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Motivations for Watching Videos on Mobile Phones While Driving in Parking lots and While Waiting at Intersections in the United States

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Author Contribution Statement

The authors confirm contribution to the paper as following:

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No competing interests were reported by any of the authors.

Highlights

- Attitude towards watching videos on phones while driving predicts intention
- Perception about state law doesn't determine watching videos while driving
- State law on distracted driving doesn't determine watching videos while driving
- Drivers think entertainment is the biggest benefit of watching videos while driving
- Drivers should be required to pass a course on distracted driving

Abstract

This is a two-part mixed methods study that investigated motivations for watching videos on mobile phones while driving. We make three theoretical contributions in this paper. First, we specifically examine watching videos on mobile phones while driving, whereas previous studies examine calling, texting, monitoring messages, and using apps. Second, we specifically focus on waiting at intersections and driving in parking lots; parking lots have not been studied in previous studies. Third, we incorporate perception about the law into the Theory of Planned Behavior model as a predictor of intention.

The quantitative survey yielded responses measuring each variable in our extended Theory of Planned Behavior model. We found that although people don't watch videos on their phones while driving as much as they text or converse, the rates of watching are disturbingly high (41% watch at intersections). The intention to watch while driving is a significant predictor of behavior, and attitude is a significant predictor of intention in both scenarios. Moral norms were a significant predictor of intention in the parking lot scenario. Nearly half (48%) of drivers don't know their state laws regarding mobile phone use while driving. Neither the subjective knowledge about state law with respect to watching videos on mobile phones while driving nor the actual state law about using handheld devices while driving were significant predictors of the intention to watch videos while driving. The qualitative survey yielded open-ended responses on drivers' salient beliefs about watching videos on mobile phones while driving. We propose using a multitude of laws to reduce mobile phone use while driving, and requiring drivers to take a short course on distracted driving.

Keywords: mobile phone, distracted driving, law, traffic psychology, video, deterrence

1. Introduction

Using mobile phones while driving is dangerous. According to NHTSA data, an estimated 33,000 people were injured in 2018 in crashes where mobile phone related activities were involved. The percentage of drivers visibly manipulating handheld devices increased from 0.6% in 2009 to 2.1% in 2018 (NHTSA, 2019). Most states have passed legislation in response to the health and safety risk posed by the use of mobile phones while driving.

However, studies have found that laws prohibiting mobile phone use while driving have been ineffective. States began to ban cell phone use while driving as early as 2001. However, data from mobile phones collected by Zendrive (2018) showed that mobile phone use while driving increased from 2017 to 2018. Zendrive is a driving data collection company that uses smart phone sensors to analyze driver behavior; Zendrive works with, among others, insurance companies to price personalized risk. Zendrive analyzed more than 4.5 million drivers from all over the US over 7 billion miles driven from 2017 to 2018. Zendrive found that in 2018, drivers who used their mobile phones while driving did so for 3 minutes and 40 seconds *per hour*, 10 seconds more per hour than in 2017. Assuming an average speed of 55mph, a car would travel the length of 42 football fields during 3 minutes and 40 seconds. Moreover, Zendrive estimates that 69 million drivers (60% of all drivers) use their phone while driving each day, much higher than the NHTSA estimate of 660,000, and that 40 million drivers use their phone at least once per hour.

Current policy responses prohibiting text messaging and talking on handheld phones are unlikely to sufficiently reduce the damage caused by mobile phone use while driving. Although texting while driving is banned in almost every state, most states have not completely ban hands-

free mobile phone use while driving. Studies of driving behavior have shown that the mental impairment from handheld phone conversations and hands-free mobile phone conversations were not significantly different (Ishigami and Klein, 2009). These studies suggest that laws restricting the use of handheld devices but permitting the use of hands-free devices are unlikely to eliminate the risk associated with the use of mobile phones while driving (Strayer et al, 2006). Further, simulated driving experiments have shown that reading text messages, which is not prohibited by current laws, doubled the time for drivers to initiate breaking and increased the probability of being in a crash six-fold (Drews et al, 2009). The distraction effects of mobile phone notifications are comparable to those of mobile phone calls and text messaging (Stothart et al, 2015). Even laws that prohibit more usages of mobile phones while driving are unlikely to eliminate mobile phone use. State laws prohibiting hands-free phone use have reduced, but not eliminated, phone use while driving according to mobile phone tracking app TrueMotion (Go True Motion, 2019). Qualitative studies of police officers have revealed that laws against mobile phone use while driving are difficult to enforce (Rudisill et al, 2019).

One particularly problematic usage of mobile phones while driving is watching videos. Video streaming has been rapidly growing in popularity. Mobile video entertainment streaming hours increased 65% from 2018 to 2020 (Munson, 2021), and the video streaming market is expected to grow by 20% annually from 2020 to 2027 (Grand View Research, 2020). Given the prevalence of mobile phone use while driving and growing trend of video streaming, watching videos while driving could cause significantly more injuries and losses in the near future if current trends continue, policy interventions are not implemented, and no technological advancements are made. Therefore, it is important to explore factors causing drivers to watch

videos on their mobile phones while driving, so that we can provide policymakers with potential solutions to complement current policy responses.

The Theory of Planned Behavior (TPB) provides a conceptual model that helps policymakers identify the factors that influence the performance of behaviors and to design interventions to reduce the performance of such behaviors (Tapera et al, 2020). TPB has been applied in studying mobile phone usage while driving, but the literature has three shortcomings that we address in this study. First, whereas previous studies focus on mobile phone usage generally, calling, or texting, we study watching mobile video streaming while driving. Second, we focus on waiting at intersections and driving in parking lots—a scenario that has not been studied in previous TPB models. Most states enforce bans against mobile phone use while driving in parking lots. Although states have different laws regarding using mobile phones while waiting at intersections, this scenario is worthy of exploration from a behavioral perspective. Third, we include perceptions about the law against mobile phone use in our TPB model, a variable that could help policymakers craft more effective interventions. Based on our findings, we propose using a multitude of laws in addition to media campaigns to discourage watching videos while driving. We also propose requiring drivers to pass a short course on distracted driving.

2. Background and Literature Review

2.1 Explanation of TPB

According to TPB, attitudes about a behavior, subjective norms related to that behavior, and perceived behavioral control (PBC) influence the intent to perform that behavior; the intent to perform that behavior leads to the actual performance of that behavior (Ajzen, 1991). PBC also influences the actual performance of behavior, but the effect of PBC on behavior depends on the degree of *actual* behavioral control over the behavior. Attitudes, subjective norms, and PBC are hypothetical variables that cannot be directly measured through observations. Researchers must infer measurements of these hypothetical variables from questionnaire responses (Knabe, 2012).

2.2 Justification for using TPB as the behavioral model in this study

TPB has been used to model many types of behavior, including smoking (Harakeh et al, 2004), plagiarizing (Uzun and Killis, 2020), binge drinking (Elliott and Ainsworth, 2012), and construction recycling (Jain et al, 2020). A meta analysis of 185 independent TPB studies shows that TPB is useful for the prediction of intention and behavior (Armitage and Conner, 2001).

TPB has also been applied to study numerous forms of behavior in urban planning and transportation, including traffic violations such as drunk driving, speeding, and overtaking (Parker et al, 1990); using public transportation (Shaaban and Maher, 2020); using carsharing (Zhang and Li, 2020); cycling (Bird et al, 2018); and walking (Bird et al, 2018; Neto et al, 2020). In fact, the TPB model by Parker and colleagues (1992) of drivers' commitment of traffic violations was cited by Ajzen (1991) in his paper on TPB as one of the 16 studies providing empirical validation of TPB. TPB models of mobile phone use while driving have shown that attitudes, social norms, and PBC are significant predictors of intention (Zhou et al, 2009; Yao et

al, 2019; McBride et al, 2020), and that intention is a significant predictor of behavior (Nemme and White, 2010; Murphy et al, 2020).

In this study we used an extended TPB model to study video streaming while driving in two scenarios: (1) waiting at intersections, and (2) driving in parking lots. We added morality, risk of legal sanctions, risk of injury, perception about state law, and actual state law as potential predictors of intention in our extended TPB model. Morality, risk of legal sanctions, and risk of injury have been found to predict intention in numerous previous studies on mobile phone usage while driving. Perceptions about state law and actual state law are our theoretical contributions.

In addition to conducting a quantitative survey, we conducted a qualitative survey in this study on the salient beliefs about watching videos on mobile phones while driving. Qualitative studies enable researchers to evaluate data without sacrificing complexity and context (Atietno, 2009). Oviedo-Trepalacios et al (2020b) used a qualitative approach to unearth important findings on attitudes towards applications that prevent distracted driving. In addition, several studies used mixed methods approaches to study mobile phone use while driving (Truelove et al, 2019; Oviedo-Trespalacios et al, 2020a).

2.3 Justification for modeling video streaming

Among the several gaps in the literature on TPB modeling of mobile phone use while driving is the lack of investigation into video streaming while driving. Ajzen states, “the behavior of interest must be clearly defined in terms of its target, action, context, and time elements” (2019). For example, exercise behavior should be specifically defined as something like “Exercising for at least 20 minutes, three times per week for the next three months.” (Ajzen,

2019). In studying mobile phone use while driving, it is necessary to distinguish different usages in terms of purpose and form, and indeed, studies have found that there are different motivations for different usages of the mobile phone while driving (Gauld et al., 2017). Policy interventions should be crafted according to motivations to use phones for different purposes. However, while research for specific types of usages and specific scenarios is necessary, the motivations for some activities under different scenarios could turn out to be similar (i.e. texting while driving and talking while driving could have similar motivations). Policymakers are not necessarily tasked with crafting myriad interventions based on different motivations.

Previous TPB models of mobile phone use while driving have only focused on calling, text messaging, and the use of social media. Walsh and colleagues (2008) used a standard TPB questionnaire (Ajzen, 2019) to model calling and texting while driving. This procedure was repeated by Przepiorka and colleagues (2018) on Polish drivers, and by Sullman and colleagues (2018) on Ukrainian drivers. Nemme and White (2010) modeled reading and sending text messages while driving. Waddell and Wiener (2014) modeled making calls, answering calls, reading text messages, and sending text messages while driving. Benson et al (2015) and Prat et al (2015) used TPB to model reading and sending text messages while driving. Shevlin and Goodwin (2019) modeled texting generally (without specifying sending or reading) while driving. Yao and colleagues (2019) modeled using GPS navigation systems while driving. Gauld and colleagues (2017) used TPB to model initiating, monitoring, reading, and sending social interactive technology, which includes calling, texting, emailing, and using social networking sites such as Facebook and Twitter. Murphy and colleagues (2019) modeled reading and monitoring social media. Truelove and colleagues (2019) studied using Snapchat while driving, but not watching videos generally, and did not apply TPB. Qu and colleagues (2020) modeled

sending text messages, reading text messages, sending voice messages, listening to voice messages, sending pictures, and browsing pictures on Wechat while driving. No TPB model of mobile phone use while driving has included video streaming while driving, despite the strong growth of this practice as indicated earlier.

2.4 Justification for studying mobile phone use in parking lots and at intersections

In addition to differentiating mobile phone usage while driving based on form and purpose, it is also important to specify the context in which it takes place in TPB modeling, as Ajzen (2019) pointed out. Walsh and colleagues (2008) defined four scenarios specifying the location and speed of driving when mobile phones are used: driving at 100 kph while running late, driving at 100kph and are not in a hurry, waiting at traffic lights while running late, and waiting at traffic lights and are not in a hurry. Other than subsequent studies by Prezpiorka et al (2018) and Sullman et al (2018), the Walsh approach of studying mobile phone use in different scenarios has not been applied in subsequent TPB models of mobile phone use while driving. Ovideo-Trespalacios et al (2018) examined six scenarios on roads with varying traffic and road conditions, but did not include intersections or parking lots.

The lack of literature on TPB modeling of mobile phone use while driving in specific scenarios is problematic. First, the more specific and well-defined the behavior studied, the more effective the interventions. Policymakers could craft more effective interventions by studying behavior in more specific contexts. TPB models of mobile phone use while driving have not been specific enough in defining the context in which it takes place to drivers participating in the study. Second, two of the most important scenarios are not included in the four scenarios posed

by Walsh and colleagues (2008): (1) driving in parking lots, and (2) driving at low to medium speeds on city streets. It is important to focus on parking lots because the percentage of drivers who would text in parking lots (56%) is significantly higher than those on surface streets (22%) and highways (16%) (NSC, 2016). This is particularly problematic because 20% of car accidents happen in parking lots (Culver, 2021). Parking lots also rarely have defined crosswalks and other markings designed to keep pedestrians safe from cars. We were unable to find data regarding the frequency and duration of watching videos while driving in parking lots and while waiting at intersections.

We focused on these two scenarios in particular because the crash risk in these scenarios is elevated. Studies have shown that the frequencies of risky secondary tasks are significantly higher at intersections and in parking lots. For example, a naturalistic study has shown that the frequency of a driver talking to an adjacent passenger while looking at him or her is nearly four times higher while waiting at an intersection or parking in a parking lot than when the driver is not in these scenarios, and that the frequency of using mobile phones is three times higher when waiting at a red light or when parking in a parking lot than when the driver is not in these scenarios (Precht et al, 2017). Drivers tactically use their phones in these situations as they perceive the driving workload in these situations to be lower (Huth et al, 2015). Further, studies have shown that crash risk rises as a result of mobile phone use while waiting at intersections and while the vehicle is moving, and therefore we decided to investigate the waiting at intersections and driving in parking lots scenarios. Huth et al (2015) found that, when waiting at red lights, drivers using mobile phones had significantly higher rates of delayed start than drivers not using mobile phones, which presents a safety risk. For driving in parking in parking lots, the

risk is also higher because many drivers consider texting while driving at low speeds as not texting while driving (Bergmark et al, 2016).

States generally enforce traffic laws on parking lots, including laws prohibiting mobile phone use while driving. Although traffic laws are generally unenforceable on private property, private property that is publicly accessible such as shopping mall parking lots and parking garages are considered public roads subject to traffic law enforcement in most states. States that enforce traffic laws such as prohibitions on mobile phone use while driving in parking lots include Massachusetts (DeCosta-Klipa, 2020), New York (Town of Bethlehem Police Department, personal communication, 2022; Law Office of Cohen & Jaffe LLP, personal communication, 2022), California (Bentley, 2018), South Carolina (S.C. Code Ann. § 23-1-15), Oregon (ORS 801.305), Nebraska (*State v. Frederick*, 2015), and Florida (Butterworth, 1988), among others.

We also note that the law regarding mobile phone use while waiting at intersections varies from state to state. For example, in Florida, texting while waiting at red lights is legal (Hersem, 2019), but in Massachusetts no usage of mobile phones while waiting at red lights or stop signs is allowed (Commonwealth of Massachusetts Office of Grants and Research, 2020). However, it is not clear whether the difference in law regarding in texting also applies to watching videos on mobile phones. We included this scenario nevertheless because it is worthy of exploration from a behavioral perspective.

2.5 Justification for including legal knowledge as a predictor of intention

We added five variables as potential predictors of intention in our extended TPB model: moral norms, risk of legal sanctions, risk of injury due to crash, knowledge of the state law, and actual state law.

Ajzen postulated the addition of other belief factors to TPB could improve the prediction of intention in his original presentation of TPB (1991). One of the potential additions considered by Ajzen (1991) was moral norms, or the personal feeling of moral obligation to perform a certain behavior. Moral norms have been added as predictors of intention in extended TPB models of mobile phone use while driving in Nemme and White (2010), Benson et al (2015), Gauld et al (2017), Shevlin and Goodwin (2019), and others. Walsh et al (2008), Prat et al (2015), and others have added the risk of apprehension as a predictor of intention. Walsh et al (2008), Prat et al (2015) and Qu et al (2020) have added the risk of crash as a risk of intention in TPB models, although Qu and colleagues referred to this concept as "moral norms" instead. The addition of moral norms, risk of apprehension, and risk of crash to TPB models of mobile phone use while driving help policymakers identify specific beliefs to tailor their interventions to. In this study, we added knowledge of the law and actual state law as potential predictors of intention in our extended TPB model.

Knowledge of the law has been found to be significantly related to compliance with the law in numerous contexts, including tax compliance (Eriksen and Fallan, 1996; Maseko, 2014), and emergency evacuations (Kim and Oh, 2015). On the other hand, studies have found that psychologists' greater knowledge of the law has not led to increases in reporting of child abuse (Beck and Ogloff, 1995), and knowledge of the law has not been an important factor in deterring drivers from drunk driving (Kenkel and Koch, 2001). Despite the mixed result of the influence of knowledge of the law on compliance, we chose to include knowledge of the law in our model.

Knowledge of the law has yet to be explored in the mobile phone use while driving literature, and results could provide policymakers with valuable information to design interventions to reduce mobile phone usage while driving, especially if there is a significant negative connection between knowledge of the law and watching videos while driving. Further, if knowledge of the law were found to significantly influence the intention to use mobile phones while driving, this study could contribute to the literature on modifying TPB.

2.6 The Current Study

In this study, we used two surveys to understand motivations for watching videos on mobile phones while driving. First, we used a quantitative questionnaire measuring variables in an extended TPB model to determine the factors that influence the intention to watch videos while driving, and whether intention and perceived behavioral control influence behavior. Our extended TPB includes all the variables in the Ajzen TPB model (behavior, intention, attitude, subjective norms, PBC), and variables we added (moral norms, risk of legal sanctions, risk of injury, knowledge about the state law, and actual state law). We apply the extended TPB model to two scenarios: watching videos while waiting intersections, and watching videos while driving in parking lots. We hypothesize the following:

Hypothesis 1: Intention to watch a short video on a mobile phone while waiting at intersections would be influenced by attitudes, subjective norms, perceived behavioral control, moral norms, risk of legal sanctions, risk of injury, knowledge about the law, and actual law.

Hypothesis 2: Watching a short video on a mobile phone while waiting at intersections would be influenced by the intention to watch and perceived behavioral control.

Hypothesis 3: Intention to watch a short video on a mobile phone while driving in parking lots would be influenced by attitudes, subjective norms, perceived behavioral control, moral norms, risk of legal sanctions, risk of injury, knowledge about the law, and actual law.

Hypothesis 4: Watching a short video on a mobile phone while driving in parking lots would be influenced by the intention to watch and perceived behavioral control.

Second, we used a qualitative questionnaire to understand the benefits and downsides of watching; the types of videos watched; the social referents people look to when considering whether to watch videos while driving; and the exogenous factors that make it easier or more difficult to watch videos while driving.

3. Method

We conducted two surveys for this study. We conducted a quantitative TPB questionnaire measuring the constructs in our extended TPB model. Our extended TPB model included all the variables in Ajzen's TPB model and five variables that we hypothesized would determine the intention to watch videos while driving—moral norms, risk of legal sanctions, risk of injury, subjective knowledge about the legality of watching videos, and actual state law on watching

videos. We also conducted a qualitative questionnaire in which we studied the salient beliefs in TPB, including behavioral outcomes, normative referents, and control factors.

3.1 TPB Sample and Procedure

For the TPB quantitative questionnaire, we collected 205 online survey responses by recruiting workers from Amazon Mechanical Turk (MTurk) in March 2021. This is a slightly greater number than the minimum sample size of 200 for SEM suggested by Kline (2010, p. 12). We set up the survey on Qualtrics, an online survey platform that administers surveys and records responses. We then set up a Human Intelligence Task (HIT) on MTurk. MTurk workers who wanted to complete the HIT were directed to our survey on Qualtrics. We requested that MTurk workers live in the United States, be car owners, and have Masters Qualification (meaning workers have completed a high number of HIT on MTurk and a significant percentage of their completed HIT were approved by the requesters). We eliminated 21 incomplete responses from our analysis. Table 1 shows the demographic breakdown of our sample.

The first part of the questionnaire had three items about demographic data. In our model, gender was treated as a binary variable (male = 1, female = 0); age was a continuous variable. Next, we showed respondents photographs depicting the scenarios in our study: waiting at an intersection, and driving in a parking lot. Next, we included a series of items measuring each construct in our extended TPB model. The questionnaire is in Appendix B.

Table 1 Demographic Characteristics of Sample

Characteristic	Relative Frequency
Male	56%
Female	44%
Non-Hispanic White	86%
Black or African American	3%
American Indian or Alaska Native	1%
Asian	7%
Native Hawaiian or Pacific Islander	0%
Other	2%
Hispanic American	2%
0-20	0%
21-30	10%
31-40	41%
41-50	26%
51-60	17%
61-70	4%
71-80	2%

3.2 Model

We fitted an extended TPB model into a structural equation model (SEM). In our extended TPB model, intention is predicted by (a) the conventional TPB constructs: attitudes, subjective norms, and perceived behavioral control; (b) constructs added by other TPB studies on distracted driving: moral norms, risk of injury, and risk of legal sanctions; and (c) two variables about the law: perception of whether the state where the driver resides has banned watching videos while driving, and whether the state has actually banned using handheld devices while driving. Figure 1 shows the model.

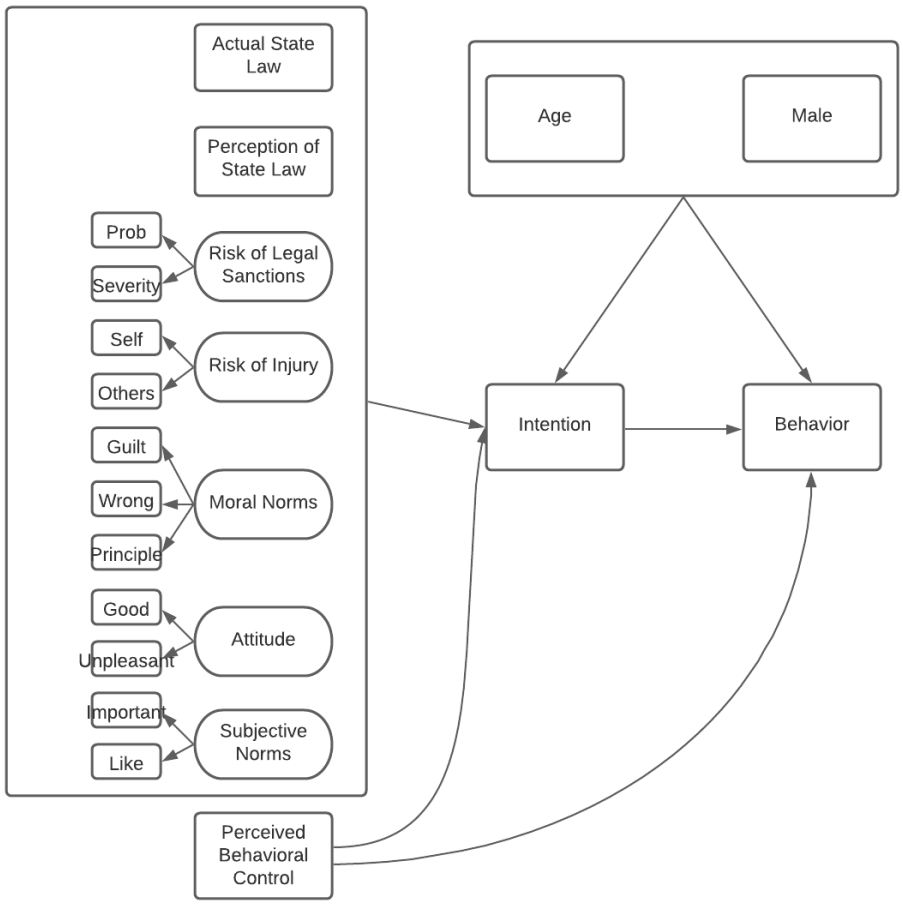

Figure 1 Extended TPB Model

3.3 Measures

The questionnaire consisted of 3 items about demographic information and 17 items measuring the TPB constructs. The questions were formulated based on Ajzen's guidelines for TPB questionnaires (2019). To avoid lengthening the questionnaire and potentially reducing data quality, we did not measure socioeconomic variables such as education and income. Each of the first 15 of the 17 TPB questions contained 4 subparts corresponding to 2 scenarios: (1) waiting at intersections, and (2) driving in parking lots.

3.3.1 Intention

Intention was measured with one item: “I intend to watch a short video on my mobile phone while driving in the following scenarios.” The answers were given on a seven-point Likert scale between Extremely Likely and Extremely Unlikely.

3.3.2 Attitudes

Attitudes were measured with two items. “Watching a short video on my mobile phone while driving in the following scenarios would be good” measured instrumental attitude. This item was labeled “good” in Figure 1. “Watching a short video on my mobile phone while driving in the following scenarios would be unpleasant” measured experiential attitude. This item was labeled “unpleasant” in Figure 1. Answers to experiential attitude were reverse coded to match the logic of our model. The answers were given on seven-point Likert scales between Extremely Good and Extremely Bad, and Extremely Unpleasant and Extremely Pleasant, respectively. These two items are labeled “good “and “unpleasant” in the tables below and in Figure 1.

3.3.3 Subjective norms

Subjective norms included both injunctive norms and descriptive norms. Injunctive norms refer to what people think others believe. Descriptive norms refer to what people think others do. Ajzen (2019) recommended measuring both injunctive and descriptive norms. We

measured only injunctive norms in this study, as descriptive norms were modeled in Waddell and Wiener (2014) and we wanted to keep the questionnaire as short as possible to avoid the potential for respondent fatigue (Hochheimer et al, 2016). Injunctive norms were measured with two items. “Most people who are important to me approve of my watching a short video on my mobile phone while driving in the following scenarios” and “Most people like me approve of my watching a short video on my mobile phone while driving in the following scenarios.” The answers to the first question were given on a seven-point Likert scale between Strongly Agree and Strongly Disagree. The answers to the second question were given on a seven-point Likert scale between Extremely Likely and Extremely Unlikely. The two items were labeled “important” and “like” in the tables below and in Figure 1. We did not measure descriptive norms.

3.3.4 Perceived behavioral control

PBC was measured using two items. “I am confident that I can watch a short video on my mobile phone while driving in the following in the following scenarios” measured the capacity aspect of PBC. “Watching a short video on my mobile phone while driving in the following scenarios is up to me” measured the autonomy aspect of PBC. The answers to the first question were given on a seven-point Likert scale between Definitely True and Definitely False. The answers to the second question were given on a seven-point Likert scale between Strongly Agree and Strongly Disagree. There was poor internal consistency between the two PBC questions (See 3.4). In our analysis, we dropped the capacity aspect of PBC in our SEM.

3.3.5 Moral norms

Moral norms were measured with three items: “I would feel guilty if I watched a short video on my mobile phone while driving in the following scenarios,” “I think that watching a short video on my mobile phone while driving in the following scenarios is wrong,” and “Watching a short video on my mobile phone while driving in the following scenarios goes against my principles.” The answers to all three questions were given on a seven-point Likert scale between Strongly Agree and Strongly Disagree. We reverse coded the scores to reach logical consistency with our model. The three items are labeled “guilt,” “wrong,” and “principle” in the tables below and in Figure 1.

3.3.6 Risk of injury

The risk of injury was measured with two questions: “My watching a short video on my mobile phone while driving in the following scenarios will cause me to be injured from an accident,” and “My watching a short video on my mobile phone while driving in the following scenarios will cause others to be injured from an accident.” For both questions, answers were given on seven-point Likert scales of Extremely Likely to Extremely Unlikely. We reverse coded the scores to reach logical consistency with our model. The items are labeled “self” and “others” in the tables below and in Figure 1.

3.3.7 Risk of legal sanctions

The risk of legal sanctions was measured with two questions: "I will be caught by the police if I watch a short video on my mobile phone while driving in the following scenarios," and "I will be punished severely by law enforcement if I watch a short video on my mobile phone while driving in the following scenarios." The answers to the first question were given on a seven-point Likert scale between Extremely Likely and Extremely Unlikely. The answers to the second question were given on a seven-point Likert scale between Strongly Agree and Strongly Disagree. We reverse coded the scores to reach logical consistency in our model. The items are labeled "prob" and "severity" in the tables below and Figure 1.

The probability of legal sanctions is a product of several probabilities, each arising the uncertainty associated with a different aspect of compliance with the law. There are two major variables that result in uncertainty over legal sanctions against a particular behavior: 1) the uncertainty over there is a substantive law that makes that behavior illegal, and 2) the uncertainty over whether law enforcement will catch the wrong-doer given that there is a law prohibiting that behavior. In this instance, there is a distinction between 1) the uncertainty that there is a law prohibiting watching videos on mobile phones while driving, and 2) given that there is such a law, the probability that the police will arrest a driver that watches a video on a phone will driving. The two uncertainties are not fungible, and have different effects on compliance (Feldman and Teichman, 2008). By "risk of legal sanctions" in this paper, we mean the latter—the uncertainty over whether law enforcement will catch a driver for watching videos on his mobile phone while driving. The former uncertainty—whether a substantive law prohibiting the behavior exists—is measured by another variable in our model, which is to be discussed in 3.3.8.

3.3.8 Knowledge of state law

Knowledge of the state law was measured by one question: "Does the law in your state prohibit watching videos on mobile phones while driving?" Answer choices were: (1) Yes, the law in my state prohibits watching videos on mobile phones while driving; (2) No, the law in my state does not prohibit watching videos on mobile phones while driving; (3) I don't know the law in my state regarding watching videos on mobile phones while driving. In our data analysis, we assigned a score of 1 to a variable we called subjective knowledge of the law if the respondent indicated that the state where he/she lives has prohibited watching videos on mobile phones while driving, and 0 for all other responses.

3.3.9 Actual state law

We asked each respondent for the state of residence. We obtained information on each state's law with respect to whether drivers are prohibited from using handheld devices while driving. We assigned the actual state law on mobile phone use while driving to each respondent based on the state where the respondent lives. In our data analysis, we assigned a score of 1 to a variable that we called actual law if the state has prohibited using handheld devices while driving, and 0 if the state has not.

Our questions about the knowledge of the law were not specified to particular scenarios. Thus the same responses were used in all SEM we estimated.

3.3.10 Behavior

Behavior was measured by one question: "How often do you watch a short video on your mobile phone while driving in the following scenarios?" Answers were given on a seven-point Likert Scale between Always and Never.

3.4 Internal Consistency of TPB Constructs

The Cronbach's Alpha analysis showed that there was acceptable internal consistency (Cronbach's Alpha > 0.70) for subjective norms, moral norms, physical risk, and legal risk in all scenarios. There was poor internal consistency between the capacity and autonomy aspects of perceived behavioral control for all scenarios; the Cronbach's Alphas are far lower for all scenarios, far lower than the generally acceptable value of 0.7 (Tavakol and Dennick, 2011).

Table 2 Cronbach's Alpha for TPB Constructs

	Intersection	Parking Lots
Attitude	0.70	0.65
Subjective Norms	0.86	0.81
Perceived Behavioral Control	0.55	0.35
Moral Norms	0.93	0.84
Risk of Injury	0.96	0.89
Risk of Legal Sanctions	0.81	0.74

According to Ajzen (2019), items may have to be dropped to achieve internal consistency of each TPB construct. We dropped one item (capacity) from PBC.

3.5 Data Analysis

Data was analyzed using the statistical package MPlus Version 8.1. We ran a structural equation model (SEM) for the intersection scenario and the parking lot scenario. For each of the two scenarios we analyzed, we ran (1) a SEM with the original TPB variables only (behavior, intention, attitude, subjective norms, and perceived behavioral control); and (2) a SEM with the original TPB variables (behavior, intention, attitude, subjective norms, and perceived behavioral control) plus additional predictor variables for intention (moral norms, risk of injury, risk of legal sanctions, knowledge about the law, and actual law). In both approaches, we used age and gender as control variables.

3.6 Qualitative Questionnaire Sample and Procedure

We conducted a questionnaire composed exclusively of qualitative questions measuring the salient beliefs. We collected 27 online survey responses by recruiting workers from MTurk in February 2021. The number of survey responses followed Ajzen's (2019) recommendation for qualitative TPB surveys. We set up the survey on Qualtrics, an online survey platform that administers surveys and records responses. We then set up a HIT on MTurk. MTurk workers who wanted to complete the HIT were directed to our survey on Qualtrics. We requested that MTurk workers live in the United States, be car owners, and have Masters Qualification.

We asked about ten questions in our qualitative questionnaire. All questions were open-ended questions with free response answers. We first asked whether the respondent has ever watched a video while driving. Respondents who answered that they had not were removed from the survey. We then asked questions about the benefits of watching videos, downsides of watching videos, and the types of videos watched while driving; these questions were used to

measure salient behavioral outcome beliefs. All respondents were required to provide three answers. We then asked the respondents to identify individuals or groups who would approve and individuals or groups who would disapprove of watching videos while driving; these two items were intended to identify injunctive normative referents. All respondents were required to provide three answers. We then asked the respondents to identify those who are most likely and those who are least likely to watch videos while driving; these two items were intended to identify descriptive normative referents. All respondents were required to provide three answers. We followed normative referents with control factors. We asked respondents to identify factors or circumstances that would make it easier and those that would make it harder to watch videos while driving. All respondents were required to provide three answers. All answers to the previous questions were one word to about ten words in length. We did not ask for any socio-demographic information in the qualitative questionnaire. Our TPB sample was not stratified for any socio-demographic dimensions, so we were not interested in the socio-demographic makeup of the qualitative questionnaire.

For data analysis, we took a summative approach to coding (Gaber, 2020). We identified several themes for each question based on the mixed TPB study on texting while driving by Benson and colleagues (2015). As we examined our data, we developed additional codes to represent themes from our study of watching videos while driving.

4. Results

4.1 Descriptive Statistics

The distributions of behavior and intention showed a disturbingly high willingness to watch videos while waiting at intersections and driving in parking lots. Only 37% of the respondents stated that it is extremely unlikely that they intend to watch a short video while waiting at an intersection, and 59% stated that they never watch a short video while waiting at an intersection. 72% of the respondents stated that it is extremely unlikely that they intend to watch a short video while driving in a parking lot, and 88% stated that they never watch a short video while driving in a parking lot.

99 of 205 (48%) of the respondents reported not knowing whether it is illegal to watch videos on their mobile phones while driving. As of January 2021, 24 states and the District of Columbia have banned using handheld devices while driving. 62 of 205 (30%) reported that it is illegal to watch videos on their phones while driving, when it is indeed illegal to use handheld devices while driving in their states. 40 of 205 (20%) reported that it is illegal to watch videos on their phones while driving, when it is actually not illegal to use handheld devices while driving in their states. 2 of 205 (1%) reported that it is not illegal to watch videos on their phone while driving, when it is indeed not illegal to use handheld devices while driving in their states. 2 of 205 (1%) reported that it is not illegal to watch videos on their phone while driving, when it is actually illegal to use handheld devices while driving in their states. Of the respondents who answered the state law question incorrectly, 40 of 42 mistakenly believed that it is illegal to watch videos while driving even though their states have not outlawed using handheld devices while driving.

Table 3 Descriptive Statistics

	Intersection		Parking Lot	
	M	SD	M	SD

Behavior	6.36	0.91	6.83	0.54
Intention	5.32	1.81	6.47	1.14
Unpleasant	5.29	1.25	6.39	0.88
Good	3.92	1.78	2.26	1.46
Important	5.75	1.50	6.59	0.84
Like	5.70	1.54	6.64	0.76
PBC	2.76	2.15	3.24	2.46
Guilt	3.35	2.01	1.93	1.49
Wrong	2.88	1.81	1.51	0.89
Principle	2.92	1.95	1.63	1.13
Self	4.37	1.84	2.83	1.67
Others	4.26	1.92	2.50	1.57
Prob	4.02	1.88	4.00	1.98
Severity	4.06	1.84	3.41	1.80

Table 4 Correlation Coefficients Among TPB Variables

Intersection Model	Behavior	Intention	Unpleasant	Good	Important	Like	PBC	Guilt	Wrong	Principle	Self	Others	Prob	Severity	Perception	Actual
Behavior																
Intention	0.708															
Unpleasant	0.458	0.540														
Good	0.606	0.688	0.576													
Important	0.431	0.539	0.488	0.582												
Like	0.467	0.502	0.481	0.517	0.745											
PBC	0.178	0.229	0.267	0.204	0.150	0.165										
Guilt	0.442	0.597	0.606	0.657	0.565	0.543	0.306									
Wrong	0.553	0.664	0.590	0.678	0.694	0.667	0.310	0.798								
Principle	0.582	0.662	0.578	0.656	0.665	0.610	0.286	0.759	0.921							
Self	0.400	0.436	0.568	0.576	0.512	0.480	0.290	0.655	0.685	0.658						
Others	0.363	0.395	0.573	0.561	0.454	0.451	0.344	0.666	0.660	0.635	0.914					
Prob	0.224	0.209	0.347	0.422	0.402	0.360	0.190	0.421	0.467	0.403	0.601	0.552				
Severity	0.230	0.267	0.378	0.391	0.407	0.402	0.224	0.518	0.547	0.494	0.614	0.585	0.680			
Perception	0.002	-0.026	-0.011	0.056	0.025	0.116	0.104	0.094	0.106	0.040	0.097	0.086	0.202	0.213		
Actual	0.124	0.143	0.072	0.145	0.161	0.083	0.026	0.132	0.215	0.156	0.111	0.064	0.166	0.170	0.229	

Parking Lot Model	Behavior	Intention	Unpleasant	Good	Important	Like	PBC	Guilt	Wrong	Principle	Self	Others	Prob	Severity	Perception	Actual
Behavior																

Intention	0.587															
Unpleasant	0.314	0.449														
Good	0.548	0.697	0.546													
Important	0.289	0.416	0.411	0.455												
Like	0.459	0.476	0.385	0.538	0.616											
PBC	0.133	0.113	0.074	0.065	-0.004	0.044										
Guilt	0.383	0.551	0.465	0.498	0.404	0.461	0.171									
Wrong	0.521	0.631	0.462	0.666	0.573	0.660	0.112	0.633								
Principle	0.497	0.644	0.466	0.631	0.521	0.593	0.087	0.670	0.794							
Self	0.193	0.278	0.400	0.432	0.240	0.270	0.159	0.452	0.415	0.409						
Others	0.263	0.319	0.422	0.488	0.332	0.434	0.193	0.517	0.529	0.523	0.796					
Prob	0.081	0.082	0.309	0.267	0.201	0.203	0.098	0.259	0.195	0.211	0.538	0.468				
Severity	0.124	0.138	0.248	0.258	0.226	0.284	0.070	0.308	0.255	0.240	0.563	0.530	0.602			
Perception	-0.190	-0.015	0.006	-0.065	0.009	-0.021	0.104	0.049	0.030	-0.050	0.079	0.045	0.151	0.170		
Actual	0.067	0.058	0.037	0.029	0.132	0.012	0.025	0.141	0.145	0.078	0.057	0.011	0.121	0.075	0.229	

4.2 SEM Goodness of Fit Indices

The goodness of fit indices mostly showed that our model was a good fit for the watching videos while waiting at an intersection and watching videos while driving in a parking lot scenarios. The Comparative Fix Index (CFI) and Tucker Lewis Index for both scenarios were both above 0.9, which is considered acceptable (Hooper et al, 2008). The Root Means Square Error of Approximation (RMSEA) for both scenarios were both roughly 0.8, which is also acceptable (Hooper et al, 2008). The Standardized Root Mean Square Residual (SRMR) for the parking lot scenario is below 0.8, which is acceptable (Hooper et al, 2008), while the SRMR for the intersection model is slightly above the acceptable level.

Table 5 Goodness of Fit Indices

	Intersection TPB Model	Parking Lot TPB Model	Intersection Extended TPB Model	Parking Lot Extended TPB Model
CFI	0.95	0.952	0.955	0.944

TLI	0.913	0.916	0.941	0.926
RMSEA	0.094	0.084	0.069	0.065
SRMR	0.084	0.061	0.099	0.078

4.3 Prediction of Intention and Behavior

In the both the original TPB model and our extended TPB model with additional variables, attitude was a significant predictor of intention for both watching videos on mobile phones while waiting at intersections and watching videos on mobile phones while driving in parking lots. Subjective norms and perceived behavioral control were not significant predictors of intention in neither the original TPB model nor in our extended TPB model.

In our extended TPB model, moral norms were a significant predictor of intention for driving in parking lots. Interestingly enough, the risk of injury was negatively related to the intention to watch videos in intersection and in the driving in parking lot scenario.

In both scenarios, intention was a significant predictor of behavior in both the original TPB model and in our extended TPB model. Age was a significant predictor of behavior in both scenarios in both models. The older the driver, the less likely the driver is to watch videos while driving.

Table 6 SEM Results

	Original TPB Model				Extended TPB Model			
	Intersection		Parking Lot		Intersection		Parking Lot	
Intention	β	p	β	p	β	p	β	P
Attitude	0.86	0.00	0.74	0.00	1.18	0.00	0.78	0.00
Subj. Norms	-0.06	0.69	0.03	0.76	-0.14	0.41	-0.24	0.15
PBC	0.05	0.32	0.07	0.15	0.04	0.44	0.06	0.22
Moral Norms					0.15	0.48	0.47	0.04
Injury Risk					-0.39	0.04	-0.32	0.05

Legal Risk					-0.15	0.23	-0.02	0.91
Know Law					-0.05	0.26	0.03	0.56
Actual Law					0.04	0.41	-0.01	0.80
Age	0.04	0.46	-0.04	0.46	0.07	0.16	0.01	0.84
Male	0.05	0.35	0.03	0.60	0.03	0.59	0.03	0.60
Behavior	β	p	β	p	β	p	β	P
Intention	0.70	0.00	0.62	0.00	0.70	0.00	0.58	0.00
PBC	0.01	0.91	0.04	0.44	0.01	0.81	0.06	0.30
Age	0.17	0.00	0.14	0.01	0.18	0.00	0.14	0.05
Male	0.06	0.27	0.09	0.10	0.07	0.15	0.08	0.19

Coefficients were standardized (STDXY)

4.4 Salient Beliefs

We collected 27 responses to the qualitative survey with open-ended questions. The responses were coded, and the table below shows all responses that appeared more than 7 times, in order of highest frequency.

Table 7 Most frequent answers to qualitative survey questions

Benefits:

- Entertainment
- Pass time or relieve boredom
- Work or multitask
- Keep up with the news

Downsides:

- Distraction
- Danger
- Car accident
- Getting caught by the police

People who think I should watch:

- Friends

- Teenagers
- Siblings

People who think I should not watch:

- Parents
- Police
- Friends

People who think I are most likely to watch:

- Teenagers
- Friends
- Young adults
- Siblings

People who I think are least likely to watch:

- Parents
- Elderly
- Police

Factors that would make it easier to watch:

- Moving slowly in traffic
- Phone mount
- Red light
- Integrated video in front console

Factors that would make it harder to watch:

- Poor weather
- Heavy traffic

Types of videos watched:

- News
- Comedy
- Video from friends/family
- Sports
- Music
- Tiktok/Twitter/Instagram

5. Discussions

5.1 Prevalence of Watching Videos While Driving and Comparison of Scenarios

The first interesting finding is that people don't watch videos on their mobile phones while driving as much as they use their phones for other purposes. Nelson et al (2009) found that 100% of drivers talk on their phone while driving at some of the time. Atchley et al (2011) found that 95% of drivers text and drive. Benson et al (2015) found that 73% of drivers read or sent a text message while driving. Truelove et al (2019) found that 84% of young drivers never use Snapchat while driving, while 85% of young drivers never send videos or photos using Snapchat while driving. We found that only 12% of drivers watch videos on their phones at some time while driving in parking lots, and only 41% of drivers watch videos some of the time on the phones while waiting at intersections. Our findings are similar to those of Gauld et al (2017), whose survey found that texting (81%) and talking (74%) on mobile phones while driving were much more common among drivers than using video-related apps such as Snapchat (41%) and Skype (4%). Similar to Walsh et al (2008), we found a difference across different scenarios in terms of the intention to use mobile phones while driving. There was also a difference in the behavior scores for the two scenarios.

The differences in perception between watching videos while waiting at an intersection and driving in a parking lot in our study were similar to the findings of other studies. Kinney and colleagues (2019) found that drivers felt more efficacious and less guilty about using mobile phone screens while stopped than while moving; they also found that drivers considered using mobile phones as less risky and more acceptable while stopped than while moving. Similarly, as Table 3 shows, we found drivers felt more capable of using their phones (as represented by PBC), less guilty, less risky, and less wrong to use their phones while they are waiting at intersections than while they are driving in parking lots.

5.2 Direct TPB Measures

Our study provided qualified support for TPB in the context of watching videos on mobile phones while driving. Consistent with numerous studies of texting or calling while driving (Walsh et al, 2008; Zhou et al, 2009; Nemme and White, 2010; Prat et al, 2015; Benson et al, 2015; Gauld et al, 2017; Shevlin and Goodwin, 2019), attitude was a significant predictor of intention. However, neither subjective norms nor perceived behavioral control were significant predictors of intention. This finding is consistent with the findings of Walsh and colleagues (2009) for calling and texting under four scenarios, and with those of Benson and colleagues (2015) for texting. Our findings stand in contrast to those of Zhou et al (2009), Waddell and Wiener (2014), and Gauld et al (2017), who found that both PBC and subjective norms were significant predictors of intention. Prat et al (2015) found that PBC was a significant predictor of intention while subjective norms were not. Few previous studies have explored the link between the intention to use a mobile phone while driving and the actual usage of a mobile phone while driving. We found that there was a significant relationship between intention and behavior, consistent with TPB.

Our findings suggest that TPB is not necessarily the ideal model for explaining or understanding watching videos while driving at the moment. It is possible that the relatively recent occurrence of watching videos while driving renders subjective norms insignificant in informing the intention to watch. A subsequent study may yield different findings about the role of subjective norms in informing intention. The lack of significance of PBC could be attributed to the possibility that watching videos while driving is a voluntary rather than involuntary behavior. TPB, as Walsh and colleagues (2008) pointed out, is best for modeling involuntary

behavior, but watching videos on mobile phones while driving could be a voluntary behavior. In addition, the poor fit of TPB could be explained by the fact that watching videos while driving is a rather extreme behavior.

Moral norms were a significant predictor of intention in the parking lot scenario but not in the intersection scenario. Other studies have similarly shown mixed results about the significance of moral norms in informing the intention to use mobile phones while driving. Gauld et al (2017) found that moral norms were a significant predictor of initiating and monitoring/reading, but not in responding to social interactive technology while driving. Benson et al (2015) found that moral norms were significant predictors of the intention to text while driving; Nemme and White also found that moral norms were significant predictors of the intention to send and read text messages while driving. It appears that moral norms should be included in subsequent TPB studies of behavior related to mobile phone use while driving, although it is not always a significant predictor of intention.

The risk of legal sanctions was not a significant predictor of watching videos while driving in either the intersection or the parking lot scenario. Our finding was consistent with those of Prat et al (2015) for reading and sending text messages while driving. This does not imply that the risk of legal sanctions should not be included in similar or related TPB studies. Walsh et al (2008) found that the risk of apprehension is a significant predictor of the intention to text, but not in the intention to call. However, our finding demonstrates the idea that extrinsic factors such as the risk of legal sanctions are secondary to intrinsic factors such as attitude in terms of motivating behavior, which has been observed in studies on compliance with the law (Tyler, 2006), including in the transportation context (Gao and Zhao, 2017; Gao and Zhao, 2018).

Surprisingly, the risk of injury had a negative relationship with the intention to watch mobile phones while driving in the parking lot scenario and in the intersection scenario; we found that the greater the perceived risk, the greater the intention to watch. This was surprising given that the risk of injury had a positive correlation with intention, and we expected the relationship to be the opposite of the relationship we found. This is likely the result of suppression by another predictor of intention. One possibility for this surprising relationship is that people who are more aware of the risk of watching videos while driving are more competent drivers, or at least perceive themselves that way. Because they are (or perceive themselves as) more competent drivers, they are more confident in their ability to drive while watching videos, and therefore have greater intentions to watch while driving despite being aware of the high risk of watching videos while driving.

Neither the perception about the state law regarding handheld device usage while driving nor the actual state law was significantly related to the intention to watch videos while driving in either scenario. However, the behavior we studied did not exactly match the law in question. The law applies to using handheld devices generally, whereas the behavior we studied was watching videos on mobile phones specifically. Further investigation is needed to determine the significance of both the perception about the law and the law itself in deterring drivers from using their mobile phones while driving.

From a policy perspective, the significance of attitude on intentions and the lack of significance of legal sanctions and awareness of the law on the intention to watch videos while driving corroborate the results of studies on drunk driving. Legal tools are a subset but not the entirety of policy interventions. The existence of variables in TPB such as attitude and subjective norms shows that behavior is shaped by numerous factors other than direct legal interventions

such as greater enforcement, more severe punishment, or awareness of the law. The lack of significance of legal sanctions and awareness does not necessarily mean that authorities cannot reduce watching videos on mobile phones while driving. Interventions should target attitude to reduce the frequency of watching videos on mobile phones while driving in parking lots and while waiting at intersections. Media campaigns have been used to change attitude in drunk driving and therefore could be useful for watching videos while driving as well. Tay (2005) found that media campaigns significantly reduced the frequency of drunk driving, whereas Evans et al (1990) found that no particular punitive law has significantly reduced drunk driving. However, Evans et al (1990) found that multiple laws (i.e. mandatory seatbelt use and beer taxes) likely had a collective effect on reducing drunk driving. It is possible that multiple laws could synergistically reduce mobile phone use while driving as well. In this instance, media campaigns and a multifront policy intervention are likely necessary to effectively reduce watching videos on mobile phones while driving (Ashford and Caldart, 2021). In addition to enacting legislation against mobile phone use while driving, requiring mobile phone service providers to raise rates for wireless service—or not offering service at all—while the user is moving above certain speeds (as a proxy for driving) or is in certain locations like on highways could further discourage drivers from watching videos while driving. This would be analogous to the law raising beer taxes to discourage drunk driving, as proposed by Evans et al (1990).

Another policy intervention would be to a state to require all drivers to pass a short online course on distracted driving. We found that moral norms were a significant motivation for watching videos while driving in the parking lot. Thus a short course that includes moral appeals could reduce the frequency of watching videos while driving in parking lots and while waiting at intersections. Drivers would be given a 90-day notice to pass the course, or have their drivers'

licenses voided. Most drivers in 2021 obtained their licenses before smartphones became popular and video streaming became possible on mobile phones. Most did not attend training courses or pass tests that required knowledge of the dangers of distracted driving. As we've found, most drivers are not aware of the law regarding mobile phone use while driving in their states. Policy interventions that are more salient, such as requiring all drivers to pass a short course, would be more effective than imposing penalties on drivers caught in the act (Chetty et al, 2009). This would also be less costly to implement. A short course informing drivers of the law and the dangers of distracted driving could reduce the incidence of watching while driving.

5.3 Indirect TPB Measures

The results from our qualitative survey were arguably our most significant contribution to crafting policy interventions to reduce watching videos while driving. This step is crucial from a policy perspective, but only one previous TPB study (Benson et al, 2015) undertook a similar qualitative survey. Subjective norms and PBC were found to be insignificant predictors of intention in our study, and attitude was too broad of a term to yield meaningful insights into policy interventions. The answers we received from our qualitative survey provide policymakers with greater understanding of reasons for watching videos while driving.

The benefits and downsides of watching videos on mobile phones while driving were the essentially the same as the advantages and disadvantages, respectively, of texting while driving in the study by Benson and colleagues (2015), with two exceptions. We found that "entertainment" was the advantage that appeared the most frequently in respondents' answers; "keeping up with news" also appeared at least seven times in respondents' answers. Benson et al

(2015) did not find these advantages in the texting while driving study. These advantages are unsurprising, given that the answer that appeared the most frequently to the type of videos watched question is news. The second most frequently appeared answer was comedy, followed by music and sports (among others), all of which could be considered entertainment. Potential policy solutions could require mobile news and entertainment videos to include warnings about the danger of mobile phone while driving.

We found that friends and teenagers were among the people whom the respondents think would approve of watching videos on phones while driving, and police and friends were among the people whom the respondents think would not approve of driving. These were the same as the findings of Benson et al (2015) on texting while driving. The fact that friends appeared in both groups could be explained to some extent by the fact that some respondents named different types of friends or particular individuals that they called their friends. For example, one respondent named “intelligent friends” among people he thinks would not approve watching videos while driving, and “less intelligent friends” among people he thinks are most likely to watch videos while driving.

It is interesting to note that siblings appeared among people the respondents think should watch videos while driving, but parents was the most frequent answer to people who think the respondents should not watch videos while driving. Benson et al (2015) did not report such findings, and reported only “family or relatives” among people who would not approve. While these findings on the indirect beliefs shaping subjective norms are interesting, subjective norms were not significant predictors of intention in either scenario. Watching videos on mobile phones while driving is therefore unlikely to be influenced by perceptions about whether friends and family watch while driving.

Two of the most frequently appeared factors in our survey, that would make it easier to watch videos according to drivers, are having a phone mount and having an integrated video screen in the front console. Poor traffic was the most frequently answered factor that would make it harder to watch videos while driving, which did not appear in the Benson et al (2015) study on texting while driving.

The salient beliefs inform attitude, subjective norms, and PBC. Respondents' perceptions about whether watching videos on mobile phones while driving in parking lots or while waiting at intersections would be "good" or "pleasant" are in particular about whether watching videos on mobile phones while driving in these scenarios would be entertaining, whether it would enable the driver to pass time or relieve boredom, whether it would enable the driver to work or multitask, whether it would enable the driver the keep up with the news, whether it would be distracting, whether it would be dangerous, whether it would cause car accidents, and whether it would make the driver get caught by the police. As Table 6 shows, attitude formed on these beliefs in turn influence intention. Respondents' perceptions about whether others would approve of watching videos on mobile phones while driving in parking lots and while waiting at intersections are particularly focused on the perceptions of their friends, teenagers, siblings, young adults, the elderly, parents, and police. However, as Table 6 shows, these perceptions do not influence intention. Respondents' perceptions about whether one can and is able to watch videos on mobile phones while driving in parking lots and while waiting at intersections are shaped by whether they are moving slowly in traffic, whether there is a phone mount, whether there is a red light, whether there is integrated video in the front console, whether there is poor weather, and whether there is poor traffic. However, as Table 6 shows, these factors shaping PBC do not influence intention.

Generally, the results of our qualitative study were similar to those in the Benson et al (2015) study. Therefore, policy interventions intended to reduce watching videos on mobile phones while driving in parking lots and while waiting at intersections could simultaneously reduce all types of usage, including texting, calling, and video watching.

5.4 Significance of the Contributions

Among our contributions are 1) data on the frequency and prevalence of watching videos on mobile phones while driving, 2) data on the perceptions about various aspects of watching videos on mobile phones while driving, 3) analysis indicating the motivational and demographic factors that are associated with watching videos on mobile phones while driving, and 4) salient beliefs about the determinants of attitude, subjective norms, and perceived behavioral control with respect to watching videos while driving. The data on the frequency and prevalence of watching videos while driving, which was previously unavailable, indicate that policymakers should strongly consider undertaking interventions to reduce this type of harmful behavior. However, we should mention that the cost of interventions and benefits of risk reduction should be considered prior to implementing interventions. The findings that attitude significantly influences intention but legal sanctions do not significantly influence intention direct policymakers to consider policy interventions other than greater law enforcement and awareness, and instead consider interventions that change attitudes, such as educational programs. This would help to make the use of social resources to make increase safety more effective and less costly. For example, our results suggest that public resources should be spent on implementing a short course on mobile phone use while driving rather than increasing policing resources on

monitoring the roads to increase the likelihood of catching drivers watching videos while driving.

5.5 Limitations

There are several shortcomings in our approach. First, our operationalization of subjective norms was limited to injunctive norms. Ajzen (2019) stated, in terms of TPB modeling, that subjective norms should include both injunctive norms and descriptive norms. Descriptive norms have been found to significantly influence the intention to initiate and respond to calls and text messages on mobile phones while driving (Waddell and Wiener, 2014). From a policy perspective, injunctive norms and descriptive norms must be aligned for normative interventions to be effective (Cialdini, 2003).

Second, our scenario of driving in a parking lot could be confusing to respondents and could be read as either navigating the car within the parking lot, or parking the car into a spot after having found a spot. These are distinctive activities that require different skills and types of attention. Future studies on driving in parking lots should clarify which of the two activities is being considered. In addition, future studies could specify the type of intersection where the driver is waiting.

Third, our sample was not demographically representative of the American population. Our sample had disproportionately more males (56%) and whites (86%) than the American population in 2021 (49% and 61%, respectively). The demographic disparity between our sample and the American population limits the generalizability of our findings to some extent. However, it should be noted that Klein et al (2014) found that there was very little statistical difference

between MTurk workers and samples recruited from universities across the US in a replication study of thirteen well known psychology experiments. Mullinix et al (2015) found that there were significant similarities between MTurk workers and nationally representative population samples. A related point is that our results are limited to the United States; similar studies in other countries may yield different results.

Fourth, our sample is missing some parts of the population altogether. Because we required our correspondents to own cars, we likely failed to include significant numbers of teenage drivers who own and use mobile phones, but do not own vehicles. In fact, the youngest respondent in our sample was 24 years old. Our oldest drivers, as a side note, was 77 years old. The missing young drivers poses challenges not only for the generalizability of our sample from a methodological perspective, but also limits the validity and applicability of policy findings. Young drivers are among the most likely to use mobile phones while driving, but our sample does not include them.

Fifth, our quantitative survey was not built from the findings from the qualitative survey. The salient beliefs underlying attitude, subjective norms, and PBC found from the qualitative survey should have been built into the quantitative survey (Azjen, 2019). For example, for attitude, in addition to asking whether watching videos while driving would be entertaining and whether watching videos while driving would be pleasant, we could have also asked whether watching videos while driving would be entertaining and whether watching videos while driving would be distracting (see Table 7 for the salient beliefs). We chose not to add the specific questions built from the salient beliefs found in the qualitative survey because we covered multiple scenarios in our study and we did not want to compromise the quality of the answers as a result of lengthening the survey.

Lastly, results for knowledge about the state law and actual state law variables need to be viewed with caution. As previously stated, the relevant state law is whether handheld devices are banned altogether, which presumably includes watching videos while driving, but the behavior in question in our TPB model is watching videos while driving. The mismatch in scope of behavior could be responsible for causing the lack of significant relationship between the predictors and intention in our model. In addition, we found that about half of our respondents don't know the relevant law in their states. Many states have expanded their prohibitions of using handheld devices while driving in the past two years. As drivers become more aware of their state laws, the role of state law in shaping behavior may change.

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Appendix A Qualitative Questionnaire

*Note: except for the first question (A1), all questions required qualitative free response answers.

A1 We are interested in your attitudes and behavior with respect to watching short videos on your phone while driving.

For the purposes of this survey, watching short videos means watching videos less than 60 seconds long on **mobile apps** such as:

TikTok Twitter Facebook and Facebook Watch Instagram and IGTV YouTube byte Periscope Snapchat ESPN Live highlights And others

Have you ever watched a short video on your mobile phone while driving a car, including when you're waiting for a red light at an intersection, and when you are driving in parking lots?

Yes	No

A2. Please take a few minutes to tell us what you think about the possibility of using your phone while driving. There are no right or wrong responses; we are merely interested in your personal opinions. In response to the questions below, please list the thoughts that come immediately to mind.

What do you see as the benefits of watching a video on your phone while driving? Please name 3 benefits.

A3. What do you see as the downsides of watching a video on your phone while driving? Please name 3 downsides.

A4. What types of videos are you most likely to watch while you are driving? Please name 3 types of the videos you watch on your mobile phone while driving, and the apps you watch them on

A5. Please list the individuals or groups who would approve or think you SHOULD watch a video on your phone while driving. Please name 3 individuals or groups of people, and their relationship to you, if applicable.

A6. Please list the individuals or groups who would disapprove or think you SHOULD NOT watch a video on your phone while driving. Please name 3 individuals or groups of people, and their relationship to you, if applicable.

A7. Sometimes, when we are not sure what to do, we look to see what others are doing. Please list the individuals or groups who are MOST likely to watch a video on their phones while

driving. Please name 3 individuals or groups of people, and their relationship to you, if applicable.

A8. Please list the individuals or groups who are LEAST likely to watch a video on their phones while driving. Please name 3 individuals or groups of people, and their relationship to you, if applicable.

A9. Please list any factors or circumstances that would make it easy or enable you to watch a video while driving. Please provide 3.

A10. Please list any factors or circumstances that would make it difficult or prevent you from watching a video while driving. Please provide 3.

Appendix B Quantitative TPB Questionnaire

Watching videos while driving

Note: some questions were eliminated as they were not used in the data analysis or simply contain instructions

B2 Please tell us your gender

Male	Female

B3 Please tell us your race and ethnicity

Non-Hispanic White	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian or Pacific Islander	Other	Hispanic American

B4 Please tell us your age

B5 Instructions

We are interested in your attitudes and behavior with respect to watching short videos on your phone while driving.

For the purposes of this survey, watching short videos means watching videos less than 60 seconds long on mobile apps such as:
TikTok Twitter Facebook and Facebook Watch Instagram and IGTV YouTube byte Periscope Snapchat ESPN Live highlights And others

B7. We are interested in your behavior and attitude with respect to watching short videos while driving.

While answering our questions on the following pages, please envision yourself driving a vehicle in these four scenarios.

B9. Waiting an an intersection

B10. Driving in a parking lot

B12. We remind you that you are eligible to complete this survey only once. If for some reason our system allows you to complete this survey more than once, you will not be compensated for completing this questionnaire more than once. If the previous instructions and questions look

familiar to you, please exit the survey now.

By clicking yes, you indicate that you have not completed this survey previously, and that you understand that you will not be compensated for completing this survey more than once.

Yes	No

B13. I intend to watch a short video on my mobile phone while

Waiting at an intersection

Extremely likely (1)	Moderately likely (2)	Slightly likely (3)	Neither likely nor unlikely (4)	Slightly unlikely (5)	Moderately unlikely (6)	Extremely unlikely (7)

Driving in parking lots

Extremely likely (1)	Moderately likely (2)	Slightly likely (3)	Neither likely nor unlikely (4)	Slightly unlikely (5)	Moderately unlikely (6)	Extremely unlikely (7)

B14. Watching a short video on my mobile phone while driving in the following scenarios would be

Waiting at an intersection

Extremely good (1)	Moderately good (2)	Slightly good (3)	Neither good nor bad (4)	Slightly bad (5)	Moderately bad (6)	Extremely bad (7)

Driving in parking lots

Extremely good (1)	Moderately good (2)	Slightly good (3)	Neither good nor bad (4)	Slightly bad (5)	Moderately bad (6)	Extremely bad (7)

B15. Watching a short video on my mobile phone while driving in the following scenarios would be

Waiting at an intersection

Extremely pleasant (1)	Moderately pleasant (2)	Slightly pleasant (3)	Neither pleasant nor unpleasant (4)	Slightly unpleasant (5)	Moderately unpleasant (6)	Extremely unpleasant (7)

Driving in parking lots

Extremely pleasant (1)	Moderately pleasant (2)	Slightly pleasant (3)	Neither pleasant nor unpleasant (4)	Slightly unpleasant (5)	Moderately unpleasant (6)	Extremely unpleasant (7)

B16. Most people who are important to me approve of my watching a short video on my mobile phone while driving in the following scenarios

Waiting at an intersection

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

Driving in parking lots

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

B17. Most people like me approve of my watching a short video on my mobile phone while driving in the following scenarios

Waiting at an intersection

Extremely likely (1)	Moderately likely (2)	Slightly likely (3)	Neither likely nor unlikely (4)	Slightly unlikely (5)	Moderately unlikely (6)	Extremely unlikely (7)

Driving in parking lots

Extremely likely (1)	Moderately likely (2)	Slightly likely (3)	Neither likely nor unlikely (4)	Slightly unlikely (5)	Moderately unlikely (6)	Extremely unlikely (7)

B18. I am confident that I can watch a short video on my mobile phone while driving in the following scenarios

Waiting at an intersection

Definitely true (1)	Probably true (2)	Somewhat true (3)	Neither true nor untrue (4)	Somewhat untrue (5)	Probably untrue (6)	Definitely untrue (7)

Driving in parking lots

Definitely true (1)	Probably true (2)	Somewhat true (3)	Neither true nor untrue (4)	Somewhat untrue (5)	Probably untrue (6)	Definitely untrue (7)

B19. Watching a short video on my mobile phone while driving in the following scenarios is up to me

Waiting at an intersection

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

Driving in parking lots

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

B20. I would feel guilty if I watched a short video on my mobile phone while

Waiting at an intersection

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

Driving in parking lots

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

B21. I think that watching a short video on my mobile phone while driving in the following scenarios is wrong

Waiting at an intersection

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

Driving in parking lots

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

B22. Watching a short video on my mobile phone while driving in the following scenarios goes against my principles

Waiting at an intersection

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

Driving in parking lots

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

B23. My watching a short video on my mobile phone while driving in the following scenarios will cause me to be injured from an accident

Waiting at an intersection

Extremely likely (1)	Moderately likely (2)	Slightly likely (3)	Neither likely nor unlikely (4)	Slightly unlikely (5)	Moderately unlikely (6)	Extremely unlikely (7)

Driving in parking lots

Extremely likely (1)	Moderately likely (2)	Slightly likely (3)	Neither likely nor unlikely (4)	Slightly unlikely (5)	Moderately unlikely (6)	Extremely unlikely (7)

B24. My watching a short video on my mobile phone while driving in the following scenarios will cause others to be injured from an accident

Waiting at an intersection

Extremely likely (1)	Moderately likely (2)	Slightly likely (3)	Neither likely nor unlikely (4)	Slightly unlikely (5)	Moderately unlikely (6)	Extremely unlikely (7)

Driving in parking lots

Extremely likely (1)	Moderately likely (2)	Slightly likely (3)	Neither likely nor unlikely (4)	Slightly unlikely (5)	Moderately unlikely (6)	Extremely unlikely (7)

B25. I will be caught by the police if I watch a short video on my mobile phone while driving in the following scenarios

Waiting at an intersection

Extremely likely (1)	Moderately likely (2)	Slightly likely (3)	Neither likely nor unlikely (4)	Slightly unlikely (5)	Moderately unlikely (6)	Extremely unlikely (7)

Driving in parking lots

Extremely likely (1)	Moderately likely (2)	Slightly likely (3)	Neither likely nor unlikely (4)	Slightly unlikely (5)	Moderately unlikely (6)	Extremely unlikely (7)

B26. I will be punished severely by law enforcement if I watch a short video on my mobile phone while driving in the following scenarios

Waiting at an intersection

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

Driving in parking lots

Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree(5)	Disagree (6)	Strongly disagree (7)

B27. How often do you watch a short video on your mobile phone while driving in the following scenarios?

Waiting at an intersection

Always (1)	Almost always (2)	Most of the time (3)	About half the time (4)	Sometimes (5)	Rarely (6)	Never (7)

Driving in parking lots

Always (1)	Almost always (2)	Most of the time (3)	About half the time (4)	Sometimes (5)	Rarely (6)	Never (7)

B29. Which state do you live in?

▼ Alabama (1) ... Wyoming (51)