Psychomusicology: Music, Mind, and Brain

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Online First Publication, January 21, 2021. http://dx.doi.org/10.1037/pmu0000273

AMERICAN PSYCHOLOGICAL ASSOCIATION

Psychomusicology: Music, Mind, and Brain

ISSN: 0275-3987

https://doi.org/10.1037/pmu0000273

An Exploratory Study of In-Cabin Music Engagement Among Young-Adult Drivers

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Not much is known about young-adults' everyday behaviors involving music while driving. To widen the inquiry, Slor and Brodsky (Slor, 2019) developed the In-Cabin Music Engagement Questionnaire (iCMEQ). The purpose of the current study was to solicit information about the use of music based on drive types, driving scenarios, driver behaviors and affective dispositions, as well as drivers' beliefs about in-cabin music. Finally, the In-Cabin Music Engagement Questionnaire highlights the imaginary enactment of a music performance by drivers while otherwise engaged in driving on the road. A total of 140 young-adult drivers in Israel completed this survey. The findings show that all respondents listened to music while driving a car; that they preplan playlists based on the driving conditions they expect to encounter; and they use music to self-regulate affect and mood while on the road. Social media has exposed young-adult drivers to conflicting messages about the effects of music on driver behavior, and, subsequently, they demonstrate great uncertainty about the effects of music engagement on driver concentration and vehicular control. As a result, young drivers may be more at risk by engaging in music than they perceive.

Keywords: Generation Y & Z, Driver Behavior & Distraction, Music & Emotion, Music-related Affect Regulation, Driving With Music

Over 40 years ago, a Swedish investigator (Oblad, 1997) noted that her participant drivers sang and tapped along with the music as they drove; she identified the *car* as the environment in which one's strongest musical experiences were reported to have occurred. The first large-scale study to document the use of music in everyday life was implemented by Sloboda among 500 representative correspondents of a British National Survey (Sheridan, 2000). Sloboda's findings unequivocally demonstrated that activities which were accompanied by music were predominantly domestic or solitary, and most frequently involved housework or driving an automobile. *In-cabin music engagement*, initially reported by Sloboda (1999) and then by Sloboda et al. (2000, 2001), was also confirmed by Rentfrow and Gosling (2003). Nonetheless, 2 decades later, not much is known about everyday music engagement while driving. Many studies have simply reported levels of frequency; these vary between a modest 12% incidence (North et al., 2004) to a significant 94% incidence (Young & Lenne, 2010). Every so often, commercial surveys flood the Internet and social media, with headlines linking specific music genres to personality traits and/or affective temperaments among drivers. Brodsky (2002) was the first to have drivers describe the music selections they listened to in the cabin; they portrayed the overall speed (tempo) of the songs on their playlist by rating pace and depicted the intensity (volume) settings used to reproduce music while driving by ranking loudness. Still, these data offer little information that is needed to appreciate *why* and *how* drivers employ music in the car.

In the only full text focused on the cognitive–behavioral implications of driving with music, Brodsky (2015) critiqued a host of traffic-related studies that entered music in the empirical platform; he demonstrated these to be ecologically unreliable. Specifically, he outlined the procedures used for music exposure, and the exemplars selected as experimental stimuli, as unfortunately leading to a rather poor face validity. Hence, Brodsky alleged many of the published findings describing the effects of music on driving a vehicle to be unacceptable and that subsequently the field of inquiry remains underdeveloped. Recently, these assumptions were corroborated by Millet et al. (2019), who published the first meta-analysis on the topic. From their original literary sample consisting of a total 120 resources, they discarded 77 items (64% of the sample) as not actually using listening to music while driving (neither in simulated driving environments or in natural-

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The author wishes to acknowledge the assistance of Zack Slor in recruiting young novice drivers as well as collecting the data from them, as part of his doctoral research. In addition, the author wishes to acknowledge the assistance of Shlomit Shnitzer-Meirovich for her support and guidance in early stages of the analysis.

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istic on-the-road driving). Then, another 31 items were disqualified (totaling 108 or 90% of the sample) because (a) the investigation did not use different music stimuli groups or a nonmusic subgroup for baseline/control, (b) the investigation did not evaluate at least one dependent variable related to vehicular performance, (c) the investigation did not provide statistical information such as effect size, or (d) the investigation used data more than once inflating alphas. Millet et al. examined the remaining 12 items and subsequently acknowledged that shortcomings and limitations of the current corpus render the possibility of targeting any effects of music listening on driver behavior as implausible. They did, however, recommend that future studies must recruit young drivers (Generations Y and Z) and should explicitly focus on arousal, attention and memory improvement, cortical entrainment, mental fatigue alleviation, positive mood modulation, and stress regulation. The former requirement relates to a demographic describing individuals born between the mid1990s and mid2000s who are "digital natives," whose perceptual and cognitive capacities have been shaped by intuitive engagement with new technologies and multimedia, and who (supposedly) engage with music-listening and driving performance much differently than earlier generations of drivers. Although it might seem that the latter suggestion prioritizes laboratory-based measurements of psychophysiological mechanisms, it would seem that to gather information highlighting the use of music while driving a car, one should not rule out the value of enlisting self-report survey-based methods—in a hope that such findings would inspire ecologically valid future simulator studies and on-road driving research that use in-cabin music listening.

Survey Studies

Several investigations with everyday drivers have been implemented by commercial agencies; these can be found in the popular press. Brodsky (2015; Brodsky et al., 2017) outlined many of these (among them, those described in the following text) as having weakened rigor. Yet. he also claimed that collectively, this body of journalism serves to document specific driver behaviors that have not, as yet, been studied in empirical settings. Two explorations surfaced in 2009: the first, by ACF Finance, surveyed U.K. drivers about their use of music in the car, whereby 70% who had received a traffic fine for speeding also admitted to have been listening to pounding fast-paced dance music before the incident; the second, a "Readers' Poll" ($N = 2{,}000$) by *AutoTrader Magazine*, whereby those listening to rap and hip-hop music styles reported to have perceived themselves as being more at-risk for road-rage and car accidents than other drivers listening to different music styles. In 2011, Quotemehappy insurance company recruited 2,050 U.K. drivers to examine the relationship between music styles and driving behaviors; they found that drivers listening to rock, heavy metal, hip-hop, or drum and bass music were twice as likely to speed, tailgate, be involved in accidents, and act-out aggressive behaviors; 50% perceived music background to cheer them up, make the journey more pleasant, keep them awake/alert, and relieve the monotony of driving. In 2012, Allianz 'Your Cover' Insurance recruited 1,000 U.K. drivers for the purpose of assessing the effects of music on driver behavior: 35% of drivers sang aloud to songs while driving; 23% of drivers reported that music distracted them; 13% reported to have had a near-crash incident due to engaging with the music; 9% reported to have been involved in a crash/accident they believe was caused by music-generated distraction; the highest levels of incidents were among those drivers listening to jazz/blues, country, and hip-hop/R&B music styles. Finally, in 2013, Kanetix online insurance recruited 1,000 Canadian drivers to explore links between music preferences and driving performances, considering behaviors such as DUIs, speeding, at-fault accidents, and aggressive/dangerous driving; drivers reporting they listen to heavy metal, house/dance, reggae, and hip-hop music styles also reported to endorse the most dangerous driving demeanors.

Taken together, these and other commercial surveys indicate that music genre is a very potent feature of in-car music that cannot be overlooked, namely, that music style and music complexity should be considered more carefully by drivers when they select music exemplars, create music playlists, or pick music channels to accompany driving excursions and road trips. The same can be said for researchers of Music Science and Traffic Psychology when conducting experiments investigating the effects of music on driver behavior, whether or not they be implemented in the laboratory on workstations or driving simulators, or in instrumented vehicles on-road in cross-town traffic.

To date, there has been only one survey published in the scientific literature targeting in-car music behaviors. Dibben and Williamson (2007) not only questioned why people drive with music, but noting the association between dangerous driving and loud/fast music, explored listening practices and driving performances by using participants' self-reported 4-year-no-claims-insurance-discount as a proxy for safe driving. Their survey recruited 1,780 British adult drivers (who were members of a proprietary online panel). Each driver was allocated to one of three subgroups based on age: 396 young-adult drivers (18–29 years old), 760 middle-aged drivers (30–50 years old), and 624 senior-aged drivers (older than 51 years). Dibben and Williamson found that 65% of the respondents reported they listen to prerecorded music or music radio; 62% claimed music sooths them while on the road; and 25% perceived music increases their concentration. Drivers of the two younger age groups maintained they sing along aloud while driving. Dibben and Williamson were the first to point out that when we drive, we also listen to the same music we hear at home (i.e., mostly chart and pop tunes); with only a small number of respondents (13%) reporting to employ specifically selected playlists for driving. To sum up, the study suggests that people drive with music because it provides an enjoyable experience, entertains, stimulates, prevents boredom, enhances relaxation, and combats fatigue.

But still, we know very little about music engagement in the car. For example, do drivers preplan the music they listen to? If so, then, when selecting music exemplars, do they account for the expected driving experience or conditions? Or, while driving on the road, do drivers use music selections as a form of self-directed mood regulation to support and/or change one's emotion? The current study considered Millet et al.'s (2019) suggestion to recruit young novice drivers members of Generation Y and Z; specifically, the study took onboard the young-adult driver group classification (aged 18–29 years old) as outlined by Dibben and Williamson (2007). Further, the study used an in-house exploratory survey measure for the purposes of gathering *prima facie* information on driver behaviors and perceived employment of in-cabin

music. The In-Cabin Music Engagement Questionnaire (iCMEQ) was developed by Slor and Brodsky in 2015 (Slor, 2019) and is constructed to facilitate data collection on a number of themes, including: drive types, driving scenarios, driver behaviors, affective dispositions, and drivers' beliefs about the power of music to influence them (e.g., their levels of arousal, attention, fatigue, mood, stress, performance, and vehicular control), as well as highlight the enactment of a music performance by themselves and/or with other passengers while driving on the road in traffic.

Methodology

Participants

A total of 140 ($N = 140$) young-adult drivers participated in the survey study. They were millennials and postmillennials recruited from two subgroups. The first were 70 high school graduates, just before they were drafted into a compulsory 3-year military service ($M_{age} = 19$ years, $SD = 0.49$, range = 18–21, $F = 69\%$, $M_{License} = 1.16$ years, $SD = 0.50$); the second were 70 undergraduates, at least 1-year postmilitary service, registered as students in general music courses from a Faculty of Humanities and Social Sciences ($M_{age} = 28$ years, $SD = 2.40$, range = 21–32, $F = 73\%$, $M_{License} = 6.8$ years, $SD = 1.94$). It should be pointed out that the novice drivers were originally a larger sample ($N = 114$); 20 participants with less than 3 months driving experience were dropped, and then when matched to the undergraduates for gender (maintaining proportions 3:1 F > M), car ownership (a proxy for socioeconomic status), and music training (to retain a sample without formal music training), another 26 participants were removed from the sample.

The final sample ($N = 140$) of young-adult drivers were on average 23 years old ($SD = 4.68$, range = 18–32, born between years 1987–1998), 71% female, with a driver's license for an average four years ($SD = 3.18$, range = 1–11). The respondents reported to drive an average 13 trips covering roughly 200 km (124 miles) per month; 81% claimed they never received a traffic violation ticket. Almost all (98%) reported to listen to music while driving: 95% select "moderately fast" or "fast" paced music pieces; 94% reproduce music at "moderately loud" to "loud" volume levels; and 77% sing along aloud with the songs while they drive (referred to as "car-aoke").

Measures

Manchester Driver Behavior Questionnaire

The Hebrew language Manchester Driver Behavior Questionnaire version is a 27-item measure. The DBQ (Mattsson, O'Brien, Lajunen, Gormley, & Summala, 2015; Reason, Manstead, Stradling, Baxter, & Campbell, 1990) consists of four principal component factors: Driver Errors (eight items), Driving Violations (eight items), Attentional Lapses (eight items), and Aggressive Driving (three items). Using a 6-point scale (0 = *never*; 5 = *nearly all the time*), the respondents rate how often they experience specific aberrant driving behaviors. The internal consistency coefficient of items in the Hebrew version were moderate (Cronbach's $\alpha = 0.52, 0.69, 0.53, 0.45$, respectively).

In-Cabin Music Engagement Questionnaire

iCMEQ developed by Slor and Brodsky in 2015 (Slor, 2019) is a five-part 67-item questionnaire survey. See Appendix.

- Part I (16 items) reports demographic background, driving history, and details of in-cabin music engagement.
- Part II (30 items) examines driving scenarios related to in-cabin music engagement, written as statements that require a response on a 4-level Likert scale (1 = *not at all like me*, 4 = *very much like me*). The scenarios cover two main components.
  1. Affective dispositions: Pressure (Items 1, 15, 26); Sad (Items 2, 16, 27); Happy (Items 3, 28); Energetic (Item 4); Tired (Items 5, 17, 29); Weak (Items 6, 18); Upset (Items 7, 19, 30); and Contemplative (Items 8, 20).
  2. Drive types: Long trips (Items 9, 21); Night-time trips (Items 10, 22); Holiday trips (Item 11); Work trips (Items 12, 23); Party trips, going to an event (Items 13, 24), or returning from an event (Items 14, 25).
- Part III (19 items) examines driver attitudes and/or beliefs related to in-cabin music engagement, written as statements that require a response on a 4-level Likert scale (1 = *not at all like me*, 4 = *very much like me*). Attitudes relate to four areas: Concentration (Items 1, 2, 3, 9, 10, 15, 16, 18); Relaxation (Items 4, 5, 12, 13, 14, 17); Fatigue (Items 7, 8); and Vehicular Control (Items 6, 11, 19).
- Part IV (18 items) examines specific driver behaviors related to in-cabin music engagement, written as questions ("To what extent do you . . .") that require responses on a 4-level Likert scale (1 = *not at all*, 4 = *all the time*). Driver behaviors focus on three modes of music engagement:
  1. Listening: General (Items 1, 7, 8, 11); Pre-Planning Playlists (Items 4, 20); Mood (Item 5); Changing Music Selections (Item 6); Presence of Passengers (Items 9, 15, 16); Music Styles (Items 10, 12, 13, 17); and Traffic Conditions (Item 14).
  2. Singing (Item 2).
  3. Drumming (Item 3).
- Part V (21 items) examines eight music genres, each pinned against specific driving scenarios. The music genres are pop, rock, Hebrew-pop, metal/heavy-metal, rap/hip-hop, dance/house/electronic, alternative, and classical music. There is also an additional response option for None (i.e., NoMusic). The scenarios are written as descriptions (e.g., "While looking for parking . . . ," "While driving with parents . . .") that require a forced choice response of an aural background.

Analyses

All data from Parts I to IV were collapsed into two response categories. All responses of "1" (*not at all*) were combined with "2" (*very little*) as a "Low" category, while responses of "3" (*quite a lot*) were combined with "4" (*all the time*) as a "High" category. Subsequently, two dichotomous entities (i.e., Low vs. High) were brought forward. A test of proportions for one sample ($N = 140$), whereby 50% reflects the null hypothesis, indicated that when either entity (Low or High) were rated at least as 58.5%, then such a finding is considered as a statistically significant result ($z = 2.01$, $p = .04$, 95% confidence interval CI [49.87, 66.76]).

The data from Part V were collapsed across the eight music genres into two stereotypical music backgrounds (hereafter referred to as MusicA vs. MusicB). These two varieties, using descriptive labels metaphorically reflecting human personality qualities, are based on a wide literature of psychomusicological studies (Bonneville-Roussy et al., 2013; Chung et al., 2019; Delsing et al., 2008; North & Hargreaves 2007a, 2007b; Rentfrow & Gosling, 2003). MusicA is an assortment comprising pop, rock, Hebrew-rock/pop, and classical music styles, featuring attributes characterized as "mainstream," "normative," "conventional," "unpretentious," "modest," "sincere," "open," "optimistic," "upbeat," "reflective," and "melodic." MusicB is an assortment comprising metal/heavy metal, rap/hip-hop, dance/house/electronic, and alternative music styles, featuring attributes characterized as "alternative," "aversive," "intense," "complex," "rebellious," "pessimistic," "energetic," and "rhythmic." The three aural backgrounds (i.e., two music varieties and no music) were collated as percentages of response for each of the 21 driving scenarios.

Results

Participants

To rule out variances between the two age groupings that together comprise the sample of respondents, comparisons were made for all descriptive data besides "age"—which from the onset was an inherent distinctive feature of each subgroup. Foremost, as a consequence of being older, the undergraduates were certified with a driver's license for a significantly longer period of time than the younger novice drivers, $F_{(1, 138)} = 560$, $MSe = 288$, $p < .0001$, $\eta_p^2 = 0.80$. Yet, there were no significant differences regarding car usage, neither for the number of trips nor for the estimated number of kilometers driven each month. It should be noted that although the number of times the undergraduate drivers self-reported to have received a ticket for traffic violations was significantly greater than the novice drivers, $M_{\text{Novices}} = 0.06$, $SD = .23$ vs. $M_{\text{Undergrads}} = 0.34$, $SD = .51$; $F_{(1, 138)} = 18.30$, $MSe = 0.16$, $p = .00004$, $\eta_p^2 = 0.88$, there were no significant findings for involvement in light collisions or accidents.

The Manchester Driver Behavior Questionnaire was used to assess disparities of driving behavior among the two age groups. No statistically significant differences surfaced for three out of four principal component factors, including Driver Errors $M_{\text{Novices}} = 0.86$, $SD = 0.48$ vs. $M_{\text{Undergrads}} = 0.95$, $SD = 0.46$, Driving Violations $M_{\text{Novices}} = 1.16$, $SD = 0.62$ vs. $M_{\text{Undergrads}} = 1.35$, $SD = 0.65$ and Attentional Lapses $M_{\text{Novices}} = 0.72$, $SD = 0.46$ vs. $M_{\text{Undergrads}} = 0.88$, $SD = 0.58$. However, a significant difference was found for the fourth factor: Aggressive Driving, $M_{\text{Novices}} = 0.94$, $SD = 0.61$ vs. $M_{\text{Undergrads}} = 1.21$, $SD = 0.71$; $F_{(1, 138)} = 5.46$, $MSe = 0.44$, $p = .021$, $\eta_p^2 = 0.04$. This finding is indicative of undergraduates reporting higher aggressive driving scores. In a further post hoc analysis of the three aggressive driving items, just one item was found to be responsible for the elevated factor score; the undergraduates more often got angry from certain types of driving styles, responding to drivers with increased hostility by *whatever means possible*, including physical gestures, verbal provocations, and belligerent steering maneuvers, $M_{\text{Novices}} = 1.43$, $SD = 0.95$ vs. $M_{\text{Undergrads}} = 1.94$, $SD = 1.33$; $F_{(1, 138)} = 6.84$, $MSe = 1.36$, $p = .009$, $\eta_p^2 = 0.05$.

Finally, it should be pointed out that there were no significant differences between the age groupings regarding frequency of music engagement (i.e., listening or singing to music) in the car while driving. In addition, no differences surfaced for the tempo/pace of the songs they selected, nor for the loudness/volume they used to reproduce the music in the vehicle cabin. When evaluating responses to the *iCMEQ* survey only few differences between the age groups were found; employing a Bonferroni correction these reflect six out of 67 items (9%).

Taking all of the above into consideration, and for the purposes of the current survey study, there seems to be no meaningful differences between the two age groups that need to be considered, and thus both were merged into a single sample described as everyday young-adult drivers.

Affective Dispositions

More than three quarters (77%) of the respondents reported that their mood dictates what they choose to listen to when driving. For example, 95% reported that it is most suitable to listen to music if driving when feeling *sad*; but neither 'loud' music (34%) or 'soft' music (32%) was perceived as more fitting. Further, 97% of the respondents felt that if driving when feeling *tired*, it was better to listen to music rather than to drive in silence, and the most suitable music selections were 'stimulative' pieces rather than 'relaxing' melodies (85% and 17%, respectfully); 85% distinctly viewed 'stimulative' music as facilitating vehicular control when *fatigued*. If driving when feeling *weak*, it was best to listen to 'intense' music reproduced at 'higher volumes' (66% and 74%, respectively). If driving when feeling *upset*, it was best to 'listen to music' rather than 'drive without music' (71% and 13%, respectively); 62% felt that 'loud' music was best when feeling *distressed*. The novice drivers were far more opinionated about the association between *stress* and 'quiet music' – unlike the undergraduates they perceived that 'quiet' music increases one's level of stress $M_{\text{Novices}} = 2.07$, $SD = 1.27$ vs. $M_{\text{Undergrads}} = 1.24$, $SD = 0.58$; $F_{(1, 138)} = 24.84$, $MSe = 0.97$, $p = .00002$, $\eta_p^2 = 0.15$. The respondents were split (50/50) whether or not drivers should listen to music when feeling *introspective* or *contemplative*; yet, and quite to the opposite, 81% reported that the most suitable tracks for driving in *thoughtful* or *reflective* moods were 'slow-paced' pieces. All drivers (100%) felt it was best to drive with music when feeling *happy*; 87% claimed to sing-along aloud, and 67% accompanied music with hand drumming on the steering wheel (tapping-out rhythms) when feeling *energetic*. Finally, 75% felt that listening to 'quiet' music is *soothing*, and 63% specified that 'loud' music is not *soothing*; the respondents were not at all certain if

'upbeat' music actually *relaxed* them, with few (13%) reporting that upbeat music increased feelings of stress.

Most of the respondents (79%) reported that during time-*pressured* driving (e.g., congested traffic) they 'turn down' the volume, and at times even turn off the music altogether. Nonetheless, 72% also viewed music as more suitable than silence during time-pressured driving. But there was no overriding opinion as to which music genre should be listened to when in a *hurry*; 63% of the drivers felt that 'slow-paced' music was most suitable for time-pressured driving, while 83% claimed that "fast-paced" music was more fitting.

Drive Types

Most of the drivers (75%) stated that they preplan a playlist based on the type of ride and driving conditions they expected to encounter. For example, they differentiated between short versus long trips, driving to work versus driving on a holiday or vacation outings, and urban interstate journeying versus inner-city cruising. Almost all (97%) drivers reported to accompany long trips with many 'short songs' rather than few 'long pieces'; 76% claimed to hear more *liberating* 'dance songs' when going on vacation or a holiday outing; 65% felt it best to play 'fast-paced' music when driving for work purposes. It is interesting to note that 90% of the respondents reported that 'upbeat' dance music was most suitable when driving to a party, while 76% further specified that the best 'upbeat pieces' were selections without lyrics. In this connection, the novice drivers felt it was far more suitable to hear music with lyrics when going to a party, $M_{\text{Novices}} = 2.09$, $SD = 1.11$, vs. $M_{\text{Undergrads}} = 1.45$, $SD = 0.72$; $F_{(1,\ 138)} = 15.79$, $MSe = 0.88$, $p = .00011$, $\eta_p^2 = 0.10$. However, when returning home in the early hours of the morning after the party was over, the respondents were not sure if the most suitable selections are those with an 'upbeat' character; still, 69% felt the best music selections for afterparty are those with lyrics. Again, the novice drivers were far more adamant about hearing music with lyrics when returning home after the party, $M_{\text{Novices}} = 2.29$, $SD = 1.07$ vs. $M_{\text{Undergrads}} = 1.63$, $SD = 0.80$; $F_{(1,\ 138)} = 17.01$, $MSe = 0.89$, $p = .0006$, $\eta_p^2 = 0.11$. Finally, 63% felt that 'light optimistic' music pieces were most suitable for night-time driving rather than "heavy pessimistic" pieces.

Driver Attitudes and Beliefs

The majority of drivers (79%) reported that although it 'may be possible' to drive without listening to music, all of them (100%) reported they drive with music 'all of the time.' It should be pointed out the novice drivers were far more insistent that driving is 'absolutely impossible' without background music, $M_{\text{Novices}} = 2.02$, $SD = 1.30$ vs. $M_{\text{Undergrads}} = 1.27$, $SD = 0.54$; $F_{(1,\ 138)} = 19.48$, $MSe = 0.99$, $p = .00002$, $\eta_p^2 = 0.12$.

The respondents were clearly uncertain about the effects of music on their capabilities of *concentration*. The novice drivers were more steadfast in believing that it is 'not at all possible' to concentrate on driving without music playing in the background, $M_{\text{Novices}} = 2.00$, $SD = 1.22$ vs. $M_{\text{Undergrads}} = 1.41$, $SD = 0.75$; $F_{(1,\ 138)} = 11.75$, $MSe = 1.02$, $p = .0008$, $\eta_p^2 = 0.08$. Most specifically, 85% of the drivers could not even fathom how music itself might cause *inattention*, with only few (3%) stating that music can—and does—interfere with alertness to road conditions and potential "hidden-hazards." Although 89% of the drivers stated that hypothetically it might be possible to concentrate on driving without music, 80% also claimed that *concentration* on traffic and road conditions is not only 'difficult,' but sometimes 'near impossible' without music playing in the cabin.

In-Car Music Engagement

Many drivers (68%) reported that in-car music 'listening' allows them to *concentrate* in every type of traffic condition and road type. Although 60% also admitted that 'singing' does little to facilitate driver *attention*, 82% felt that caraoke does not interfere with concentration. Finally, although 80% felt that 'drumming' on the steering wheel impedes driver *attentiveness* and might hamper driver *performance*, the novice drivers were significantly more committed to the notion that drumming on the steering wheel enhances *vehicular control*, $M_{\text{Novices}} = 2.07$, $SD = 1.28$ vs. $M_{\text{undergrads}} = 1.34$, $SD = 0.59$; $F_{(1,\ 138)} = 18.80$, $MSe = 0.99$, $p = .00003$, $\eta_p^2 = 0.12$.

Unlike previous findings (Stutts et al., 2003, 2005; Young & Lenne, 2010), the respondents did not report to continuously change radio stations, swap between CDs, or scroll through playlists while driving. Similar to findings reported by Dibben and Williamson (2007), the majority (61%) of respondents claimed to listen to the same music tracks in the car as they usually listen to at home (i.e., 74% reported to listen to pop music). One unique finding here is that although the drivers do not sit and listen to music before pulling away from stationary parking, the majority (77%) stated that they often remain in the car after arriving at their destination just to hear the end of a song. Almost all (89%) respondents reported to drive with music when alone as well as when passengers are present; 73% reproduce music when accompanied by a romantic partner, and 59% play music when parents are nearside travelers.

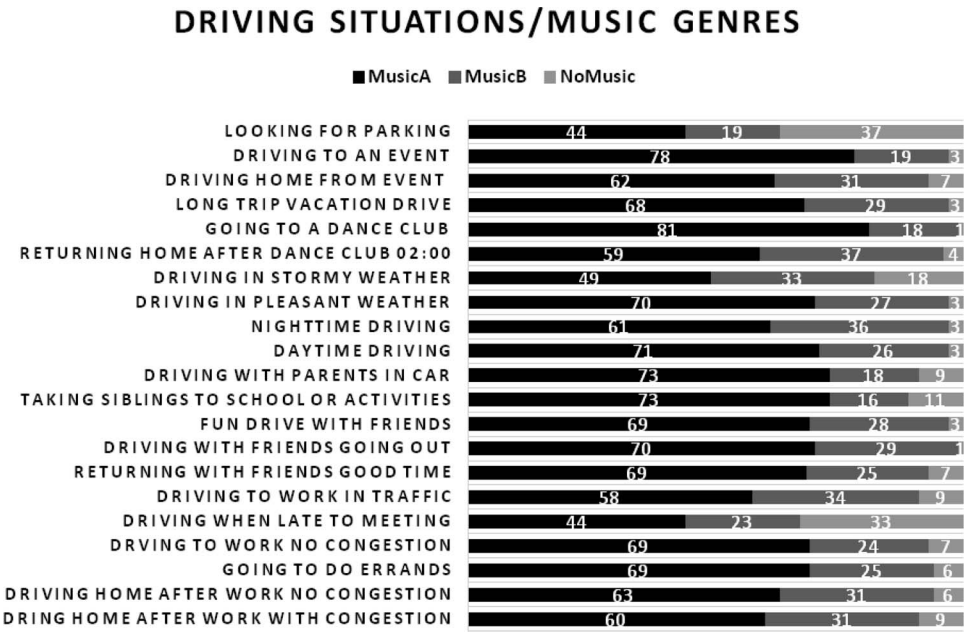
Music Genres

The survey assessed in-cabin music engagement linked to 21 driving scenarios. Paired *t test* analyses, using a Bonferroni correction, demonstrated that MusicA (pop, rock, Hebrew pop/rock, and classical styles) was reproduced more often than MusicB (metal/heavy metal, rap/hip-hop, dance/house/electronic, and alternative styles): $M_{\text{MusicA}} = 65\%$, $SD = 9.97$ versus $M_{\text{MusicB}} = 27\%$, $SD = 6.18$; $t = 14.90$, $df = 40$, $SE = 2.56$, $p < .0001$, 95% CI [32.97, 43.31], $d = 4.60$. See Figure 1.

Discussion

Foremost, the survey found that *all* of the driver respondents self-reported listening to music in the car, and most conveyed it is even impossible for them to imagine driving without music. Given that the sample of participants were millennial and postmillennial young-adult drivers, we might consider that technology had surrounded them throughout their formative years. Namely, today's young drivers were raised in an era of mobile music reproduction in the car; perhaps they never once experienced an automobile ride in which the driver, whether they were parents or siblings, did not reproduce music from radio broadcasts, cassette tapes, or CDs.

Figure 1
Specific Driving Scenarios and the Music Genres Heard in the Cabin



That is, music reproduction was certainly an ever-present part of their overall automobile experience from early childhood, and hence remains so today. The respondents recounted that they listen to loud music while driving, sing-along with the songs, and even tap-out beats on the steering wheel. Hence, perhaps music engagement is not simply for entertainment sake, but rather a fervent component of the autosphere; music is reproduced when alone as well as when passengers are present (e.g., family, friends, work colleagues, and romantic partners).

Turner (2015) pointed out that members of Generation Y and *Z* absorb great amounts of information throughout the day, every day since birth, and they seem to be prewired to do so. Accordingly, they cannot perceive a world without access to Wi-Fi, and clearly live off narratives from compatriots via social media such as Facebook, Twitter, Instagram, Pinterest, and Snapchat. But perhaps these young-adults are not as equipped with real-life wisdom as were previous generations at the same age, nor have they developed levels of literacy to the same extent (simply because their acquired knowledge seems to exclusively stem from web-based sources quickly eyeballed over iPad and smartphone screens). The findings from the current survey somewhat indicate that the respondents may have oversimplified *what* and *why* they select specific music exemplars for driving. On the one hand, their intentions seem to be highly practical: young-adult drivers anticipate preplanning music playlists based on the type of ride and driving conditions they expect to encounter. For example, they report to select songs by duration (short vs. long trip), function (traveling for work vs. holiday/vacation), or road type (intercity vs. interstate driving). Moreover, they report to accompany longer trips with many short songs, to hear lively dance-oriented music when going on vacation or holiday, to play fast-paced music when driving for work purposes, to play more optimistic pieces when driving at nighttime, to reproduce upbeat music without lyrics on the way to a party, and to play more moderately paced music with lyrics on the way back in the early hours of the morning after a party. However, one must be asked if these drivers even once considered that music selections could also be inefficient for controlling a motor vehicle?

The survey found that the respondent young-adult drivers do not question if music selections might increase driving risks, and they are very uncertain about the effects of music on concentration and vehicular control. How sonic features and complexities of music might ultimately cause some tracks to be more maladaptive for driving does not even rise to their cognizance. Perhaps one reason for this is that Internet searches on the topic make a claim of there being "no harm" in listening to music while driving. The web is saturated with headlines such as:

> Listening to Music While Driving Has Very Little Effects on Driving Performance.
>
> Music Doesn't Hurt Driving Performance.
>
> Listening to Music Isn't a Distraction in the Car.
>
> Listening to Music Has Little Effects on Your Driving—So Crank It Up!

The proponents for these notions were Unal and colleagues (Unal, 2012, 2013; Unal, de Waard, et al., 2013; Unal, Platteel, et al., 2013); they demonstrated that some forms of aural stimuli can be handled quite well by drivers, and therefore concluded that auditory distraction is not detrimental to driving. Nonetheless, although a host of scientific literature provides empirical evidence to the contrary (e.g., Brodsky, 2015; Brodsky & Slor, 2013; Brodsky et al., 2017) young-adult drivers do not necessarily access

such scientific literature, and subsequently continue to be baffled as to whether or not listening to music hampers concentration and/or degrades mental capabilities required to drive a car in traffic.

At this point, we must consider that given their lifetime of multitasking (i.e., monitoring incoming information streaming from multiple sources, applications, and screens), today's young-adult drivers may not only reveal lower levels of concentration (averaging roughly 8 s), but also exhibit an overall inability to effectively concentrate on one thing at a time—referred to as Acquired Attention Deficit Disorder (Turner, 2015). Perhaps, then, today's young-adult drivers feel they *need* far more stimulation just to maintain a moderate level of efficient driver concentration and vehicular control. In this connection, the current survey found that younger novice drivers were certain that it is *impossible* to pay attention to the road, nor *efficiently* drive a car, without music playing in the background. Furthermore, they believe that caraoke singing does not interfere with concentration, and that drumming on the steering wheel enhances driver performance and vehicular control.

The iCMEQ raises the possibility that today's young drivers do not necessarily perceive the three ill-effects of driving with music as described by Brodsky (2015), that are as follows: (a) music-intensity evoked arousal, (b) music-tempo generated distraction, and (c) music-genre induced aggression. Each of these constitutes different specific risks for driver miscalculations, inaccuracies, violations, aggressive driving, and even potential road accidents. To this end, Slor (2019) recently examined a protocol for changing attitudes among young novice drivers concerning in-cabin music. He implemented an educational workshop to instill knowledge about risk factors, and explored the outcome of an empirical intervention engaging simulated driving. Slor used the compilation of music playlists as a behavioral measure to identify the affective mechanisms associated with music listening patterns in conjunction with simulated drives. In his study, drivers were required to reevaluate the suitability of preintervention constructed playlists after simulated driving. Slor concluded that an interactive approach utilizing a simulated driving experiential, linking emotional dimensions about music and music preferences (e.g., perceptions, expectations, and attitudes), enabled drivers to construct more adaptive playlists that decrease risk, and hence, increase driver safety.

Music psychology research has long ago found that listeners use music selections as a form of self-regulating affect and mood (Chamorro-Premuzic & Furnham, 2007; DeNora, 2000, 2003; Goethem & Sloboda, 2011; Greasley & Lamont, 2011; Greb et al., 2018; Hargreaves & North, 1999; North et al., 2004; Sloboda, 1998, 1999, 2001, 2005, 2010; Sloboda & O'Neill, 2001; Sloboda et al., 2000, 2001). The current study not only confirms such findings, but for the first time places the *automobile* within this context, whereby individuals directly select music exemplars according to mood—rather than for the sake of entertainment and passing time. Today's young-adult drivers feel they choose music genres, artists, albums, and even specific tracks based on their current affective state. They intend to employ music either to enhance a specific mood, or to initiate a change of emotional valence they intuitively feel is overwhelming.

The current survey also found that young-adult drivers preferred to turn down the volume during time-pressured driving. Although reports of this nature may have existed in the past, this finding is perhaps the first documented data that reports such behavior. Further, a finding that has never been reported previously, is that the majority of the respondents claimed to remain in the car for a few moments after arriving at their destination just to hear the end of a song. These two examples illustrate the captivating nature of music, and its effects on task performance.

Unlike previously published research studies (Stutts et al., 2003, 2005; Young & Lenne, 2010), the young-adult driver respondents did not constantly engage in manual manipulation of the music equipment while they drive; they did not report turning on/off the radio, toggling channel knobs/buttons, adjusting volume pans, flipping cassette tapes, swapping CDs, or thumb-scrolling through mp3 playlists. Perhaps this formerly reported music behavior echoes technologies of yesteryear that have since eclipsed with the advancement of wireless Bluetooth linking smartphones to the vehicle's entertainment center. For the most part, today's young-adult drivers employ third-party web-based subscription applications that provide music depositories with holdings beyond 30 million songs (e.g., Apple Music, Google Play Music, Jango, Pandora, Slacker, Sound Cloud, Spotify, TuneIn, YouTube, etc.). The evidence herein indicates that a previously documented counterindication for in-car music—known as *structural mechanical interference*—may have been eradicated by the provision of on-board in-vehicle technologies.

The current study confirms findings by Dibben and Williamson (2007) indicating that drivers do listen to the same music in the car as they usually do elsewhere. Such a finding seems to be a clear demonstration that young-adult drivers have not yet come to an understanding that the motor vehicle is a highly unique listening environment, which perhaps, necessitates alternative music backgrounds (e.g., Brodsky & Kizner, 2012). Cross-town traffic may not necessarily be a place to rekindle or replicate specific emotions or feelings of previous music experiences that originated on a dance floor, karaoke bar, restaurant, fitness club, living room, or bedroom. The road is clearly a highly volatile and life-threatening environment. The car may be the only music listening environment that requires one to consider *self-preservation* and *survival* as the principal factors when selecting exemplars as background music.

Finally, the current study sought to explore if young-adult drivers differentiate between music styles as a function of specific driving scenarios typically experienced on the road: Do drivers select music styles based solely on their musical tastes and preferences 'come what may,' or do drivers select and change music styles depending on the circumstances they encounter in real time? The survey found, that for the most part, young-adult drivers listened to music characterized as 'mainstream,' 'normative,' 'conventional,' 'optimistic,' 'upbeat,' and 'melodic.' There were, however, few circumstances they deemed just as appropriate for listening to music's characterized as 'alternative,' 'intense,' 'complex,' 'energetic,' and 'rhythmic.' This finding may be seen as an illustration of the reciprocal feedback model of musical response (Hargreaves, 2012). The model accounts for the three-way interaction between the music being heard (the actual pieces), the background environment in which the listening takes place (the real-world situation), and the individual characteristics of the listener (distinctions based on sex, education, and temperament). Namely, by accounting for the related musical, contextual, and personal factors, Hargreaves claims that music heard and used in

nonmusical contexts—specifically the style, genre, and quality—cause effects on listeners responses. Music pieces of various styles, which present an overall architecture perceived on a continuum of complexity and familiarity recognized as comprised of typical features, may or may not be an appropriate fit for a particular context in which music is experienced. Brodsky (2015) underlined the fact that today listeners experience music not only in the festive artistic atmosphere of a concert hall or in the entertaining extravagant comfort of their living room, but rather in everyday situations that most often involve other activities such as driving a vehicle. Accordingly, ". . . it is not only the physical activity when listening to music while driving that influences driving performance, but rather it is the music—the sounds themselves—that affect drivers' behavior. [. . .] Driver deficiencies are the result of selecting musics that are highly inappropriate for driving a vehicle. The fit between driving and music accompaniment, is essential for improved vehicular performance and increased driver safety" (p. 304). It should be noted that one specific scenario (i.e., 'looking for parking') was reported to be just as suitable for not listening to music as it was to listening to music.

Although it was never the intention of the iCMEQ to target the general effects of music on driver behavior per se (as is the case with simulator-based studies such as: Brodsky, 2002; Brodsky et al., 2017), the findings do suggest that the presence of music in the vehicle cabin has more to do with *level of engagement* than previously considered. Here, then, lies both the limitations and contributions of the current exploratory survey study. iCMEQ was not designed to offer a 'diagnostic impression,' nor was it the intention of the study to tease out psychometric properties of items and principal component factors of subscales. The survey questionnaire was simply an inventory by which *prima facie* evidence could be accessed, that might designate new departure points for future researchers. Among other limitations of the study is a small sample size ($N = 140$) consisting of a disproportion of female versus male drivers (albeit, the proportions were based on registration figures of undergraduate students in humanities and social sciences in Israel).

The implications for future studies are evident to those investigating music perception and cognition, however, not so for researchers of Traffic Psychology. Yet, it must be pointed out that as the future seems to be welcoming the fully automated car, with drivers otherwise engaged in a host of secondary tasks while the car takes over transport and care for safety, all drivers (especially young-adults) will occupy themselves with popular forms of leisure—one of which is music. As if performing the music themselves, young-adult drivers will sing melodies, chant background fills and vocalize harmonies, pick-out rhythmic strums and finger solos in an air-guitar fashion, pound-out drum kicks and syncopated rhythms on their laps and soles, as well as dance choreographed movements in their seats (and perhaps even unbuckle a seat belt altogether). Applied empirical efforts must turn to the investigation of in-car music engagement among drivers. Especially when considering that the standard benchmark for the *time to get back in the loop* is measured as a 7 s duration interval (Gold et al., 2013), we must consider that the occupants of futuristic fully automated cars may not necessarily disengage from music so easily when required to take-over vehicle control. The situation could be life threatening! Listening to music in the car will not be given up simply because it may place drivers more at risk. Cars are here to stay, and in-car listening will forever be part of our driving experience.

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(*Appendix follows*)

Appendix

In-Cabin Music Engagement Questionnaire (iCMEQ)

Developed by
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The Music Science Lab, Department of the Arts
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PART I: Background and Personal Information

1. Sex: M/F
2. Year of birth: 19 _____ 2a. Age: _____
3. How many years have you had a drivers' license?_____
4. How many times (number of trips) have you driven during the last month?_____
5. How many miles do you normally drive per month?_____
6. Who is the owner of the car you drive?
7. How many times have you been stopped for a traffic violation?_____
8. How many times has your driving license been revoked?_____
9. How many times were you involved in a "fender bender" or car accident?_____
10. To what extent do you listen to music while driving?

Not at all	To some extent	Moderately	Very much
1	2	3	4

11. How loud is the music you listen to while driving?

Not at all	Mostly Quiet	Moderately	loud Very loud
1	2	3	4

12. What tempo (pace) is the music you listen to while driving?

Not at all	Slow-paced	Moderate-paced	Fast-paced
1	2	3	4

13. To what extent do you sing to music while driving?

Not at all	To some extent	Moderately	Very much
1	2	3	4

14. Do you have formal music training: Yes No

If "yes", then:
Number of years playing an instrument:
Place of learning instrument:_____

(*Appendix continues*)

PART II: Driving Scenarios

The following statements relate to listening to music while driving. Read each statement and mark how much the statement is correct for you.

Driving scenarios	*not at all like me*	*a little like me*	*moderately like me*	*very much like me*
1. When hurrying, it is most suitable to listen to fast-paced music	1	2	3	4
2. When sad, it is best to listen to loud music	1	2	3	4
3. When happy, it is best to sing out loud with music	1	2	3	4
4. When feeling energetic, its best to accompany the music by drumming	1	2	3	4
5. When feeling tired, it is most suitable to listen to stimulative music	1	2	3	4
6. When feeling weak, it is most suitable to listen to music at intensive volume	1	2	3	4
7. When feeling upset, it is most suitable to listen to intense music	1	2	3	4
8. When feeling contemplative, the most appropriate music to listen to is slow-paced music	1	2	3	4
9. During long drives, it is most suitable to listen to long pieces	1	2	3	4
10. During nighttime drives, it is most suitable to listen to heavy and pessimistic compositions	1	2	3	4
11. When going on holiday, it is most suitable to listen to liberating music	1	2	3	4
12. During work trips, its most suitable to listen to fast-paced music	1	2	3	4
13. On the way to a party/event, it is most suitable to listen to upbeat music	1	2	3	4
14. On the way back from a party/event, it is best to listen to upbeat music	1	2	3	4
15. When hurrying, it is most suitable to listen to slow-paced music	1	2	3	4
16. When sad, it is most suitable to listen to music at a low volume	1	2	3	4
17. When feeling tired, it is most suitable to listen to relaxing music	1	2	3	4
18. When feeling weak, it is best to listen to music at a low volume	1	2	3	4
19. When feeling upset, it is most suitable to listen to quiet music	1	2	3	4
20. When feeling contemplative, it is most suitable to listen to fast-paced music	1	2	3	4
21. During long trips, it is most suitable to listen to short pieces	1	2	3	4
22. During nighttime drives, it is best to listen to light and optimistic pieces	1	2	3	4
23. During work trips, it is most suitable to listen to slow-paced music	1	2	3	4
24. On the way to a party/event, it is best to listen to music with lyrics	1	2	3	4
25. On the way back from a party/event, it is most suitable to listen to songs with lyrics	1	2	3	4
26. When hurrying, it is most suitable not to listen to music	1	2	3	4
27. When sad, it is most suitable not to listen to music	1	2	3	4
28. When happy, it is most suitable not to listen to music	1	2	3	4
29. When tired, it is best not to listen to any music at all	1	2	3	4
30. When feeling upset, it is most suitable not to listen to music	1	2	3	4

(*Appendix continues*)

PART III: Driver Attitudes

The following statements relate to listening to music while driving. Read each statement and mark how much the statement is correct for you.

Attitudes about music listening while driving	*not at all like me*	*a little like me*	*moderately like me*	*very much like me*
1. Listening to music enhances concentration on driving	1	2	3	4
2. Concentration on driving is impossible without listening to music	1	2	3	4
3. Listening to music allows concentration on driving in all traffic situations	1	2	3	4
4. Listening to loud music while driving is soothing	1	2	3	4
5. Listening to upbeat music while driving is relaxing	1	2	3	4
6. Drumming on the steering wheel while driving aids vehicular control	1	2	3	4
7. Listening to stimulative music hampers driving while fatigued	1	2	3	4
8. Listening to stimulative music facilitates driving while fatigued	1	2	3	4
9. Listening to music disrupts concentration on driving	1	2	3	4
10. Car-aoke singing while driving interferes with concentration on the road	1	2	3	4
11. It is possible to drive without listening to music	1	2	3	4
12. Listening to quiet music while driving is stressful	1	2	3	4
13. Listening to low-volume music while driving is soothing	1	2	3	4
14. Listening to up-beat music while driving is stressful	1	2	3	4
15. Concentrating on driving is possible without listening to music	1	2	3	4
16. Car-aoke singing while driving enhances concentration on the road	1	2	3	4
17. Listening to quiet music while driving is soothing	1	2	3	4
18. Concentration on driving is not possible while listening to music	1	2	3	4
19. Driving (not even just a little bit) is impossible without listening to music	1	2	3	4

(*Appendix continues*)

PART IV: Driver Habits and Preferences

The following statements relate to listening to music while driving. Read each statement and mark the relevant answer (i.e., how much) for you.

In-car music habits and preferences	*not at all*	*very little*	*quite a lot*	*all the time*
1. To what extent do you listen to music in the car (i.e., play the radio, CD player, mp3 player)?	1	2	3	4
2. To what extent do you like to sing along with music while driving?	1	2	3	4
3. To what extent do you like to drum along with the music while driving?	1	2	3	4
4. To what extent do you preplan you're playlist before a trip?	1	2	3	4
5. To what extent does your mood dictate what you listen to while driving?	1	2	3	4
6. To what extent do you change the radio stations, CDs, mp3 tracks, while driving?	1	2	3	4
7. To what extent do you stay in your car a few moments after arriving at your destination to hear the end of a song?	1	2	3	4
8. To what extent do you start listening to music before you pull away from parking?	1	2	3	4
9. To what extent do you listen to music while driving even if there are passengers in the car?	1	2	3	4
10. To what extent do you listen to music styles (genres) while driving that you do not usually listen to?	1	2	3	4
11. To what extent do you listen to loud music while driving?	1	2	3	4
12. To what extent do you listen to pop music radio station while driving?	1	2	3	4
13. To what extent do you listen to classical music radio stations while driving?	1	2	3	4
14. To what extent do turn down the volume, or turn off the music all together, when driving in highly congested traffic?	1	2	3	4
15. To what extent do you listen to different music while driving with parents (or other adults) in the car?	1	2	3	4
16. To what extent do you listen to different music when you have a romantic partner in the car?	1	2	3	4
17. To what extent do you listen to talk or news radio (i.e., broadcast without music) while driving?	1	2	3	4
18. To what extent do you pre-plan a playlist according to the type of ride (i.e., short/long trip, holiday vacation, urban/intercity driving conditions)?	1	2	3	4

(*Appendix continues*)

PART V: Driving Situations and Music Genres

What kind of music do you prefer to listen to during the following driving situations? Mark an X for only one genre of music per each situation.

Driving situations	Israeli (Hebrew) pop/rock	Pop	Rock	Metal Heavy metal	Rap Hip-hop	Dance house Electro	Alternative	Classical	None
1. While looking for parking									
2. While driving to an event (i.e., wedding, etc.)									
3. While driving back home from an event (i.e., wedding, etc.)									
4. While on an outing or long vacation drive									
5. While on the way to a dance party/nightclub									
6. At 02:00 am on the way back from a dance party/nightclub									
7. While driving in difficult weather (storm, wind, rain)									
8. While driving in pleasant weather (bright)									
9. Nighttime driving									
10. Daytime driving									
11. While driving with parents									
12. While taking siblings to school or afternoon activities									
13. “Fun” drive with friends									
14. While driving with friends going out for a “good time”									
15. While driving with friends coming back from a “good time”									
16. While driving in traffic on the way to work									
17. While driving in traffic when late to a meeting									
18. While driving to work without traffic congestion									
19. While driving errands (shopping, bank, hairdresser, etc.)									
20. While driving home at end of workday without traffic congestion									
21. While driving home at end of workday work with traffic congestion									

Received July 29, 2020
Revision received November 15, 2020
Accepted November 23, 2020 ■