Tutorial On The Cognitive-Behavioral Implications Of Driving With Music

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ABSTRACT

The traffic psychology literature targeting driver behavior has scarcely investigated *music* as a source of inattention or distraction. There is great confusion regarding what is music, and the difference between 'music' versus 'auditory' stimuli is not always clear. Unfortunately, traffic and automotive researchers employing music in their investigations demonstrate little knowledge about musical structures (i.e., the actual complex of sound, rhythm, harmony), and further exhibit a total disregard for the level of rigor necessary to incorporate music stimuli within empirical frameworks. For the most part, exemplars selected as stimuli for studies have been contaminated, and conditions of exposure have been flawed. In general, hypotheses about *in-car music* listening are based on intuition without scientific grounding. It is no wonder that findings have typically inferred that 'music causes little, if any, effects'. This tutorial attempts to fill that gap and expose researchers of the automotive sciences to the effects of music on driver behavior. The session will offer guidelines for implementing future studies incorporating music.

Author Keywords

In-Car Music; Car Audio; Secondary Task; Human Factors; Driver Safety; Driver Distraction; Driver Aggression; Structural Interference; Cognitive Overload; Perceptual Masking; Social Diversion

ACM Classification Keywords

H.1.2: User/machine system, human factors, human information processing
H.5.1: Multi-media information systems, audio input/output
H.5.2: User interfaces, auditory feedback, ergonomics, interactive styles
H.5.5: Sound and music
J.4: Social and behavioral sciences, psychology, sociology

INTRODUCTION

The automobile has become a vehicle of daily life, and car-audio has developed as an integral feature component of the machinery. Since the turn of the millennium, the context and activity that has been consistently reported to be the most popular location where people engage in music listening, is while they are in a car. As drivers envisage feeling secure and protected by their automobile, the last thing they would ever 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. The central belief of drivers worldwide is that background music is as much of a natural and fundamental constituent of driving as is accelerating, looking ahead, steering, and braking.

Most drivers get through a lifetime of driving without ever being involved in a car crash. It then seems of no consequence that as they drive they also spend much time adjusting the radio, switching between CDs, searching through playlists, and singing happily along with the music as they shimmy in their seats. And, while there seems to be handful of benefits to driving with music (such as combating fatigue and regulating the emotional experience of the trip itself), by adding music to a milieu consisting of driver performance and vehicular control within a highly dynamic and potentially hazardous traffic-based road environment, there may also be some shortcomings as far as personal safety is concerned [1]. The consequences may even be fatal.

Many in-cabin and portable devices provide drivers with the opportunity to engage in music listening; among these are broadcast and satellite radio, cassette tape players, compact disk players, MP3 digital music players, smartphones, and notebook tablet computers. Many drivers sing along with the tunes (referred to as *Car-aoke*), drum on the steering wheel, gearshift handle, and dashboard, or play in an air-guitar style, and even dance in their seat – as if participating in the performance itself. Music engagement does cause inattention and distraction. It should be pointed out that while there is a very limited pool of information concerning the interaction of cars and music to begin with, and the corpus of empirical studies on the subsequent

effects of driving with music is very thin, Brodsky [2] outlined specific contraindications to the use of background music while driving, and further detailed three explicit *ill-effects* of listening to music on driver behavior in an epidemiological fashion. Much can be gained from the evidence of investigations concerning mobile devices and cellphones; cellphone behavior is similar to music engagement in the sense that the use of a mobile-phone is a secondary task that preoccupies drivers in mechanical, perceptual, and cognitive process, as well as in verbal activity with other social agents – all of which can be executed when either alone in the cabin or when accompanied by other passengers.

GOALS AND TOPICS OF THE TUTORIAL

The tutorial will educate participants about the effects of music on drivers, and raise awareness about the benefits, contraindications, and ill-effects of music on vehicular performance. The tutorial will offer a newly developed conceptual underpinning about in-vehicle entertainment services that claims to enhance the driver experience, behavior, and performance, as well as raise awareness about the needs of drivers in relation to background music. One aim of the tutorial is that by exposing participants to the subject matter, they might subsequently serve in the future development of entertainment interfaces that increase driver safety.

Among the relevant conference topics that will be introduced are:

- In-car entertainment and social experiences
- Music contexts for interactive experiences in the car
- Music-related vehicle-based apps
- Appropriate methods towards the standardization of tools and stimuli for automotive music research (including simulation and naturalistic field studies)
- Effects of music on models employing techniques for cognitive workload and visual demands
- Effects of music on driver performance and vehicular control
- Music preference and taste of different user groups and user group characteristics
- Contraindications of subliminal cues, warnings, and feedback to augment driving behavior when listening to in-cabin music
- Effects of music on driver affect

ORGANIZATION OF THE TUTORIAL

Initially the tutorial will address issues concerning the everyday use of music listening while driving a car. The relationship between cars and music will be presented in an effort to understand how music behavior in the car can either enhance driver safety or place the driver at risk for incidents, near-crashes, accidents, and fatal crashes. Music

behaviors of drivers – both adaptive and maladaptive – will be outlined. These will focus on:

1. Benefits of in-car music, highlighting emotional regulation, entertainment, stress reduction, combating boredom, and counteracting fatigue
2. Contraindications to in-car music, highlighting structural interference (HMI ergonomics and mechanical configurations), perceptual masking, capacity interference to central attention (subsequent to overtaxed cognitive faculties), and social diversion
3. Ill-effects of in-car music, highlighting music-evoked driver arousal, music-generated driver distraction, and music-induced driver aggression
4. Countermeasures and applications for safer driving with background music

Finally, the tutorial will present an experimental music program designed to increase driver safety [3], and provide evidence from reliability studies and a clinical trial [4] about its effectiveness.

OUTCOMES OF THE TUTORIAL

The tutorial will pass on a common understanding of how the presence of background music (in-cabin exposure) affects drivers, will increase the awareness about the necessary requirements for employing music behavior and stimuli in research investigations (methodological rigor), and will share newly developed approaches and research findings concerning the effects of music on driver behavior and vehicular control.

FORMAT OF THE TUTORIAL

The tutorial will engage the participants in a more active mode of presentation beyond what can be delivered in a paper presentation. During the tutorial both audio and video examples will be presented. In addition, the participants will partake in experiential exercises. The participants will receive a booklet (worksheets) to be used during the tutorial; these will be collected at the end of the sessions.

NOTE: Each participant is asked to bring his/her favorite driving tunes to the tutorial; participants should upload playlists as MP3 files on a USB stick (disk-on-key) or on their smartphone – and bring these to the tutorial as part of a planned activity.

The duration of the tutorial is a 4-hour unit, of two 90-minute sessions, with a 20-minute coffee break wedged in-between the sessions. It is expected that the tutorial will accommodate a minimum of 25 participants. The tutorial will conclude with a group discussion exploring gaps that may still exist in the research landscape, and attempt to raise suggestions for future projects. It is hoped that the tutorial will be instrumental in motivating participants to form a small international team of researchers with mutual

interests, who will envision, plan, and implement the next generation of music-engendered traffic safety and automotive user-interface research studies.

ORGANIZER'S SHORT BIOGRAPHY

Warren Brodsky is Professor of Music Psychology in the Arts Department at Ben-Gurion University of the Negev (Beer-Sheva, Israel). He completed a music performance degree and majored in early childhood music development at the Rubin Academy of Music in Jerusalem; underwent advanced clinical training as a music psychotherapist at Hahnemann Medical University in Philadelphia, PA. USA, thereafter realizing a 10-year clinical career; Warren completed a doctoral degree in Psychology at Keele University in Staffordshire, UK. At Ben-Gurion University of the Negev, Warren completed a 2-year post-doctorial fellowship in neuropsychology of music, after which he became a Senior Lecturer and the Director of the Music-Science Lab. Among his research initiatives and projects is a proof-of-concept study for General Motors (GM) investigating the employment of design-language generated music targeting automotive characteristics towards enhancing brand profiles [5], and an on-road high-dose double-exposure within-subjects clinical-trial exploring music as a component factor variable of driver distraction under the auspices the Israel National Road Safety Authority (RSA) [4]. In 2015 Warren published the first (and only) book on interactive outcomes of driving a car while engaged in active music listening, titled: *Driving With Music: Cognitive-Behavioural Implications* (Ashgate, UK). The book is among the dozen volumes from the celebrated Human Factors In Road And Rail Transport series (edited by Lisa Dorn, Gerald Matthews, and Ian Glendon) addressing driver behavior and training, in-vehicle technology, simulation, and automotive engineering, and driver health and driver assessment.

REFERENCES

1. Brodsky, W. 2002. The effects of music tempo on simulated driving performance and vehicular control. *Transportation Research Part F: Traffic Psychology And Behavior*, 4, 219-241.

2. Brodsky, W. 2015. *Driving With Music: Cognitive-Behavioural Implications*. Surry, UK.: Ashgate Publishing Ltd.

3. Brodsky, W. and Kizner, M. 2012. Exploring an alternative in-car music background designed for driver safety. *Transportation Research Part F: Traffic Psychology And Behavior*, 15, 162-173

4. Brodsky, W. and Slor, Z. 2013. Background music as a risk factor for distraction among young-novice drivers. *Accident Analysis & Prevention*, 59, 382-393.

5. Brodsky, W. 2011. Developing a functional method to apply music in branding: design language generated music. *Psychology of Music*, 39, 261-283.