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Exploring an alternative in-car music background designed for driver safety ☆

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ABSTRACT

Young drivers listen to highly energetic aggressive music of a fast-tempo and accentuated beat at elevated volumes. They are not aware of the effects that music may have on perception, performance, and control of the vehicle. The crux of the matter is not the use of music per se, but rather the abuse of music that is hazardous. The current study developed a viable alternative music background for in-car listening towards improved driver safety. After a group of everyday listeners confirmed the experimental music as suitable for in-car music listening, 22 drivers each drove four trips while listening to either preferred music CDs or the experimental background, then 31 drivers each drove ten trips while listening to the alternative background. Study A demonstrated criterion related validity, although the experimental background preoccupied less attention. While Study B indicated habituation effects, drivers reported ever increasing levels of positive mood states throughout.

1. Introduction

Everyday drivers anticipate taking their music along for the ride, and they have been doing so since the 1920s when mass ownership of the automobile paralleled the growth of domestic technologies such as the radio, gramophone, and telephone. In 1929 scientist Paul Galvin introduced the car radio to Americans just when the *home* was being transformed into a space of aural pleasure and recreation. The *car* then became an emblem of individualized freedom of movement, and already in the 1930s manufactures associated the radio with personalized mediated listening in automobiles (Bull, 2004). Most certainly, automobiles have increasingly become highly developed mobile sound machines: "... the cassette deck in the 1960s further revolutionized the nature of automobile habituation, while today many cars are fitted with digital radios and sophisticated sound systems that work with push button efficiency, enabling the driver to switch seamlessly between radio, cassette, and CDs at will" (p. 246). Then in 1982, the transformation of audio sound systems began when Delco and Bose jointly developed a platform for the *Seville* and *Eldorado* (Cadillac), *Riviera* (Buick), and *Toronado* (Oldsmobile). Subsequently, in the 1990s the auto industry split over audio attributes and components: Ford, Lincoln, Toyota, BMW, and Lexus supplied Harmon-JBL; Subaru installed McIntosh; Jaguar and Lincoln-LS mounted Alpine; and Buick, Chevrolet, Hummer, Pontiac, and Volkswagen fitted Monsoon (Berger, 2002).

☆ Preliminary results of the study were presented under a different title at the 2nd International Conference on Driver Distraction and Inattention (DDI) Gothenburg Sweden (September 5–7, 2011), and the 5th International Conference on Traffic and Transportation Psychology (ICTTP), Groningen, The Netherlands (August 29–31, 2012).

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1.1. In-car background music

From an acoustic designer's point of view, it is all the more possible to create a consistent pleasant listening experience in an automobile than in a living room, where room size, type and density of furnishings, and the number of inhabitants cannot be controlled. Consequently, the vehicle cabin has become the ultimate *mobile listening booth*. Shortly after the new millennium, Berger (2002) unveiled the $900 Bose *AudioPilot* (featured in select Cadillac and Mercedes models) as the future in-car entertainment system, which automatically adjusted sound levels to counteract ambient noise. A decade later, it is not surprising that consumers are offered an array of possibilities to outfit their vehicles as an optimal aural-environment. Drivers, especially the young, customize their car with remote-controlled built-in audio components including compact-disk players, changers, amplifiers, equalizers, and speakers of every configuration. In addition to fitted sound equipment, there are numerous PC-downloadable portable devices such as MP3 audio-file players and *iPods*™ which can be heard through ear-buds and headphones, or connected by cable and *Bluetooth* wireless technology.

The 'coat-of-arms' of an Autocentric Culture, which is the product of a society passionately preoccupied with automobility (Bull, 2004; Sheller, 2004), may just be *in-car background music* – as it has truly become a principle component of driving. For example, the Los Angeles In-Car Listening Survey conducted 1000 telephone interviews; the study found that 87% of drivers listen to the radio so frequently that they considered it *the* most dominant in-car activity, while 35% claimed that as they drive they are consistently changing radio stations in search for better music (Arbitron/Edison, 1999). In another American survey commissioned by Quicken Insurance (Quicken, 2000), 91% reported to drive with their preferred music cassette tapes and CDs playing in the background, and 71% claimed to sing along with music regardless if they are alone or in the presence of a passenger. Rentfrow and Gosling (2003) analyzed everyday music activities among 3500 Americans; the activity most frequently listed as involving background music was 'driving a car' (above and beyond other pursuits such as studying, exercising, being with friends, or going to sleep). Stutts et al. (2003, 2005) investigated on-the-road behaviors of 70 USA drivers; analyses of in-cabin videotapes confirmed an overall 71.5% incidence of listening to background music (radio = 85.5%). Finally, Dibben and Williamson (2007) surveyed a representative sample of 1780 British adults about in-vehicle music behavior; there was an even split between exclusively listening to music radio, pre-recorded music (tapes and CDs), and listening to both radio and pre-recorded music; above half reported to sing along with the music while driving.

Being that music can relieve anxieties, sooth headaches, and boost morale, drivers might assume that listening to music will enhance their driving skills and vehicular performance. Sheller (2004) found that drivers feel they can match the mood of their journey through their music selections. Dibben and Williamson (2007) reported that 62% of drivers sense that music can sooth them, and make them more relaxed while driving. Several studies (Cummings, Koepsell, Moffat, & Rivara, 2001; Oren-Gilad, Ronen, & Shinar, 2008; Reyner & Horne, 1998) found that background music was a good method for maintaining alertness to counter monotony and sleepiness while driving. In light of a high incidence of *audiophile-drivers*, specialty CD compilations (recommended by Direct Line Car Insurance company) have become readily available through *Amazon.com*, such as: *Best Of Driving Rock*; *Classic Country: Road Songs*; *Classic FM Music For Driving*; *Classics for Driving*; *Greatest Ever Driving Songs*; *Hot Wheels & Highways: Great Driving Songs*; *The Ultimate Driving Experience*; *Top Gear Anthems: Seriously Cool Driving Music*; and *Trucker Jukebox*. Further, search engines like *Google* will quickly provide lists of music tracks recommended by auto enthusiasts, and motor-magazines such as *AutoTrader* print 'Reader's Polls' promoting favorite driving-tunes. It is interesting to note that in 2002 and 2004 Britain's *RAC Foundation* published warnings about Wagnerian music as the most dangerous 'soundtrack' for driving (BBC, 2004; RAC, 2004; USA Today, 2004): the 'Top-5 Most Recommended Driving Tunes' were *Come Away with Me* (Norah Jones), *Mad World* (Gary Jules), *Another Day* (Lemar), *Too Lost in You* (The Sugababes), and *Breathe Easy* (Blue); the 'Top-5 Most Dangerous Tunes For Driving' were *Ride of the Valkyries* (Wagner), *Dies Ire* from *Requiem* (Verdi), *Firestarter* (Prodigy) *Red Alert* (Basement Jaxx), and *Insomnia* (Faithless). Although little empirical research has ever gone into any commercially available compilation, the public is undeniably predisposed by *Billboard* position; driving-related tracks sell well, and can be found in automobiles worldwide. Unfortunately, some traffic studies (for example, Matthews, Quinn, & Mitchell, 1998) have employed such playlists *as if* they had properties demonstrated by valid reliability studies.

1.2. Music as a risk factor

Cars elicit a range of feelings from the *pleasure* of driving to the *thrill* of speed (Sheller, 2004). Further, drivers envisage feeling *secure* by driving a safe car. Therefore, the last thing any driver would think about is: How safe is it to turn on the radio, toggle a channel knob, adjust the volume, flip a cassette tape, or swap a CD? (Power, 2009). After all, if digital music systems are installed as features of intelligent vehicles that the auto-industry has referred to as *smart-cars* (including cruise control, voice activated entry and ignition, GPS-navigation, hands-free mobile phones, and telemetric devices for cellular internet and email), then, *how unsafe could it be*? Yet, Stutts et al. (2003, 2005) naturalistic study demonstrated that 91% of drivers constantly manipulate audio-controls while driving, with hand maneuvers occurring roughly 7.4 times per hour. These results confirmed previous reports (Wikman, Nieminen, & Summala, 1998) linking the 'fine-tuning of radio controls' or 'inserting a cassette-tape' to 'eyes directed inward away from the road' or 'no-hands on the steering wheel' – two significantly high-level risk behaviors. These correlations have also been confirmed by simulator studies (Horberry, Anderson, Regan, Triggs, & Brown, 2006). Wikman et al. conclude that shifting attention to audio controls denotes neglecting primary tasks such as lane-keeping and looking for other vehicles, which increase the possibility of running off the road.

While the frequency of music-related automobile accidents is not known, and perhaps this statistic is too difficult to account for while investigating accidents, there are numerous anecdotes (with photos) depicting such collisions on public access Internet sites (see: 'Music-related Crashes' at Car-Accidents.com). Unfortunately, accidents of this type have been known for some time. For example, in their annotated commentary of UK and Wales Police accident reports covering 5740 fatal accidents between 1989–1995, Stevens and Minton (2001) reported 'changing a radio channel, cassette tape, or CD' as the third most frequently cited cause of distraction leading to an accident (beyond cellular phone use, map reading, fixation on dash-board clocks and gages, eating, or smoking). Similar findings were reported by the American AAA Foundation for Traffic Safety (Stutts, 2001; Stutts, Reinfurt, and Rodgman, 2001a; Stutts, Reinfurt, Staplin, & Rodgman, 2001b) for North Carolina and Pennsylvania (between 1995 and 2000) covering more than 5000 police-reported crashes: 'adjusting in-vehicle audio equipment' was the source of distraction for 11.4% crashes. In a study by McEvoy, Stevenson, and Woodward (2006) 1347 residents from New South Wales and Western Australia claimed that 'adjusting the stereo' was the fourth most distracting activity reported (beyond eating, drinking, smoking, mobile phone use, seeking directions, and map reading). Finally, the RAC's Annual Report (2009) disclosed a survey of 1109 British motorists in which 433 (39%) stated that they become 'seriously distracted' when driving, while 257 (57%) claimed that 'adjusting radio controls or changing a CD' was their most significant in-car distraction. The report claims that during the five seconds one needs to change a CD, the car will have traveled roughly 156 m with the driver essentially unaware of the road environment. Moreover, the RAC survey also found that younger drivers were the most likely to lose concentration behind the wheel, and that one-in-five listen to music through headphones while driving. Finally, a study in Miami with 27 young-adult drivers found that not only did all participants drive while listening to music, but did so simultaneously to talking on the cell phone (Bellinger, Budde, Machida, Richardson, & Berg, 2009).

Clearly, some driving tasks may interfere with one another. Consiglio, Driscoll, Witte, and Berg (2003) point out that decrement of vehicular performance can occur from either structural interference (subsequent to poor mechanical configurations) or capacity interference to central attention (subsequent to overtaxed cognitive faculties). Regarding the later, it is unfortunate that neither police investigators nor traffic-accident researchers are mindful of the risks associated with *music* itself. Moreover, several high profile studies do not even mention 'music listening' among alleged risk factors (such as the '100-Car Naturalistic Driving Study': Dingus et al., 2006; Klauer, Dingus, Neale, Sudweeks, & Ramsey, 2006a; Klauer, Sudweeks, Hickman, & Neale, 2006b). Further still, others erroneously declare that having a radio, tape, or CD playing in the background is 'not at all associated with negative driving performance (Stutts et al., 2003, p. 205).[1] Subsequently, Driver's Education courses are not concerned with the effects that background music may have on vehicular control. To further complicate the issue, popular beliefs about in-car music listening are widespread. For example, White, Eiser, and Harris (2004) reported that 'listening to radio' and 'singing to yourself' were perceived by 200 British drivers from Sheffield as causing *little-to-no-risk* among sixteen activities that could potentially increase the chances of an automobile accident; Patel, Ball, and Jones (2008) found that 'listening to music' was accepted by 40 London drivers as the *most valid activity* one can engage in while on the road, perceiving it as the *lowest-risk-factor* among fourteen causes of driver distraction. Finally, Titchener, White, and Kaye (2009) studied 113 Australian women drivers who reported that 'listening to music' was the most frequent propulsion-unrelated activity initiated by drivers, and perceived it as the *lowest-level-of-risk* compared to nineteen activities that can lead to in-vehicle distractions and crashes. Nevertheless, most lawyers acknowledge that although they ask those involved in an accident if they had the radio on at the time of the crash, no matter what the answer may be, or how a driver perceives music activity as a diminutive risk factor, their inference is that most likely the driver was not attentive to the road because they were listening to music (Smith, 2006).

1.3. Music-generated cognitive distraction

Most drivers choose to travel with background music playing in the vehicle; the majority listen to highly energetic aggressive music consisting of a fast-tempo and accentuated beat played at strong intensity levels. While many readers may feel that such a statement is highly unreliable (given that it may not apply to those who prefer talk radio, sedate classical music, parents of young children in the vehicle, older drivers, or those who drive with no audio present), this phenomenon has been corroborated by several surveys in the USA and UK: *Quicken Insurance* corroborated that 95% of drivers who had a traffic violation in 1999 were playing music in the car, and roughly one-third drove while listening to fast-paced music of loud intensity (Quicken, 2000); *ACF Car Finance* reported that 73% of those charged with speeding violations in 2008 had been listening to loud Rock or fast Dance musics while driving (ACF, 2009). Further, Dibben and Williamson (2007) found that when drivers between ages 18–30 described the circumstances of their last accident they commonly reported to have been listening to Dance or House music. More recently, *AutoTrader Magazine* conducted a survey in which over 2000 readers were asked about their in-car music listening behavior and preferences (Daily Telegraph, 2009; Milne, 2009). Accordingly, the 'Most Popular UK Driving Tracks' were *Bohemian Rhapsody* (Queen) and *Man in the Mirror* (Michael Jackson), while Rap and Hip-Hop musics were reported to have adverse effects on at least 50% of drivers, with nearly one-in-five disclosing

[1] A highly cited conclusion from their exploration of driver distraction as based on two outcome measures (i.e., 'eyes directed inward away from the road' and 'no-hands on the steering wheel'), which are less than amenable to target the cognitive effects of music on driving behavior.

that these styles prompt aggressive conduct. Is it any wonder, then, that the US National Highway Traffic Safety Administration recommends that angry drivers tune to stations broadcasting relaxing music? (NHTSA, 2000).

Whether or not music listening is a contributing factor to distraction-related crashes is relatively unknown (Eby & Kostyniuk, 2003; RSC, 2006). As defined by NHTSA, *distraction* is any competing stimulus that occupies cognitive resources that could interfere with any process and have detrimental effects on road position, speed maintenance and control, reaction times, and negotiation of gaps in traffic. The Royal Society for the Prevention of Accidents (UK) asserts that auditory distraction is caused when sounds prevent drivers from making the best use of their hearing, because their attention has been drawn to whatever caused the sound (RoSPA, 2007). If safe and effective driving necessitates detection of auditory information embedded in a background of continuously changing sounds (Slawinski & MacNeil, 2002), then, there is every possibility that the presence of *music* along with road noise in vehicles will not only cover the sounds of external auditory warning signals (such as sirens and horns), but also mask self-monitoring sounds that serve as sources for vehicle feedback (such as engine revs) (Dibben & Williamson, 2007). The dramatic boost of in-vehicle entertainment systems in recent years has spurned concerns about driver distraction and effects on hazard recognition and vehicle control (Bellinger et al., 2009). Moreover, given the increasing provision of critical auditory warning signals (as part of current vehicle designs to compensate for visual overload during driving), safety implications for listening to music on driver performance must be considered (Ho & Spence, 2005, 2008).

On the most basic level, listening to songs while driving requires one to process sounds as well as words, and often results in tapping along to the rhythm or singing aloud (Dibben & Williamson, 2007). The response drivers have to certain pieces depends upon a range of variables, including: gender, age, personality, arousal and sensation seeking, emotional mood state, music preference, and familiarity (North & Hargreaves, 1999). Accordingly, the greater the *complexity* of the music, the larger the effects on critical tasks necessary to safely operate a motor vehicle. For example, Ayres and Hughes (1986) found that momentary peak levels in loud-music play a role in disrupting vestibulo-ocular control, while Turner, Ferdandez, and Nelson (1996) found loud music to decrease response time to randomly presented unexpected red (rear break) lights; both have been replicated by Consiglio et al. (2003), Horberry et al. (2006), and McEvoy et al. (2006). In addition, Brodsky (2002) linked the tempo of background music to cruising speed as well as to the frequency of traffic violations (i.e., speeding, collisions, lane weaving, and disregarded red traffic-lights); the study demonstrated that 'faster drivers' exhibit significantly more at-risk driving behaviors with fast-paced music than 'slower drivers'. The later was considered an essential find towards understanding the effects of in-car music (Campbell, 2002; Hamer, 2002).

It is worrying that drivers of all ages underestimate the effects of distraction, and are not conscious of situations or behaviors that reduce their ability to spot hazards (RoSPA, 2007; RSC, 2006). White et al. (2004) and Patel et al. (2008) emphasize the importance of considering the dangers of in-car distractions and activities, which are widely acceptable but not necessarily safe, involving a range of mundane activities such as *simply listening to music*. Drivers should become aware that as they get 'drawn-in' by a song, they move from extra-personal space involving driving tasks to a more personal space of active music listening (Fagiolo & Ferlazzo, 2006; Ferlazzo, Faglioli, Di Nocera, & Sdoia, 2008). Recently, electronic bulletin boards, blogs, and web-based social-media (i.e., *Facebook* and *Twitter*) have raised concerns over in-car music listening. For example, Power (2009) advocates that drivers first think about what is to be listened to before heading out on a Sunday drive. In an effort to promote safer driving, *ACF Car Finance* commissioned a *Billboard* chart study whereby the weekly Top-10 Hits were re-ranked in order of temporal velocity (*a*' *la* Brodsky). According to Betts (2009), ACF's most recommended Safe-driving Tracks were *Love Story* by Taylor Swift (UK Chart #5) and *Dead and Gone* by T.I. featuring Justin Timberlake (UK Chart #6), while they warned against driving with *The Fear* by Lilly Allen (UK Chart #7) and *Just Cant Get Enough* by The Saturdays (UK Chart #2).

In an effort to explore a platform that is proactive towards mediated intervention, the current project developed an original background music program (rather than search for well-known hit-tunes) that could serve as an optimal listening environment for driver safety. Thereafter, we conduct two studies in an effort to explore the feasibility of employment as an alternative music background among young drivers.

2. Developing an alternative in-car music background

We consider the car to be a unique listening environment, and take into account a dynamic temporal flow that is required to improve functional congruency between the aural conditions of driving and critical perceptual/motor tasks necessary for safely operating the car. In this connection, we view *music complexity* as the crucial feature in execution of necessary perceptual processes (portrayed as a bi-polar dimension). High music complexity is the consequence of faster tempo, lower levels of structural repetition, polyrhythmic syncopated rhythms, dissonant melodic motives, dense instrumental layers, and high vocal meaningness. High complexity music is *stimulative* in nature, whereas low complexity music has a sedative quality; the higher the complexity the greater the cost on attention resources and mood states (arousal). Therefore, in an effort to provide a moderate level of perceptual complexity, we envision a *music template* involving instrumental music, with a stylistic character that merges several music genres, composed and arranged with music elements that are well balanced. See Table 1.

A composer of popular music (the second author) re-mastered music tracks originally recorded by professional studio players as a playback accompaniment for an admired vocal artist of yesteryear; we note that the music remains effectively unknown to the public. The music (minus vocal tracks) were digitally remixed from the original 2″ tapes in a recording

Table 1
The Effects of Music Elements on Affective Mood States.

Emotional State	Music Elements						
	Instrument Range	Tone Frequency	Arrangement	Voicing Texture	Tempo	Intensity	Rhythmic Activity
Positive (Happy)	Wide	High	Heavy Busy	Dense	Fast	Loud	Not Constant
Negative (Sad)	Narrow	Low	Light Simple	Transparent	Slow	Low	Constant
Aroused	Wide	Changing	Heavy Busy	Transparent	Medium Fast	Changing	Changing
Optimal For Driving	Balanced Medium	Balanced Medium	Balanced Medium	Balanced Medium	Balanced Medium	Balanced Medium	Balanced Medium

studio according to an aural structural design that we project will furnish an optimal acoustic background for vehicular driving. The music program is an 8-track 30-min blend of easy-listening, soft-rock, light snappy up-beat smooth-jazz, with a touch of ethnic world-music flavor. The tracks were chosen and mixed to attenuate medium-quality tone frequencies, instrumental ranges, arrangements, voicing textures, tempos, intensities, and rhythmic activity. Most outstandingly, each track employs lush tonal harmonies with accompanying sophisticated syncopated melodic fragments, but yet, none have a specific memorable melody line.[2] We propose that this architecture will furnish a driving environment that maintains alertness and positive mood without diverting cognitive resources. The proposed background has no previous memories for the driver to dwell on, no vocal contents and therefore no language processing, nor is there a clear melody line to sing along with while driving. We propose that this more functional genre of in-car music will remain in the *background*. Initially, we assess the music program for face-validity via a survey implemented at a university gala social reception.

2.1. Survey

2.1.1. Participants

Out of approximately 60 guests, 25 questionnaire cards (42%) were returned; three were discarded because of missing data. The final sample of 22 guests was evenly split between the genders, with an average age of 45 years old ($SD = 16.05$, range 25–65).

2.1.2. Materials

Prior to a gala reception, sets of six 5″ × 7″ survey cards and six 2B pencils were placed on 20 circle-shaped pedestal dining tables dispersed throughout the 15 m^2 garden. The cards requested each guest to rate the 'suitability' of the music as a background for five activities of everyday life: home chores, learning, office work, social reception, and driving in a car. The participants judged *suitability* on a 4-level rating scale (1 = 'not at all suitable'; 4 = 'highly suitable').

2.1.3. Procedure

Background music was heard already when the guests arrived. The music was supplied from a DJ-quality CD-player (*Gemini*) and 12-channel mixer (*Macke*) to four 2-way 100w powered speakers (*D.N.Y.*) on tripod stands (2 m height). Surround-sound exposure was at a volume of roughly 90 dbl (which given the free-field garden environment is loud enough but not as deafening as a wedding celebration or dance club); the music was presented with a flat EQ (i.e., no audio reproduction effects were added). The full 8-track 30-min music program was heard twice (with the exception of a 10-min break for reception greetings). As is the case in social receptions, the music heard served a background for a host of activities (such as talking, laughing, and eating), although there is every possibility that some might have been well attentive. The guests returned their completed survey card to a slotted ballet-box when leaving the reception.

2.1.4. Results

The results indicate that the background music was considered to be highly-suitable for a *social reception* ($M = 3.48$, $SD = 0.75$), moderately-suitable for *driving in a car* ($M = 2.68$, $SD = 1.13$) and *home chores* ($M = 2.62$, $SD = 1.20$), but only slightly-suitable for *learning* ($M = 1.60$, $SD = 0.88$) or *office work* ($M = 1.\ 66$, $SD = 0.51$). There were no differences between the genders or age groups. In addition, the music was judged significantly more-suitability for a *social reception* than *driving in a car* ($t = 3.44$, $df = 20$, $p < .05$), and significantly more-suitable for *driving in a car* than for *learning* ($t = 3.445$, $df = 19$, $p < .05$) or *office work* ($t = 2.645$, $df = 20$, $p < .05$).

2.1.5. Discussion

As a first phase we developed and produced an 8-track 30-min music program with the intent of employment as a background for driving an automobile. We found that everyday listeners perceived the music as more energizing than background music that they might have experienced in office spaces or applied during reading and studying. Although the participants in our survey judged the music as most appropriate for a social reception, this bias may be due in part to priming

[2] A sampler of all 8-tracks can be heard at: http://cmsprod.bgu.ac.il/humsos/departments/art/staff/Warren.htm.

effects (i.e., the circumstances in which the survey was carried out). Nevertheless, the results seem to confirm that listeners across both genders, from a wide range of ages (25–65 years old), envisioned the custom-tailored music background as suitable for in-car music listening.

3. On-the-road exploration

To explore how drivers respond to the proposed music background in a real-world setting, we implemented two on-the-road studies. Study A compared between Experimenter-designed background music versus Driver-preferred driving music CDs brought from home. Study B evaluated repeated listening multiple exposure of the alternative in-car background music.

3.1. Study A

3.1.1. Participants

Initially 26 undergraduates participated in the study; each received extra credit points. However, the data of four were dropped from subsequent analyses because of self-reported unlawful driving histories, including: increased number of collisions/accidents (i.e., 4–9 within the past 5-year cycle), and/or prosecution in a traffic-court (i.e., period of probation/cancelation of license). The remaining 22 drivers were 64% male, on average 26.3 years old (SD = 1.83, range = 23–31), with a valid drivers' license for at least 5 years (M = 8.6, SD = 2.38, range = 5–10). While none had experienced any legal action, 58% had previously been involved in one-to-three 'fender-benders'. Almost all (95%) drivers reported to listen to music *all of the time* when driving; 82% played background music at intensity volumes described as *moderately-loud* or *very-loud*, and 72% reported to listen to tracks portrayed as *relatively-fast* or *extremely-fast* pieces. Prior to the study, the drivers attended a briefing meeting, received an information letter describing the procedures, and confirmed informed consent to participate by signature.

3.1.2. Materials

A 13-page booklet was allocated for each driver. The booklet contained a 1-page survey for background details, four 2-page diary-like questionnaires, and two 2-page surveys outlining the playlists of music they brought from home (described below). Among the background information solicited was history of traffic violations, and music-related driving behavior. The trip diaries were formatted in three parts: (1) descriptive information about the journey (including: *time of day*, trip-*duration*, trip-*distance*, and estimated trip-*speed*); (2) seven 4-level rating scales (1 = 'not at all'; 4 = 'very much') to judge *feeling at-ease*, *control over the car*, *awareness of music*, *enjoyment of music*, *attention to musical elements*, *music-effects on driving performance*, and *music-generated distraction*; and (3) a 32-item adjective list from four 8-item subscales of the *Profile of Mood States* (McNair, Lorr, & Droppelman, 1971) to assess positive affect (*PA* = *friendly* + *vigor* subscales) and negative affect (*NA* = *tension* + *fatigue* subscales). With the playlist surveys, each driver provided the names of the performers and CDs they brought from home as their preferred music to listen to while driving.

3.1.3. Procedure

The participants were required to drive a total of four trips paired with another participant-driver who served as a passenger throughout, and then subsequently both switched roles; the passenger served to ensure that the driving conditions were put into action, and countersigned the trip-diaries as confirmation of authenticity. On two of the trips experimenter-designed background music was heard in the cabin, while driver-preferred music CDs were played during the other two trips. We point out that the drivers randomly implemented the listening conditions; analyses of the trip-diaries indicated that the majority (95%) employed one of four presentation orders (*aabb*, *bbaa*, *abba*, *baab*). Roughly half (48%) of the CDs brought by the drivers were Israeli musics of various styles, including: Pop, Rock, Hip-Hop, Reggae, Ethnic, and Jewish-Soul. Other genres, were: American/British Pop-Rock (34%), Reggae and World music (9%), Classical music (5%), and movie soundtracks (4%). The drivers were asked to complete all four trips within one calendar month; driving took place in the Spring, during dry weather conditions, between 6 am and 12 am time zones, on routes involving urban boulevard and/or highway intercity traffic. The protocol banned short trips (i.e., <30 min), as well as two journeys within the same day/time zone (i.e., less than six hours apart). The participants drove their own automobiles, which were both European models (*Citron*, *Opel*, *Peugeot*, *Renault*, and *Volkswagen*), as well as models from the Far East (*Daihatsu*, *Honda, Hyundai, Mazda*, and *Toyota*). All of the vehicles were fitted with a CD-player and speakers; although half were built-in by the car manufacturer, 50% had custom-installed configurations (the popular brands were: *Blaupunkt*, *Kenwood*, and *Pioneer*). For the most part (72%) the cars were fitted with a standard 2-pair set of stereo speakers. In total, there were 88 journeys; the average trip was 45 min (SD = 13.62), across a distance of 60 km (SD = 30.03 [37.3 miles]), at a speed of 98.7 kph (SD = 9.25 [61.3 mph]). Each driver completed a trip-diary questionnaire upon completion of each trip.

3.1.4. Results

To explore differences between experimenter-designed background music versus the driver-preferred music CDs, ratings from all outcome variables were averaged across both trips in each condition. See Table 2. Then, these were entered into within-groups repeated measures analyses of variance (ANOVAs). No significant differences surfaced between the music listening conditions for trip-*time*, trip-*distance*, estimated trip-*speed*, perceived *control over the car*, *attention to musical*

Table 2
Study A: Outcome Variables By Music Type.

	Experimenter-Designed Background Music		Subject-Preferred Music Brought From Home	
	M	*SD*	*M*	*SD*
Time (min)	45	14.33	48	14.38
Distance (km)	57	27.73	65	37.06
Speed (kph)	99	10.96	99	12.34
Perceived Control Over Car	3.73	0.48	3.93	0.18
Music Generated Distraction	1.91	0.73	1.75	0.67
Music Effects on At-ease	2.45	0.65	3.68	0.42
Music Effects on Driving	1.80	0.68	1.83	0.71
Enjoyment of Music	2.16	0.81	3.66	0.63
Awareness of Music	3.07	0.62	3.41	0.65
Attention to Music Elements	2.66	0.73	2.82	0.81
Positive Affect	2.61	0.42	3.00	0.41
Friendly	2.81	0.42	3.07	0.44
Vigor	2.48	0.42	2.93	0.43
Negative Affect	1.91	0.48	1.60	0.37
Tension	1.76	0.48	1.55	0.37
Fatigue	1.96	0.56	1.61	0.43

elements, *music-generated distraction*, or *ill-effects of music*. However, there were significant differences between the musics for mood states involving both *positive-* and *negative-affect* (*PA*: $F_{(1,21)} = 14.37$, $MSe = 0.1191$, $p < 0.001$, $\eta_\rho^2 = 0.41$ [*friendly*: $F_{(1,21)} = 6.75$, $MSe = 0.1130$, $p < 0.05$, $\eta_\rho^2 = 0.24$; *vigor*: $F_{(1,21)} = 14.73$, $MSe = 0.1513$, $p < 0.01$, $\eta_\rho^2 = 0.41$]; *NA*: $F_{(1,21)} = 10.17$, $MSe = 0.0998$, $p < 0.01$, $\eta_\rho^2 = 0.33$ [*tension*: NS, $p = 0.56$; *fatigue*: $F_{(1,21)} = 7.76$, $MSe = 0.1716$, $p < 0.05$, $\eta_\rho^2 = 0.27$]. Overall, these findings indicate that mood states were more positive and less negative for driver-preferred musics. Nevertheless, the results indicate that in both music types *PA* was significantly higher than *NA* (experimenter-designed background music: $F_{(1,21)} = 17.52$, $MSe = 0.3066$, $p < 0.001$, $\eta_\rho^2 = 0.46$; driver-preferred music: $F_{(1,21)} = 104.38$, $MSe = 0.2069$, $p < 0.0001$, $\eta_\rho^2 = 0.83$), but the difference between these two diametrically opposed mood states was greater for driver-preferred music ($M = 1.40$ [$SD = 0.64$] versus $M = 0.70$ [$SD = 0.74$]; $F_{(1,21)} = 13.68$, $MSe = 0.3968$, $p < 0.01$, $\eta_\rho^2 = 0.40$). In addition, significant differences between the music types surfaced for ratings of *feeling at-ease* ($F_{(1,21)} = 78.51$, $MSe = 0.2110$, $p < 0.0001$, $\eta_\rho^2 = 0.79$), *awareness of music* ($F_{(1,21)} = 4.40$, $MSe = 0.2903$, $p < 0.05$, $\eta_\rho^2 = 0.17$), and *enjoyment of music* ($F_{(1,21)} = 42.43$, $MSe = 0.5833$, $p < 0.0001$, $\eta_\rho^2 = 0.67$); for these variables ratings were higher for driver-preferred music.

3.1.5. Discussion

Study A found no differences between the alternative music background (designed to provide an optimal acoustic background for vehicular driving) and the driver-preferred music CDs as regards travel parameters (*duration*, *distance*, and estimated trip-*speed*) or perceptual-motor parameters (levels of *distraction*, *control*, and *performance*). These findings are compelling *prima facie evidence* in a first effort to demonstrate criterion related validity. However, Study A found clear differences in favor of driver-preferred music for affective parameters: *positive-* and *negative-mood states*, feeling more *at ease*, and higher levels of *enjoyment*. Such findings are in line with studies demonstrating that the more familiar a listener is with music, the more distinct and intensive will be their experience and subjective emotion (Hargreaves, 1987–1988; Parncutt & Marin, 2006), as well as their level of liking the music (North & Hargreaves, 1995; Schubert, 2007). In all fairness though, listening to the experimenter-designed background music also produced significantly higher ratings of positive versus negative mood-states among drivers – albeit drivers were less passionate than when listening to their own CDs. Nonetheless, one paramount finding is that driver-preferred music was rated significantly higher for *awareness* of the aural environment. We note that awareness of the heard music connotes cognitive space, and in this context, the key feature of the experimental music was the facility to remain distant in the background taking up considerably less resources of central attention while driving on the road.

Yet, we wonder if the latter finding could be an artifact of inattention. After all, familiarity is indicative of experience, and hence, it is warranted to raise the question of repeated exposure and habituation. That is: Does repeatedly listening to the alternative in-car music background eventually produce an in-cabin experience that would be different from the one reported above? For example, perhaps over time drivers would become less irritated and more emotionally positive with this soundtrack? Or to the opposite, negative affect (as reflected by ratings of *tension* and *fatigue*) might lead to perception of greater distraction and decreased control. Given this major issue, we implemented a second on-the-road study that required ten trips per driver while listening to the alternative music background.

3.2. Study B

3.2.1. Participants

Initially 33 undergraduates participated in the study; each received extra credit points. However, the data of two were dropped from subsequent analyses because of self-reported increased number of collisions/accidents (i.e., 5 within the past

5-year cycle) and/or missing data. The remaining 31 drivers were 65% female, on average 25.5 years old (*SD* = 2.07, range = 21–32), with a valid drivers' license for at least 5 years (*M* = 8, *SD* = 2.21, range = 4–15). While none had experienced any legal action, 55% had previously been involved in one-to-three 'fender-benders'. Almost all (94%) drivers reported to listen to music *all of the time* when driving; 88% played background music at intensity volumes described as *moderately-loud* or *very-loud*, and 93% reported to listen to tracks portrayed as *relatively-fast* pieces. Prior to the study, the drivers attended a briefing meeting, received an information letter describing the procedures, and confirmed informed consent to participate by signature.

3.2.2. Materials

A booklet was allocated for each driver; it was similar to Study A, but with ten identical 3-part diary-like questionnaires (and no playlist surveys). The trip diaries were in three parts: (1) descriptive information about the journey (including: *time of day*, trip-*duration*, trip-*distance*, estimated trip-*speed*, *road type*, and *number of passengers*); (2) three 4-level rating scales (1 = 'not at all'; 4 = 'very much') to judge *awareness of music*, *enjoyment of music*, and *level of driver caution*; and (3) 32-item adjective list to assess *PA* and *NA* mood states.

3.2.3. Procedure

The participants were required to drive a total of ten trips without accompanying passengers while listening to experimenter-designed background music. That is, no other stimuli (i.e., driver-preferred music CDs, taped lectures, or car-radio) were to be heard during driving. The drivers were asked to complete all ten trips within one springtime calendar month during dry weather conditions. As the participants were asked to drive in accordance to their natural lifestyle, trips could be implemented during three *drive time*s (i.e., morning, afternoon, night) and on three *road type*s (i.e., residential, boulevard, intercity highway). Nevertheless, the protocol banned short trips (i.e., <30 min), as well as two journeys within the same day/time zone (i.e., less than six hours apart). All participants drove their own automobiles: 61% were from the Far East (*Daihatsu*, *Hyundai*, *Mazda*, *Mitsubishi*, *Nissan*, *Subaru*, *Suzuki*, and *Toyota*), 37% European (*Citron*, *Fiat*, *Opel*, *Peugeot*, *Renault*, *Skoda*, and *Volkswagen*), and one American *Chevrolet*. All of the vehicles were fitted with a CD-player and speakers; although half were built-in by the car manufacturer, 49% had custom-installed configurations (the popular brands were: *JVC*, *Kenwood*, and *Pioneer*). For the most part (87%) the cars were fitted with a standard 2-pair set of stereo speakers. In total, there were 310 journeys; the average trip was 53 min (*SD* = 23.91), across a distance of 55 km (*SD* = 26.78 [34.2 miles]), at a speed of 92 kph (*SD* = 11.44 [57.2 mph]). Each driver completed a trip-diary questionnaire upon completion of each trip. We point out that while the participants were directed to drive alone, on 66 trips (21%) drivers reported to have been accompanied by passengers, and as result of this unexpected methodological violation, we were able to add this independent variable into the analyses.

3.2.4. Results

To examine repeated exposure of the alternative in-car music background, ratings from all outcome variables were averaged across all ten journeys. In general, the participants were moderately *aware of the music* playing in the background (*M* = 2.85, *SD* = 0.54), and expressed a moderate level of *enjoyment* (*M* = 2.28, *SD* = 0.61). Further, an overall moderate level of *positive affect* was maintained throughout: *PA* (*M* = 2.68, *SD* = 0.55 [*friendly*: *M* = 2.76, *SD* = 0.62; *vigor*: *M* = 2.57, *SD* = 0.51]) was higher than *NA* (*M* = 1.63, *SD* = 0.32 [*tension*: *M* = 1.56, *SD* = 0.33; *fatigue*: *M* = 1.70, *SD* = 0.37)]), and these differences were statistically significant ($t = 7.731$, $df = 30$, $p < .000001$). Similarly to other studies (Parncutt & Marin, 2006), a significant positive correlation surfaced between *enjoyment of music* and *PA* ($r = .50$, $p < 0.05$). Finally, the drivers perceived an overall high level of *driver caution* (*M* = 3.69, *SD* = 0.31).

Subsequently, the outcome measures were entered into repeated measures ANOVAs to explore main effects of 'time.' No effects surfaced for trip-*time*, trip-*distance*, estimated trip-*speed*, perceived level of *driver caution*, or *enjoyment of music*. However, main effects surfaced for *awareness of music* ($F_{(9,270)} = 4.4134$, $MSe = 0.4633$, $p < 0.0001$, $\eta_\rho^2 = 0.13$); this finding is a significant demonstration of habituation. See Fig. 1A. Further, while no effects were found for *NA*, significant main effects of 'time' surfaced for *PA* ($F_{(9,270)} = 2.7823$, $MSe = 0.1940$, $p < 0.01$, $\eta_\rho^2 = 0.08$). See Fig. 1B.

Finally, all outcomes were tallied for 'drive-time,' 'road-type,' and 'passengers' as independent grouping variables. See Table 3. Subsequently, these were entered into repeated measures ANOVAs. There were no significant differences of 'drive-time' for trip-*duration*, trip-*distance*, estimated trip-*speed*, perceived level of *driver caution*, *awareness* and *enjoyment of music*, or *PA*/*NA* (including all four subscales thereof). See Table 3A. Further, when considering 'road-type' there was a near-significant difference for trip-*distance* ($F_{(2,8)} = 3.855$, $MSe = 1639.9$, $p < 0.06$, $\eta_\rho^2 = 0.49$) as well as statistically significant differences for estimated trip-*speed* ($F_{(2,8)} = 20.312$, $MSe = 159.41$, $p < 0.001$, $\eta_\rho^2 = 0.84$); both findings indicate that drivers journeyed for longer distances at perceived higher speeds during highway intercity driving than they did during local trips. However, no other significant effects surfaced for perceived level of *driver caution*, *awareness* and *enjoyment of music*, or *PA*/*NA*. See Table 3B. Finally, when comparing between trips involving driving-alone versus driving-with-passengers, several issues surfaced. For example, among the same twelve drivers, although there were no differences in trip-*duration* or trip-*distance*, statistically significant differences surfaced for estimated trip-*speed* ($F_{(1,11)} = 6.5390$, $MSe = 73.238$, $p < 0.05$, $\eta_\rho^2 = 0.37$); trips with passengers were perceived to be at higher speeds than when driving alone. Moreover, there were effects of mood states; the presence of passengers promoted an overall higher level of *PA* ($F_{(1,11)} = 11.887$, $MSe = 0.0150$, $p < 0.01$, $\eta_\rho^2 = 0.52$ [*friendly*: $F_{(1,11)} = 11.773$, $MSe = 0.0204$, $p < 0.01$, $\eta_\rho^2 = 0.52$; *vigor*: $F_{(1,11)} = 4.9535$, $MSe = 0.0256$, $p < 0.05$,

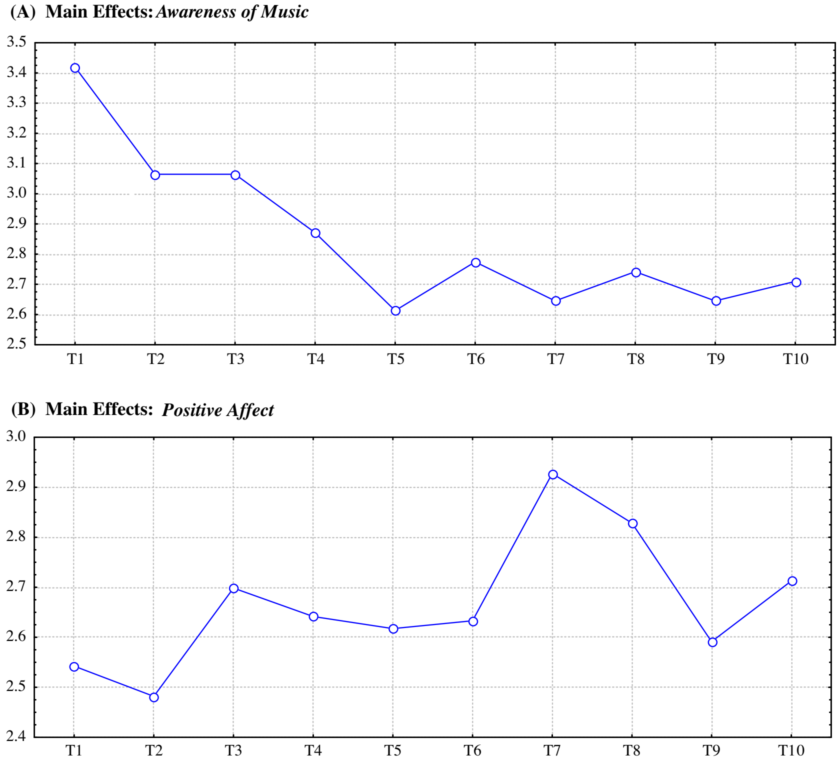

Fig. 1. Effects of repeated exposure (10 trips).

$\eta^2_\rho = 0.31$]), although no effects were seen for *NA*. Finally, while there were no differences for perceived level of *driver caution* or *enjoyment of music*, differences surfaced for *awareness of music* ($F_{(1,11)} = 8.4717$, $MSe = 0.1830$, $p < 0.025$, $\eta^2_\rho = 0.44$); drivers reported to be much more attentive to music heard in the vehicle when driving alone. See Table 3C.

3.2.5. Discussion

Study B most certainly highlights compliancy. That is, 31 participants drove ten trips, totaling 310 journeys, covering an overall distance of 17799 km (i.e., 11060 miles), while listening to experimenter-designed background music. The findings show that while the drivers consistently rated only moderate-levels of enjoyment from the listening experience, there was no indication of avoidance, irritation, or negative affect. Some might ridicule the study for not employing a strategy by which one could know without-a-doubt that the drivers listened to the music during their driving sessions. Skeptics might otherwise claim that the participants turned down the volume of the alternative in-car music background, or turned it off altogether; that drivers did not actually listen to music at all, but rather simply completed self-report trip-diaries. After all, given the lack of choice about music type drivers were to listen to, there should have been negative effects to mood, perceived control, and driving performance. Yet, the results indicate exactly the opposite: that is, throughout the study positive affect remained significantly high, and was consistently rated higher as the sessions proceeded. This level of mood was associated to increased levels of enjoyment. Furthermore, *awareness* of the aural environment (i.e., the cognitive involvement of attentive processes to the auditory stimuli) decreased as exposure to the background music progressed. Finally, the drivers' perceived level of *driver caution* remained stable throughout. Considering these findings, we view the results of Study B as validation of the structural architecture we used to design the experimental music.

It is interesting to note that there were no effects of the music with regard to *drive-time* or *road-type* – with the exception that participants drove longer distances at higher speeds when traveling on the highway. On the other hand, comparing between trips whereby the driver was alone in the vehicle versus those in which there were accompanying passengers, several differences surfaced. Foremost, the participants reported to have experienced increased mood states of *friendliness* and *vigor* with passengers present, as well as estimating their cruising *speed* to be significantly higher than when driving alone. While one would have expected passengers to offer comments and criticism of experimenter-designed music playing in the background, and such discussions should have amplified the drivers' attention towards the music, there is no indication of such in the trip-diaries. Again, we note that quite to the contrary, participants reported higher levels of awareness to the background music when driving-alone. Beyond these, there were no differences of trip-*duration*, trip-*distance*, perceived level of *driver caution*, *enjoyment of music*, or *NA*.

Table 3
Study B: Outcome Variables By Drive-Time, Road-Type, and Presence of Passengers.

(A) Drive-Time	Morning-Time Driving (06:00 am–12:59 pm)		Noon-Time Driving (13:00 pm–18:59 pm)		Night-Time Driving (19:00 pm–02:00 am)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Time (min)	53	35.36	52	24.37	56	25.07
Distance (km)	51	33.53	54	31.52	60	28.65
Speed (kph)	90	15.03	93	14.45	95	12.00
Perceived Caution	3.76	0.37	3.62	0.44	3.72	0.37
Enjoyment of Music	2.42	0.70	2.21	0.78	2.19	0.70
Awareness of Music	3.03	0.56	2.82	0.65	2.83	0.76
Positive Affect	2.66	0.61	2.67	0.55	2.66	0.60
Friendly	2.76	0.64	2.75	0.61	2.76	0.70
Vigor	2.57	0.61	2.59	0.54	2.57	0.56
Negative Affect	1.61	0.42	1.64	0.35	1.70	0.39
Tension	1.60	0.44	1.54	0.34	1.61	0.45
Fatigue	1.62	0.45	1.75	0.45	1.78	0.44
Number of Cases	28		31		30	

(B) Road-Type	Local Neighborhood Residential Driving		Boulevard Intra-City Driving		High-Way Inter-City Driving	
	M	*SD*	*M*	*SD*	*M*	*SD*
Time (min)	31	14.05	35	10.34	60	30.63
Distance (km)	22	19.14	22	8.24	66	35.44
Speed (kph)	58	22.27	67	15.88	100	8.89
Perceived Caution	3.67	0.47	3.67	0.54	3.69	0.32
Enjoyment of Music	2.60	0.83	2.30	0.74	2.23	0.61
Awareness of Music	2.67	1.13	2.84	0.88	2.79	0.60
Positive Affect	2.84	0.57	2.71	0.54	2.68	0.58
Friendly	2.98	0.61	2.74	0.58	2.78	0.66
Vigor	2.70	0.64	2.68	0.54	2.59	0.55
Negative Affect	1.45	0.26	1.46	0.28	1.64	0.33
Tension	1.42	0.31	1.45	0.28	1.56	0.34
Fatigue	1.47	0.23	1.46	0.34	1.73	0.42
Number of Cases	8		19		31	

(C) Passengers	Driving Alone In Vehicle		Driving With Passengers In Vehicle	
	M (*SD*)	*M* (*SD*)	*M*	*SD*
Time (min)	49 (19.58)	46 (28.80)	63	48.01
Distance (km)	51 (25.00)	39 (33.02)	62	52.00
Speed (kph)	91 (12.51)	81 (12.67)	89	16.06
Perceived Caution	3.62 (0.40)	3.66 (0.39	3.75	0.23
Enjoyment of Music	2.31 (0.62)	2.54 (0.68)	2.33	0.78
Awareness of Music	2.97 (0.57)	3.10 (0.54)	2.59	0.72
Positive Affect	2.63 (0.55)	2.64 (0.52)	2.87	0.56
Friendly	2.72 (0.60)	2.78 (0.52)	2.98	0.60
Vigor	2.55 (0.52)	2.67 (0.56)	2.76	0.54
Negative Affect	1.63 (0.31)	1.55 (0.24)	1.62	0.30
Tension	1.57 (0.32)	1.58 (0.30)	1.58	0.39
Fatigue	1.69 (0.38)	1.52 (0.24)	1.65	0.32
Number of Cases	31	12	12	

4. General discussion and conclusion

It seems to be absurd that as we gain driving skills and experience, we also learn to pay less attention to the road and traffic (Shinar, 2007). That is, we increasingly share driving demands with more and more non-driving tasks. Activities such as turning on the radio, toggling a channel knob, adjusting the volume, fine-tuning the tone button, flipping-over a cassette tape, or swapping between compact disks, have consistently been seen as causing at-risk behavior leading to decrement of vehicular control, traffic violations, and crashes. Yet, no one – with the exception of Shinar – lists *music* (i.e., the actual sounds heard in the cabin) as a possible risk factor for driver distraction.

Studies seeking to target possible effects of *in-car listening* usually put into operation stratagem based on telephone surveys, pen and paper questionnaires, and laboratory simulations – albeit a few roadway studies exist. For the most part, these studies focus on the contribution of music to driver distraction by advocating empirical approaches that employ observation, encourage deduction, and promote documentation; the typical study explores the nature, frequency, and circumstances in which background music might cause distraction. However, it also seems warranted to implement other more proactive approaches that advance mediated forms of intervention in an effort to explore *potential methods to deal with the ill-effects of music*. This was the goal of the current study.

Listening to music in the car will not be given up simply because it may place drivers more at risk. Therefore, we wondered if a music program that was custom-tailored with a unique aural structural design as an optimal acoustic background for in-car listening and driver safety, could serve as an alternative in-car music background environment. In truth, we would not expect that such music programs replace drivers preferred music CDs. But rather, we feel that such an alternative music background might prove to be more adaptive in circumstances of higher risk – for example when driving home from work at the days end, or under *after-party* duress in the wee-hours. Perhaps, through these efforts, instructors and teachers of Driver Education courses might increase awareness about the possible consequences of in-car music listening, and inform potential, novice, and experienced drivers how to choose CDs more wisely.

After producing a music prototype, the study found that listeners perceived the experimenter-designed background music as different from other *aural wallpaper* (such as those found in offices or applied to learning situations), and was more suitable for driving in a car. Then in two studies, participant-drivers most frequently reported to be only moderately-aware of the custom-tailored music, and consistently accounted for higher levels of driver safety and positive mood states.

We are optimistic that the experimental music developed herein may one day become a form of self-mediated intervention for drivers. We acknowledge the need for further more precisely controlled investigations, employing larger samples of drivers, in naturalistic on-the-road studies. We predict that future investigations will employ in-vehicle data recorders (IVDRs) that can objectively demonstrate the ill-effects of *in-car music* listening, and/or compare driving performance in conditions variegated by music (i.e., driver-preferred music CDs versus alternative music backgrounds). Further, it may be more than reasonable that future studies target specific at-risk populations, such as young drivers, who choose to drive with music that is highly energetic and aggressive, consisting of fast-tempo accentuated beats, played at strong intensity levels of elevated volumes.

Given the current times in which we live, and our society's passionate preoccupation with automobility, we recognize that cars are here to stay, and *in-car music* listening will forever be part of vehicular performance. Especially considering this last point, the current study explored an alternative in-car music background designed for driver safety.

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