for the evaluation.

Participants were also recruited by sending the project flyer out to UMTRI staff, as well as staff at the Department of Veterans Affairs, Health Services Research and Development in Ann Arbor, Michigan, asking employees at these locations to pass the information along to their children, neighbors, and friends with the invitation to contact the Principal Investigator for more information and to be scheduled for the evaluation.

Participants

Twenty-four teens participated in the evaluation; however, one individual played the video game, but did not complete either the pre- or post-test surveys. The participants were 74% male (n = 17), 30% Asian American (n = 7), 70% White (n = 16), 13% freshmen (n = 3), 57% sophomores (n = 13), and 30% juniors (n = 7). They ranged in age from 15 to 17 years. All participants reported that their typical marks in school were mostly C’s or higher, and 52% (n = 12) reported A’s as their typical marks. Only one person reported getting mostly C’s.

The majority (91%, n = 21) of the participants were in Level 1 of the Michigan Graduated Driver License program and lived in a town (83%, n = 19), as opposed to a rural area.

Details regarding participants in each of the four focus groups follow. Group One included seven teens, two female. Group Two included two male teens. Group Three included four male teens, and Group Four included six teens, two female. Discussion time for each
group ranged from about 40 to 60 minutes. In general, the teens seemed serious about learning to drive and eager for good information to help them learn. They showed respect and understanding of their parents' driving experience and knowledge, and of Michigan's GDL program. Several teens seemed unimpressed with their Segment 1 driver education classes (24 classroom hours, 6 behind-the-wheel sessions), which almost all had attended. They acknowledged that they needed the information and road advice, but did not enjoy some of the educational methods and materials used.

Evaluation

The evaluation was conducted at the University of Michigan Media Union on August 30, 2003, with the surveys and video game in a computer lab, and focus groups in a conference room. The information sheets given to potential participants during recruitment included a map showing the location, giving the Media Union street address and instructions for locating the evaluation room. On the day of the evaluation, a large sign announcing the evaluation was placed at curbside, and signs were posted inside the building to guide participants to the computer lab.

The evaluation was conducted in four consecutive sessions, beginning at 8:30am, 10:30am, 12:30pm, and 2:30pm. The video game component of the evaluation occurred first. This began with a welcome by C. Raymond Bingham, PhD, brief instruction and administration of a computerized pre-test survey (Appendix) that allowed immediate storage of the data in a database located on the computer lab server. The pre-test was followed by 50 minutes of game play, then the administration of the post-test survey (Appendix), which was also computerized. Project staff were available throughout the video game component of the evaluation to answer questions, and to monitor participants to ensure that they played the video game as instructed.

When all participants completed the post-test survey, they were escorted to the conference room for the focus group discussions (see Appendix, Focus Group Moderator's Guide). Not all the teens who took part in the video game portion of the evaluation were able to remain for the focus group. Five teens elected to not take part in the focus groups. One Borders gift certificate worth $15 was given to each of these individuals following the post-test survey.

A total of 19 teens (15 male and 4 female) participated in the four focus groups. The focus groups were held in a windowed conference room with a large table and chairs around it. Juice and cookies were served. The discussions were led by Jean T. Shope, MSPH, PhD,
using the Moderator's Discussion Guide included in the Appendix. Notes were taken by Helen Spradlin, research assistant. In some groups, the discussion rolled along, and the actual questions from the moderator’s guide did not need to be specifically asked. The discussions were audio-taped as back-up, and duplicate tapes were sent to the game developers at WildTangent. Most of the focus groups were observed by one to four staff members of GMMB and DaimlerChrysler. They sat on chairs in one corner of the room, and asked a few questions after the moderated focus group was finished. At the conclusion of each session, participants were thanked and each given two $15 Border's gift certificates; one for playing the video game; and one for participating in the focus group.

Quantitative Measures
The pre- and post-test surveys containing the measures used in this study are provided in the Appendix.

Demographics
The demographic measures included sex (1 = male, 2 = female), race (1 = African American, 2 = Asian American, 3 = Caribbean Islander, 4 = Latino/Hispanic, 5 = Native American Indian, 6 = Pacific Islander, and 7 = White), date of birth, location of residence (1 = rural [in the country], 2 = in town [in a neighborhood]), grade in school (1 = Freshman – 9th grade, 2 = Sophomore – 10th grade, 3 = Junior – 11th grade, 4 = Senior – 12th grade), and marks in school (1 = Mostly A’s, 2 = Mostly A’s & B’s, 3 = Mostly B’s, 4 = Mostly B’s & C’s, 5 = Mostly C’s, 6 = Mostly C’s & D’s, 7 = Mostly D’s, 8 = Mostly D’s & F’s [E’s], 9 = Mostly F’s [E’s]).

Mission/Game Specific Questions
At the post-test, the teens were asked several questions about their experience with the Streetwise video game. Examples of these items are: How much did you enjoy playing the video game?; What was the highest mission you reached in the video game?; and Which of the following did you like best about the video game? (see Appendix, Post-Test Survey for all post-test items and response categories).

Outcome Measures
Perception of Personal Driving Risks. This content area was one of the four primary areas that the video game was designed to influence, and it was assessed by two measures. The first was a 9-item measure of Perception of Personal Driving Risk (both pre- and post-test),
that asked the teens to rate how much each of nine risky driving behaviors increases THEIR OWN risk of being in a car crash. Each item was rated on a five-point scale with 1 = not at all, 2 = a little, 3 = somewhat, 4 = very, and 5 = extremely (see Appendix, Pre-Test Survey, item 12, and Post-Test Survey, item 5). The scores on these items were averaged to provide a single overall score of participants’ perceptions of their personal driving risk. Internal consistency reliability (α) for this scale ranged from 0.91 to 0.93 and test-retest stability, tested using the Pearson Product Moment Correlation (r), was 0.80.

The effect of the video game on Risk Awareness was measured by a single item at the post-test measuring how much more aware of driving risks the teen felt s/he was as a result of playing the video game (see Appendix, Post-Test Survey, item 15). Responses to this item were 1 = no more aware, 2 = a little more aware, 3 = somewhat more aware, 4 = quite a bit more aware, and 5 = a lot more aware. The Pearson Product Moment Correlation between the Perception of Personal Driving Risk scale score and this item was 0.46.

Increased understanding of driving risks that resulted from playing the video game was measured by a single post-test item that asked the teen how much the video game helped him/her better understand the risks that new drivers face (see Appendix, Post-Test Survey, item 10). Responses were 1 = Not at all, 2 = A little, 3 = Some, 4 = Quite a bit, and 5 = A lot. Correlations between this item with Risk Awareness, and Perception of Personal Driving Risk were 0.51 and 0.70, respectively.

**Intention to Avoid High-Risk Driving Behaviors.** The effect of the video game on avoidance of high-risk driving behaviors was assessed by two measures. The first was the Intention to Avoid High-Risk Driving scale (see Appendix, Pre-Test, item 4 and Post-Test Survey, item 9). This 9-item scale in the pre-test and post-test asked the teen to rate how likely s/he was to do each of nine behaviors related either to risk avoidance or taking driving risks. The items were rated on a 5-point scale, with 1 = not at all, 2 = a little, 3 = somewhat, 4 = very, and 5 = extremely. The scale was scored so that a higher score indicated greater risk avoidance. Test-retest stability was r = 0.52 and α ranged from 0.55 to 0.64.

The second measure of driving risk avoidance was a single item in the post-test that asked the teen if s/he was more likely to protect her/himself from driving risks as a result of playing the video game (see Appendix, Post-Test Survey, item 15). Responses to this Self Protection measure were 1 = yes, 2 = no. The Spearman Correlation Coefficient relating this item to the Intention to Avoid High-Risk Driving scale was 0.40.
Attitudes toward Guidelines. The teens’ attitudes toward driving guidelines were measured by the Positive Attitudes Toward Driving Guidelines scale (see Appendix, Pre-Test, item 2 and Post-Test Survey, item 11). This 11-item scale asked teens (pre-test and post-test) how much they agreed or disagreed with 11 statements reflecting either a positive or a negative attitude toward a driving guideline. Agreement was rated on a five point scale, with 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree. Scale scores were calculated so a higher score reflected a more positive attitude toward driving guidelines. Test-retest stability was 0.49 but internal consistency reliability was low (α ~ 0.30).

Acceptance of Driving Guidelines. The teen’s willingness to follow driving guidelines was measured using the Acceptance of Driving Guidelines Scale (see Appendix, Pre-Test, item 6 and Post-Test Survey, item 12). This 10-item scale (pre-test and post-test) asked the teen to rate how willing s/he would be to accept each of 10 driving guidelines. Willingness was measured on a 5-point scale: 1 = not at all, 2 = a little, 3 = somewhat, 4 = very, and 5 = extremely. Test-retest stability was 0.84, and α ranged from 0.88 to 0.89.

Potential Confounding Variables

Risk-Taking Propensity. Attitudes toward general risk-taking were measured at pre-test by the 19-item Sensation Seeking Scale (Zuckerman, Kolin, Price, & Zoob, 1964; Zuckerman & Link, 1968) (Appendix, Pre-Test Survey, item 8). Each of the 19 items in this scale is a statement about a risky or high sensation behavior, and the teen responded with 1 = true (i.e., the statement is true of the teen), or 0 = false (the statement is not true of the teen). The scale was scored so that a higher score indicated greater risk-taking propensity. The Kuder-Richardson-20 estimate of internal consistency was 0.84.

Driving-Risk-Taking. A 12-item scale measuring Driving Risk Taking asked the teens at pre-test to rate how strongly they expected to have each of 12 risky driving experiences (see Appendix, Pre-Test Survey, item 13). They rated each item on a 5-point scale with 1 = not at all, 2 = a little, 3 = somewhat, 4 = very, and 5 = extremely. This scale had an internal consistency of α = 0.92 and correlation with the Risk-Taking Propensity of r = 0.49.

Driving Experience Prior to Driver Training. Driving experience prior to taking driver education was measured was measured at pre-test, and assessed the diversity in pre-licensure driving experience (see Appendix, Pre-Test Survey, item 11). Prior driving experience was measured by 10 items asking the teen to respond 1 = yes or 0 = no to indicate if they had ever driven prior to starting driver education classes, and if yes, had they driven a car/minivan/bus,
pick-up truck, full-size van, farm truck (larger than a pick-up), motorcycle, tractor, three- or four-wheeled ATV, a riding mower, or another vehicle (verbatim response). The teens were also asked at pre-test how often they had driven before beginning driver education (see Appendix, Pre-Test Survey, item 3). The responses to this single item measure were 0 = never, 1 = a few times – one to six times, 2 = several times – seven to 12 times, 3 = occasionally – once or twice a month, 4 = often – weekly, 5 = regularly – a few times a week, 6 = frequently – almost every day, and 7 = daily.

Extent of Driver Training Experience. Participants were asked at pre-test to report how much time they had spent practice-driving since they began driver education (see Appendix, Pre-Test Survey, item 1). Responses to this single item were 0 = I haven’t started driver education classes, 1 = 1 to 30 minutes, 2 = 31 minutes to 1 hour, 3 = 1 to 2 hours, 4 = 3 to 6 hours, 5 = 7 to 10 hours, 6 = 11 to 20 hours, 7 = 21 to 30 hours, 8 = 31 to 40 hours, 9 = 41 to 50 hours, and 10 = more than 50 hours. A second item asked the participant how far s/he had advanced in the GDL program. Responses were 1 = I haven’t begun driver education, 2 = currently taking Segment 1 driver education classes, 3 = Level 1 – supervised learner’s license, 4 = currently taking or have taken Segment 2 driver education classes, 5 = Level 2 – license that limits nighttime driving, and 6 = Level 3 – license with full privileges.
Quantitative Results

The analyses were conducted in three sets, and the results of these analyses are presented in three sections called Results I, Results II, and Results III. Results I describes the overall reaction of the participants to the video game. Results II presents the results of tests of the central hypotheses of this evaluation by examining changes in perceptions of personal driving risk, intentions to avoid risky driving behaviors, positive attitudes toward driving guidelines, and acceptance of driving guidelines from pre- to post-test. Results III identifies the characteristics of the participants that were associated with an increase, or lack of an increase, in perceptions, intentions, attitudes, or acceptance. Each set is presented separately, and is directly preceded by a description of the statistical tools and decision criteria used to examine the data and interpret the statistical results from that set.

Results I: Teens’ Reactions and Game Performance

Analysis I

The comparisons in this section were made by cross-tabulating the variables in pairs. Differences in responses across groups were then identified by a visual inspection of the tables. No statistical tests were used, because these statistics were intended only to describe the teens’ reactions to the game and their performance playing the game.

Results I

The reactions of the participants to the game were generally positive. All of the participants indicated that they enjoyed the video game at least “a little,” and 43% indicated that they enjoyed the game either “quite a bit” or “a lot.” Boys gave the game an overall higher rating than girls, with 47% of boys and 33% of girls saying they enjoyed the game at least “quite a bit.”

The mission that the participants liked the most was Mission 3, “King of the Neighborhood,” with 48% (n = 10) rating this as their favorite. It still appeared to be the most liked when mission completion was taken into account. One person only progressed to Mission 2; however, of those who made it to Mission 3 or further, 10 indicated Mission 3 was their favorite. Overall, Mission 1 was voted the best by one person, Mission 2 by two, Mission 3 by 10, Mission 4 by two, and Mission 5 by three. Five participants (22%) said they didn't like any of the missions.
The boys and girls who played the game agreed on aspects of the game they liked the most and the least. The most liked aspect was the challenge the game offered (n = 11, 48%), while the least liked was the degree of maneuverability of the car (n = 7, 33%).

Finally, when asked about further engagement with the game, 70% of the teens were either indifferent or stated that they were not likely to play the game more if given the chance. Thirty percent (n = 7) of the teens said that if they were given the chance, they were neither likely nor unlikely to spend more time playing the game, and equal numbers said they were unlikely (n = 5, 22%) and likely (n = 5, 22%) to spend more time playing the game. Similarly, when asked how likely they were to recommend this game to a friend, 41% (n = 9) said they were neither likely nor unlikely to recommend it to a friend. However, the likelihood of recommending the game to a friend was slightly different for boys and girls. Thirty-eight percent of boys (n = 8) and 33% of the girls (n = 2) said they were likely to recommend the game to a friend.

Results II: Changes from Pre- to Post-Test

Analysis II

Change in perceptions of personal driving risks (perceptions), intentions to avoid risky driving behaviors (intentions), positive attitudes toward driving guidelines (attitudes), and acceptance of driving guidelines (acceptance), measured both before and after the teens played the video game, were tested using the signed ranks test and difference t-tests. The difference t-test was chosen because it is widely used to examine repeated measures and paired data. The signed ranks test was also selected because it is suitable for use with these data, and is slightly more liberal than the difference t-test, making it better suited for examining effects in small samples. Finally, measures of effect size (5) were also calculated, so that the actual magnitude of the video game effect, rather than just statistical tests of significance, could be used to evaluate the effect of the video game on teen’s intentions, perceptions, attitudes and acceptance. Effect sizes are considered small if they are in the range of 0.2, medium in the range of 0.5 and large if they are about 0.8 (Cohen, 1992).

Result II

Intentions, perceptions, attitudes, and acceptance were each measured at pre- and post-test. To test the hypothesis that intentions, perceptions and acceptance would increase, and
attitudes would improve, statistical comparisons were made between pre- and post-test using both the difference t-test and the signed ranks test.

Perceptions of personal driving risk increased 11.2% from pre- to post-test. This increase was significant, both for the difference t-test ($t = 3.16, p > .0045$) and the signed ranks test ($S = 84.5, p \geq .0002$). The difference constituted a small to medium effect, with $\delta = 0.30$.

Intentions to avoid risky driving behaviors increased 2.4% from the pre- to post-test. This increase was not significant as tested by the difference t-test ($t = 1.45, p > 0.1614$), or the signed ranks test ($S = 46.5, p \geq 0.1318$). The effect size associated with the difference t-test was very small at $\delta = 0.10$.

Attitudes toward driving guidelines increased 2.2% (became more favorable) from pre-test to post-test. However, this did not constitute a significant change (difference $t = 1.45, p > 0.1614$; $S = 46.5, p \geq .1318$). The effect size was very small at $\delta = 0.08$.

Acceptance of driving guidelines remained nearly stable from pre- to post-test, demonstrating a minimal increase of 1.1%. This increase was not significant, with a difference t-test $= 0.58 (p > 0.5705)$, and a signed ranks test $= 21.5 (p \geq 0.4349)$. The effect size was very small at $\delta = 0.03$.

Results III: Characteristics Related to Increases

Analysis III

Bivariate comparisons between different variables were conducted using cross tabulation tables. Due to the small sample, measures of effect size, rather than significance tests, were used to interpret the statistics and to identify potentially interpretable results. To facilitate this method of comparison, the measures of perceptions, intentions, attitudes, and acceptance that were made at the beginning and the end of the video game session were used to create four new categorical variables, one each for perceptions, intentions, attitudes, and acceptance. These variables had two categories, one included teens who responded to the video game as hypothesized (i.e., increased intentions to follow driving guidelines), and the other represented those who did not (i.e., showed no change, or changed opposite the direction hypothesized). These categorical variables were then contrasted with other measures (e.g., game enjoyment, understanding driving risks), to identify the characteristics of teens who did/did not exhibit change in the hypothesized direction.

Odds ratios were used to identify effects in cross-tabulations of two categorical variables that have only two categories each (2 X 2 table). To extend the usefulness of the odds ratios,
many of the variables that had more than two categories were recoded (categories collapsed) so that they formed two groups, (i.e., not at all likely versus any degree of likelihood). However, some measures could not be reduced to two meaningful categories (i.e., marks in school). The associations of these measures with the categorical outcomes were made using larger tables (2 X j, where j > 2), which were interpreted either visually, or by breaking them down into sets of 2 X 2 comparisons if clear patterns could not be determined through visual inspection. Due to the complexity of these latter sets of analyses and to avoid confusion, odds ratios are not reported for tables larger than 2 X 2, but the direction and nature of the effects is described verbally.

Odds ratios represent the likelihood that cases will be in a particular cell in the table; hence they allow precise statements to be made about how much more likely one group is than the other to have particular characteristics (e.g., male teens were 4.2 times more likely to do x). Odds ratios range from 0 to infinity but, because odds ratios greater than one are more intuitive, all effects in this report are interpreted in the direction of odds greater than one. In the preparation of this report, odds ratios less than 1.5 were treated as no effect. Odds ratios from 1.5 to 1.9 were considered small effects. Odds ratios from 2.0 to 2.9 were medium effects and those 3.0 and larger were considered large effects. Cohen recommends that when his method of calculating effect size is used, effects from 0.20 to 0.49 be considered small effects, 0.5 to 0.79 as medium effects, and 0.06 and larger as large effects (Cohen, 1992). In this report, Cohen’s effect sizes less than 0.20 were interpreted to be null effects.

Result III

The video game’s desired outcomes were: increased awareness of driving risks, greater acceptance of driving guidelines, positive attitudes toward driving guidelines, and intentions to avoid driving risks. The results are reported in separate sections for each predictor variable.

Demographic Factors. The demographic factors examined include sex, grade in school, marks in school, and area of residence (i.e., rural versus in town). Seventeen boys and six girls took part in the evaluation. Female teens were more likely than male teens to say that they were more aware of driving risks as a result of playing the video game (odds ratio [o.r.] = 3.1), and they were also more likely to increase their acceptance of driving guidelines as a result of playing the video game (o.r. = 5.6). However, boys were 4.7 times more likely than girls to report an increase in their perception of personal driving risk as a result of playing the video game. Boys and girls did not differ from each other in their intentions to protect themselves against driving risks, intention to avoid risky driving behaviors, or in positive attitudes toward driving guidelines.
Asian-American and White teens differed on several game outcomes. White teens were much more likely (odd ratio > 12) to increase their perceptions of personal driving risk, 1.7 times more likely to increase their acceptance of driving guidelines, 11 times more likely to report an increase in positive attitudes toward driving guidelines, and 7.7 times more likely to report an increase in their intentions to avoid risky driving behaviors from pre- to post-test.

For this sample, grade in school can be used as a proxy for age, as well as a marker of advancement through school, because the two variables were nearly perfectly correlated. Three freshmen, 13 sophomores, and seven juniors played the video game. The sophomores and juniors were less likely than the freshmen to enjoy the game. Juniors were less likely than the other grades to enjoy playing the game, to feel that the game helped them understand driving risks, or to feel that playing the game had made them more aware of driving risks. Sophomores were less likely than the other teens to increase their perceptions of personal driving risk and more likely to increase their intention to avoid risky driving behavior from pre- to post-test. But they were less likely to report that they would take action to protect themselves from driving risks. Participants from the three grades did not differ in their enjoyment of the game, their acceptance of driving guidelines, or their attitudes toward driving guidelines.

“Marks in school” was not a strong predictor of game outcomes. People with higher marks were more likely to show an increase in positive attitudes toward driving guidelines from pre- to post-test, and to report being more aware of driving risks as a result of playing the game. Marks were not associated with any other outcomes.

The sample included 14 in-town residents, and eight rural residents. Location of residence (i.e., rural versus in-town) was associated with several of the outcome measures. Teens living in rural areas were 4.1 times more likely than teens living in town to say they were more aware of driving risks as a result of playing the video game. Place of residence was not associated with increased acceptance of driving guidelines, or increased intentions to avoid risky driving behaviors.

Driving Experience. Teens in the sample varied in terms of their driving experience. Seven teens reported that they had never driven before taking driver education. This lack of driving experience included never having driven a car/minivan/SUV, pick-up truck, full-size van, farm truck larger than a pick-up, motorcycle, three- or four-wheeled ATV, or a riding mower. Participants who had driven any of these vehicles before driver education were 3.2 times more likely to report an increase in their intentions to avoid risky driving behaviors. Teens who had never driven before taking driver education were 2.2 times more likely to increase in their acceptance of driving guidelines from pre- to post-test, and 2.4 times more likely to report being
more aware of driving risks as a result of playing the video game. There were no differences in increase in perceptions of personal driving risk or attitudes toward driving guidelines.

The sample also reported a wide range of time spent practice-driving as part of their learning to drive, ranging from two reporting that they had not started driver education to two who reported having driven more than 50 hours. The most common amount of practice driving was from 11 to 20 hours. For these analyses, practice driving was collapsed into three categories, which encompassed 0 to six hours, seven to 20 hours, and more than 20 hours of driving. Teens with six hours of practice driving or less were more likely than the other two groups to improve their attitudes toward guidelines from pre- to post-test. Teens with 7 to 20 hours of practice driving increased their acceptance of driving guidelines from pre- to post-test. Finally, teens with more than 20 hours of practice driving were more likely to increase their intentions to follow the guidelines from pre- to post-test. No other outcomes were associated with practice driving.

**Video Game Experience.** The amount of previous video game experience varied widely across members of the sample. For the purposes of these analyses, participants were classified into two groups, experienced and inexperienced video game players. Experienced players included participants who reported playing video games weekly or more often (n = 15) and inexperienced players played video games less than weekly (n = 8).

All of the experienced players were boys. Compared to inexperienced players, the experienced players were 1.5 times less likely to report that they enjoyed the game. Experienced players were also 1.9 times more likely to increase their intentions to avoid risky driving behaviors, 6.5 times more likely to report increased perception of personal driving risks, 3.4 times more likely to increase in acceptance of driving guidelines, and 1.7 time more likely to increase in positive attitudes toward driving guidelines from pre- to post-test. The experienced and inexperienced players did not differ in their likelihoods of driving before they started driver education, or in awareness of driving risks.

Compared to the inexperienced players, the experienced players were more likely to reach higher missions. Seven of the experienced players (four to Mission 5 and three to Mission 6) and only one of the inexperienced players (Mission 6) got beyond Mission 4.

Regardless of video-game-playing experience, there were no differences in the aspects of the game participants liked best (the challenge for both groups); however, experienced players were more likely to indicate that the maneuverability of the cars was what they liked least about the game (35% [n = 5] for the high group, and 29% [n = 2] for the low group), or to indicate that they did not enjoy any of the Missions (27%, n = 4; inexperienced: 13%, n = 1). Finally,
compared to the inexperienced players, the experienced players were more likely to report being either “unlikely” or “very unlikely” to spend more time playing the game if given the chance.

Risk-Taking Propensity. High (n = 11) and low risk-taking propensity (n = 10; two cases with missing scores) groups were formed by dividing the sample at the median score of the risk-taking propensity scale. Surprisingly, girls (n = 4, 66%) in this sample were three times more likely to be in the high propensity group than boys (n = 6, 40%), and this may be a result of the very small numbers of participants in these groups. Participants in the high propensity group were 1.5 times less likely than the low propensity teens to experience an increase in their perception of personal driving risks from pre- to post-test. High and low propensity groups did not differ from each other on change in the intentions to avoid risky driving behaviors, awareness of driving risks, change in their levels of acceptance of driving guidelines, or change in their attitudes toward driving guidelines.

Driving-Risk-Taking. High and low driving risk groups were formed by dividing the sample at the median score of the Driving-risk-taking scale. Compared to the low group, participants with high driving-risk-taking scores were 1.7 times less likely to increase their intentions to avoid risky driving behaviors, two times less likely to increase their acceptance of safe driving guidelines, and 1.9 times less likely to adopt more positive attitudes toward driving guidelines.
Qualitative Results

Overall Reactions to Streetwise

While experience with video games and time spent playing video games varied widely, the majority of teens seemed to enjoy playing Streetwise and enjoyed talking about it, and providing their impressions and feedback. While most thought the game somewhat fun and at least not boring, a few claimed it was boring. This was not as clearly true of the last focus group. The last group was more negative about the game than the other groups had been, but this was plainly caused by a few outspoken, contrary members. Nevertheless, some teens did not feel that the game was much fun or very exciting. A few teens felt the game was childish and said they would have to be really bored to choose to play it.

Most of the teens said the video game was a helpful addition to the process of learning to drive. They were also mindful that the game was not for profit and primarily educational/informational in purpose and, therefore, could not be expected to match the quality of commercial entertainment games currently on the market.

Achievement of the Game's Goals

Increase Awareness of Driving Risks

A majority of teens (but not all) understood the driving risks caused by the distractions portrayed in the game, especially the potential distractions caused by passengers. For some, the game was harder with passengers. They do believe passengers are a risk, but they mentioned having heard that warning over and over. A few stated that limiting passengers is unrealistic, even impossible. They want their license so they can do things with their high school friends. That is why they want to drive. "Why else would you want it?" They felt that the other risks were less well portrayed.

Several teens agreed that trying to deal with the distraction tasks (i.e., drinking the soda) made it tough to concentrate on anything else. Overall, they felt the game did a "pretty good job of showing you the risks." One teen stated that the primary messages conveyed by the game were, "You must constantly pay attention to driving. Don't talk on the cell phone while driving or load up your friends, and night driving is harder."

The teens also said the game taught them about hazards that were new to them and that they "should pay more attention and be careful." One teen said the game brought out "watching the numbers of passengers and speed risk." Another noted "the eat and/or drink
A minority claimed to have learned nothing new about driving risks, but the game refreshed their memory. They said that they are bombarded with the same messages delivered by the game. Others said the game made them more aware of what could happen. The game "reminds you of other unpredictable objects, i.e. UPS trucks backing out. But dancing clowns are a bit far fetched. And UFO's don't really fit. It would help if you saw trucks actually swerving."

Several said the message for safety belt use was peppered throughout the game, but the messages were not very specific.

Some teens found it a lot harder and were slower to react in the night mission of the video game, while others said it was "still like just pushing buttons." When asked about alcohol messages in the game, respondents mentioned that you have to avoid other alcohol users, "there are more drunk drivers on the road at night." Some participants did not realize there was anything about alcohol in the game, probably because they had not reached that mission.

Many teens commented that the game helped their reaction time, but they were less clear about how well that would translate to real driving situations. An observer could have gotten the impression that some teens thought the game was enhancing their skill in dealing with the risks, rather than in learning about and understanding the risk. One even said the game "helps with multi-tasking" as though that had been the goal.

**Increase Acceptability of Guidelines During Early Driving**

The participants did not feel that the driving guidelines were portrayed well enough in the game. Some mentioned, however, that the game helped them to understand the rationale behind some of the state laws and their parents' guidelines for protecting new teen drivers from risk (i.e., passenger restrictions). One said it backed up how his mother always says “Do not distract the driver.”

**Increase Understanding that Driving Experience Must be Gained**

The value of practice was also not conveyed well by the video game, according to many of the participants. They felt that emphasis on the value of practice driving and gradually gaining experience before licensure could be highlighted more. They noted that practicing with parents was emphasized in the game, but not for night driving. However, some teens said that
the graduated skill levels across the missions put a clear emphasis on the importance of practice and experience in becoming a safe driver.

Grades for Streetwise Goals

At the end of the first focus group, one of the sponsors' staff shared the four goals of the game as: (1) entertainment, (2) education about driving risk, (3) guidelines to protect against risks and (4) the need for gaining driving experience. Each focus group participant was asked to give the video game a grade for how well each goal was achieved. The results of this rough grading (influenced, of course, by the group setting) follow:

Entertainment: Over half the participants gave the video game a B.

Education regarding risks: Nearly three quarters of the participants gave the video game a B or better.

Education regarding guidelines: Nearly a third gave the video game a B or better.

Education regarding driving experience: Nearly one half gave the video game a B or better.

Overall Educational Suggestions

Many teens had hoped the game could teach even more than it did about driving safely. Suggestions were made, such as having the game allow the players to buckle their seatbelts, adjust their mirrors, check their blind spots, etc., on their own rather than just in response to instructions. Many teens wanted more realism in the game, in the vehicles, the obstacles, the road hazards, and the need to perform certain actions, such as checking their blind spots while driving. In addition, many were surprised that they weren't allowed/required to control more of the car's movements.

Some teens commented that they didn't really need to think or make decisions in the game; all they needed to do was respond to the red arrows. They would have liked more decision control (i.e. the ability to turn the wrong way on a one-way street; the ability to choose and not be forced to wear belts). Consequences in the game could then be moderated by the decisions made by the player (i.e., they die in a crash, rather than just being injured).

An additional driving risk for teens that was suggested regarded regular brakes versus ABS brakes. Teens said they need practice with both types, but the game did not focus much on correct braking. In fact, the only braking allowed was hard braking that made the tires screech. Controlled braking was not included in the game.
They also wanted more realistic feedback (even injury) on the consequences of their driving errors (i.e., if they hit a pothole, they might have to change a tire, be delayed, or pay for the repair), as well as their score and reaction times. They suggested "adding a text message saying what happened to you (specifically) if you did not wear the safety belt, or if you hit the animal, etc. (specific injuries, details, and cost)." Many of the teens wanted more feedback on their driving ability, and felt it would be helpful if they were ranked relative to other players on their driving ability/performance in the game. However, one teen said feedback was not important; you learn by "picking it up" and you shouldn’t drive fast if you keep hitting trees. Finally, the scoring procedure for the game was not clear to the teens. Some said they didn’t even know how they earned their points in the game.

Many teens did not take the time to read the informational text boxes that appeared on the game's screen. They said the messages were "just factoids" (i.e. # of Minnesota deaths), and skipped them quickly to continue with the game, especially when they realized some of them were repeated. Other teens saw them, but were tempted to skip over them. One teen read them, but "already knew all of that stuff." It refreshed his memory, however. "The car stops so you will read message," but they still didn’t read it. When the moderator asked, "What would help you to read the message?" the teens responded, "If you had to do something to progress [like answer questions] so that you were forced to read them."

Specific Educational Suggestions

"It would be more realistic if obstacles were oncoming, not behind you."

"Top, middle screen is an area without much going on. You could add a mirror, so you can see behind you."

"For night-time driving, it would have been nice to have low and high-beam headlights."

"Add skill levels, street lights, headlights, mirrors, and receiving verbal driving directions."

"Map reading could be another skill level."

"Game could allow experience with what it is like to be driving drunk, with blurred vision, slow reaction times, etc. in order to get the message across."

"Various types of weather during driving scenarios would be educational."

"Four way stops are needed, with more traffic. Red lights, signs, and turn signals should all be added, as 'those mistakes can kill you.' Variation in the roadway type would be helpful, too."
"Tickets (police citations) should be issued, which you are penalized for by skill level."

"Add more traffic zones, such as construction zones where you can control the speed. Traffic zone it has slowed your car down."

"Making things more realistic would help; have opposite traffic leg of a 4-way stop."

"Include a mission for learning to drive. Allow user to be able to drive the car more."

"Model the mission like a city vs. rural, try various environments. Add blind corners with houses limiting your vision."

"You should be able to choose your risk level, and make bad vs. good decisions (i.e. pick up one guy, he says to go pick up his friend, you do it, or not)."

Several teens commented on the unlikely road hazards. They felt there were too many unlikely road hazards (toilet, piano from sky, clowns). Several said the crazy objects made the game less realistic, and they didn't like that. But they also said the game would not teach any better even if they were realistic, and the crazy obstacles offered minor entertainment value. The teens said the game is easier because you don't have to drive, and that the pop-ups kept them busy.

Technical Suggestions

There seemed to be some game features that only some teens figured out (i.e., how to increase speed). Only three out of eight in the first focus group realized the "up" arrow made you go faster. Some of the teens who were experienced and knowledgeable about video games were more interested in talking about the technical aspects of the game and ways to enhance it. Feedback on the game included some technical suggestions, for example, the desire for more control of the car (speed, handling). In general, they also wanted more realism in the vehicles and the obstacles/road hazards. Several specific suggestions follow:

"The patterns on each mission are always exactly the same; same obstacles come up at the same time each time. You need around five different versions of each mission which load randomly."

"Offer a 'quit mission' option."

"Interface could be set up so that there would be arrows to move you in a direction. Or you could use the number pad to do certain functions (i.e. "Squirrel Combat" is an entirely keyboard based game)."

Tones for maneuvers: "If they varied by each of the four arrows, it would have helped get the hand to block the sound."
"After you were out of the first level, you didn't need to use the turn signal any longer; it was only necessary while with Mom in the car. You should have to use it all of the time."

"Need more first-level car options." They want to drive different cars in both handling and color (a black car and pickup truck were suggested).

Teens wanted more car control. For example, the game always picked up the same people, and did not allow the player any choice.

"Interface and game did not get more complicated with time or obstacles."

"There was a speedometer on the screen, but you could hardly control it. Having control of speed would make it better and more challenging."

"Adding sound information to the game would make it harder, causing you to go through an obstacle."

Teens suggested making the handling of the vehicles more realistic, and felt that would make the game more fun. They also noticed no change between vehicle types in handling or control. "Include a pickup truck. Have the Neon skidding." "Game needs to have different types of cars to choose, which work and drive different by model."

"Game needs lead time for deer jumping out, driveway pull-outs, and UFO."

"Including a van, which you could fill with passengers, would make the game harder."

"Label the streets. Include more traffic interaction, like another car going through the light against their turn."

"It would be better if you could do more than one function at one time, like using two keys for stopping and turning."

"Would like not to have to pick up the little sister!" That left one teen hanging, wondering what was going on.

Feedback on driving, points adding up quick, or winning fake money would be good.

"Have an indicator so that if you hit a deer, you have only so much more 'car health' left, or if you popped your tire into a pot hole, it would reduce it."

"If arrows and cell phone you have to click on were in a more unpredictable place, it would make it more difficult."

"Friends need to be more annoying, trying to take wheel away. They are noisy in game, but are easy enough to tune out."

Some teens thought it would help if they saw trucks actually swerving, or swaying.
"It would be better if you could speed up," but for those who figured out that you could, you could then only slow down to a certain point. One teen said he heard a cop’s siren on the screen after speeding up.

Maneuvering “around” puddle (or other objects) was not very accurately controlled.

The game should include traffic lights, other traffic, and people walking or construction workers in more appropriate places.

Some said they read the pop-up bubbles, but some did not, in part because sometimes the bubbles said the same thing. One teen said it was hard to read the conversation bubbles at the bottom of the screen and they seemed irrelevant to the game, so he ignored them. A few teens said if bubble statements were verbal, it would be better, and the verbal statements could serve as another distraction.

Technical Problems

The teens did not like that they could not correct mistakes in level selection. Once they had selected a wrong level (i.e., the same one they just completed, because the game does not automatically advance you when you succeed at a level), they could not go back to select the next level without playing the same level again.

One left-hand player had a tough time with the interface. He said he switched mouse with keyboard, but he had problems with that arrangement that led him to repeat the third level twice.

One teen thought the mouse was "kind of hard" to use, and wished you could use the "enter" key.

One teen picked a car, went on to the next one and somehow skipped a screen. As a result Mission 1 had to be repeated three times.

Graphics were overlapping (briefly at end of session).

Keys didn’t work as they should. For example, tapping the key didn’t work.

Future Use of the Game/Recommendations

Participants thought that the video game would be helpful to teens who were in the process of learning to drive, having just started driver’s education, or doing their practice driving. This was because “It improves reaction time,” and, “The facts stop you, and the quizzes in the beginning give you useful theory.” Others recommended that teens play the game before Segment 1 driver’s education and before Segment 2 and while holding a Level 2 license. “By 16 you are living the game.” Younger is better, and it was suggested that perhaps the Segment 1 driver’s education class instructor could recommend the game to the students. One boy said
any time before or after Level 2 licensed driving (independent) is good. He felt the game would be particularly helpful to those who have only driven a little. The focus group that was most negative about the game thought it was for young children or those in middle school, but they agreed that it is uncertain if kids who played the game so long before taking driver education would remember the material later when they were learning to drive.

Many of the teens said they would enjoy competing with other people via the internet. They thought that would make the game more fun. But some were not interested in challenging others, and some felt the game was not challenging enough to really promote or sustain competition.

Communication with Teens

In general the participants said they thought that a video game was a good, if not the best, way to communicate with them. They said that video games are more interesting and engaging than other modes of communication. They said they felt video games were a good way of getting their attention, although a few said that they would have preferred written material. But while the teens generally expressed that a video game was a good teaching method, they said they did not think it was the ideal method for conveying information. The most negative participants said they don’t want to learn when they play video games. They said they play video games for fun, not education, and that they already "hear about it all too much." Finally, another teen commented, "The video game is not the right tool to eliminate risks, but it did inform."
Evaluators' Comments on the Results

Change in Perceptions, Intentions, Attitudes, and Acceptance

The video game appears to increase perceptions of personal driving risk. The change in this variable from pre- to post-test was relatively robust, in spite of having a small sized effect. However, there was not evidence that the game influenced overall intentions to avoid risky driving behaviors, attitudes toward driving guidelines, or acceptance of driving guidelines. This lack of effect may have been partly due to the impression highlighted in the focus group sessions where some of the teens pointed out that information about driving guidelines and their importance was not directly conveyed through playing the game. Instead, much of that information, with the notable exception of limiting teen passengers, was provided indirectly through the use of pop-up text boxes. The information in these boxes was largely disregarded by the teens, who felt they were mere “factoids.” Integrating the guidelines more fully into game play may help address this issue, as might implementing the suggestion that the game offer more choices and report consequences based on those choices as well as on driving behavior.

Tying the guidelines more directly to game play activities would only address the lack of effect on attitudes and acceptance, and would not address the lack of an effect on intentions to avoid risky driving behaviors. While increasing teens’ perceptions of driving risks is important, unless it is coupled with appropriate intentions, it will not help reduce the risk of motor vehicle crashes. Drawing from the focus group feedback, it would help the teens develop an appreciation of the real-life consequences of events depicted in the game if the following changes were made: 1. More information was given on the realistic consequences of the crashes that occur in the game (e.g., cost of car repair, points for a ticket and increase in insurance costs, likelihood that the person would have been slightly injured, injured and taken to the hospital for ambulatory care, injured seriously with a stay in the hospital, injured permanently, or killed); 2. Feedback was given on the effect that the driver’s choices had on the results of the crash (e.g., speeding made it worse, not wearing a seatbelt cost a driver his/her life); and, 3. More player control over certain aspects of the game (e.g. choice to wear a seatbelt, choice to follow posted speed limits). This feedback might help teen drivers to understand the importance of taking action to reduce their driving risk and to actively avoid unnecessary risks.
Game Enjoyment and Engagement

The teens enjoyed the game, overall. Most of the participants reported a mission that they liked best, a small minority said they did not like any of the missions. Some teens said they would be likely to recommend the game to a friend, but this response was more common for boys than for girls. This difference may be due to the greater popularity of video games among boys than girls and may not relate to their enjoyment of the game, per se. This finding raises questions about the effectiveness of the game to engage teenage girls to the extent needed for the intended effects. Also, the majority of the teens stated that they were either indifferent or were unlikely to spend more time playing the game if given the chance, and the experienced video game players indicated that they were unlikely to recommend the game to a friend. This finding also raises concerns over engagement and having sufficient interaction with the game to benefit from playing it.

Players who advanced further in the game were more likely to show positive changes. Therefore, it seems that the players must be sufficiently engaged so that they play the game long enough and progress far enough to benefit from the information conveyed by the game. This is evidenced in part by the greater positive effects seen among the experienced game players who, even though they were less likely to report enjoying the game, were more likely than inexperienced players to increase in perceptions, intentions, attitudes, and acceptance from pre- to post-test. This may identify a potential barrier that will limit the benefit of the game to less experienced players, including girls. In order to have a generalized positive effect, the game will need to appeal highly enough to inexperienced and female players to ensure that they play long enough and progress far enough to benefit from the game.

Demographics and Potential Confounds

White teens showed improvement in perceptions, intentions, attitudes, and acceptance, while the Asian-American teens were less likely to report any effects of playing the game. Further analyses were conducted to determine if this was due to pre-existing differences between these groups. The Asian-American and White teens were compared on their pre-test perceptions, intentions, attitudes, and acceptance. These comparisons showed that at the pre-test the Asian-American teens had higher scores on perceptions, intentions, attitudes and acceptance, with Cohen’s effect sizes ranging from 0.43 for acceptance of driving guidelines, to 1.3 for perception of personal driving risk. While the White teens increased on these measures
from pre- to post-test, the Asian-American teens maintained their already high levels on these variables.

Younger teens were more likely than older teens to benefit from playing the game. While this finding supports the focus group recommendations that the game would be more appropriate for people who are in the early stages of learning to drive, it is not supported by other quantitative results indicating that more practice driving was associated with greater game effects. Overall, these somewhat contradictory quantitative results, along with the focus group recommendations may suggest that the game has something to offer for both younger, less experienced drivers, and those who have had more practice driving.

Marks in school were not associated with the game outcomes. This is probably good news, as it suggests that the game may be equally beneficial to teens that vary in their academic performance, rather than being limited in its effectiveness. However, it is worth remembering that the lowest achieving participants reported getting mostly C’s in school, and that the poorest performing students were not represented in this sample.

Rural teens were less likely than those living in town to increase in positive attitudes toward driving guidelines and perception of personal driving risks. Further analyses indicated that rural teens also had less positive attitudes than teens living in town before they played the video game (Cohen’s effect size = 0.41). This was not the case for perception of personal driving risk. Teens living in rural areas and in town did not differ in their perceptions on the pre-test survey, but the teens living in town were more likely to increase their perceptions from pre- to post-test. Further analyses also indicated that this difference was not due to the rural teens having greater driving experience than teens living in town prior to playing the game. One potential explanation of this difference in effects may be that the rural teens were all inexperienced video game players. This, again, raises questions about the issue of engagement.

Driving experience prior to beginning driver education was not associated with any of the outcomes. This finding is good, suggesting that prior driving experience does not lessen the game effect and that teens, regardless of prior experience, are equally likely to benefit from playing the game.

Risk-Taking

Several differences were found between high and low risk-taking propensity groups on the game outcomes, but some of these differences are counter intuitive. Compared to low risk-
taking propensity teens, the teens in the high propensity group were simultaneously more likely to report that they will avoid driving risks, and less likely to report increases in their intentions to avoid risky driving behaviors from pre- to post-test. One explanation of these apparently opposing effects may be the marginal size of these effects, which barely reach the 1.5 minimum value for accepting an effect in this study.

High driving-risk-taking teens were uniformly less likely to increase their perceptions, intentions, attitudes, and acceptance from pre- to post-test. This pattern is not uncommon among brief interventions. Generally, regardless of the target behavior or the method of the intervention, brief interventions are not sufficient to change the behavior of individuals who have the highest levels of risk. Therefore, it may be unreasonable to expect a video game intervention to alter the perceptions, intentions, attitudes, and acceptance of teens for whom taking driving risks is appealing.
Limitations

Several limitations to this study should be kept in mind when interpreting the results. First, the sampling method relied entirely on convenience. It was not random – participants were not recruited in a manner to ensure that the sample was representative of all teens learning to drive. This was due to an extremely short study time-frame. This sampling method is completely open to, and may even promote, certain sources of selection bias. For example, those who participated may have been systematically more likely than other teens in the population to enjoy and be interested in video games, be more altruistic or more socially aware and willing to help out or contribute, understand the importance of the topic of the evaluation, etc. The characteristics of this sample suggest that some selection bias was at work, as the teens in this study had good grades and, overall, were very risk-averse. These characteristics suggest that the results of this evaluation may not apply to teens that do poorly in school, and/or are more risk-inclined.

Another major limitation of this study was the small sample size. In addition to being a convenience sample, this study only included 23 participants. This small sample in combination with the method to recruit participants, further limits the chance that the sample could be used to represent the population of teen drivers taking driver education. It is also decreases the ability of statistical tests to identify game effects that were real but too small to identify in a small sample. The effect of the small sample size was especially apparent in the general lack of statistical significance in cases where effect size estimates suggested a large game effect, and in the large number of small or empty cells in the cross-tabulations.

Finally, the evaluation design was weakened by several characteristics. First, the post-test was given within an hour of the pretest. The proximity of the two surveys increases the chance that observed response patterns were due to social desirability, learning, and/or practice. The teen participants, who were not blind to the study purpose, may have remembered how they responded on the pre-test, and consciously or unconsciously given the desired responses on the post-test. Hence, the observed effects may not have been entirely due to the game.

Second, a single post-test was given immediately following the video game play session. This makes it impossible to guess about the longevity, or lack thereof, of the video game effect on the evaluation outcomes. In addition, it is not possible to make inferences about any effect the game might have had on subsequent teen driving behavior.
Third, there was no control group condition against which the effects of the video game could be contrasted and judged. As a result, observed game effects cannot be compared to the effects of a control condition on changing perceptions, intentions, attitudes, and acceptance.
Evaluators' Recommendation

The results of this evaluation were positive and encouraging. They suggest that video games might be an effective means of reaching teens with important messages about public health issues, such as traffic-related morbidity and mortality among young drivers. These results also raise a variety of intriguing questions about Streetwise and how it might be employed to help keep teen drivers safe. Based on these positive results, the evaluators recommend that the results of this study be treated as preliminary evidence of the video game's effectiveness, and used to guide the design of other studies that strategically sample, track, and measure participant outcomes to determine the effect of the full Road Ready Teens program on driving-related outcomes, parent-teen interactions around teen driving and learning to drive, and the effects of this program on the actual driving outcomes of teens during their driver training and beyond. The Social and Behavioral Analysis Division of the University of Michigan Transportation Research Institute would be pleased to offer assistance with the development and execution of further investigations into the Road Ready Teens program.
References


Evans L, Wasielewski P. Risky driving related to driver and vehicle characteristics. Accident Analysis and Prevention, 15, 121-136. 1983.


Jonah BA. Age differences in risky driving. Health Education Research, 5, 139-149. 1990.

Jonah BA, Dawson NE. Youth and risk: age differences in risky driving, risk perception, and risk utility. Alcohol, Drugs and Driving, 3(3-4), 13-29. 1987.


Peck RC. The role of youth in traffic accidents: a review of past and current California data. Alcohol, Drugs and Driving, 1, 45-68. 1985.

Wasielewski P. Speed as a measure of driver risk: observed speeds versus driver and vehicle characteristics. Accident Analysis and Prevention, 16, 89-103. 1984.


Appendix
Pre- and Post-Test Surveys
The University of Michigan
Transportation Research Institute
Road Ready Teens Video Game Pre-Test Survey

i. ID Number

ii. What time is it now?

1. Since you began driver education classes, how much time have you spent practice driving?

0 I haven’t started driver education classes
1 1 to 30 minutes
2 31 minutes to 1 hour
3 1 to 2 hours
4 3 to 6 hours
5 7 to 10 hours
6 11 to 20 hours
7 21 to 30 hours
8 31 to 40 hours
9 41 to 50 hours
10 More than 50 hours

2. Please, indicate how much you agree or disagree with each statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Guidelines that limit my driving do not reduce my chances of being in a car crash.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2 My driving gets better as I get more driving experience.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3 Making a written agreement with my parents about my early driving is a bad idea.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4 Driving for 50 hours with an adult will not help me learn to drive better.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5 Limiting how much I drive at night decreases my chances of being in a car crash.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>6 Driver education classes are a waste of my time.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7 Limiting the number of teens riding in my car when I am driving reduces my risk of being in a car crash.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>8 I am willing to accept and follow driving guidelines that are designed to keep me safe as I gain driving experience.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>9 It is not important to wear my safety belt if I am only driving a short distance.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>10 I am at greater risk of being in a car crash if I drive after drinking even a little alcohol.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11 Limiting distractions won’t reduce my risk of being in a car crash.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
3. About how often did you drive before taking any driver education classes?

0  Never
1  A few times – One to six times
2  Several times – Seven to 12 times
3  Occasionally – Once or twice a month
4  Often – Weekly
5  Regularly – A few times a week
6  Frequently – Almost daily
7  Daily

4. While you are gaining driving experience, how likely are you to:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Not at all</th>
<th>A Little</th>
<th>Somewhat</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid talking on a cell phone while driving</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Drive fast through a construction zone</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Limit driving after dark</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Drive after drinking alcohol</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Always wear a safety belt</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Have one or more teenage passengers in the car with you when you are driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Avoid eating while driving</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Drive late at night</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Ignore guidelines that limit your driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

5. How far have you advanced in the graduated driver licensing (GDL) program?

1  I haven’t begun driver education
2  Currently taking Segment 1 driver education classes
3  Level 1 – supervised learner’s license
4  Currently taking or have taken Segment 2 driver education classes
5  Level 2 – license that limits nighttime driving
6  Level 3 – license with full driving privileges

6. How willing are you to accept each of the following driving guidelines as you gain driving experience?

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Not at all</th>
<th>A Little</th>
<th>Somewhat</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never drive after drinking alcohol</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Always wear a safety belt</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Always limit the number of teen passengers in the car when driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Maintain a clean driving record (no tickets)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Always drive the speed limit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Keep music at a level that allows me to hear traffic, horns, and sirens when I am driving.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Limit driving after dark</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Never eat while driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Obey all traffic laws</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Never talk on a cell phone while driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
7. What is your race?

1. African American
2. Asian American
3. Caribbean Islander
4. Latino/Hispanic
5. Native American Indian
6. Pacific Islander
7. White

8. Please answer true (the statement is true of you) or false (the statement is not true of you) to each of the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Before I begin a complicated task, I make careful plans.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2. I would like to take off on a trip with no preplanned or definite routes or timetables.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3. I like to have new and exciting experiences and sensations even if they are a little frightening.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4. I usually think about what I am going to do before doing it.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5. I would like the kind of life where one is on the move and traveling a lot, with lots of change and excitement.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>6. I sometimes like to do things that are a little frightening.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7. I very seldom spend much time on the details of planning ahead.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>8. I enjoy getting into new situations where you can't predict how things will turn out.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>9. I sometimes do &quot;crazy&quot; things just for fun.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>10. I like &quot;wild&quot; uninhibited parties.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>11. I like to explore a strange city or section of town by myself, even if it means getting lost.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>12. I often get so carried away by new and exciting things and ideas that I never think of possible complications.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>13. I like doing things just for the thrill of it.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>14. I am an impulsive person.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>15. I'll try anything once.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>16. I tend to begin a new task without much advance planning on how I will do it.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>17. I often do things on impulse.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>18. I prefer friends who are excitingly unpredictable.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>19. I tend to change interests frequently.</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

9. When were you born?

month / day / year

10. In what area do you live?

1. Rural (in the country)
2. In town (in a neighborhood)
11. BEFORE taking driver education classes, what kind(s) of vehicle(s) had you driven?

(mark all that apply)
0 I never drove before starting driver education classes
1 Car/Minivan/SUV
2 Pick-up truck
3 Full-size van
4 Farm truck (larger than a pick up)
5 Motorcycle
6 Tractor
7 Three- or four-wheeled ATV
8 Riding mower or garden tractor
9 Other: ________________________________

12. While you are gaining driving experience, how much does each of the following increase YOUR risk of being in a car crash?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Not at all</th>
<th>A Little</th>
<th>Somewhat</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Eating while driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2 Driving after dark</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3 Driving 20 mph over the limit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4 Driving after midnight</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5 Talking on a cell phone while driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6 Driving without wearing a safety belt</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7 Driving 10 mph over the limit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8 Driving after drinking alcohol</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9 Having one or more teen passengers with me in the car when I am driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

13. How much do you expect to do each of the following?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Not at all</th>
<th>A Little</th>
<th>Somewhat</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Taking risks just for the fun of it while driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2 Driving fast down country roads at night</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3 Driving 20 mph or more over the speed limit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4 Weaving quickly through traffic on the freeway</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5 Testing your driving skills in ways others might find risky</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6 Making the car fishtail on gravel or icy roads</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7 Seeing how fast you can drive out of curiosity</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8 Driving dangerously because you enjoy it</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9 Taking some driving risks because it feels good</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10 Racing or playing cat and mouse with people who are driving other cars</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11 Trying to beat other drivers leaving a stoplight</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12 Out-maneuvering other drivers for the thrill of it</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

14. What is your sex?

1 Male
2 Female

15. What grade will you be in this fall?

1 Freshman – 9th grade
2 Sophomore – 10th grade
3 Junior – 11th grade
4 Senior – 12th grade
iii. *What time is it now? ________*
vi. ID Number __________

vii. What time is it now? ________________

1. How much did you enjoy playing the video game?

   4 A lot
   3 Quite a bit
   2 Some
   1 A little
   0 Not at all

2. What was the highest mission you reached in the video game?

   1 Mission 1: “Mom’s Gauntlet” Driving Mom and little sister around town
   2 Mission 2: “Driving with Friends” Dealing with passenger distractions
   3 Mission 3: “King of the Neighborhood” Neighborhood hazards and rural driving
   4 Mission 4: “Night Driver” Driving at night
   5 Mission 5: “Bad Weather” Driving in stormy weather
   6 Mission 6: “Drink Drivers” Being a designated driver and avoiding drunk drivers

3. Which of the following did you like best about the video game?

   1 Character options
   2 Graphics
   3 Sound
   4 Challenging scenarios
   5 Car options
   6 How maneuverable the vehicles are
   7 Other: ____________________________

4. How likely would you be to recommend this video game to your friends or classmates at school?

   5 Very likely
   4 Likely
   3 Neither likely or unlikely
   2 Unlikely
   1 Very unlikely
5. While you are gaining driving experience, how much does each of the following increase your risk of being in a car crash?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Not at all</th>
<th>A Little</th>
<th>Somewhat</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving after drinking alcohol</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Driving after dark</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Driving without wearing a safety belt</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Having one or more teen passengers with me in the car when I am driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Eating while driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Driving after midnight</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Talking on a cell phone while driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Driving 10 mph over the limit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Driving 20 mph over the limit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

6. Of the missions you completed, which did you like the most?

1. Mission 1: “Mom’s Gauntlet” Driving Mom and little sister around town
3. Mission 3: “King of the Neighborhood” Neighborhood hazards and rural driving
4. Mission 4: “Night Driver” Driving at night
5. Mission 5: “Bad Weather” Driving in stormy weather
6. Mission 6: “Drink Drivers” Being a designated driver and avoiding drunk drivers
7. I didn’t like any of them

7. Which of the following did you like least about the video game?

1. Character options
2. Graphics
3. Sound
4. Challenging scenarios
5. Car options
6. How maneuverable the vehicles are
7. Other: __________________________

8. How likely would you be to spend more time playing the video game?

1. Very unlikely
2. Unlikely
3. Neither likely or unlikely
4. Likely
5. Very likely

9. While you are gaining driving experience, how likely are you to:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Not at all</th>
<th>A Little</th>
<th>Somewhat</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid talking on a cell phone while driving</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Drive after drinking alcohol</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Drive late at night</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Limit driving after dark</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Avoid eating while driving</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Drive fast through a construction zone</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Ignore guidelines that limit your driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Always wear a safety belt</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Have one or more teenage passengers in the car with you when you are driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
10. How much did the video game help you better understand the risks that new drivers face?

1. Not at all
2. A little
3. Some
4. Quite a bit
5. A lot

11. Please, indicate how much you agree or disagree with each statement.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Limiting the number of teens riding in my car when I am driving reduces my risk of being in a car crash.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>My driving gets better as I get more driving experience.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Driver education classes are a waste of my time.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>I am willing to accept and follow driving guidelines that are designed to keep me safe as I gain driving experience.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>It is not important to wear my safety belt if I am only driving a short distance.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Limiting distractions won’t reduce my risk of being in a car crash.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Driving for 50 hours with an adult will not help me learn to drive better.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>I am at greater risk of being in a car crash if I drive after drinking even a little alcohol.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Limiting how much I drive at night decreases my chances of being in a car crash.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Making a written agreement with my parents about my early driving is a bad idea.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>Guidelines that limit my driving do not reduce my chances of being in a car crash.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

12. How willing are you to accept each of the following driving guidelines as you gain driving experience?

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A Little</th>
<th>Somewhat</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Always drive the speed limit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Never talk on a cell phone while driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Limit driving after dark</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Maintain a clean driving record (no tickets)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Never eat while driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Always wear a safety belt</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Never drive after drinking alcohol</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Keep music at a level that allows me to hear traffic, horns, and sirens when I am driving.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Always limit the number of teen passengers in the car when driving</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Obey all traffic laws</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
13. After playing the video game, how much more aware were you of the risks you face as a new driver than you had been before playing the game?

1. No more aware
2. A little more aware
3. Somewhat more aware
4. Quite a bit more aware
5. A lot more aware

14. What are your typical marks in school?

1. Mostly A’s
2. Mostly A’s & B’s
3. Mostly B’s
4. Mostly B’s & C’s
5. Mostly C’s
6. Mostly C’s & D’s
7. Mostly D’s
8. Mostly D’s & F’s (E’s)
9. Mostly F’s (E’s)

15. Are you more likely to protect yourself from driving risks as a result of playing the video game?

1. Yes
2. No

16. How much time do you spend playing video games?

0. None
1. About once or twice a year
2. A few times a year
3. About once a month
4. A few times a month
5. About one day a week
6. A few days a week
7. Once every day
8. Several time a day

viii. What time is it now? ________
Focus Group Moderator’s Guide
Focus Group

Road Ready Teens Video Game

Moderator's Discussion Guide

1- What did you think of the video game? How much fun was it?

2- Would you want to play the game again, or play more of it? What about the game makes you want to or not?

3- How much fun would it be to compete with other players on the Web? Reasons?

4- What did you get out of the game about teen driving?

5- How much have you thought about the driving risks you'll be facing and your own safety? How much more aware of the risks are you after playing the video game?

6- How did the game help (or not help) you understand the driving risks that teens face? What did you find new or interesting?

   How could the video game be changed to be more clear about specific driving risks?

7- How did the game help (or not help) you understand guidelines for protecting teens from driving risks? (gradual exposure, practice, night, passengers, alcohol, safety belt, distractions) What information did you find new or interesting?

   How could the video game be changed to be more clear about guidelines to protect teens from driving risks?
8- Are there other driving risks or guidelines for teens that should be included?

9- How do you think playing the game would help other young drivers understand the driving risks they face? And the steps they could take to reduce the risks?

10- Who do you think should play the video game? (pre-driver ed, in driver ed, post driver ed)

11- Would you recommend this game to friends or classmates? Why or why not?

12- What could be changed that would make the game the more fun to play? More helpful regarding teens’ driving risks and guidelines to reduce those risks?

13- Is there anything else you'd like to share about your experience today with the video game?

14- Is the video game a good way to communicate with you? How would it compare to a video? Pamphlet? Book?

15- Should organizations consider video games as they endeavor to communicate with you?

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The Booze Cruise: Impaired Driving in Virtual Spaces

In January 2007, the University of Calgary offered the first Canadian course in Serious Game Development.\textsuperscript{1,2} Computer Science 701.03 was officially a high-level graduate course, but it included participants from the arts and interdisciplinary studies at senior undergraduate levels. The course evaluation was based on a game project. The class selected a simulation of impaired driving, and called it the Booze Cruise. Before embarking on the simulation, we consulted with the Calgary Police Service. Its alcohol unit was keen to help and gave a summary of the what and why of accident types related to alcohol consumption.

Impaired driving is a serious problem and a preventable cause of death and injury. Private and public health organizations are always seeking better ways to reach the public with the message that drinking and driving is dangerous and socially irresponsible. When we announced the game in October 2007, the media response was huge (see Figure 1). The game also won the best student game and people's choice categories in the FuturePlay 2007 Conference's games competition that year (www.futureplay.org). In this article, we summarize the game's design process and development stages. We also look at media responses, which are still active.

Booze Cruise Design

The course began with no predefined project. The original idea for the Booze Cruise game emerged from scrums held during the first two weeks of the semester with the entire class, which consisted of four computer scientists and two artists. After proposing and discarding a handful of ideas, the team focused on a game about drunk driving for three main reasons:

- many in the group had some experience with an accident or injury caused by an impaired driver;
- impaired driving is a high-profile problem being addressed by police groups and nongovernmental organizations, such as Students against Destructive Decisions (SADD); and
- a software base was available from professor James R. Parker's book, Start Your Engines: Developing Driving and Racing Games.\textsuperscript{3}

From the scrums, we generated a concept design document outlining the game play, assets, and interface. Because the development time was restricted to one semester (13 weeks), we decided to use the simple driving-game engine that Parker built for his book.\textsuperscript{3}

The game description in the concept design document is simple: The player wakes up in the trunk of a car after a lot of drinking and tries to drive the car home. The backstory concerning how the player ended up in the trunk is irrelevant to the game description, but the fact that the player is still legally impaired is essential. The player's drug alcohol is simulated at 0.25, roughly three times the legal limit. The game gives the player 90 seconds to get home. The route includes pedestrians, traffic, police cars (a check stop), and animals. Observations of game play over a six-month period showed that the chance of getting home within the time frame is small.

Real-World Design Considerations

While part of the computer science team worked on tailoring the game engine code, the remainder arranged to meet with the Calgary Police Service's alcohol unit. We wanted to keep the game grounded in reality and decided that if any group would understand alcohol's effect on a driver, the police alcohol unit surely would.

The police initially seemed amused and perhaps unconvinced at the prospect of a video game based on impaired driving. They were nonetheless very helpful and provided information essential to the game's technical design. In particular, they gave three fundamental effects of alcohol on a driver that could be simulated in a game.

First, the police quantified the reduction in human reaction time that accompanies alcohol consumption. People lose 0.15 seconds of reaction
time for each standard drink consumed. On the basis of this information, we added a time delay to the interface design. This delay occurs between the time a player types a key to control the vehicle and the time the command is implemented. This is the most obvious game play feature, according to all the players we’ve observed.

Second, the police interviews suggested that people who have been drinking see bright lights against a dark background as blurred. We addressed this issue by adding a visual halo around bright lights. This was easy to implement, but we decided to enhance the effect by setting the game play at night. This is also the time when impaired drivers are most likely to be on the road.

Finally, the police noted that vision tends to blur as a function of blood alcohol content. This effect is most pronounced in moving objects, especially when the driver moves his or her head. This turned out to be the most difficult aspect of impaired driving to simulate. It required the use of the pixel shader in OpenGL, which lets developers program the graphics card.

**Visual Design**

The concept design document specifies generalities about game play, leaving its look and feel for the next development stage. The artist team members addressed these issues in the lab.

The game was planned as a 3D drive home, taking place in an urban environment to give a richer visual presentation and permit a greater number of possible obstacles for the driver. We drew a map showing the route and surrounding spaces. However, we felt that a single 2D rendering couldn’t represent the environment properly, so we constructed a physical model of the play area, as shown in Figure 2.

**Random Latency**

Players can learn to deal with a fixed time delay similarly to the way they learn to deal with the lag from latency in network games. To make the Booze Cruise delay more difficult to manage, we added randomness in the steering and acceleration delays. It’s easy to imagine that drivers are less precise in their movements, depending on the quantity of alcohol absorbed, which makes this random effect a simulation.

**Audio Design**

The development team had music industry connections, which is how the initial version of our game came to include a musical composition called “Traffic” from Gloom Room, an Edmonton band. However, as demand for distribution arose, avoiding licensing fees became important. We therefore composed our own music tracks using the commercial software FL Studio. (The music is available for download at www.minkhollow.ca/Studio/mhstudio.html.)

We selected OpenAL as the audio display mechanism. Unlike alternatives such as DirectX, OpenAL isn’t associated with a particular platform, which makes the game more portable. This selection also avoids the complexity of using the Component Object Model interface in a rather small game. OpenAL has an easy-to-use audio display interface. It implements positional sound and mixes game sounds in real time during play.

The game uses a large collection of voice files to urge the player on while driving, so the programmers appreciated OpenAL’s simplicity and effectiveness. We distribute an OpenAL install script with the game for players who don’t have it installed already—likely a majority of players.
Implementation: Simplicity Is Key
As we stated earlier, Parker's game-programming textbook provided the basis of our system implementation. The book gives programs for moving a simple object about a 3D surface under user control, but we had to add programs for collision detection, the user interface, and importing the artistic assets such as sound and the splash screens that appear at the beginning and end of the game. (Splash screens give players information about the game, such as rules, and let them specify parameters, such as their weight and name. Because the time frame for development was limited, we had to devise a simple, yet effective development protocol.

User Interface: Boozification
The process for making the user interface appear as if the user had been drinking became known as "boozification" within the group. It was the focus of a good deal of experimentation.

The user input to the game consists of key presses. The arrow keys control acceleration, braking, and left/right steering. Instead of being passed to the software immediately, users commands (key presses) are saved in two circular buffers: one for steering and one for acceleration. The game runs at a fixed 30 frames per second. During each iteration, the user interface interprets all buffer commands for the next 0.033 seconds in temporal order. So, when the user presses a key, the software calls a function (drunk_delay) that determines the precise time to apply the associated command and then places the command into the buffer for that time.

Every time the player takes a drink, it increments the variable delay_base, which represents the mean-time delay caused by blood alcohol content, 0.15 seconds per drink. This is obviously a simplification. To this delay, we add a random value between 50 and 150 percent of delay_base, making the delay unpredictable.

For example, in the case of one drink, the total delay is between 0.075 and 0.225 seconds with a mean of 0.15 seconds (50 to 150 percent of delay_base). In addition to changing the moment when the command is effected, the system also changes the command's value in a similar way. We're talking about seconds, but the program functions actually return values as a number of frames, and each frame is supposed to be 0.033 seconds long. The program rounds the values to fit a frame boundary, but it runs at different speeds on different computers. So, at the start of each loop, we calculate the time spent during the previous one. That gives a better delay value. Otherwise, the driving simulation would prove impossible on a slow computer.

We can't really know if the simulation is true to life—first, because we didn't rely on the results of players who were actually impaired and, second, because alcohol's effects vary from person to person. The first two screens ask players for their sex, their weight, and the number of drinks they're pretending to have consumed. The game computes a blood alcohol content (BAC) value from this data and determines the basic delay. The vision blur is harder to figure, but it is also a function of BAC. As in all video games, the issue is to make things appear to be correct rather than to make them literally correct. We implement the blur using a pixel shader program, so the game depends on the player's graphics card having a proper OpenGL implementation.

Figure 3 shows two user interface screens from the Booze Cruise.
Camera
The camera's position relative to the car is not fixed. As with most driving games, the camera is positioned above and behind the car, and its height increases with speed. Unfortunately, the random motions introduced by the boozification process cause jerky camera movements that are quite distracting.

We solved this problem by computing the camera's position based on the car's average speed over the previous 15 frames. This moving-average technique is common enough in driving games, but it's essential in the Booze Cruise.

Collision Detection
An important aspect of any real-time game is collision detection. For the Booze Cruise, we again took a simple approach, using a lookup table of object locations. The system identifies collisions by looking up the vehicle's x and y coordinates in the table. Depending on the value (0 or 1), the car will have collided with a stationary object or not. If a collision takes place, then a simple bouncing mechanism returns the car to the course.

The need for simplicity inspired this algorithm, which checks squares around the vehicle's current location in the lookup table until it finds a free square or reaches a maximum radius of five squares. Although this method leaves something to be desired in terms of realism in ricocheting off walls, it works well enough for this particular game's purpose, and it's fast.

The Booze Cruise populates the lookup table by reading in a map file at the game's start. This file specifies the location of fixed objects as 1 or 0 in 2D, indexed by position. This loading approach makes it easy to change the course layout by simply modifying the map file and (for aesthetic reasons) the ground texture map.

One limitation of this method is that the collision detection begins to fail as the frame rate decreases. This results from the car moving so far in one frame that it goes outside the bouncing radius and can no longer find the road. If the frame rates remain sufficiently high, this limitation doesn't cause problems during actual game play. However, they might show up if the game is running on a slow computer.

Implementation Results
Our first implementation of the game was saddled with a long startup time. Reading and parsing the large number of object models, textures, and sound files took up to 45 seconds—a large fraction of the whole program's 2 minutes total running time. Ultimately, we solved this problem by loading all the objects and then writing the in-memory image to files. The program could map these files directly onto object structures, reading the files quickly with no need to parse. In this way, we reduced the startup time to a few seconds.

Players felt comfortable with the keyboard interface. The arrow keys form a standard driving-game interface, which is a key aspect of the game. We could use one of the USB steering wheel/pedal interfaces available at many electronics stores. These tend to generate key presses as their interface to the game, and the Booze Cruise mapping is exceptionally simple.

The combination of simplicity in implementation and practical design was wildly successful. The development team received support from both the Calgary Police Service and the University of Calgary's Dean of Fine Arts, and a dozen media outlets attended the game's initial public release. Media requests for interviews continued for a week, resulting in more than 20 requests for copies of the game by police agencies, schools, and groups like SADD.

One interesting issue arose from this media attention. Some reporters and a caller to an open-line radio program suggested that people could use the game to learn how to avoid being caught as impaired drivers. They seemed to feel that practice with the game could keep drivers from being identified as impaired by improving their skill at driving under the influence. Of course, if this were so, it would be a good thing in and of itself. If drunk drivers can become more competent by practicing with our game, then we could still save lives.

However, this is unlikely. The point of the game is that it doesn't actually involve driving. It involves playing a driving game and, as such, it's a practical metaphor for impaired driving. The target audience knows what it's like to play a driving game, and the Booze Cruise controls are the same as might be found in any typical instance of that genre. The connection is subtle: some a driving game is to Booze Cruise as driving is to impaired driving. Indeed, many Booze Cruise players might never have driven a real car and so wouldn't know what that's like. Many will never have been drunk either, so it's hard to explain why it's impossible to drive a car properly while impaired. This game shows what it's like to play a driving game impaired. Specifically, it shows the impossibility of avoiding the perception problems connected with impairment.

The traditional approach to impaired-driving education has been to show consequences, such as bent, twisted vehicles and torn, bleeding bodies. It might well prove more effective to show instead that the effects of impairment are unavoidable and unaccountable.
The Booze Cruise project in serious game development led to a practical tool for use in schools and displays. A variety of driving simulators already exist for training drivers and offer specific scenarios with respect to driving habits and legal understanding. The National Advanced Driving Simulator (www.nads-sc.uiowa.edu) and DriveSafety (https://www.drivesafety.com) are two examples. In contrast to these simulators, the Booze Cruise is a game. It has the control sequences familiar to players of driving games and the look and feel of a traditional driving game as well. The Booze Cruise tries to show that drivers can't accommodate the effects of intoxication—that it's impossible to "think yourself straight." This approach might be more effective than the usual approach of showing the consequences of driving under the influence. Many people feel that they can drive while impaired by simply being careful. The typical reaction to play at the 0.1 BAC level and above is "Wow, that's hard." In addition to what we learned about serious games from the class, realizing this perception was our project goal.

The game has received funding from the US Army Combat Readiness/Safety Center to make it suitable for deployment. It will be made freely available on the Internet for download and use by social agencies, schools, and police services. The next stages will include a long-term assessment of the Booze Cruise and an expansion to a second version that concerns itself with speed issues, another major killer on the highways.

REFERENCES
1. B. Sawyer, “Serious Games: Improving Public Policy through Game-Based Learning and Simulation,” white paper, Woodrow Wilson Center, 2002.

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