DOES SOCIAL REJECTION INCREASE SUSCEPTIBILITY TO PEER INFLUENCE? TESTING A MODEL OF SOCIAL REJECTION, PHYSIOLOGICAL STRESS, AND PEER INFLUENCE ON RISKY DRIVING AMONG ADOLESCENTS AND YOUNG ADULTS

by

Jessica E. Sutherland

Master of Arts in Criminology and Sociolegal Studies, University of Toronto, 2013

Bachelor of Arts in Psychology and Criminal Justice, Ryerson University, 2012

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AUTHOR'S DECLARATION

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Abstract

Does social rejection increase susceptibility to peer influence?

Testing a model of social rejection, physiological stress, and peer influence on risky driving among adolescents and young adults

Doctor of Philosophy, 2018

Jessica E. Sutherland

Psychology, Ryerson University

Peer passengers are a significant risk factor for young drivers experiencing collisions and other adverse driving outcomes. A number of studies have tested the effect of peer passengers on driving behaviour, but few have manipulated contextual variables, such as social evaluation, that predict risky behaviour in other contexts. Further, it is not clear how individual susceptibilities to peer influence, such as physiological stress, interact with contextual variables to affect risky behaviour. The current study explored whether social evaluation (via social rejection or social acceptance) affect driving outcomes (acceleration, speed, and lane positioning) and if the type of social evaluation affects perception of risky peer norms. Individual differences, including physiological stress and sensitivity to social evaluation, were measured to determine if they moderate the relationship between social evaluation and driving outcomes. A total of 75 adolescents and young adults between the ages of 17 and 25 years were randomized to complete the study alone or with a confederate who was instructed to socially accept or socially reject them, as well as model risky or risk-averse driving norms. Results indicated that peer passengers and peer driving norms, regardless of the social-evaluative context, did not generally affect mean values of driving outcomes, but did affect variability in driving outcomes, particularly in intersections. Physiological stress and perceptions of social acceptance also predicted driving

outcomes, such that participants who had higher mean heart rates and felt more socially accepted by the confederate had more variability in their driving outcomes. These findings suggest that peer passengers increase variable, or inconsistent, driving patterns, perhaps due to passengers distracting young drivers from road conditions. Further, feeling socially accepted increases the strength of the relationship between presence of peer passengers and inconsistent driving patterns, indicating that social rewards may precede risky behaviour more often than social threats do.

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CHAPTER ONE

INTRODUCTION

Overview

Impulsivity and risk-taking are characteristic traits of adolescence and young adulthood across cultures (Duell et al., 2016). While risky behaviour may be developmentally normative during this stage of the lifespan, it can lead to a range of negative outcomes. Driving, in particular, has been identified as a key behaviour subject to the higher propensity for risk-taking during adolescence and young adulthood, with significant consequences for young peoples'[1] health. Motor vehicle crashes are the leading cause of death for young people aged 12-19 years in the United States (Centers for Disease Control, 2010; 2017) and unintentional accidents, including motor vehicle crashes, are the leading cause of death for young people aged 15-24 years in Canada (Statistics Canada, 2018). Previous research indicates that the likelihood of a motor vehicle crash is much higher when young drivers[1] have peer passengers in the vehicle, possibly due to peers serving as a distraction from road conditions (Curry, Mirman, Kallan, Winston, & Durbin, 2012). For example, peer passengers may have loud conversations or physically interact with the driver (Foss & Goodwin, 2014). Unlike older drivers with more experience, young drivers have not yet developed automaticity while driving (i.e. maintaining driving skills in the face of possible distractions; Keating, 2007). A lack of automaticity makes the distracting power of passengers a stronger risk factor for young drivers' safety.

[1] A 'young person' refers to an individual who has experienced puberty (approximately age 12) to a young adult (approximately age 25) based on neurodevelopmental and brain-based research supporting the onset of adulthood in the mid-twenties (e.g. Cohen et al., 2016). 'Young drivers' fall into this category as well, with the caveat that a young driver is between the ages of 16 and approximately the mid-twenties.

However, the high rates of motor vehicle crashes that occur among adolescents with peer passengers indicate a pressing need to identify other risk factors that increase susceptibility to peer passenger influence. While some experimental research has found a positive relationship between the presence of peer passengers and risky driving behaviours, few studies have manipulated social and contextual factors known to increase susceptibility to peer influence, such as social evaluation. As they leave childhood behind, adolescents[2] begin to spend more time with same-aged peers and less time under parental supervision (Brown, 2004). Adolescents are acutely aware of peer norms and tend to rely on the behaviour of their peers as guides for their own behaviour (Centifanti, Modecki, MacLellan, & Gowling, 2016). Social-developmental research on peer group dynamics has found that adolescents experience stress and fear at being evaluated by peers more than children do (Michiel Westenberg, Drewes, Goedhart, Siebelink, & Treffers, 2004) and they may comply with peer norms (i.e. via risk-taking) in order to gain acceptance into peer groups (Williams, 2007). For example, a young person's first experience with smoking is more likely to occur in a peer context (Haas & Schaefer, 2014). Substance-using friends significantly increase the likelihood and frequency that a young person will also use substances (Allen, Chango, Szwedo, Schad, & Marston, 2012; Ennett et al., 2006; Mundt, 2011). With regard to sexual activity, peers' sexual activity may influence not only the onset of sexual activity, but also the number of partners (Ali & Dwyer, 2011). In an experimental context, observing peers can also increase willingness to engage in hypothetical risky sexual behaviour

[2] An 'adolescent' refers to an individual who has experienced puberty (approximately age 12) up to the age of 19, when they reach legal majority. Researchers (Duell et al., 2016; Shulman, Harden, Chein, & Steinberg, 2016; Steinberg, Albert, Cauffman, Banich, Graham, & Woolard, 2008) distinguish between 'early' (ages 12-15) and 'late' adolescents (ages 16-17) and young adults (ages 18-25) due to the measureable changes in socio-emotional skills, biological and neural development, and autonomy.

(e.g. with an unknown person; Widman, Choukas-Bradley, Helms, & Prinstein, 2016). Last, having antisocial peers significantly increases a young person's engagement in criminal behaviour (Miller, 2010). These findings indicate that young people will engage in a range of risky behaviours in order to gain or maintain acceptance in a peer group.

The relationship between social rejection and risky behaviour, however, is less clear. Research finds that adolescents tend to experience social rejection as especially painful, given their strong desire for social acceptance (Sebastian, Viding, Williams, & Blakemore, 2010). This type of social context may increase risk-taking due to a desire to re-gain social acceptance (Williams, 2007). Emotional arousal due to social evaluation can increase physiological stress (Somerville, Jones, Ruberry, Dyke, Glover, & Casey, 2013; Stroud et al., 2009) and overwhelm immature cognitive control systems among adolescents (Zelazo & Carlson, 2012). Emotional and physiological arousal may subsequently impair behavioural inhibition, leading to a higher likelihood of engaging in risky behaviour.

The pain of rejection, however, may depend on the social status of the rejecting peer. Despite the general finding that the desire for social acceptance can drive risk-taking, experimental research testing models of adolescent risky behaviour have not explored whether some peers are more or less influential than others. Using social network analytic modeling and peer nomination methods, a peer's social status in a group's social hierarchy has been implicated in the nature and direction of their influential capabilities, particularly in the context of risk-taking. High-status peers (e.g. attractive, friendly) are more likely to be risk-takers, and are also more likely to influence lower-status peers' risk-taking (Allen, Porter, & McFarland, 2006). Since 'fitting in' is an important social goal for young people, risky behaviour modeled by higher-status peers may be more likely to influence lower-status group members. At the brain-

based level, neurobiological models suggest that adolescent brains are especially sensitive to social stimuli in their environments (Forbes & Dahl, 2010) and that puberty triggers a massive re-organization of neural structures that facilitate adaptive social behaviour in what is known as the *social re-orientation of adolescence* (Nelson, Leibenluft, McClure, & Pine, 2005). Though this is believed to occur to facilitate successful reproduction from an evolutionary perspective, this sensitivity to social stimuli can also increase risky behaviour in the pursuit of social goals, such as social dominance (Forbes & Dahl, 2010). Thus, adolescents appear to be developmentally primed to attend to environmental cues that will increase the likelihood of social acceptance, which may include attending to cues such as peer norms or a peer's social status.

Currently, no experimental research has integrated and manipulated multiple environmental and peer-related variables, such as social evaluation, physiological arousal, and peer social status, to test how these interact to affect driving behaviour. Epidemiological evidence finds that approximately half of motor vehicle crashes with young drivers and passengers occur during evenings and weekends, particularly Friday and Saturday nights (Insurance Institute for Highway Safety, 2015). This trend aligns with times of the week when young people are likely socializing, indicating that social or peer-related factors prior to or during the drive may affect the degree to which a peer passenger can influence driving. To build on the existing experimental literature exploring peer passenger effects on young drivers, this study tested an integrative model of risky driving in the presence of a peer passenger. Specifically, it explored whether: 1) social acceptance and social rejection have different effects on risky driving; 2) peer passengers increase physiological stress before and while driving; and 3) physiological stress interacts with peer-related variables to increase risky driving.

This chapter provides a review of the literature in four distinct sections. First, research on adolescent neurodevelopment is presented, explaining why and how risk-taking behaviour increases during this developmental period and how the presence of peers affects such behaviour. Second, peer-specific and social environment-related factors that impact peer influence are discussed, including social evaluation, social acceptance, and social rejection, with emphasis on how these contexts can enhance risk-taking propensity. Third, research on the effect of peer passengers on young drivers and motor vehicle crashes is reviewed, emphasizing current gaps in the literature. Finally, the justification for the current study is outlined.

Risk-Taking in Adolescence

The following section addresses the question of why risk-taking increases in adolescence and how peers operate to increase risk-taking. As will be shown, risk-taking is developmentally normal, but also places young people at risk for adverse health and psychosocial outcomes. In spite of the fact that risky behaviour is developmentally normative, the predominant theoretical models and experimental evidence for adolescent risk-taking are critical for understanding and explaining when and why peers have a powerful influence on risky behaviour.

While there are myriad factors that can increase the prevalence of risky behaviour in adolescence, including low parental monitoring (Parkes, Henderson, Wight, & Nixon, 2011), higher tolerance of ambiguity in the outcome of taking a risk compared to adults (Tymula et al., 2012), and increased opportunities for it (Boyer & Byrnes, 2009), explanations of risk-taking behaviour in adolescence primarily emphasize significant neurodevelopmental changes that encourage sensation-seeking and impulsivity. Several theories of adolescent risk-taking behaviour are known as *dual systems models* because they emphasize two competing neural systems (sensation-seeking and behavioural inhibition) that develop along different trajectories

(Casey, Getz, & Galvan, 2008; Luciana & Collins, 2012; Luna & Wright, 2016; Steinberg, 2008). While all dual systems models agree that these systems are directly implicated in risk-taking, they differ in how they propose the temporal relationships emerge between these two systems. Generally, dual systems models state that hypersensitive reward circuitry ensures that pleasurable activities or sensations are especially rewarding during adolescence. However, immature cognitive control structures inhibit adolescents' ability to regulate their behaviour, especially in the context of rewarding behaviour. Unlike factors such as parental monitoring or risk opportunities that may be influenced by temporal or cultural norms, dual systems models of risk-taking have empirical support across multiple cultural and ethnic backgrounds, indicating a strong biological basis (Duell et al., 2016).

Findings from this research indicate that reward seeking and immature inhibitory control are typical features of adolescence that underlie the increase in risky behaviour. In the following sections, three dual systems models will be reviewed for their explanatory mechanisms of how reward-seeking and inhibitory control interact to produce risky behaviour. In particular, Steinberg's (2008) dual systems model, relative to those of Casey et al. (2008), Luciana and Collins (2012), and Luna and Wright (2016), has received the most empirical attention and support not only in the context of propensity for risky behaviour, but also risk-taking in the presence of peers. A review of the current state of research on the role of peers in dual-systems models of risk-taking behaviour follows.

Dual Systems Models: Sensation-Seeking and Inhibitory Control

Underlying the dual systems models of risk-taking is the massive re-organization of the brain that occurs during and after puberty. The adolescent brain undergoes significant synaptic pruning, changes in cortical thickness, and increased white matter volume particularly in the

prefrontal cortex (PFC; Drzewiecki, Willing, & Juraska, 2016; Petanjek et al., 2011) and other structures responsible for attention, cognitive abilities, and memory (Barnea-Goraly et al., 2005). Changes in dopamine, glutamate, and GABA neurotransmission between midbrain structures, including the limbic system, and the PFC are believed to underlie the significant improvement in cognitive skills during adolescence (Caballero, Granberg, & Tseng, 2016). Known as *executive functions* (Miller & Cohen, 2001; Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000), cognitive skills such as working memory, behavioural inhibition, and cognitive flexibility become more proficient as the PFC develops. Improvements in executive functioning have been attributed to increased myelination in the adolescent brain, leading to faster information processing (Lee, Bull, & Ho, 2013). Neuroimaging research suggests that adolescents can demonstrate adult-like levels of executive functioning, but that performance of these skills increases activity in the dorso-lateral prefrontal cortex, which is associated with more neural effort (Luna, Padmanabhan, & O'Hearn, 2010). That it requires more effort to make adult-like decisions, such as avoiding risky scenarios, may underlie adolescents' higher likelihood of engaging in risky behaviour.

Despite these adult-like capabilities in executive functioning, adolescents have immature inhibitory control capabilities and strong sensation-seeking drives. Neural networks that respond to rewarding stimuli are heightened during adolescence and may underlie the desire for novelty and new sensations (Doremus-Fitzwater & Spear, 2016; Spear, 2013). Significant changes in dopaminergic neurotransmission and availability of dopaminergic receptors in limbic, striatal, and frontal cortex structures are also believed to be mechanisms underlying sensation-seeking in adolescence, given the known role dopamine plays in reward sensitivity (Casey et al., 2008; Galvan, 2010; Galvan, 2013). Experimental and neuroimaging evidence supports these changes

in dopaminergic neurotransmission and receptor availability, as previous findings suggest adolescents experience the rewarding effects of risk-taking more so than children and adults (Defoe, Dubas, Figner, & Aken, 2015; van Duijvenvoord, Peters, Braams, & Crone, 2016). Alongside this increase in sensation-seeking and reward sensitivity, adolescents are simultaneously continuing to develop self-regulation and inhibitory control. Across adolescence and into early adulthood, the PFC and connections between the PFC and midbrain structures continue to strengthen, supporting the maturation of inhibitory control, particularly in the presence of rewarding activities (Somerville, Jones, & Casey, 2010).

The interaction between heightened sensitivity to reward (i.e., drive for novelty and sensation-seeking) and immature inhibitory control make up the two processes implicated in dual-systems models of adolescent risk-taking. Steinberg's (2008) dual systems model proposes that sensation-seeking peaks in early to mid-adolescence and then declines, while impulse control capabilities increase linearly into early adulthood. Casey et al. (2008) propose an alternative dual systems model, but posit that sensation-seeking remains stable throughout adolescence, only declining in response to improved impulse control. The distinctions between these two models may centre on the types of risk-taking or sensation-seeking being measured. Laboratory-based measures of risk-taking often indicate a peak in risky behaviour in early to mid-adolescence according to Steinberg's (2008) model. However, evidence also suggests that other forms of risky behaviour, such as sexual risk behaviour and impaired driving, emerge in later adolescence and early adulthood, despite improvement in risk-taking on laboratory tasks (Casey et al., 2008). More recent dual systems models proposed by Luna and Wright (2016) and Luciana and Collins (2012) suggest a peak in sensation seeking in mid-adolescence due to socio-emotional information overwhelming cognitive control systems, which they believe plateau by

mid adolescence. With the exception of Steinberg's (2008) model, limited evidence supports the models proposed, primarily due to limited research directly testing or comparing them. What all models do generally agree on, however, is that sensation-seeking increases and impulse control is not yet fully developed during adolescence.

Cross-sectional research appears to support Steinberg's (2008) conceptualization of the dual systems model. Harden and Tucker-Drob (2011), Shulman et al., (2016), and Duell et al. (2016), all found that sensation-seeking and inhibition developed independently of each other, with a sharp increase in sensation-seeking in middle adolescence, followed by a decline, while inhibitory control linearly increased into the mid-twenties. Similar trajectories are found in both males and females, though females peak in sensation-seeking and decline earlier than males, while males take slightly longer to develop inhibitory control (Shulman, Harden, Chein, & Steinberg, 2015). These results indicate that decreased sensation-seeking does not rely on improved inhibitory control, as suggested by Casey et al. (2008).

Despite fewer studies directly testing them, the models proposed by Luna and Wright (2016) and Luciana and Collins (2012) highlight the importance of socio-emotional environmental stimuli, such as emotional arousal and peers, during adolescence and their effects on inhibitory control. Though the current experimental evidence primarily supports Steinberg's (2008) model, dual systems models that implicate other contextual factors, such as emotional arousal and peers, may be more appropriate conceptualizations of adolescent risk-taking behaviour than models focused primarily on neurodevelopment. As noted by Defoe et al. (2015), adolescents do not uniformly take more risks in laboratory-based research than do adults or children, unless they are in the presence of peers. The following section reviews the growing body of experimental research on adolescent risk-taking that has incorporated peer-related

factors. The particular aspects of peer presence that can overwhelm inhibitory control are discussed, namely that peers may enhance the rewarding nature of sensation-seeking or be rewarding goals in and of themselves.

Peer Effects on Risky Behaviour

When adolescents are in emotionally arousing scenarios, such as trying something for the first time or when any immediate benefits are weighted more heavily than long-term consequences, they tend to not make adaptive decisions (Reyna & Farley, 2006). Known as 'hot' executive functions, these refer to cognitive skills such as decision-making that are sensitive to affective arousal (Zelazo & Carlson, 2012). In contrast, 'cool' executive functioning refers to cognitive skills such as cognitive flexibility that can be less sensitive to affective arousal. The presence of peers can be a significant source of both emotional arousal and reward, which may undermine adaptive decision-making capabilities (Zelazo & Carlson, 2012). For example, Cowell (2013) found that the presence of peers compromised adolescents' performance on 'hot' executive functioning tasks, but their performance was not compromised when tasks were completed alone. Under 'hot' decision-making contexts, such as risk-taking opportunities, the presence of peers might increase emotional arousal and the likelihood of risk-taking. Thus, one of the most important methodological considerations in risk-taking research with adolescents is social context (Defoe et al., 2015).

Peer group norms are an important aspect of the social context, because the norms of the peer group can provide a guide for adolescents against which to measure their behaviour (Brown, 2004). Survey research on adolescent driving found that perception of peers' risk-taking behaviour, individual risk propensity, and a perceived norm of risky behaviours in their social group interacted to predict distracted driving behaviours (e.g. texting, watching a video) in

adolescent drivers (Carter, Bingham, Zakrajsek, Shope, & Sayer, 2014). Further, a higher number of deviant peers and increased tolerance for risky behaviour predicted speeding at least ten kilometres over the speed limit in young drivers (Simons-Morton et al., 2012). However, experimental findings indicate that the relationship between peer norms and risky driving are less clear. In a sample of adolescent males randomized to risky and risk-averse conditions to test the effect of peer-modeled driving norms, Ouimet, Pradhan, Simons-Morton, Divekar, Mehranian, and Fisher (2013) had a male confederate demonstrate risk-accepting (e.g. verbally expressing excitement) or risk-averse norms (neutral expressions, slowly getting into the vehicle) in a driving simulator. When driving with a passenger, participants were more likely to make dangerous left turns when they reported higher tolerance of peer deviance. Contrary to hypotheses, a risk-accepting confederate did not increase risky driving and participants were instead more likely to wait longer to make left turns and left more space between themselves and vehicles ahead of them.

These findings suggest that while peer passengers do affect adolescent males' driving performance, peer norms may need to be explicitly stated. In a replication of Ouimet et al. (2013), sixty-six male adolescents completed a driving simulation study with a male confederate (Simons-Morton et al., 2014). The confederate communicated either clear risk-accepting ("I usually drive really fast") or risk-averse ("I drove slowly and hit every yellow light") social norms to participants by arriving late to the study and making the appropriate explanation as to why they were late (i.e. because they had driven slowly). Confederates also indicated a preference for risky or safe driving during both the driving rating tasks (i.e. watching videos of driving and rating the risky nature of particular behaviours with the participant) and the practice drives. When participants drove, the presence of the confederate increased failures to stop and

the amount of time spent in an intersection during a red light compared to when they drove alone. However, this effect was strongest when the passenger was risk-accepting, suggesting that, while subtle social cues can influence driving behaviour (e.g. Ouimet et al., 2013), adolescents also infer specific expectations for their behaviour via clear communication of norms from their peers and then adjusting their own behaviour accordingly (Ehsani et al., 2015; Reynolds, MacPherson, Schwartz, Fox, & Lejuez, 2014; Simons-Morton et al., 2012).

Risk-averse peer passengers have also been found to reduce risky driving, even when young drivers have a higher propensity for risky behaviour. Centifanti et al. (2016) tested whether peers' active influence (calling out advice and working together to complete tasks) or passive influence (completing tasks individually but next to each other) produced different levels of risk-taking behaviour on a computer-based driving task. Participants also completed measures assessing risk-taking propensity for themselves and for their friends. Risk-accepting peers (those scoring high on self-reported risk-taking propensity) ultimately exerted the strongest influence on risky driving during the active influence condition, and this effect also occurred in the passive condition. Risk-averse peers (those scoring low on self-reported risk-taking propensity) influenced safer driving in the active condition. However, risk-accepting drivers were more likely to drive in a safer fashion when they reported their peers as less risk-accepting, even in the passive condition. Both Centifanti et al. (2016) and Simons-Morton et al. (2014) indicate that peer group norms are primarily influential when they are explicitly, rather than implicitly, stated.

However, the perceived social status of the confederate was not explored as a moderator of successful communication of peer norms in these prior studies. It is possible that a peer passenger's ability to influence a young driver's behaviour might depend on the driver's desire to seek approval from or impress them in the face of evaluation. Perhaps in Simons-Mortons et al.

(2014)'s study, risk-accepting peers were seen as more socially dominant or higher status, which might increase risk-taking (Bruyn & Cillessen, 2006; Keifer & Wang, 2016; Mayeux, 2014). To test the effect of social dominance, Voroboyev, Kwon, Moe, Parkkola, and Hamalainen (2015) conducted a study with 35 male adolescents who completed a computerized driving task under an fMRI. They were randomized to either a no-competition (control) or peer competition (told their results would be posted at school) condition. Participants were also categorized as 'high' or 'low' risk takers based on the number of risks they took on the driving task. In the competition condition, participants took significantly longer to brake and took more driving risks; however, contrary to expectation, risk categorization did not predict risky driving. Neural regions associated with reward, such as the ventromedial prefrontal cortex, demonstrated increased activity when risky choices were made and positive outcomes achieved (i.e., no crashes). This effect was particularly pronounced for the competition condition, and Voroboyev et al. (2015) suggest that this might indicate not only successful completion of the task, but also the impending social reward of their performance being posted for peers to see. Interestingly, Voroboyev et al. (2015) also found increased activation in neural regions previously implicated in ego-dystonic behaviour for low risk-takers in the competition condition, which might indicate that when the possibility of social reward is salient, risk-taking will occur but requires more cognitive effort for this group.

Finally, the presence of peers during risky scenarios may act as a buffer from possible negative consequences of risky behaviour (e.g. substance misuse). It is possible that peers enhance feelings of safety when making risky choices, thereby increasing their likelihood of occurring in peers' presence. Findings by Haddad, Harrison, Norman, and Lau (2014) seem to support this, as early to late adolescents consistently made more risky decisions with a peer, even

when the peer provided advice on making a safer decision. However, in a gambling study, adolescents between the ages of 15 to 17 were significantly more likely to make a risky gamble when they believed a peer was observing them even when they were told of the higher probability of a poor outcome (Smith, Chein, & Steinberg, 2014). This effect held when the level of risk was presented as ambiguous or especially risky. Smith et al. (2014) propose that when the consequences of a risky choice are either ambiguous or likely to occur, adolescents may be most susceptible to peer influence. That is, even when the consequences may be swift and significant, the presence of peers might reduce adolescents' perceptions of risk and increase feelings of safety.

However, this heightened effect of peers during ambiguous or especially risky scenarios seems to decline into late adolescence and early adulthood. A sample of 18- to 20-year-olds learned and adapted their approach during multiple trials of a gambling task after receiving positive and negative feedback from peers (Silva, Shulman, Chein, & Steinberg, 2016). In this case, the presence of peers increased not only risky gambling, but also the speed at which participants learned to make adaptive gambling choices from positive (i.e. long-term gains) and negative (i.e. long-term losses) environmental feedback. This effect may occur due to the emergence of more advanced cognitive control capabilities among this age group, relative to younger adolescents. This finding by Silva et al. (2016) is also consistent with the experience-driven dual-systems model (Murty, Calabro, & Luna, 2016), which states that adolescents depend on social experiences to generate heuristics in order to avoid future negative consequences and guide behaviour. As young people enter adulthood, peers may still increase risky choices, though there may be a point at which risk-taking stops conferring social rewards and experience instead guides behaviour.

The experimental literature thus far demonstrates a consistent effect of peer presence on risky behaviour for adolescents. However, the degree to which young people are susceptible to peer influence in risky contexts might depend on the social context and individual factors. Previous experimental research has not tested the combined effects of social context and individual variables on peer influence in risk-taking contexts. For example, it is not yet understood how a peer's social status or social dominance affects their ability to successfully communicate peer group norms in a driving context. Therefore, it remains unclear under what social circumstances young people are more or less susceptible to peer influence on risky behaviours, and to what extent individual differences interact with social circumstances to predict this. In the following sections, the processes of social evaluation, social acceptance, and social rejection are explored as social contexts that may place young people in situations likely to lead to risky behaviour. These processes occur during a developmental period when a highly 'social brain' is emerging, which means that adolescents are especially sensitive to social rewards and threats. The neurodevelopmental literature explaining how social evaluation, social acceptance, and social rejection can heighten susceptibility to peer influence is reviewed, emphasizing the roles of environmental social stimuli and individual differences in susceptibility to peer influence.

Peer-Related Influences on Adolescent Behaviour

Although friends are important across the lifespan, adolescence is a unique developmental stage when the desire for peer acceptance is especially strong. Being accepted into a peer group is an important social goal for most young people. Likewise, rejection and exclusion can be especially painful. Compared to children, adolescents are more likely to report being afraid of social threats, such as being embarrassed or performing a task in front of others;

by contrast, children are more likely to endorse fears related to physical threats (Michiel Westenberg et al., 2004). Michiel Westenberg et al. (2004) suggest that adolescents' concern about how others may perceive them reflects more complex social information processing, including increasing self-consciousness, which children have yet to develop. These changes in social information processing have been called the *social re-orientation of adolescence*, when a more sophisticated social information processing network emerges to manage drives to socialize and form romantic and sexual relationships (Nelson et al., 2005).

The evidence for an emerging "social brain" provides a developmental lens through which peer influence-related research can be viewed. In light of these brain-based changes, the processes of social evaluation, acceptance, and rejection have unique implications for increasing susceptibility to peer influence. In particular, this section highlights how peer evaluation and acceptance can increase allegiance to peer norms, which can subsequently lead to risky behaviour. However, social rejection has received less empirical attention in the context of adolescent risk-taking. This is in spite of evidence from research on ostracism, which indicates that individuals will often conform to social norms in an effort to re-gain acceptance after rejection (Williams, 2007). Finally, although adolescents may fear evaluation, they also evaluate others to determine with whom they would like to affiliate. This section includes research findings on how peer group dynamics can make some young people have more influence in peer groups and less susceptible to the influence of others, indicating that peer social status within a group is an important variable to consider in risk-taking research. As this section demonstrates, the capability of a peer to influence another seems to depend on: 1) the social context they are in, and 2) the characteristics of the influencing peer.

The Adolescent 'Social Brain'

The developmental period of adolescence is triggered by puberty, at which time a surge of sex hormones initiates significant changes in neurodevelopmental and endocrinal systems. Forbes and Dahl (2010) propose that these hormonal changes increase motivational drives not only for reproduction, but also for social engagement and relationships. The drive to reproduce improves and refines social skills and adaptive responding to all forms of social stimuli in order to be successful at reproduction goals; however, it can also lead to problematic pursuit of social goals, such as attaining social dominance (Forbes & Dahl, 2010). Puberty also triggers significant growth in oxytocin and vasopressin receptors (Gordon, Martin, Feldman, & Leckman, 2011), two hormones known to facilitate social bonding and affiliation (Feldman, 2012). This increase in bonding-related hormone receptors is believed to sensitize adolescents to social information and increase their motivation to attend to peer-related stimuli (Albert, Chein, & Steinberg, 2013). Thus, adolescents experience physiological drives to seek out social relationships, while the influx of oxytocin and vasopressin receptors ensure that any potential bonds that are found feel especially rewarding.

To facilitate adaptive responding to social stimuli during adolescence, other neural networks that support social interaction become more refined. Nelson et al. (2005) propose a three-stage, hierarchical model of neural changes that culminates with the rapid expansion and refinement of social skills and abilities in adolescence. The detection stage develops over infancy and early childhood when individuals develop rudimentary social skills to recognize and prefer faces and identify basic emotions. Face processing skills, however, continue to be refined and improve into adolescence, as more complex social interactions and emotions are encountered (Blakemore, 2008). The second, affective stage emerges during and after puberty, when

adolescents begin applying higher-order attention and cognitive skills to determine whether to approach or avoid particular environmental stimuli. While adolescents generally approach opportunities for social contact, they tend to avoid experiences that may be socially embarrassing or cause self-consciousness, such as scenarios where peers may evaluate them (Burnett & Blakemore, 2009; van den Bos, de Rooij, Miers, Bokhorst, & Michiel Westenberg, 2014). This also occurs as adolescents begin spending more time with peers and forming more complex social relationships outside of their families (Brown, 2004), increasing opportunities to refine their social skills.

Finally, the cognitive-regulatory stage refines theory of mind processes, goal-directed social behaviour, and self-regulation (e.g. inhibiting an urge to interrupt) during social situations. Experimental and neuroimaging research finds that neural networks supporting advanced social skills, such as inferring the mental states of others ("mentalizing"), become more specialized and refined during adolescence (Blakemore, 2008; Burnett, Sebastian, Cohen Kadosh, & Blakemore, 2011). Compared to adults, adolescent brains demonstrate greater functional connectivity when experiencing 'social' emotions (e.g. embarrassment or guilt) compared to basic emotions, such as fear (Burnett & Blakemore, 2009). Embarrassment, for example, requires an individual to be able to infer that their behaviour reflects poorly on them from the perspective of another person. Burnett and Blakemore (2009) posit that increased connectivity among neural regions responsible for social emotions reflects the still-developing nature of self-regulation in emotional circumstances. This could also indicate that experiencing social emotions triggers a different response pattern in adolescents, activating socio-emotional and affective neural structures.

Further, neuroimaging evidence suggests that the presence of a peer enhances the effect of rewarding activities in the adolescent brain. Neural regions implicated in reward processing,

such as the ventral striatum, demonstrate significantly more activation during risk-taking tasks when peers are present than when peers are absent (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; Smith et al., 2014). This finding is supported by laboratory-based behavioural research, which has found that adolescents prefer immediate rewards to delayed rewards when with peers (O'Brien, Albert, Chein, & Steinberg, 2011). These findings might indicate that the presence of peers hyper-sensitizes adolescents to potential rewards in their environments (Albert et al., 2013; Gardner & Steinberg, 2005). Alternatively, the peer's presence may in fact be a desired reward. Some evidence has found that the presence of a peer on its own is an especially salient reward for adolescents, even in the absence of other potentially rewarding activities, like risk-taking (Smith, Steinberg, Strang, & Chein, 2015).

Thus, the emerging 'social brain' in adolescence appears to prime young people to perceive and desire social contact, while simultaneously reinforcing the benefits of social contact via activation of reward circuitry. While gaining acceptance into a desired peer group is a goal for many young people, the experiences of social evaluation, acceptance, and social rejection can be stressful and emotionally arousing. Social hierarchies also differentially affect the ability of young people to be influential in their peer group, particularly when they are perceived as being of a higher status (e.g. more attractive, popular). In the following sections, the processes of peer evaluation, peer acceptance, and peer rejection are explored as social contexts in which peer influence on risky behaviour can occur. The role of status in a peer group is also considered as an important moderator during the experience of evaluation, acceptance, and rejection in adolescent peer groups.

Social Evaluation

Elkind and Bowen (1979) theorized that adolescents experience the world as though they are the stars of a show with an "imaginary audience" (p. 38) constantly observing and evaluating their behaviour. In turn, the feeling of being watched by an imaginary audience increases self-consciousness and hyper-awareness of how they appear to others. In a study exploring whether observation by a peer impacted self-conscious emotions, adolescents were more likely than children to report feeling embarrassed after completing a task where they believed they were being observed (Somerville et al., 2013). Interestingly, this effect held even when adolescents were anticipating, but not yet actually, being observed by a peer (e.g. while taking a break between tasks).

Experiencing social evaluation appears to trigger physiological stress in adolescents. In studies assessing stress hormone responses (cortisol and salivary alpha amylase) after a social stressor like a public speaking task, adolescents experienced higher stress responses (Stroud et al., 2009; van den Bos et al., 2014) and increased skin conductance (Somerville et al., 2013) than did children. Adolescents also demonstrate decreased activation of neural structures involved in self-regulation and behavioural inhibition when receiving social feedback (e.g. indicators of peer acceptance or rejection) and increased activation of affective structures (Sebastian et al., 2011; Somerville et al., 2013). This suggests that social feedback is emotionally arousing and reduces behavioural inhibition. The combination of increased physiological stress and emotional arousal may create a state of vulnerability for maladaptive decision-making.

The aspects of social evaluation that are stressful or emotionally arousing may be moderated by gender. In a study using fMRI and a chat room paradigm, adolescents were asked to rate how interested they were in meeting other youth based on photos and hobbies and were told their photos and hobbies would also be rated by teens at other research institutions (Guyer,

McClure-Tone, Shiffrin, Pine, & Nelson, 2009). Later, they were asked how interested teens in other institutions would be in meeting them. When adolescents were interested in meeting a particular youth and believed the youth would be similarly interested in them, female participants, in particular, demonstrated increased neural activation of brain regions associated with affect regulation and reward, suggesting that young women are particularly attuned to indicators of positive social evaluation. This effect was not found for male participants. Guyer et al. (2009) explain these findings by stating that girls tend to value social cohesion and interpersonal relationships, whereas boys respond to competition and opportunities for social dominance, echoing Voroboyev et al. (2015). The different rewarding functions of social relationships by gender may result in different aspects of social evaluation (i.e. cohesion versus competition) causing physiological arousal for males and females. In particular, social acceptance versus social rejection may have different effects on arousal and subsequent risk-taking between young men and women, though limited experimental research has directly tested this hypothesis.

Social Acceptance

A key reason social evaluation may be emotionally arousing for adolescents is because of the implications it has for peer acceptance. Feeling accepted and supported by a peer group has significant long-term benefits for young adults. For example, the ability to form healthy friendships and succeed socially is associated with successful adult social and romantic relationships (Connolly, Furman, & Konarski, 2000), desistance from delinquency (Monahan, Steinberg, & Cauffman, 2009), and fewer workplace conflicts in early adulthood (Sandstrom & Cillessen, 2010).

Peer acceptance is typically measured by how popular a young person is in their grade or school, as nominated by peers (Allen, Porter, McFarland, Marsh, & McElhaney, 2005). Peer-rated popularity can be paradoxical, however. Two competing typologies of popular adolescents were empirically identified by Coie, Dodge, and Coppotelli (1982), who found that peer-rated popular classmates typically fit into either a 'controversial' or a 'liked' category of popularity. Controversially popular adolescents were widely known by other youth but were associated with more disruptive and problematic behaviour, suggesting a stronger social impact in terms of notoriety. Uncontroversial popular adolescents were rated highly on prosocial behaviour and less on disruptiveness and interpersonal aggression.

Being rated as popular, either controversially or not, has implications for risky behaviour and influential power. A higher propensity for risky and antisocial behaviour is associated with not only being popular generally, but also valuing popularity (van den Broek, Deutz, Schoneveld, Burk, & Cillessen, 2016). Survey research has also found that self- and peer-nominated popular adolescents are more likely to have recent drug and alcohol use relative to no drug use (Tucker, Green, Zhou, Miles, Shih, & D'Amico, 2011). The propensity for risky behaviour of popular youth might be explained by Allen et al.'s (2005) popularity-socialization hypothesis: popular youth tend to be more socially adaptive and competent, but also have more exposure to both positive and negative peer group norms. This could increase their desirability or notoriety as a peer, but also provide more opportunities to engage in risky behaviour.

This typology of popularity depends on ratings by peers but does not account for youth who may not be rated as popular in their schools, but are still accepted in other peer groups. In other words, these youth might *feel* socially accepted into a peer group, which is distinct from social acceptance as measured by popularity. Since school is not the only place adolescents can

find a peer group, extracurricular activities or workplaces can also provide social acceptance. In a study comparing social outcomes (e.g. aggression; desirability as a friend) in high school based on self-rated peer acceptance and peer-rated popularity, adolescents who perceived themselves as socially accepted (regardless of whether or not their peers did) were reported by peers to be less hostile, aggressive, and socially withdrawn over time (McElhaney, Antonishak, & Allen, 2008). Peer-rated popular youths had similar outcomes on hostility, aggression, and social withdrawal (regardless of their own perceptions). Interestingly, youth who fared the worst over time on peer-reported measures of hostility, aggression, and withdrawal felt less socially accepted and were also rated as unpopular by peers. These findings indicate that perceived acceptance, regardless of others' perceptions, might be sufficient to confer the benefits of social acceptance or popularity.

Though peer-rated popularity may not be necessary to feel socially accepted, the desire to be socially accepted can drive adolescents to select certain types of friends to spend time with or engage in specific behaviours to achieve acceptance. Young adolescents who reported they wished to be popular in middle school were significantly more likely to change their clothing, romantic interests, and friend choices in order to conform to more popular peers' standards (Dawes & Xie, 2014). Longitudinal research over high school has found that adolescents typically prefer to socialize with same- or higher-status peers in their social hierarchy in an effort to maintain or improve their own social standing (Dijkstra, Cillessen, & Borch, 2013). Further, higher-status adolescents were less likely to associate with low-status peers to avoid the possible social threat of this association. The drive to associate with higher-status peers might indicate that these peers have desirable traits, such as physical attractiveness (Dijkstra, Cillessen, Lindinberg, & Veenstra, 2010). Some evidence also suggests that people will distance

themselves from people they perceive as unattractive, ostensibly to avoid the possible social threat of associating with lower-status others (MacDonald, Barrata, & Tzalazidis, 2015).

The preference for acceptance by higher-status peers is supported by findings that indicate peer group dynamics are predictive of risky behaviour. Lower-status peers in a peer group are more susceptible to peer pressure and engage in risky behaviour and aggression more often when higher-status members of their group do as well (Allen et al., 2006; Shi & Zie, 2012). Thus, the influential capabilities of a young person may depend on their status in the peer group. If a peer communicates a social norm, it may become more salient, and therefore appealing to conform to, if the receiving young person perceives their peer as higher in the peer group's social hierarchy. In the context of risk-taking, this means that not all peers are similarly influential. Consistent with the popularity-socialization hypothesis, a more popular or high-status peer might be more likely to engage in risky behaviour in general, but this is not due to fears of evaluation by the lower-status peer. Conversely, a lower-status peer might conform to a higher-status peer's communicated norms in an attempt to gain acceptance and experience significantly more social evaluation-related stress. However, this pattern of risky behaviour based on status in a peer group has not been experimentally tested, particularly in the context of social evaluation.

Social Rejection

In light of their sensitivity to social evaluation and acceptance, it stands to reason that social threats, such as rejection and exclusion, can be especially painful for adolescents. However, unstable friendships and changing peer groups are normal as adolescents' identities and values evolve over their teen years (Poulin & Chan, 2010). The unstable nature of a peer group or prior experiences of rejection may also make social threats in a young person's environment more salient. Evidence suggests that similarities between peers in terms of levels of

social competence and high/low status in a peer group predict stable friendships in adolescence (Hartl, Laursen, & Cillessen, 2015). However, differences in social status, in particular, can create more opportunities for exclusion or rejection to occur. Some evidence suggests that while adolescents do not necessarily exclude others for malicious reasons, they prefer to maintain boundaries between social groups or remain exclusive based on preferences of who they want in their peer group, rather than who is interested in being in their peer group (Horn, 2003). Compared to children, adolescents are more likely to endorse a nuanced understanding of peer group dynamics: excluding others can be unfair or immoral, but they value loyalty to their group's norms or preferences for membership (Mulvey, 2015). Explicit examples of exclusionary behaviour, such as engaging in interpersonal aggression to keep others out of a social group, can be employed by adolescents to assert or maintain social power and status, particularly among adolescent girls (Pronk & Zimmer-Gembeck, 2010).

Social rejection can be a painful experience because it threatens a basic social need to affiliate with others (Williams, 2007). Williams, Cheung, and Choi (2000) propose that when social rejection occurs, people may react by conforming to the rejecting group's norms or by taking steps to gain acceptance. Some experimental research has explored the effects of social rejection on adolescent behaviour. Sebastian et al. (2010) suggest that initial distress responses to ostracism are felt similarly between adolescents and adults. Where differences might emerge is how adolescents recover from rejection and its impact on subsequent behaviour compared to adults. In Gross (2009), both young adults and adolescents reported increased self-esteem and relational value (feeling accepted, respected) after being given the opportunity to instant message with a same-aged peer following rejection, but only adolescents experienced a significantly greater reduction in negative mood. Salvy, Bowker, Nitecki, Kluczynski, Germeroth, and

Roemmich (2011) also found that concerns about their social lives or prior memories of rejection may direct adolescents' attention away from self-regulation of their distress and towards maladaptive coping strategies after being rejected by a peer. Thus, social rejection may increase emotional arousal in adolescents, possibly compromising behavioural inhibition (Zelazo & Carlson, 2012) and affecting the methods chosen to cope with it.

Social rejection has been found to predict physiological stress and maladaptive coping in young people. Perceived stress, negative affect, and salivary cortisol increased after adolescents experienced peer rejection (Beekman, Stock, & Marcus, 2016). Comparing children and adolescents on physiological stress responses to performance or peer rejection stressors, Stroud et al. (2009) found that adolescents experienced significantly higher physiological stress after both stressors. Additionally, male adolescents demonstrated higher salivary cortisol after an achievement stressor, while female adolescents had higher salivary cortisol after a rejection stressor (Stroud, Salovey, & Epel, 2002). This is consistent with Guyer et al. (2009)'s suggestion that female adolescents perceive social connections as rewarding, while Voroboyev et al. (2015) indicate that male participants perceive social dominance as rewarding. When these social rewards (connection or dominance) are threatened, physiological stress may increase.

In the context of risk-taking, experiencing rejection may prime young people to attend to social cues in their environments that may help them re-gain acceptance (Bernstein, Young, Brown, Sacco, & Claypool, 2008; DeWall, Maner, & Rouby, 2009; Park & Baumeister, 2015), though there is currently limited research exploring risk-taking as a mechanism for attaining social acceptance after rejection. During a risky driving task under fMRI, adolescent participants took more risks and demonstrated significantly more activation in neural regions associated with mentalizing and social cognition after experiencing social exclusion from fictional virtual peers

(Peake, Dishion, Stormshak, Moore, & Pfeifer, 2013). Peake et al. (2013) suggest that participants might have been considering how their peers would evaluate them and were aware of how their performance might be viewed, so they behaved in ways they believed their peers would expect to obtain acceptance. However, this effect was particularly pronounced in participants with self-reported low resistance to peer influence. This suggests that the underlying motivation for risk-taking after exclusion might be due to a preference for social re-connection instead of adaptive decision-making (Buelow & Wirth, 2017) and be subject to individual differences in susceptibility to peer influence (Peake et al., 2013). If sensitivity to social information increases after rejection, peer norms may serve as environmental stimuli that young people are more likely to attend to in order to facilitate their re-acceptance (Chester, DeWall, & Pond, 2016; Jones et al., 2014; Park & Baumeister, 2015; Peake et al., 2013).

Despite these findings, social rejection has not been compared to social acceptance on how different social-evaluative contexts affect peer influence on risky behaviour. Further, it is not clear how traits such as sensitivity to rejection (Downey & Feldman, 1996) and peer social status affect the physiologically arousing nature of social rejection. Previous research has found rejection sensitivity, or the expectation that one will be rejected in social situations, can increase susceptibility to rejection-related stress (Massey, Byrd-Craven, Auer, & Swearingen, 2015) and emotional distress after rejection (Masten et al., 2009). A heightened stress response in rejection-sensitive young people might further diminish inhibitory control, increasing their willingness to engage in risky behaviour after rejection. Currently, no experimental research has considered the role of the rejecting peer's social status, relative to the rejected individual, in predicting risky behaviour after rejection. It is possible that experiencing social rejection interacts with peer-

related factors, like peer social status, and individual differences in rejection-related traits that predict risk-taking.

Current Study

Based on the existing literature, an integrative model (see Figure 1) is proposed as an explanation of how social evaluation and physiological stress, can affect peer influence on risky driving. The current study tests three components of this model in particular, but not the entire model. First, it assumes that presence of a peer creates an environment for passive social evaluation. When a peer is present, young people may attend to environmental cues that actively signal either acceptance or rejection by the peer. Second, when a young person's perception of the (evaluating) peer's social status is high, this will be associated with more physiological stress. Finally, increased physiological stress may in turn sensitize young people to social stimuli in their environments, including peer norms to engage in risky behaviour, to maintain or re-gain acceptance.

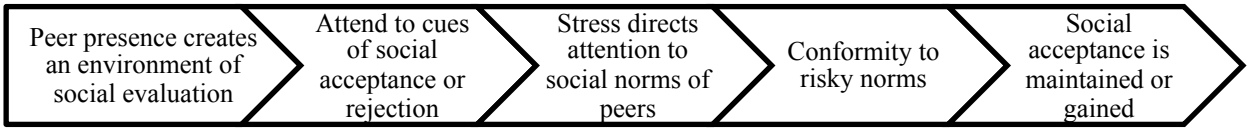

Figure 1. A proposed model of how social acceptance and rejection may increase risky driving. A social-evaluative context where young people are with a peer will increase attention to social cues in the environment that indicate acceptance or rejection and subsequently increase physiological stress. Stress, however, will depend on how the peer's social status is perceived. The heightened physiological arousal sensitizes young people to social cues in their environment that will help maintain or re-gain social acceptance, such as risky peer norms, which in turn maintains or re-gains social acceptance.

This proposed model is based on a number of limitations in the literature on peer influence and risky behaviour. First, the vast majority of experimental studies has manipulated the presence of peers (either in person or in virtual spaces) and/or the type of influence provided by peers (e.g. communicating risky peer norms), but have largely ignored the possibility that not all peers are equally influential by virtue of being present. As noted above, adolescents are sensitive to nuanced social cues, including social hierarchies and the social status of peers (Pattiselanno, Dijkstra, Steglich, Vollebergh, & Veenstra, 2015). If an observing peer is perceived as lower status based on their perceived levels of social dominance or desirability as a friend, for example, their ability to influence may be limited.

Second, susceptibility to peer influence is not uniform across adolescents. Individual differences in variables associated with susceptibility to peer influence, such as physiological arousal and rejection sensitivity, may strengthen the rewarding nature of peers and worsen the impact of social threats. As suggested by prior research, following social rejection, the likelihood of engaging in risk-taking behaviour may be even greater for rejection-sensitive adolescents who then are also given the opportunity to re-establish a social connection with the rejecting peer. The presence of a peer and the nature of the social environment (i.e. one that is accepting or rejecting) may trigger physiological arousal, compromising inhibitory control capabilities and increasing risky behaviour. A heightened physiological stress response might be especially prominent among socially rejected young people. Accordingly, this state of arousal then sensitizes them to social cues, such as peer norms. Brief stressors, such as being suddenly rejected without an extended performance-related stressor, may also produce different patterns of physiological arousal on non-hormonal measures. While previous research has primarily tested the effect of social stressors on hormonal indicators of stress like cortisol, a recent meta-analysis

on physiological stress and driving suggests that cardiovascular stress measures may be more appropriate to capture sudden stressors and subsequent effects on driving (Antoun, Edwards, Sweeting, & Ding, 2017). Further, the effects of a stressor on cortisol generally appear some time after the administration of a stressor (Stroud et al., 2009), whereas cardiovascular indicators of stress appear immediately after a stressor and can remain high. Because the current study seeks to determine the effect of a social stressor on immediate physiological arousal and subsequent behaviour, cardiovascular measures were selected as the operational measure of stress.

Third, with the exception of driving scenarios, laboratory-based studies of risk-taking often do not represent actual situations where adolescents can cause harm to themselves and others by engaging in risky behaviour with peers. Outside of driving studies, the bulk of experimental research thus far has used computer-based risk tasks with peers as observers, where the tasks measuring risk-taking are contained to a small computer screen or game. However, studies using driving simulator or naturalistic data collection methods indicate that driving with peers increases the likelihood of riskier driving, including behaviours such as excessive speeding, reduced visual scanning, and driver error (Ouimet et al., 2015; Pradhan, Li, Bingham, Simons-Morton, Ouimet, & Shope, 2014; Curry et al., 2012; Simons-Morton et al., 2014; Simons-Morton et al., 2011; Simons-Morton, Lerner, & Singer, 2005). By testing different social contexts that young drivers may experience prior to driving, the mechanisms through which peers affect risky driving (i.e. via peer social status and physiological stress) will be explored. This research methodology allows for a more precise assessment of peer passenger influence on driving behaviour among young people.

Finally, prior experimental studies of peer effects on driving using a full-sized driving simulator have generally not compared male and female drivers. Peer passenger effects have been found to differ by gender in epidemiological studies. Adolescent males engage in riskier driving in the presence of peers than females, despite peer passengers also predicting riskier driving in females (Simons-Morton et al., 2005). Driver gender is also associated with the *type* of distractor that may precede a collision. Adolescent female drivers are more likely to be distracted by interior stimuli within the vehicle (e.g. looking around at passengers), while adolescent male drivers are more likely to be distracted by exterior stimuli outside the vehicle, such as traffic, even when passengers are present (Curry et al., 2012). Male adolescents are more likely to experience single-vehicle and head-on collisions, while female adolescents are more likely to experience crashes on the left and right sides of the vehicle (Bingham & Ehsani, 2012). These findings suggest that gender is a key predictor of distinct driving-related behaviors that may increase injury risk and crashes.

To address these limitations, the current study: 1) incorporated male and female participants; 2), used an ecologically valid measure of risky driving via a full-sized driving simulator; and 3) manipulated the social dynamics of the driving scenario via a social evaluation paradigm. Further, it assessed whether high- or low-status confederate (from the perspective of the participant) were more (or less) influential on behavior, and whether physiological stress impacted risky driving after experiencing social acceptance or rejection.

Research Questions and Hypotheses

The model to be tested included whether social acceptance or rejection, peer social status, and physiological stress interact to predict risky driving, controlling for relevant confounders

(age, years of experience, and gender) as covariates in all statistical models. The specific research questions and hypotheses were:

1) Under what social circumstances do young people take more risks in a risky driving simulation scenario?
    a. H1: Compared to controls, participants who perceive the confederate as higher-status (i.e. attractive, desirable as a friend) will be more likely to demonstrate riskier driving in the risk-accepting condition and risk-averse driving in the risk-averse condition.
    b. H2: Compared to social acceptance, after experiencing social rejection from the confederate, participants will be more likely to demonstrate riskier driving in the risk-accepting condition and risk-averse driving in the risk-averse condition.
2) Does physiological stress predict increased risk-taking in a peer's presence?
    a. H3: Compared to controls, the presence of a confederate will increase physiological reactivity and result in riskier driving.
    b. H4: Experiencing social rejection will significantly increase physiological stress compared to social acceptance, and will predict riskier driving compared to participants in the social acceptance condition.
3) Do physiological stress and peer-related variables predict riskier driving outcomes?
    a. H5: Physiological stress and peer-related variables (rejection sensitivity, fear of negative evaluation, and peer social status) will significantly predict riskier driving outcomes.

CHAPTER TWO

METHODS

Participants

A total of 53 participants were recruited from the Ryerson University undergraduate psychology student participant pool (SONA) and received 1.5 (1.5%) course credits for participating. Participants from the SONA pool are not eligible to receive financial compensation for studies they complete in exchange for course credit. Participants were required to be enrolled in a first year undergraduate introduction to psychology course to participate. Prior to completing the study, participants were screened via an online screening questionnaire on SONA for a history of medical or cognitive conditions that would preclude them from driving a vehicle (e.g. visual disabilities) or interacting with a passenger (e.g. speech or communication disorders) and a history of nausea or motion sickness in virtual reality/three-dimensional environments. Participants were asked to confirm their age via the SONA screening questionnaire to ensure all participants were between the ages of 16 and 25.

An additional 22 participants were recruited from the community via posters around the Ryerson University campus and local driving schools, as well as online advertisements via Craigslist and Kijiji. Participants from the community were recruited to avoid an exclusively undergraduate sample, which may not be representative of all young people, and in order to recruit students still in high school. All participants were screened over the phone for a history of medical or cognitive conditions that would preclude them from driving a vehicle or interacting with a passenger and a history of nausea or motion sickness in virtual reality/three-dimensional environments. Participants were asked to confirm their age as being between 16 and 25. In exchange for their participation, community participants received $20 CAD compensation.

The final sample comprised 75 participants (52% female) with a mean age of 19.55 (*SD* = 2.16; range 17 – 25) years. Approximately 33.3% were Caucasian, 25.3% were Asian, 18.7% were Southeast Asian, and 22.7% had another ethnic background (Black, Hispanic, Middle Eastern, Mixed). Participants had on average 2.41 (*SD* = 2.35) years of driving experience and 62.7% (*n* = 47) had a G2 or G status license.[3] Eight participants (10.7%) reported a previous minor driving incident, including rear-endings and colliding with a pillar. Five participants (6.7%) reported a previous speeding ticket.

Measures

All measures are provided in full in Appendix A and all correlations between demographics, measures, physiological stress, and driving outcomes are provided in Appendix B.

Demographics. Participants were asked to report their age, gender, ethnic background, years of driving experience (including time on a restricted license, such as a G1 in the province of Ontario), current license status, and any history of traffic tickets or incidents (see Participants section above).

Sensation seeking and impulsivity. To control for baseline sensation seeking and impulsivity, participants completed the eight-item Brief Sensation Seeking Scale (BSSS; Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002; Zuckerman, 1964) and the 20-item Short Urgency, Perseverance, Premeditation, Sensation-Seeking, and Positive Urgency scale (SUPPS-

[3] In the province of Ontario, a G1 status license is a learner's permit that allows new drivers to drive with a fully licensed passenger. A G2 status license allows drivers to drive alone with some restrictions (e.g. not on highways over certain speeds, have a zero blood alcohol level), and a G status license is a full license with no restrictions, unless the driver is under the age of 19, in which case they are prohibited from driving with teenaged passengers during certain hours and must maintain a zero blood alcohol level.

P, Lynam, 2013). Summing individual items created total scores for the BSSS and subscales for the SUPPS-P. The BSSS demonstrated good internal consistency (α = .82), consistent with previous findings (Hoyle et al., 2002). Three of the SUPPS-P subscales demonstrated adequate to good internal consistency (negative urgency [NU] α = .66, sensation-seeking [SS] α = .75, and positive urgency [PU] α = .77), consistent with Cyders, Littlefield, Coffey, and Karyadi (2014). However, a reliability analysis of the two additional SUPPS-P subscales, lack of perseverance (LPer, α = .11) and lack of premeditation (LPre, α = -.08) revealed very low and problematic internal consistencies, respectively. When Item 2 ("My thinking is usually careful and purposeful") on the lack of perseverance subscale was removed, internal consistency improved (α = .70). When Item 11 ("I finish what I start") on the lack of premeditation subscale was removed, internal consistency improved (α = .65). These items were removed from the subscale scores and results are on the modified subscales.

History of risky behaviour. The Youth Risk Behavior Survey (YRBS, Centers for Disease Control and Prevention, 2017) was used to measure the frequency of participants' risky behaviour, including smoking, alcohol and drug use, driving, fighting, and sexual activity.

Sensitivity to social evaluation. The Single Item Need-to-Belong Scale (SINTB; Nichols & Webster, 2013) and the Brief Fear of Negative Evaluation Scale – Revised (BFNE-R; Carleton, McCreary, Norton, & Asmundson, 2006) were used to assess sensitivity to social evaluation. The SINTB is a one-item measure, thus internal consistency cannot be calculated. The 12-item BFNE-R demonstrated good internal consistency (α = .95).

Rejection sensitivity. The Rejection Sensitivity Questionnaire (RSQ; Downey & Feldman, 1996) was used to assess sensitivity to rejection via two subscales. The first subscale (RSQ Scale 1) contains 18 items and assesses the extent to which an individual is anxious or

concerned about asking a friend or significant other for a series of different requests. The second subscale (RSQ Scale 2) contains the same 18 items but assesses the extent to which an individual believes their friend or significant other would honour their request (i.e. the likelihood that they would be rejected). Both subscales demonstrated good internal consistency, $\alpha = .82$ and $\alpha = .87$, for the first and second subscales respectively.

Resistance to peer influence. The Resistance to Peer Influence Scale (RPI, Steinberg & Monahan, 2007) was used to assess the extent to which individuals believe in their ability to resist peer influence relative to others. Due to problematic response patterns across most participants, sum scores and internal consistency alphas could not be calculated. The RPI is designed such that all 10 items have four possible responses and participants are to select one, but items are written in such a way that this response requirement may not be clear. For example, item 1 asks, "Some people go along with their friends just to keep their friends happy" BUT "other people refuse to go along with what their friends want to do, even though they know it will make their friends unhappy." Participants may select *really true for me* or *sort of true for me* to either statement, but not to both, though most participants did select a response item for both statements, making scoring the RPI not possible for most participants. Participants were not asked to complete the RPI, or any other missing items, upon their arrival for the in-lab portion of the study to avoid priming participants about the true purpose of the study.

Risky driving. The dependent variable, risky driving, was measured via: 1) speed, measured in kilometres per second; 2) duration of time to acceleration to top speed, measured in seconds; and 3) lane positioning (distance from the centerline of the road), measured in metres. Using the STISIM Drive simulation software (Systems Technology Incorporated, Hawthorne, CA), a customized 5-kilometre road scene (Figure 2) was developed that incorporated

pedestrians, traffic lights, a left turn into oncoming traffic, and buildings on either side of the road. The STISTIM Drive simulation software is desktop computer-based, from which the drive scene is projected in front of the fixed-base sedan participants drive. Throughout the drive scenario, participants heard sounds as they accelerated or stopped (e.g. squealing tires during hard braking, police sirens if they sped through a red light). The STISIM Drive simulation software captures acceleration, speed, and lane positioning figures in 0.54 second intervals, generating means and standard deviations across all intervals.

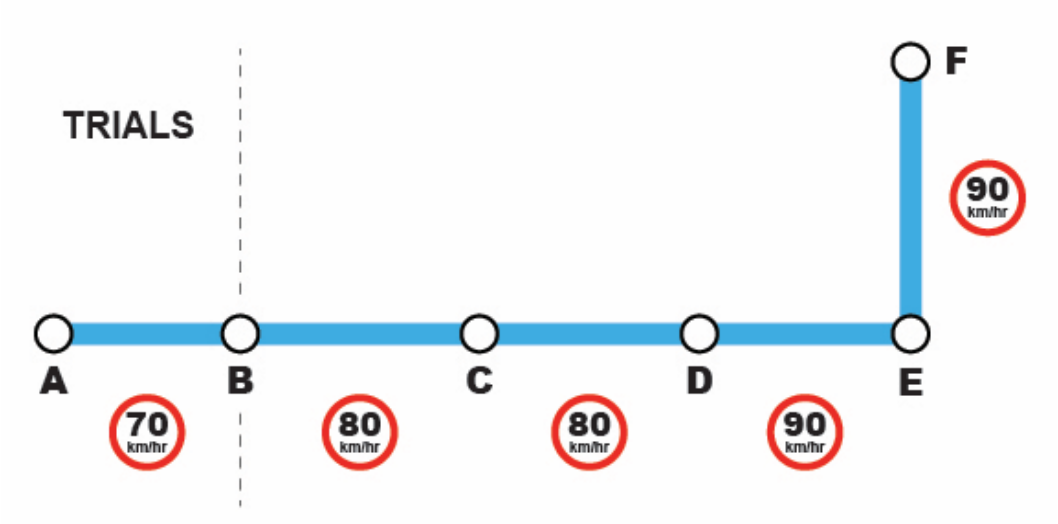

Figure 2. The road scene. Participants completed a trial drive to adjust to the vehicle from Point A to Point B. Points B, C, D, and E indicate intersections.

The means and standard deviations of speed, acceleration, and lane positioning were used as the measures of each driving outcome in all analyses. Driving outcomes during intersections and straight drive segments were also considered separately in analyses to account for different expectations of behaviour between them. Mean values of behaviours under study are common outcome measures of risk-taking, but variability in risk-taking outcomes (as measured by

standard deviations) have begun to be used to model within- and between-participant patterns of risky behaviour (e.g. DeMartini et al., 2014; McLean, Pincus, Smyth, Geier, & Wilson, 2018). Variability may be a more appropriate indicator of risk-taking propensity instead of traditional measures (i.e. mean values) when situational and contextual factors are included in the model being tested (McLean et al., 2018). This is because individual differences in responses to the testing environment over the experiment's duration may create different patterns of risk-taking behaviour.

Physiological stress. Physiological stress was measured via BIOPAC MP-150 (BIOPAC Systems, Inc., Goleta, CA) wearable biopotential recording systems. As seen in Figure 2, participants' heartbeats per minute (BPM) were measured continuously via three sensors placed on the chest and abdomen and transmitted wirelessly via an MP150 biopotential amplifier connected to a laptop, where AcqKnowledge software recorded electrocardiographic data (BIOPAC Systems Inc., Goleta, CA).

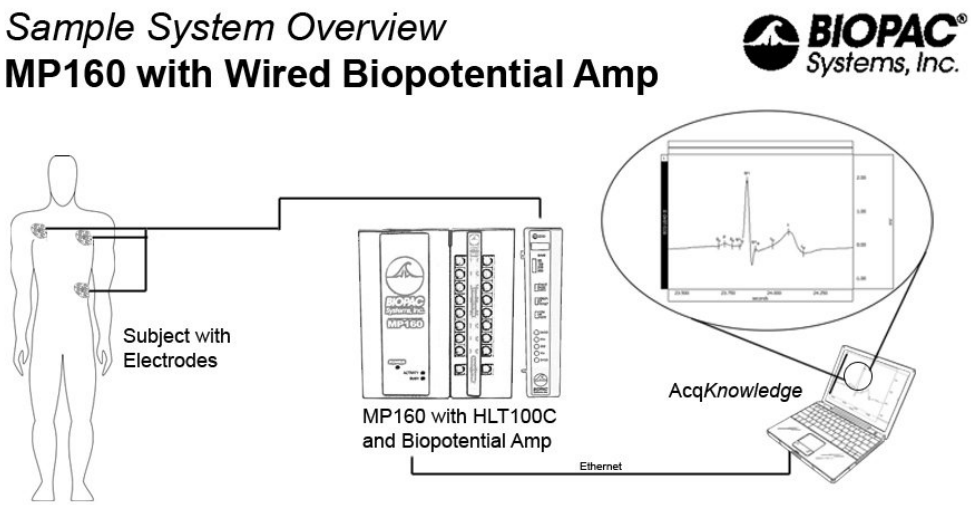

Figure 3. Placement of electrocardiogram electrodes and subsequent transmission and recording of data (Adapted from BIOPAC Systems Inc., Goleta, CA).

Respiration was measured via a respiration band placed around the participant's upper chest or upper diaphragm, depending on the participant's comfort level (see Figure 3 for placement of the respiration band).

Figure 4. Placement of the respiration band on participant's chest (Adapted from BIOPAC Systems Inc., Goleta, CA).

Mean BPM were used as the indicator of heart rate across each experimental segment. However, the respiration data were found to be inconsistently collected across participants, possibly due to the mobile nature of the study tasks. That is, as participants moved around or switched positions, the wireless signal between the wearable band and AcqKnowledge would drop. Due to the inconsistent nature of the data, no findings related to respiration are reported, and all physiological stress results report on beats per minute only.

Peer social status. To measure peer social status, participants in a social condition rated the confederate on a Likert scale of 0 (definitely not) to 4 (definitely) on physical attractiveness, desirability as a friend, dominance, leadership, and approachability. The items were summed

with higher scores indicating higher social status. Internal consistency was adequate (α = .68). This questionnaire was administered after Task 1 and before the stressor.

Manipulation checks. Participants in a social condition completed manipulation checks. These checks were used to test whether the social manipulation (rejection versus acceptance) and the driving manipulation (risk-accepting versus risk-averse) were effective. Prior to driving, the participant rated their level of agreement from 0 (definitely not) to 4 (definitely) on items reflecting their perception of social acceptance by the confederate. Internal consistency was high (α = .91). This questionnaire was administered after Task 2 and before the participant and confederate got into the driving simulator. After driving, the participant rated their level of agreement from 0 (would definitely not approve) to 4 (would definitely approve) as to whether their partner would approve of certain risky driving behaviors (e.g. weaving in and out of lanes) as the check of successful peer driving norm manipulation (adapted from Bingham et al., 2016). Internal consistency was adequate (α = .63). This questionnaire was completed after the participant and confederate exited the vehicle and before being debriefed.

Debriefing questions. After the conclusion of the study and prior to being debriefed about its true purpose, participants were asked to reflect on their participation and how they felt the study went, whether or not someone had told them about the study before they arrived to participate (beyond merely being referred to it), and their impressions of the study's goals based on the tasks they completed. These debriefing questions were not used in analyses, but were used only to determine if participants had suspicions about the nature of the experiment and to begin the debriefing procedure.

Procedure

Prior to the study beginning, research ethics board (REB) approval was obtained from Ryerson University (Appendix C). Participants completed the first part of the study, completing the BSSS, SUPPS-P, BFNE, SINTB, YRBS, RSQ, and RPI online via a personalized Qualtrics survey link emailed to them. The questionnaires took approximately 20 minutes to complete. Using a random number generator, participants were randomized into Control (n = 27), Rejection (n = 24), and Acceptance (n = 24) social evaluation conditions. Rejection and Acceptance participants were then further randomized into Risk-Averse (n = 23) or Risk-Accepting (n = 25) peer driving conditions. Prior to data collection beginning, the principal investigator did all randomization of participants and provided each participant's allocation to the research assistant and confederate on the day of the participant's attendance.

The second part of the study was completed in the Road Safety Research Laboratory in Ryerson University's Department of Civil Engineering. Scripts for both control and social conditions are provided in Appendix D. Each phase of the experiment (baseline, Task 1, stressor, Task 2, confederate driving, participant driving, and return to baseline) was segmented in AcqKnowledge, allowing for temporal comparisons across the entire study. Upon arrival for controls, participants were reminded that the study was about driver stress when driving with a passenger. After obtaining consent, participants had the cardiovascular sensors and respiration band placed on their bodies (see Figures 3 and 4) and completed the demographic questionnaire and Task 1, identifying 20 road signs from all Canadian provinces, for approximately five minutes. The road signs were collected from across all provinces to ensure that some would be difficult to name, based on the assumption that most participants would not be knowledgeable about road signs outside of Ontario. Task 1 served merely as a distractor task for controls and these data were not collected or used in analyses. They then completed the driving simulation

after being told several general guidelines: to drive like they would in real life; that they would see the same types of signage and traffic lights as they would on a real road; and that they would need to make a left turn at the final intersection (a recorded voice announced the turn and reminded them to do so). As seen in Figure 2, the 500-metre drive segment between Point A and Point B was used as a practice drive to allow participants to get used to the simulator's controls and was not used in analyses. After completion of the study, participants were debriefed.

Upon arrival for social condition participants, the gender- and age-matched confederate was waiting in the lobby of the building. They were told the study was about driver stress when driving with a passenger, and that the confederate had been randomized to be the passenger and the participant to be the driver that day. Since only the driver's stress was a variable of interest, the participant was only told they would need to wear the physiological measurement devices, but that the passenger (confederate) would get a chance to try the simulator as well. After obtaining consent, the physiological stress measures were placed on the participant and both the confederate and participant completed the demographic questionnaire. They then completed Task 1 for approximately five minutes, which was solely used to facilitate participant and confederate interaction in social conditions. In the social acceptance condition, the confederate was instructed to agree with the participant's suggestions for what the road sign indicated approximately 50% of the time, and ask the participant if they agreed with their guess the other 50% of the time. In the social rejection condition, the confederate was instructed to disagree with the participant's suggestions approximately 50% of the time and to appear skeptical before accepting the participant's guesses the other 50% of the time. This method of having the confederate agree or disagree approximately 50% of the time was selected to ensure participants

did not become suspicious of the confederate exclusively agreeing or disagreeing with them. After Task 1, the participant and confederate completed the peer social status questionnaire.

The social stressor was then administered. The participant and confederate were told they had one more task to complete (Task 2) for approximately 5 minutes before getting in the vehicle to drive and that they could complete it together or work on their own if they preferred. In the social acceptance condition, the confederate smiled and asked the participant if they would like to just keep working together. In all cases, the participant accepted and they were given one road rules quiz to complete together, with the same instructions given to the confederate in Task 1 to be agreeable with the participant's suggestions. In the social rejection condition, the confederate asked if they could complete the task on their own. In this case, the participant and confederate were given their own road rules quiz to complete independently at different desks. After Task 2, the participant and confederate completed the social acceptance manipulation check.

At this point, the confederate was told they could take a few minutes to try out the simulator. While the confederate was in the driver's seat and the participant in the passenger's seat, they received the same guidelines to follow as controls, with the exception that they would switch seats at the first intersection and we would pause the simulator to allow this. To model peer driving norms, in the Risk-Averse condition, the confederate drove in a risk-averse manner (accelerating slowly once the simulator started, braking as soon as a yellow light appeared as they approached the intersection, reaching for the seatbelt right away). In the Risk-Accepting condition, the confederate drove in a risk-accepting manner (accelerating quickly once the simulator started, braking quickly as they approached the intersection, not reaching for the seatbelt). After the first intersection of the drive, the confederate switched seats and the participant completed the full drive. As seen in Figure 2, the 500-metre drive segment between

Point A and Point B was used as a practice drive to allow participants to get used to the simulator's controls and was not used in analyses. After driving, the participant and confederate completed the driving manipulation check questionnaire and then were debriefed, where the true role of the confederate was revealed to the passenger. Across all participants in the acceptance and rejection conditions, the debrief questionnaire revealed that 100% of participants believed the confederate was a true peer completing the study with them. The second part of the study took approximately 25 (controls) to 40 (social conditions) minutes to complete.

Statistical Analyses

A power analysis using GPower (Faul, Erdfelder, Lang, & Buchner, 2007) revealed that a sample size of 75 was sufficient to detect a medium effect size of $\eta^2 = 0.15$ when alpha is set to 0.05 and power (1 - β) set to 0.90. Demographic and manipulation check measures were entered into an SPSS database immediately after a participant completed the study. After all participants had completed the study, questionnaire data were downloaded from Qualtrics, imported into SPSS, and cleaned for missing data. With the exception of one participant who opted not to enter answers for any of the questionnaire items and so was dropped from analyses involving questionnaire data, most participants completed all questionnaire items. Individual questionnaires were scored and checked for normality, and all appeared to have no major deviations from normality.

Electrocardiogram data were cleaned for artifacts in AcqKnowledge, which removes outliers and major deviations from the pattern of heartbeats, before being exported into MATLAB, Excel, and AcqKnowledge files to identify mean beats per minute across each study segment. Because the cleaning process in AcqKnowledge removes outliers, all physiological data were normally distributed. Driving data were downloaded from the STISIM Drive software

into Excel, where the mean and standard deviation were generated for each segment of the drive. Most drive segments had significant deviations from normality on acceleration, speed, and lane positioning, so values that fell outside of three standard deviations above or below the mean were excluded from analyses. Finally, the beginning and end time points of each drive segment were calculated and mapped onto the confederate and participant driving segments of the physiological stress data.

The sample demographics and questionnaires were first compared for both experimental condition and by gender in SPSS to check baseline group and gender equivalencies. A multi-level modeling approach was selected as the appropriate statistical method to use because of the nested nature of the data (i.e. data points were nested within individuals and across time points). Unlike linear models, which assume independence of variables inserted into the model, mixed effects modeling accounts for multiple measurements of the same variable from the same participant in the model. Each level of data being entered in the model is considered a random effect, such that each level is assigned a random intercept that models variation within that level, and accounts for the non-independence of these measurements. Variables that are hypothesized to predict the outcome variable of interest are fixed effects. An example of how random and fixed effects were modeled in this study is below, using R notation:

accel_mean ~ Condition + age + years of experience + gender + (1 | ID) + (1 | intersection)

In this example, the dependent variable of mean acceleration (accel_mean) is predicted by the experimental condition, age, years of driving experience, and gender as fixed effects. However, acceleration was assumed to vary across two levels (individuals and intersections), so the model assumes different intercepts for the individual (represented as “ID” at level 1) and intersection

(level 2) levels for acceleration mean. To test the primary research questions and hypotheses, linear mixed effects modeling was conducted using the “lme4” package in R Studio (R Core Team, 2013).

CHAPTER THREE

RESULTS

Sample descriptives, manipulation checks, and questionnaires

The current sample includes 75 participants, of which 39 are female and 36 are male. Table 1 provides comparisons between male and female participants on age, driving experience, peer social status, manipulation checks (social acceptance and peer driving), ethnicity, and license status. Men were significantly older than women, ($t(69) = 2.352$, $p = .022$) and the female sample had a significantly higher proportion of Caucasian participants ($\chi^2(7) = 16.295$, $p = .023$).

Table 1

Sample demographics, driving history, and manipulation checks by gender

Variables	Males ($n = 36$)	Females ($n = 39$)	t
	M(SD)	M(SD)	
Age	20.14 (1.76)	18.97 (2.37)	2.352*
Years Driving	2.90 (2.24)	1.95 (2.38)	ns
Peer Social Status	12.40 (3.29)	13.19 (2.41)	ns
Social Acceptance	11.63 (2.90)	9.69 (3.87)	ns
Peer Driving	7.22 (3.08)	7.61 (3.26)	ns
	%	%	χ^2
% Caucasian	27.8%	38.5%	16.295*
G2/G License[a]	72.2%	53.8%	ns

[a] Refers to proportion of participants with a G2 or G Class license.
*$p < 0.05$

Participants were also compared across randomized groups (Control, Social Acceptance/Risky, Social Acceptance/Risk-Averse, Social Rejection/Risky, Social Rejection/Risk-Averse). No group differences emerged on demographic variables (age, years of

driving experience, gender, ethnicity, or driver's license status). As expected, group differences emerged on manipulation checks. Socially rejected participants were significantly more likely to report feeling less socially accepted ($F(3,44) = 5.121$, $p = .004$). Post-hoc analyses using the Least Squares Difference (LSD) test revealed no significant differences in feelings of acceptance between Social Rejection/Risky and Social Rejection/Risk-Averse conditions, but both groups felt significantly less accepted than both Social Acceptance conditions. However, post-hoc analyses on the peer driving manipulation check using LSD tests revealed unexpected patterns. Participants in the Social Acceptance/Risky condition reported that confederates were significantly less likely to approve of a range of risky driving behaviours compared to participants in the Social Acceptance/Risk-Averse, Social Rejection/Risky, and Social Rejection/Risk-Averse conditions. As an additional peer driving manipulation check, mean BPM while confederates drove were compared between conditions, but revealed no significant differences. See Table 2 for a detailed breakdown of comparisons across conditions.

Table 2

Sample demographics, driving history, and manipulation checks by experimental conditions

Variables	Control (n = 27)	Acceptance (n = 24)		Rejection (n = 24)		F
		Risk-Averse (n = 11)	Risky (n = 13)	Risk-Averse (n = 12)	Risky (n = 12)	
	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	
Age	19.64 (2.12)	20.00 (2.96)	19.31 (1.75)	19.67 (2.60)	19.17 (1.75)	ns
Years Driving	2.31 (2.39)	2.8 (3.01)	1.89 (1.98)	3.01 (2.87)	2.13 (1.34)	ns
Peer Status	-	13.36 (2.11)	11.84 (4.33)	13.00 (1.95)	13.25 (2.13)	ns
Social Acceptance	-	12.27 (2.53)	12.46 (3.04)	8.66 (3.89)	8.91 (3.02)	5.121**[a]
Peer Driving	-	8.54 (4.2)	5.30 (1.65)	7.83 (2.97)	8.33 (2.64)	3.209*[b]

	%	%	%	%	%	χ^2
% Female	48.1%	63.6%	46.2%	58.3%	50.0%	ns
% Caucasian	33.3%	27.3%	53.8%	33.3%	16.7%	ns
G2/G License[c]	51.8%	72.8%	53.9%	75.0%	75.0%	ns

[a] LSD post-hoc analyses revealed no significant differences between Rejection/Risky and Rejection/Risk-Averse groups, but significant differences between both Rejection conditions and Social Acceptance/Risky and Social Acceptance/Risk-Averse conditions.
[b] LSD post-hoc analyses revealed significant differences between Social Acceptance/Risky and Social Acceptance/Risk-Averse, Social Rejection/Risky, and Social Rejection/Risk-Averse.
[c]Refers to proportion of participants with a G2 or G Class license.
** $p < 0.01$, *$p < 0.05$

Participants also completed a questionnaire battery assessing baseline impulsivity, sensation-seeking, and sensitivity to social evaluation. One male participant in the Social Acceptance/Risk-Averse condition did not enter a response for any questionnaire item and so was dropped from these analyses. Males had significantly higher scores on the BSSS Experience-Seeking subscale ($t(72) = 2.386$, $p = .020$), lower scores on the SUPPS-P Negative Urgency subscale ($t(72) = -2.162$, $p = .034$), lower scores on the SUPPS-P Positive Urgency subscale ($t(72) = -1.996$, $p = .05$), and lower scores on the RSQ Scale 2 ($t(72)= -2.043$, $p = .045$). See Table 3 for the breakdown of questionnaire scores across genders. Across experimental conditions, no significant differences emerged across groups with the exception of the SUPPS-P Sensation Seeking subscale ($F(3,44) = 3.377$, $p = .014$), such that the Social Rejection/Risky condition had significantly lower scores than Social Acceptance/Risky and Social Acceptance/Risk-Averse participants. See Table 4 for comparisons across experimental conditions.

Table 3

Questionnaire scores by gender

Questionnaire	Males (n = 35)	Females (n = 39)	t
	M(SD)	M(SD)	
BSSS (Sum)	27.6 (6.9)	25.1 (6.7)	ns
BSSS (ES)	7.6 (2.3)	6.4 (2.0)	2.386*
BSSS (B)	6.7 (2.0)	6.8 (2.1)	ns
BSSS (TS)	6.7 (2.6)	6.4 (2.2)	ns
BSSS (D)	6.6 (2.4)	5.5 (2.3)	ns
SINTB	3.5 (1.1)	4.0 (0.8)	ns
BFNE-R	24.8 (12.5)	24.9 (10.7)	ns
SUPPS-P (NU)	9.6 (2.4)	10.8 (2.3)	-2.162*
SUPPS-P (LPers)	9.3 (1.6)	9.6 (1.4)	ns
SUPPS-P (LPre)	9.6 (1.9)	9.6 (1.3)	ns
SUPPS-P (SS)	8.3 (2.9)	9.3 (2.4)	ns
SUPPS-P (PU)	10.4 (2.6)	11.5 (2.1)	-1.996*
RSQ Scale 1	60.1 (16.6)	56.9 (13.9)	ns
RSQ Scale 2	75.1 (13.8)	81.4(12.5)	-2.043*

Note. BSSS (Sum) – Brief Sensation Seeking Scale Sum; BSSS (ES) - Brief Sensation Seeking Scale Experience-Seeking; BSSS (B) - Brief Sensation Seeking Scale Boredom; BSSS (TS) - Brief Sensation Seeking Scale Thrill Seeking; BSSS (D) - Brief Sensation Seeking Scale Disinhibition; SINTB – Single Item Need to Belong; BFNE-R – Brief Fear of Negative Evaluation Revised; SUPPS-P (NU) – Short Urgency, Perseverance, Premeditation, Sensation-Seeking, Positive and Negative Urgency; SUPPS-P (LPers) - Short Urgency, Perseverance, Premeditation, Sensation-Seeking, Positive and Lack Perseverance; SUPPS-P (LPre) - Short Urgency, Perseverance, Premeditation, Sensation-Seeking, Positive and Lack Premeditation; SUPPS-P (SS) - Short Urgency, Perseverance, Premeditation, Sensation-Seeking, Positive and Sensation-Seeking; SUPPS-P (PU) - Short Urgency, Perseverance, Premeditation, Sensation-Seeking, and Positive Urgency; RSQ Scale 1 – Rejection Sensitivity Questionnaire Scale 1 (Concerns about Rejection); RSQ Scale 2 – Rejection Sensitivity Questionnaire Scale 2 (Expectations of Rejection).
*$p < 0.05$.

Table 4

Questionnaire scores by experimental condition

Study segment	Controls (n = 27)	Acceptance (n = 23)		Rejection (n = 24)		F
		Risk-Averse (n = 10)	Risky (n = 13)	Risk-Averse (n = 12)	Risky (n = 12)	
	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	
BSSS (Sum)	26.3 (5.9)	23.9 (6.2)	23.3 (8.9)	28.1 (7.8)	29.8 (4.1)	ns
BSSS (ES)	7.1 (2.0)	5.7 (1.9)	6.4 (2.6)	7.5 (2.5)	7.9 (1.7)	ns
BSSS (B)	6.9 (1.8)	6.1 (2.0)	5.8 (1.9)	7.0 (2.6)	7.8 (1.7)	ns
BSSS (TS)	6.2 (2.5)	5.9 (1.9)	5.6 (2.9)	8.1 (1.4)	7.1 (1.9)	ns
BSSS (D)	6.1 (2.2)	6.2 (2.0)	5.5 (2.8)	5.5 (2.8)	7.0 (2.2)	ns
SINTB	3.7 (1.1)	3.8 (0.6)	3.5 (1.1)	4.0 (1.1)	3.8 (0.9)	ns
BFNE-R	23.8 (13.1)	26.5 (9.2)	24.1 (12.8)	23.4 (11.7)	28.1 (8.1)	ns
SUPPS-P (NU)	9.8 (2.6)	10.8 (1.9)	10.5 (1.9)	10.4 (2.8)	10.3 (2.4)	ns
SUPPS-P (LPers)	9.4 (1.6)	8.8 (1.0)	9.8 (1.3)	9.1 (1.8)	10.1 (1.5)	ns
SUPPS-P (LPre)	9.7 (2.0)	9.0 (0.0)	9.5 (1.8)	9.3 (1.4)	10.0 (1.3)	ns
SUPPS-P (SS)	9.2 (2.2)	10.2 (2.0)	9.5 (3.0)	8.2 (3.5)	6.8 (1.9)	3.377*
SUPPS-P (PU)	10.8 (2.5)	11.4 (1.4)	11.5 (1.9)	10.6 (3.1)	10.9 (2.5)	ns
RSQ Scale 1	59.6 (15.5)	55.5 (14.5)	61.7 (13.5)	52.4 (16.1)	60.6 (16.4)	ns
RSQ Scale 2	77.3 (14.0)	75.9 (13.0)	77.3 (14.6)	84.3 (10.6)	78.6 (14.2)	ns

Note. BSSS (Sum) – Brief Sensation Seeking Scale Sum; BSSS (ES) - Brief Sensation Seeking Scale Experience-Seeking; BSSS (B) - Brief Sensation Seeking Scale Boredom; BSSS (TS) - Brief Sensation Seeking Scale Thrill Seeking; BSSS (D) - Brief Sensation Seeking Scale Disinhibition; SINTB – Single Item Need to Belong; BFNE-R – Brief Fear of Negative Evaluation Revised; SUPPS-P (NU) – Short Urgency, Perseverance, Premeditation, Sensation-Seeking, Positive and Negative Urgency; SUPPS-P (LPers) - Short Urgency, Perseverance, Premeditation, Sensation-Seeking, Positive and Lack Perseverance; SUPPS-P (LPre) - Short Urgency, Perseverance, Premeditation, Sensation-Seeking, Positive and Lack Premeditation; SUPPS-P (SS) - Short Urgency, Perseverance, Premeditation, Sensation-Seeking, Positive and Sensation-Seeking; SUPPS-P (PU) - Short Urgency, Perseverance, Premeditation, Sensation-Seeking, and Positive Urgency; RSQ Scale 1 – Rejection Sensitivity Questionnaire Scale 1 (Concerns about Rejection); RSQ Scale 2 – Rejection Sensitivity Questionnaire Scale 2 (Expectations of Rejection).
*$p < 0.05$

Finally, participants completed the YRBS to identify histories of risk behaviours. More men (31.4%) reported significantly more fights in the last 12 months than did women (7.7%; $\chi^2(1) = 7.807$, $p = .020$). Males were also significantly more likely to indicate having ever tried

smoking ($\chi^2(1) = 4.226$, $p = .040$) but an older age category at first time smoking ($\chi^2(5) = 11.617$, $p = .040$). Men and women did not have significant differences on any other driving, drug and alcohol use, or sexual risk behaviours. Across experimental conditions, only smoking cigars in the past 30 days significantly differed between groups ($\chi^2(4) = 10.286$, $p = .036$). Experimental conditions did not significantly differ on any other driving, drug and alcohol, smoking, or sexual risk behaviours.

Experimental condition effects on driving outcomes

Prior to testing each research question and hypothesis, both social conditions (acceptance and rejection) were combined and compared to the control condition on all driving outcomes to determine an overall peer passenger (regardless of experimental social condition) effect. Covariates (age, years of experience, and gender) were also included in all models alongside the experimental social condition.

Control versus Social Acceptance/Social Rejection. Appendix D contain results tables for the linear mixed effects models testing the effect of experimental social condition (Control versus Social Acceptance/Social Rejection), covariates (age, years of driving experience, gender), and experimental condition/covariate interactions on the means and standard deviations of acceleration, speed, and lane positioning during interactions (Table D-1) and straight drive segments (Table D-2). Table 5 contains a summary of all significant main effects of conditions and interactions.

Intersections. Results indicated that covariates (age, gender, and years of driving experience) had significant main effects on acceleration, speed, and lane positioning means, and experimental condition had a significant main effect on acceleration means (see Figure 5 for comparisons across conditions on all driving outcomes in intersections). Participants in the

control condition (b = -0.2110, SE = 0.096, p = .0317) and those who were older (b = -0.0930, SE = 0.037, p = .0155) had lower acceleration means, and whereas those with more years of driving experience (b = 0.0867, SE = 0.033, p = .0109) had faster acceleration means. A significant interaction between condition and age revealed that participants in the control condition had lower acceleration means when they were older (b = -0.1686, SE = 0.063, p = .0096) whereas age was not predictive of acceleration means in the social conditions (b = -0.0175, SE = 0.040, p = .6626). For speed and lane positioning, female participants had higher mean speeds (b = 0.6113, SE = 0.253, p = .0187) but wider lane positioning means (i.e. further from the midline of the road; b = 0.0802, SE = 0.037, p = .0364), respectively.

For standard deviations, a main effect of condition indicated that participants in Social Acceptance or Social Rejection conditions had more variability in acceleration (b = 0.1254, SE = 0.051, p = .0171) and lane positioning (b = 0.1399, SE = 0.052, p = .0085). A significant main effect of age indicated that older age was predictive of less variability in speed (b = -0.1532, SE = 0.069, p = .0302). Age also significantly interacted with condition to predict more variability in speed (b = 0.1563, SE = 0.069, p = .0271). In this case, older age predicted significantly less variability in speed for participants in the control condition (b = -0.3096, SE = 0.117, p = .0105) but did not predict any variability in speed for participants in the social conditions (b = 0.0030, SE = 0.072, p = .9662). A significant interaction between years of driving experience and condition also emerged (b = -0.1233, SE = 0.060, p = .0467), such that more driving experience had a marginal effect on more variability in speed among control participants (b = 0.1884, SE = 0.100, p = .0666). This effect did not hold for participants in social conditions (b = -0.0581, SE = 0.067, p = .3929).

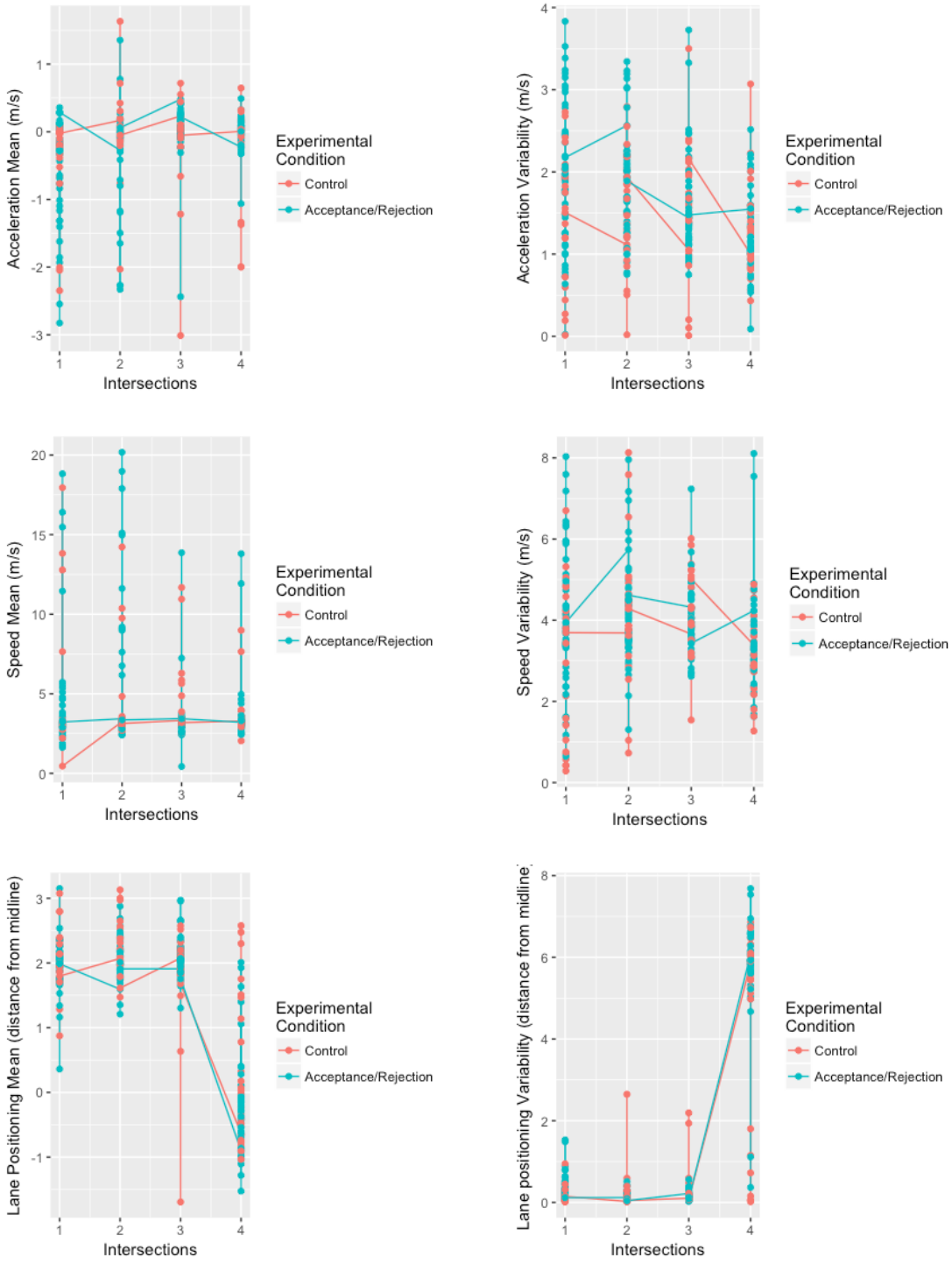

Figure 5. Acceleration, speed, and lane positioning means and standard deviations between experimental conditions (Controls versus Social Acceptance/Rejection) during

intersections. Intersections 1, 2, 3, and 4 refer to intersections B, C, D, and E, respectively, on the x-axis. On the y-axis, acceleration and speed are measured in metres per second and lane positioning in metres from the midline of the road.

Straight drive segments. The experimental condition did not yield any significant main effects or interactions on means or standard deviations of driving outcomes across straight drive segments. No significant main effects or interactions were found for acceleration or speed means, but a main effect of gender was found for lane positioning means, such that being female predicted wider lane positioning means (b = 0.0743, SE = 0.026, p = .0064). For standard deviations, main effects of age and years of driving experience were found for acceleration, such that older age resulted in less variability (b = -0.0395, SE = 0.018, p = .0321) and more years of driving experience resulted in more variability (b = 0.0651, SE = 0.016, p = .0001). Gender had a main effect on speed, such that women had more variability in speed (b = 0.2684, SE = 0.129, p = .0422).

Table 5

Summary of significant social and peer driving norm effects on driving outcomes

Intersections	Acceleration	Speed	Lane Positioning
Means	• Controls have lower acceleration means • Control x Older age have lower acceleration means • Risk-averse peer driving has higher acceleration means	• None	• None
Standard Deviations	• Acceptance/Rejection participants have more variability • Risky peer norms have less variability	• Control x older age have less variability • Control x more years of driving have more variability	• Acceptance/Rejection participants have more variability

		• Risky peer norms have less variability	
Straight Drives			
Means	• None	• None	• None
Standard Deviations	• None	• Acceptance/Rejection have more variability	• None

Social Acceptance versus Social Rejection and peer driving norms. Given that the experimental condition was found to have both main effects and interactive effects on driving outcomes, the first research question explored whether driving outcomes differed between participants in the Social Acceptance/Risky, Social Acceptance/Risk-Averse, Social Rejection/Risky, and Social Rejection/Risk-Averse conditions based on peer social status. Tables D-3 and D-4 in Appendix D contain results of linear mixed effects models testing the effect of social condition (Acceptance versus Rejection), peer driving norms (Risky/Risk-Averse), covariates, peer social status and interactions between condition, covariates, and peer social status during intersections and straight drive segments. Table 5 contains a summary of all social and peer driving condition significant effects and Figure 6 contains comparisons between peer driving norms on all driving outcomes.

Intersections. Results indicate that peer-modeled risk-averse driving norms had a significant main effect on acceleration means, such that risk-averse peer driving norms were associated with higher acceleration means (b = 0.0924, SE = 0.045, p = .0418). No other main effects or interactions were found for speed or lane positioning means. However, peer-modeled risky driving norms had a significant main effect on the standard deviations of acceleration (b = -0.1718, SE = 0.062, p = .0096) and speed (b = -0.3310, SE = 0.101, p = .0023), indicating that risky peer driving norms were associated with less variability in both during intersections. No

main effects or interactions were found for lane positioning during intersections. See Figure 6 for comparisons between peer norm conditions and all driving outcomes during intersections.

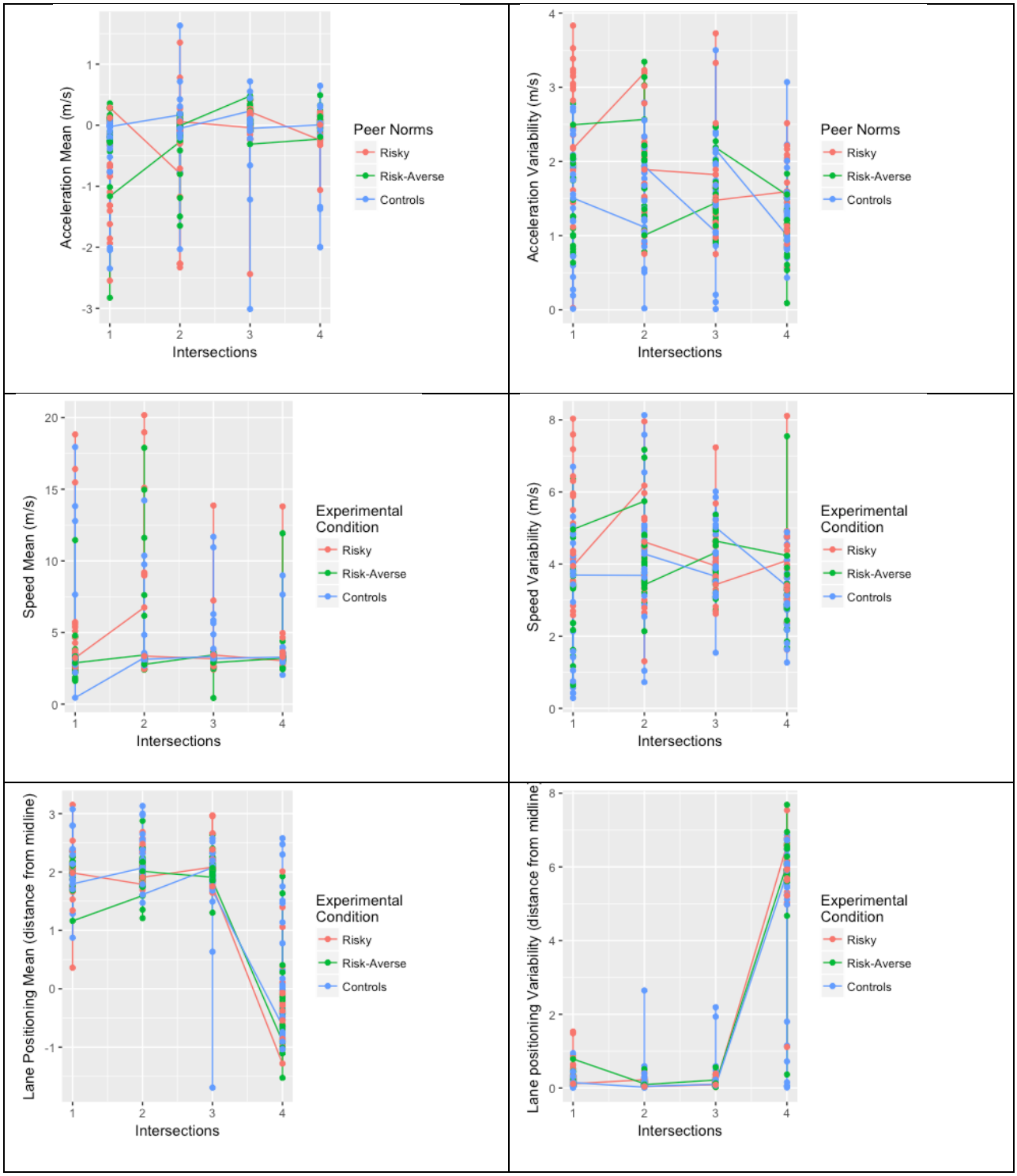

Figure 6. Acceleration, speed, and lane positioning means and standard deviations between peer norm conditions (Risky versus Risk-Averse). Control data is provided for comparison. Intersections 1, 2, 3, and 4 refer to intersections B, C, D, and E, respectively, on the x-axis. On the y-axis, acceleration and speed are measured in metres per second and lane positioning in metres from the midline of the road.

Straight drive segments. During straight drives, the social and peer driving condition had no significant effects on driving outcomes during straight drive segments. No main effects or interactions were found for acceleration and speed means. For lane positioning means, significant main effects of gender (b = 0.0904, SE = 0.027, p = .0022) and years of driving experience (b = -0.0387, SE = 0.017, p = .0382) were found, such that women had greater distances from the midline of the road and drivers with more years of driving experience had closer distances to the midline of the road.

Significant main effects of age (b = -0.0503, SE = 0.022, p = .0303) and years of driving experience (b = 0.0704, SE = 0.023, p = .0042) were found on acceleration standard deviations. Older age was predictive of less variability in acceleration, whereas more years of driving experience predicted more variability in acceleration. No main effects or interactions were found for speed standard deviations. Finally, a significant main effect of gender was found for lane positioning variability (b = 0.0400, SE = 0.018, p = .0333), such that women had more variability in their distance from the midline of the road during straight drive segments.

Experimental condition effects on physiological stress

The second research question was whether participants' physiological stress would differ across study segments (baseline, Task 1, stressor, Task 2, the confederate driving, the participant

driving, and return to baseline) depending on experimental condition. Testing the hypothesis that the presence of a peer would be associated with physiological stress across the study segments compared to controls, Table 6 contains the results of linear mixed effects models testing main effects of condition, age, and gender and interactions between condition, age, and gender on mean BPM. No significant main effects or interactions based on experimental condition, age, and gender emerged for mean BPM across study segments.

Table 6

Physiological stress across entire study segments by condition (Control vs Social Acceptance/Social Rejection)

		b	*SE*	*p*
BPM (Mean)				
Model 1				
	Control vs Acc/Rej	0.5672	1.572	.7190
Model 2				
	Control vs Acc/Rej	0.5123	1.584	.7470
	Age	-0.1253	0.718	.8620
	Gender	2.5207	1.564	.1120
Model 3				
	Control vs Acc/Rej	0.8496	3.213	.7920
	Age	-0.0915	0.780	.9070
	Gender	2.5606	1.664	.1290
	Control vs Acc/Rej x Age	-0.0954	0.780	.9030
	Control vs Acc/Rej x Gender	-0.1269	1.664	.9390

While peer presence did not have a significant main effect on physiological stress, higher perceptions of social acceptance had a marginal main effect on physiological stress. Table 7 contains results of linear mixed effects models comparing acceptance and rejection conditions, gender, peer social status, and perceptions of social acceptance on mean BPM across study segments for participants in social conditions only.

Table 7

Physiological stress across entire study segments by peer condition (Social Acceptance/Social Rejection)

			b	*SE*	*p*
BPM (Mean)					
	Model 1				
		Acc vs Rej	-1.358	1.843	.4650
	Model 2				
		Acc/Rej	0.3189	2.171	.8840
		Gender	3.5360	1.889	.0684
		Peer social status	0.6154	0.686	.3749
		Social acceptance	1.1324	0.645	.0868
	Model 3				
		Acc/Rej	6.8130	11.967	.5725
		Gender	2.9441	2.198	.1884
		Peer social status	0.1929	0.856	.8230
		Social acceptance	1.4906	0.876	.0972
		Acc/Rej x Gender	0.3645	2.1982	.8692
		Acc/Rej x Peer social status	0.1873	0.856	.8280
		Acc/Rej x Social acceptance	-0.7639	0.876	.3890

As seen in Table 7, the peer condition did not yield any main or interaction effects on mean BPM across study segments, nor did peer social status. However, the marginal effect of perceptions of social acceptance indicated that participants who felt more socially accepted by the confederate (regardless of social condition) also experienced higher mean BPM across study segments. To test whether the *perception* of acceptance was a more powerful predictor of mean BPM than experimental social conditions, feeling more socially accepted approached significance (b = 0.9015, SE = 0.496, p = .0736) when run independently in Model 1. In Model 2, feeling socially accepted had a significant main effect on mean BPM (b = 1.0770, SE = 0.516, p = .0433), though gender approached significance (b = 3.4826, SE = 1.381, p = .0641), and peer social status did not (b = 0.6496, SE = 0.637, p = .3141). However, feeling socially accepted, gender, and peer social status did not significantly interact. This indicates that the perception of social acceptance, regardless of experimental condition, may be a better predictor of physiological stress across study segments.

Integrating physiological stress, rejection-related variables, and driving outcomes

The third research question asked whether integrating physiological stress and peer-related variables into models of driving outcomes further accounted for the effects of a peer passenger. During intersections, mean BPM alone did not significantly predict acceleration means, approached significance for speed means (b = 0.0270, SE = 0.014, p = .0715), and significantly predicted lane positioning means (b = 0.0059, SE = 0.002, p = .0313). Mean BPM did not significantly predict variability in acceleration (b = -0.0020, SE = 0.003, p = .5570) or lane positioning (b = -0.0060, SE = 0.004, p = .1520), but did predict variability in speed (b = -0.0155, SE = 0.005, p = .0073). During straight drive segments, mean BPM did not significantly predict acceleration means (b = 0.0005, SE = 0.000, p = .5360), speed means (b = -0.0109, SE =

0.015, p = .4910), or lane positioning means (b = 0.0002, SE = 0.001, p = .8820). Mean BPM also did not significantly predict variability in acceleration (b = 0.0002, SE = 0.001, p = .8768), speed (b = 0.0089, SE = 0.009, p = .3481), or lane positioning (b = 0.0009, SE = 0.001, p = .3671).

Since perceptions of social acceptance appear to be a stronger predictor of physiological stress than experimental conditions, it was entered into models for each driving outcome instead of experimental conditions alongside driving covariates (age, gender, and years of driving experience) and measures related to sensitivity to social evaluation, including the RSQ Scale 2 as a measure of expectations of rejection and the BFNE. Table 8 contains a summary of all significant main effects and interactions related to BPM, social acceptance, and driving outcomes, and full models are in Tables D-5 and D-6 in Appendix D.

Table 8

Summary of physiological stress, perceptions of social acceptance, and rejection-related variables on driving

Intersections	Acceleration	Speed	Lane Positioning
Means	• Higher BPM has a marginal main effect on lower acceleration means	• Main effect of social acceptance on lower speed means • Significant interaction between higher BPM x higher perception of social acceptance on lower speed means	• Higher BPM has a marginal main effect on lower lane positioning means
Standard Deviations	• Higher BPM x higher RSQ Scale 2 significantly interact on more acceleration variability	• None	• None
Straight Drives			

Means	• None	• Significant interaction between higher BPM x higher BFNE on lower speed means	• None
Standard Deviations	• None	• None	• None

CHAPTER FOUR

DISCUSSION

This study was the first to compare social acceptance to social rejection to identify mechanisms of peer passenger influence on driving outcomes of young drivers. Four findings are highlighted here. First, results indicated that peer passengers primarily influenced driving behaviour in intersections rather than during straight drive segments. Second, peer passengers were associated with more variability in driving outcomes, rather than overall (i.e. mean) driving outcomes. Third, stronger perceptions of social acceptance were associated with more physiological stress across the study and while driving, and social evaluation-related variables interacted with physiological stress. Fourth, contrary to hypotheses, social acceptance, rather than social rejection, appeared to drive changes in physiological stress and driving outcomes.

Overall, partial support for the model presented in Figure 1 was found. When completing the study session with a peer, participants did experience more physiological stress as their perception of social acceptance increased, but this did not depend on peer social status. Further, social rejection did not have a meaningful effect on any driving outcomes or physiological stress. Some effects for peer-modeled driving norms were found, but these were independent of the effects of physiological stress, indicating that peer norms and physiological stress may direct attention toward different social cues in the environment and have different impacts on driving outcomes. Specifically, participants' conformity to risky and risk-averse peer driving norms affected some driving outcomes in the expected directions, suggesting that participants attended to these social cues and adopted the norms. However, physiological stress only interacted with variables related to sensitivity to social evaluation and not to experimental manipulations to reduce risky driving behaviour. This may mean that young drivers who are more sensitive to

social evaluation fear being perceived negatively for risky driving. Thus, conformity to peer norms may also depend on young drivers' sensitivity to social evaluation.

Driving Outcomes

Intersections. The finding that peer passengers exerted the most influence on drivers' behaviour at intersections is not surprising. A recent report indicated that 42.5% of collisions in Ontario took place at or near intersections (Ontario Ministry of Transportation, 2014), likely due to the more complex nature of navigating intersections compared to other road segments. In the present study, across intersections, control participants had significantly lower acceleration means than participants in the social acceptance or social rejection conditions, indicating that they accelerated to top speeds faster in intersections than participants in the two social conditions. This finding also interacted with age, such that older participants in the control condition had lower acceleration means than younger participants. This suggests that when driving with a peer, young drivers may behave more cautiously and accelerate slowly in intersections. Previous studies have found that despite peer passengers increasing the risk of adverse driving outcomes, young drivers report wanting to protect their passengers and keep them safe (Ehsani et al., 2015; McDonald & Sommers, 2016).

However, socially accepted and socially rejected participants evinced more variability in acceleration and lane positioning at intersections. This indicates that peer passengers may affect inconsistent driving behaviours, not just overall acceleration, speed, or lane positioning mean values. Inconsistent driving behaviour is a concern, because variability in acceleration and lane positioning may result in drivers creating conditions for a collision to occur. Calvi and de Blasiis (2011) found that young drivers' acceleration variability increased as traffic volume increased, affecting drivers' decisions to merge into other traffic lanes. This suggests that as traffic

scenarios increase in complexity, the cognitive demands placed on drivers may result in hesitation to initiate maneuvers, possibility resulting in varying acceleration patterns. Since intersections are more cognitively demanding driving scenarios, drivers' attention may be directed away from maintaining a consistent acceleration pattern to successfully complete a maneuver and, instead, be directed towards other stimuli. As noted by Romer, Lee, McDonald, and Winston (2014), young drivers tend to have *inattention blindness*, meaning that they attend to one source of information in the driving field while neglecting other equally important sources. For example, they might attend to the traffic volume of a neighbouring lane while neglecting to maintain speed to successfully merge.

Aside from the cognitive demands of an intersection, distractions in the vehicle can also direct attention away from maintaining consistent driving patterns. A recent model of the effect of driver distractions on acceleration, acceleration pedal position, and speed revealed that artificial neural network methods were able to detect with extremely high accuracy driver engagement in secondary tasks (e.g. cell phone usage, engaging with a passenger) while driving (Ye, Osman, Ishak, & Hashemi, 2017). Artificial neural networks use repeated inputs of data sources, identify patterns among these inputs, and 'learn' which patterns produce particular outcomes. In Ye et al. (2017), artificial neural networks revealed that whether drivers were using a cell phone or interacting with a passenger, both distractors produced more variability in acceleration, compared to when drivers were not distracted. This finding indicates that passengers may be indistinguishable from other forms of distractions, such as phones, supporting the notion that passengers influence young drivers' behaviour due to social stimuli possibly serving as distractions. Other findings by Zhao, Reimer, Mehler, D'Ambrosio, and Coughlin (2013) also indicate more hard braking and acceleration events, indicating that changes in

acceleration patterns are associated with distractors inside the vehicle. Echoing these findings between distractors and acceleration variability, Foss and Goodwin (2014) found that young passengers engaging in horseplay (e.g. rowdiness, roughhousing with other passengers and/or the driver) and having loud conversations were associated with adolescent drivers' higher likelihood of high g-force events (i.e. sudden acceleration and/or deceleration).

Unlike acceleration, experimental conditions in the current study did not have an effect on mean lane positioning outcomes. However, peer passengers did affect variability in lane positioning, which may reflect more swerving, crossing the midline of the road into opposing traffic, or veering off the road. Young and Salmon (2012) noted that drivers tend to engage in fewer micro-steering (i.e. minimal, but necessary) maneuvers to remain on a steady path on the road when they are distracted and when attention is diverted away from the road. Instead, drivers tend to hold the steering wheel in a fixed manner, which can cause drivers to subsequently over-correct the vehicle's positioning. Interestingly, the findings of the present study are in opposition to He, McCarley, and Kramer (2013), who found that young adult drivers were better able to maintain their lane position under high cognitive load, compared to low cognitive load; however, speed was reduced. He et al. (2013) proposed that when cognitive demands are high, drivers might protect their lane positioning but sacrifice maintaining speed. However, it was unclear as to why the present study's findings are in opposition to He et al. (2013). These inconsistent results may be due to sample characteristics, such as drivers' ages and years of experience driving. He et al.'s (2013) sample comprised young drivers with a mean age of 23 and an average of 4 years of driving experience. In the present study, the sample was several years younger on average and had less driving experience. Maintaining lane positioning may be a

driving skill that develops with age and experience, making novice drivers more susceptible to the distracting effects of peer passengers and the higher cognitive demands of intersections.

Finally, experimental conditions did not affect mean driving outcomes for speed in intersections. Because the drive was relatively short at 5 kilometres and involved multiple stopping points at intersections, there may have been insufficient driving time for participants to reach a range of top speeds. This circumstance might have obscured possible condition effects on mean speed. It is also possible that the effect of condition on speed was nullified by combining higher and lower speeds during intersections in analyses. Irrespective of condition, however, female participants had significantly higher mean speeds and wider lane positioning in intersections. This could be explained by the significantly lower age and fewer (but not significantly) years of driving experience among the female participants, since younger age and less driving experience are associated with riskier driving behaviours (Curry, Pfieffer, Durbin, & Elliott, 2015). In this case, higher mean speeds and wider positioning at an intersection may result in higher collision risk. A significant interaction effect also emerged between condition, age, and years of experience, but only for control participants; older age reduced variability in speed, but years of experience increased variability. The protective effect of age on speed variability is not unexpected. The increasing speed variability with more years of driving experience may reflect less cautious behaviour at intersections, such as advancing slowly while waiting for a green light.

Straight drives. Unlike during intersections, experimental conditions generally did not affect driving outcomes during straight drive segments. When participants drove on straight road segments, peer passengers had less influence on driving performance than when participants

drove in intersections. With the exception of variability in speed being higher for participants in the social acceptance and rejection conditions, compared to controls, driving outcomes during straight drive segments were primarily predicted by gender, age, and years of experience. This is consistent with previous research indicating that gender differentially predicts driving outcomes for young drivers (Curry et al., 2012) and that age and driving experience are associated with safer driving outcomes (Romer et al., 2014). As expected, older age predicted less variability in acceleration, similar to findings during intersections, yet years of driving experience also had a main effect on more variability in acceleration, again possibly reflecting less cautious behaviour. Further, similar to intersections, female participants had higher speed variability and lane positioning mean values, which may be explained by their younger age and less experience, relative to male participants. These findings during straight drives reveal that age, years of experience, and gender may be more powerful predictors of driving behaviour during less complex driving scenarios (e.g. straight drives) in young people than peer passengers. During drive segments where the cognitive load is not as high (i.e. when driving straight relative to approaching an intersection), driving experience and age may protect young drivers from adverse outcomes (Curry et al., 2015). However, more specific comparisons between more and less complex driving scenarios and the protective effects of age and experience in the presence of peer passengers are needed.

Peer Driving Norms

The findings revealed that, despite no significant differences on driving outcomes between participants in the social acceptance or rejection conditions, the peer driving norm manipulation did produce some main effects. During intersections, risk-averse peer driving norms had a significant effect on higher acceleration means; such that risk-averse driving norms

were associated with slower acceleration to top speeds. However, risky driving norms reduced acceleration and speed variability. These findings suggest that risk-averse peers can prompt more cautious (i.e. slower) acceleration at intersections; however, risky peers can prompt more consistent acceleration and speed. Young drivers reported that they perceived driving with their friends as a performance and felt pressure to appear confident and competent (Ehsani et al., 2015) which might reduce caution or hesitation while driving. Risky peer norms may bolster young drivers' confidence and/or mitigate hesitation while driving, leading to less variability in driving outcomes. Risky peer norms may also prime impulsive behaviour and enhance the salience of rewards in the environment. The presence of a social reward, such as peer approval (i.e. by adhering to risky driving norms), may overwhelm young drivers' self-regulation capabilities, leading to more impulsive behaviour (Zelazo & Carlson, 2012). However, peer presence can enhance the rewarding nature of a task when a positive outcome is achieved (e.g. peer approval) (Chein et al., 2011; Voroboyev et al., 2015). The desire to obtain social rewards like peer approval may explain why young people can behave in risky and risk-averse manners that are modeled by peers (e.g. Centifanti et al., 2016), despite findings that peer presence often increases risky behaviour when risk tolerance is not modeled by peers (e.g. Gardner & Steinberg, 2005).

These trends echo previous studies that have manipulated peer driving norms. The growing literature on peer driving norms seems to indicate that peer passengers have the strongest effects on risky driving when they are perceived as risky by the driver, and that risk-averse passengers decrease risky driving (Bingham et al., 2016; Centifanti et al., 2016; Shepherd, Lane, Tapscott, & Gentile, 2011). Peer social status, however, did not have any effects on peer driving norms or driving outcomes, contrary to hypotheses. This finding is similar to Bingham et

al. (2016), who found that male participants' driving was not significantly affected by their identification with a confederate, but was affected by the confederate-modeled driving norms.

Physiological Stress

Contrary to expectation, no differences were found for physiological stress across conditions throughout the study or while driving. Instead, perceptions of social acceptance had a marginal effect on physiological stress, such that, participants who felt more accepted by the confederate, regardless of experimental condition, peer social status of the confederate, or gender, experienced higher mean BPM. This might indicate that the current study is capturing physiological arousal and not necessarily physiological stress. A study by van der Veen, van der Molen, Sahibdin, and Franken (2014) had similar unexpected findings when comparing physiological responses to acceptance and rejection, such that social rejection slowed heart rates. In van der Veen et al. (2014), participants experienced significantly slower heart rates after being rejected by a virtual peer when they had anticipated being accepted by them compared to participants who had no expectations of acceptance. Additionally, participants who experienced acceptance by a virtual peer demonstrated more neural activity in the frontal cortex compared to rejected participants, particularly when this acceptance was expected. van der Veen et al. (2014) propose that individuals may find it especially rewarding to be liked by others they wanted or expected to be liked by, resulting in the enhanced physiological response; however, experiencing unexpected rejection slows this response. The findings in the present study seem to support a similar process as van der Veen et al. (2014), whereby feeling socially accepted enhanced physiological arousal, indicating that this response pattern may be due to the social reward of acceptance. This suggests that while social evaluation may be stressful for young people when measured by hormonal secretions, social rewards may be more associated with physiological

arousal as measured by cardiovascular indicators, and this may have consequences for driving behaviour.

During the driving segment of the present study, physiological stress alone had some main effects on driving outcomes in intersections. Physiological stress was associated with higher lane positioning mean values, less variability in speed, and had a marginal effect on higher speed means; however, no effects were observed during straight drive segments. A recent study by Musicant, Botzer, Laufer, and Collet (2018) also found greater physiological stress responses (i.e., heart rate and skin conductance) from drivers during driving scenarios that required more (versus less) cognitive effort to navigate. This study by Musicant et al. (2018) provides some support for the physiological stress effects observed in this dissertation during intersections but not straight drive segments. In Musicant et al. (2018), drivers experienced the strongest physiological stress responses during intensive (sudden) braking events. The elevated physiological stress response may result from the cognitive effort involved in acceleration and deceleration decision-making, and this effect may extend to driving scenarios with higher cognitive demands like intersections. In contrast to Musicant et al. (2018), the present study found less variability in speed and higher speed means with heightened physiological stress, but no effects on acceleration. It is possible that under heightened stress, participants maintained steady, though higher, speeds and sacrificed lane positioning, in contrast to He et al. (2013)'s conclusion that cognitive load is protective for lane positioning but harmful for speed. The different response patterns of physiological stress and driving outcomes between participants in this study and those of Musicant et al. (2018) and He et al. (2013) may again be explained by the lower age and fewer years of driving experience of this study's participants. For novice and

younger drivers, physiological stress may increase due to the novelty of the driving task or still-developing automaticity while driving (Keating, 2007).

Despite the possibility that physiological stress may occur due to task novelty, the relationship between physiological stress and driving outcomes was hypothesized to be affected by sensitivity to social evaluation. The effects of physiological stress on driving outcomes when social evaluation-related variables were added to the model confirmed this expectation. Perceptions of social acceptance significantly interacted with physiological stress to affect speed means, such that heightened stress and feelings of social acceptance were associated with lower speeds during intersections. During straight drives, heightened stress and stronger fears of negative evaluation similarly reduced speed means. Physiological stress and stronger expectations of rejection also interacted on more acceleration variability at intersections. Taken together, these findings might reflect other studies that have found young drivers occasionally reduce risky driving, such as speeding, when driving with peer passengers (e.g. Ehsani et al., 2015; Ouimet et al., 2013), and that this may be due to concerns about being perceived negatively for engaging in behaviours that threaten passengers' safety (McDonald & Sommers, 2016). More conservative driving behaviour by drivers with higher physiological stress and sensitivity to social evaluation is consistent with previous findings that low stress responsivity was associated with higher crash and near-crash risk (Simons-Morton et al., 2015) and driving while impaired (Couture et al., 2015). Thus, individual differences in sensitivity to social evaluation may also explain the relationship between driving outcomes and young drivers' perception of their peer passengers as risky or risk-averse. That is, the extent to which young drivers are concerned about how their passengers perceive them, independent of how a young

driver perceives the passengers' risk tolerance, may have a unique contribution to how peer driving norms influence young drivers.

That perceptions of social acceptance and concerns about negative evaluation, rather than social rejection, were associated with heightened physiological stress responses is not surprising. Johnson, Dariotis, and Wang (2012) found that, while older adolescents did engage in riskier behaviour under stressful conditions, the magnitude of this behavioural response to stress was dependent on trait-level individual differences, such as planning orientation (i.e. calculated risk-taking) and impulsivity. Reynolds, Schreiber, Geisel, MacPherson, Ernst, and Lejuez (2013) also found that higher (versus lower) levels of social anxiety, which includes fear of negative evaluation and rejection, interacted with a social stressor to increase risk-taking in adolescents. Smith and Jordan (2015) propose that social-evaluative threats activate feelings of shame over possible loss of status, and heightened physiological stress may result when individuals are particularly sensitive to social evaluation and receive a social reward. This is consistent with the current study's findings that fear of negative evaluation and expectations of rejection interacted to produce heightened physiological stress, independent of experimental condition or perceived acceptance.

However, the relationship between physiological stress and sensitivity to social evaluation did not generally increase risky driving, as was predicted by the model. The current study's findings are also in opposition to Falk et al. (2014), who found that neural responses to social exclusion predicted risky driving in a simulator. There may be two explanations for the unexpected findings in the current study. First, Scott-Parker (2017) notes that experiencing positive emotions, such as feeling socially accepted, can decrease risk perception in young drivers, leading to riskier driving. This may partially explain why feeling socially accepted,

rather than socially rejected, had more of an effect on driving outcomes; however, it does not explain why feeling socially accepted did *not* increase risky driving outcomes. It is possible that sensitivity to social evaluation may explain why driving outcomes were more conservative among participants, such that they were concerned about how confederates may perceive them and, accordingly, drove more cautiously. Further, Falk et al. (2014) measured driving behaviour one week after participants had experienced social exclusion. It is possible that exclusion induces negative mood, resulting in risky behaviour to compensate for negative mood. This relates to the second explanation, that social acceptance and social rejection induce different emotional responses, which have different consequences for impulsive or sensation-seeking behaviour (Cyders & Smith, 2008). Positive urgency, or impulsive behaviour in the face of positive mood, has been associated with more risky driving behaviour in a sample of college students (Pearson, Murphy, & Doane, 2013). Impulsive behaviour in the face of positive mood (i.e. one induced by a social reward) may underlie expectations that a particular behaviour will achieve a desired positive outcome, but this effect might depend on sensitivity to social evaluation. That is, positive urgency may increase risky driving, but in the presence of peers, this response style might interact with sensitivity to social evaluation and concerns about passengers' perceptions of a young driver.

Thus, the primary consequences of social evaluative threats on physiological stress and driving outcomes may be distinct, rather than intertwined. The rewarding nature of social acceptance appears to heighten physiological stress overall, but does not have a major impact on driving outcomes. However, concerns about rejection and negative evaluation, independent of social acceptance, do have consequences for some driving outcomes, and this supports previous research suggesting that risky driving with peer passengers is dependent on how the driver

perceives their passengers' risk tolerance. In addition to considering their passengers' risk tolerance, individual differences in sensitivity to social evaluation may result in young drivers behaving in more riskier or cautious manners.

Limitations

This study has several limitations. First, physiological stress was defined solely by mean heartbeats per minute, due to the respiration data being unusable. Therefore, it was not possible to replicate the findings on physiological stress through an additional measure. It is possible that mean heartbeats per minute may in fact be representing physiological arousal in the presence of a social reward or a novel task (driving in a simulator) and not physiological stress. Future research should consider implementing psychophysiological methods that capture physiological arousal and physiological stress to determine if a driving and/or peer passenger task induces arousal, stress, or both. Second, the peer driving norms manipulation check revealed unexpected response patterns based on the driving manipulations. Participants randomized to the risky driving condition did not report that confederate was more likely to endorse risky driving behaviours. This raises the concern that the manipulation was ineffective and perhaps too subtle for participants to notice. At the same time, peer driving norms did affect driving outcomes in some expected directions, suggesting that the manipulation may have been effective but the manipulation check itself was not sensitive enough to detect it. Third, the driving simulation was relatively short compared to other simulator studies with young drivers who completed drives over 20 kilometres long (e.g. Pradhan et al., 2014; Simons-Morton et al., 2014). Generalizability to all driving scenarios and driving outcomes is therefore limited. Fourth, the sample was primarily young drivers from urban and suburban areas and as a result may drive differently. It might be the case that young drivers from urban and suburban areas do not drive frequently,

despite being licensed, or that they have delayed becoming licensed drivers because of the availability of public transportation. Comparing the effects of peer passengers on young drivers from rural and urban or suburban areas is warranted. Finally, confederates were used to socially accept or reject participants and to model driving norms in the study. Using a confederate had the significant benefit of experimental control, in that they followed a script and there were no unknown pre-existing relationship dynamics between them and the participant. Despite these benefits, confederates reduced the ecological validity of the experiment and are not analogous to relationships between participants and their friends in the real world.

Conclusions

Taken together, this study's findings provide preliminary support for two primary mechanisms through which peer passengers exert influence on young drivers, partially supporting the proposed model. First, the presence of a peer passenger is associated with more variability in driving outcomes, and this effect is especially prominent during intersections. These findings support previous research suggesting that social evaluation may be a form of distraction, and distractions are especially concerning during driving scenarios with higher cognitive demands. When the cognitive demands are higher, attention appears to be directed away from the road conditions and towards the social environment, resulting in inconsistent driving patterns. Second, sensitivity to social evaluation is associated with physiological stress while driving, regardless of the social evaluative context or peer driving norms, and this results in lower acceleration, speed, and inconsistent lane positioning. Though stress does not appear to increase risky driving in the traditional sense (i.e. higher speed, more lane positioning changes), it is possibly predictive of less attention to changing road conditions, resulting in lower acceleration and speed. The current study joins the larger literature on how peer passengers can

affect driving outcomes among young drivers, indicating a significant need to incorporate training on managing the effect of passengers into driver education.

Building on the current study's findings, future research should consider how peer passengers, sensitivity to social evaluation, and physiological stress interact to affect young drivers during other complex driving scenarios, such as inclement weather, roundabouts, or winding roads. Using additional physiological stress measurement methods simultaneously would also allow for replication of and increased confidence in the current findings, as well as distinguishing between whether peer passengers may be inducing physiological stress or physiological arousal. Finally, direct comparisons between the use of confederates and young drivers' friends as peer passengers in experimental driving research are currently lacking in the literature. Future research should consider how individual differences in sensitivity to social evaluation might differentially affect young drivers depending on whether they have a pre-existing relationship with the passenger.

Appendix A - Measures

Demographics and Driving Questionnaire

Age:

Ethnicity (circle one): Caucasian Black Hispanic Indigenous

Asian Southeast Asian Middle Eastern Mixed Other

Do you currently have a driver's license? (circle one)

G1 G2 G No license

Please estimate the length of your driving experience, using the appropriate time metric (e.g. if you have had a G2 for 3 months and previously a G1 for 1 year, estimate 1 year and 1 month). If you have none, enter 0.

Years:

Months:

Weeks:

Have you ever received traffic tickets (excluding parking tickets), been in an accident, rear-ending, or fender-bender when you were the driver? (Circle one)

Yes No Not licensed/never driven

If yes, please describe briefly:

Traffic tickets:

Accidents:

Rear-endings:

Fender-benders:

Peer Status Check

On a scale of 0 (Definitely not) to 4 (Definitely), to what extent do you agree with the following?

My partner is physically attractive.

My partner seems like a leader.

My partner seems socially dominant.

My partner seems approachable.

My partner seems like someone I would want to hang out with.

Manipulation Check – Acceptance/Rejection

On a scale of 0 (Definitely not) to 4 (Definitely), to what extent do you agree with the following?

I would like to work with my partner again on similar tasks.

I think my partner would want to work with me again on similar tasks.

I think my partner and I got along and worked well together.

Overall, I feel accepted by my partner.

Manipulation Check – Driving Style

On a scale of 0 (would definitely not approve) and 4 (would definitely approve), to what extent do you think your partner would approve of the following behaviours?

Weaving in and out of lanes in slow traffic

Using alcohol or substances before driving

Being a passenger in a car with a driver who had used alcohol or substances

Driving very carefully

Not wearing seatbelts

Playing music so loudly they would not be able to hear sirens or horns outside

Brief Sensation-Seeking Scale (BSSS)

On a scale from 1 (strongly disagree) to 5 (strongly agree), please rate your agreement with the following statements.

1. I would like to explore strange places
2. I would like to take off on a trip with no pre-planned routes or timetables
3. I get restless when I spend too much time at home
4. I prefer friends who are excitingly unpredictable
5. I like to do frightening things
6. I would like to try bungee jumping
7. I like wild parties
8. I would love to have new and exciting experiences, even if they are illegal

Subscales:
Experience-Seeking: 1 + 2
Boredom Susceptibility: 3 + 4
Thrill- and Adventure-Seeking: 5 + 6
Disinhibition: 7 + 8

Hoyle, R. H., Stephenson, M. T., Palmgreen, P., Lorch, E. P., & Donohew, R. L. (2002). Reliability and validity of a brief measure of sensation seeking. *Personality and Individual Differences, 32*(3), 401-414. doi:10.1016/S0191-8869(01)00032-0

Single-Item Need to Belong Scale (SIN-B)

On a scale from 1 (strongly disagree) to 5 (strongly agree), please rate your agreement with the following statement.

1. I have a strong need to belong.

Nichols, A. L., & Webster, G. D. (2013). The single-item need to belong scale. *Personality and Individual Differences, 55*(2), 189. doi:10.1016/j.paid.2013.02.018

Centers for Disease Control and Prevention Youth Risk Behavior Survey (YRBS)

**note: only items pertaining to study-relevant risk behaviours are included; items related to unhealthy dietary choices, physical activity, sexual victimization, bullying, and suicidality are excluded.*

Driving behaviours

1. How often do you wear a seat belt when **riding** in a car driven by someone else?
A. Never
B. Rarely
C. Sometimes
D. Most of the time
E. Always

2. During the past 30 days, how many times did you **ride** in a car or other vehicle **driven by someone who had been drinking alcohol**?
A. 0 times
B. 1 time
C. 2 or 3 times
D. 4 or 5 times
E. 6 or more times

3. During the past 30 days, how many times did you **drive** a car or other vehicle **when you had been drinking alcohol**?
A. I did not drive a car or other vehicle during the past 30 days
B. 0 times
C. 1 time
D. 2 or 3 times
E. 4 or 5 times
F. 6 or more times

4. During the past 30 days, on how many days did you **text or e-mail** while **driving** a car or other vehicle?
A. I did not drive a car or other vehicle during the past 30 days
B. 0 days
C. 1 or 2 days
D. 3 to 5 days
E. 6 to 9 days
F. 10 to 19 days
G. 20 to 29 days
H. All 30 days

Violent behaviours

5. During the past 30 days, on how many days did you carry **a weapon** such as a gun, knife, or club?

A. 0 days
B. 1 day
C. 2 or 3 days
D. 4 or 5 days
E. 6 or more days

6. During the past 30 days, on how many days did you carry **a weapon** such as a gun, knife, or club **to school or work**?
A. 0 days
B. 1 day
C. 2 or 3 days
D. 4 or 5 days
E. 6 or more days

7. During the past 30 days, on how many days did you **not** go to school or work because you felt you would be unsafe on your way to or from school or work?
A. 0 days
B. 1 day
C. 2 or 3 days
D. 4 or 5 days
E. 6 or more days

8. During the past 12 months, how many times were you in a **physical fight**?
A. 0 times
B. 1 time
C. 2 or 3 times
D. 4 or 5 times
E. 6 or 7 times
F. 8 or 9 times
G. 10 or 11 times
H. 12 or more times

Smoking behaviours

9. Have you ever tried cigarette smoking, even one or two puffs?
A. Yes
B. No

10. How old were you when you first tried cigarette smoking, even one or two puffs?
A. I have never tried cigarette smoking, not even one or two puffs
B. 8 years old or younger
C. 9 or 10 years old
D. 11 or 12 years old
E. 13 or 14 years old
F. 15 or 16 years old
G. 17 years old or older

11. During the past 30 days, on how many days did you smoke cigarettes?
A. 0 days
B. 1 or 2 days
C. 3 to 5 days
D. 6 to 9 days
E. 10 to 19 days
F. 20 to 29 days
G. All 30 days

12. During the past 30 days, on the days you smoked, how many cigarettes did you smoke **per day**?
A. I did not smoke cigarettes during the past 30 days
B. Less than 1 cigarette per day
C. 1 cigarette per day
D. 2 to 5 cigarettes per day
E. 6 to 10 cigarettes per day
F. 11 to 20 cigarettes per day
G. More than 20 cigarettes per day

13. Have you ever used an electronic vapor product?
A. Yes
B. No

14. During the past 30 days, on how many days did you use an electronic vapor product?
A. 0 days
B. 1 or 2 days
C. 3 to 5 days
D. 6 to 9 days
E. 10 to 19 days
F. 20 to 29 days
G. All 30 days

15. During the past 30 days, on how many days did you use **chewing tobacco, snuff, dip**, **snus, or dissolvable tobacco products**, such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandits, Copenhagen, Camel Snus, Marlboro Snus, General Snus, Ariva, Stonewall, or Camel Orbs? (Do not count any electronic vapor products.)
A. 0 days
B. 1 or 2 days
C. 3 to 5 days
D. 6 to 9 days
E. 10 to 19 days
F. 20 to 29 days
G. All 30 days

16. During the past 30 days, on how many days did you smoke **cigars, cigarillos, or little**

cigars?
A. 0 days
B. 1 or 2 days
C. 3 to 5 days
D. 6 to 9 days
E. 10 to 19 days
F. 20 to 29 day

Alcohol behaviours

17. How old were you when you had your first drink of alcohol other than a few sips?
A. I have never had a drink of alcohol other than a few sips
B. 8 years old or younger
C. 9 or 10 years old
D. 11 or 12 years old
E. 13 or 14 years old
F. 15 or 16 years old
G. 17 years old or older

18. During the past 30 days, on how many days did you have at least one drink of alcohol?
A. 0 days
B. 1 or 2 days
C. 3 to 5 days
D. 6 to 9 days
E. 10 to 19 days
F. 20 to 29 days
G. All 30 days

19. During the past 30 days, how did you **usually** get the alcohol you drank?
A. I did not drink alcohol during the past 30 days
B. I bought it in a store such as a liquor store, convenience store, supermarket, discount store, or gas station
C. I bought it at a restaurant, bar, or club
D. I bought it at a public event such as a concert or sporting event
E. I gave someone else money to buy it for me
F. Someone gave it to me
G. I took it from a store or family member
H. I got it some other way

The next 2 questions ask about how many drinks of alcohol you have had in a row, that is, within a couple of hours. For the first question, the number of drinks you need to think about is different for females and males.
20. During the past 30 days, on how many days did you have **4** or more drinks of alcohol in a row (if you are **female**) or **5** or more drinks of alcohol in a row (if you are **male**)?
A. 0 days
B. 1 day

C. 2 days
D. 3 to 5 days
E. 6 to 9 days
F. 10 to 19 days
G. 20 or more days

21. During the past 30 days, what is the largest number of alcoholic drinks you had in a row?
A. I did not drink alcohol during the past 30 days
B. 1 or 2 drinks
C. 3 drinks
D. 4 drinks
E. 5 drinks
F. 6 or 7 drinks
G. 8 or 9 drinks
H. 10 or more drinks

Drug-related behaviours

22. During your life, how many times have you used marijuana?
A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 to 39 times
F. 40 to 99 times
G. 100 or more times

23. How old were you when you tried marijuana for the first time?
A. I have never tried marijuana
B. 8 years old or younger
C. 9 or 10 years old
D. 11 or 12 years old
E. 13 or 14 years old
F. 15 or 16 years old
G. 17 years old or older

24. During the past 30 days, how many times did you use marijuana?
A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 to 39 times
F. 40 or more times

25. During your life, how many times have you used **any** form of cocaine, including powder,

crack, or freebase?
A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 to 39 times
F. 40 or more times

26. During your life, how many times have you sniffed glue, breathed the contents of aerosol spray cans, or inhaled any paints or sprays to get high?
A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 to 39 times
F. 40 or more times

27. During your life, how many times have you used **heroin** (also called smack, junk, or China White)?
A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 to 39 times
F. 40 or more times

28. During your life, how many times have you used **methamphetamines** (also called speed, crystal, crank, or ice)?
A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 to 39 times
F. 40 or more times

29. During your life, how many times have you used **ecstasy** (also called MDMA)?
A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 to 39 times
F. 40 or more times

30. During your life, how many times have you used **synthetic marijuana** (also called K2, Spice, fake weed, King Kong, Yucatan Fire, Skunk, or Moon Rocks)?
A. 0 times

B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 to 39 times
F. 40 or more times

31. During your life, how many times have you taken **steroid pills or shots** without a doctor's prescription?
A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 to 39 times
F. 40 or more times

32. During your life, how many times have you taken **prescription pain medicine** without a doctor's prescription or differently than how a doctor told you to use it? (Count drugs such as codeine, Vicodin, OxyContin, Hydrocodone, and Percocet.)
A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 to 39 times
F. 40 or more times

33. During your life, how many times have you used a needle to inject any **illegal** drug into your body?
A. 0 times
B. 1 time
C. 2 or more times

Sexual behaviours

38. Have you ever had sexual intercourse?
A. Yes
B. No

39. How old were you when you had sexual intercourse for the first time?
A. I have never had sexual intercourse
B. 11 years old or younger
C. 12 years old
D. 13 years old
E. 14 years old
F. 15 years old
G. 16 years old
H. 17 years old or older

40. During your life, with how many people have you had sexual intercourse?
A. I have never had sexual intercourse
B. 1 person
C. 2 people
D. 3 people
E. 4 people
F. 5 people
G. 6 or more people

41. During the past 3 months, with how many people did you have sexual intercourse?
A. I have never had sexual intercourse
B. I have had sexual intercourse, but not during the past 3 months
C. 1 person
D. 2 people
E. 3 people
F. 4 people
G. 5 people
H. 6 or more people

42. Did you drink alcohol or use drugs before you had sexual intercourse the **last time**?
A. I have never had sexual intercourse
B. Yes
C. No

43. The **last time** you had sexual intercourse, did you or your partner use a condom?
A. I have never had sexual intercourse
B. Yes
C. No

44. The **last time** you had sexual intercourse, what **one** method did you or your partner use to **prevent pregnancy**? (Select only **one** response.)
A. I have never had sexual intercourse
B. No method was used to prevent pregnancy
C. Birth control pills
D. Condoms
E. An IUD (such as Mirena or ParaGard) or implant (such as Implanon or Nexplanon)
F. A shot (such as Depo-Provera), patch (such as Ortho Evra), or birth control ring (such as NuvaRing)
G. Withdrawal or some other method
H. Not sure

Centers for Disease Control and Prevention. (2017). Youth Risk Behavior Survey. Accessed via www.cdc.gov/YRBSS. Accessed on June 1, 2017.

Brief Fear of Negative Evaluation – Revised (BFNE-R)

On a scale of 0 (not characteristic of me) to 4 (very characteristic of me), please rate the extent to which you agree with the following statements.

1. I worry about what other people will think of me even when I know it doesn't make any difference.
2. It bothers me when people form an unfavourable impression of me.
3. I am frequently afraid of other people noticing my shortcomings.
4. I worry about what kind of impression I make on people.
5. I am afraid that others will not approve of me.
6. I am afraid others will find fault with me.
7. I am concerned about other people's opinions of me.
8. When I am talking to someone, I worry about what they may be thinking about me.
9. I am usually worried about what kind of impression I make.
10. If I know someone is judging me, it tends to bother me.
11. Sometimes I think I am too concerned with what other people think of me
12. I often worry that I will say or do the wrong things.

Carleton, R. N., McCreary, D. R., Norton, P. J., & Asmundson, G. J. G. (2006). Brief fear of negative evaluation scale—revised. *Depression and Anxiety, 23*(5), 297-303. doi:10.1002/da.20142

Short UPPS – Positivity Scale (SUPPS-P)

On a scale of 1 (strongly agree) to 4 (strongly disagree), please rate the extent to which you agree with the following statements.

1. I generally like to see things through to the end. (R)
2. My thinking is usually careful and purposeful.
3. When I am in great mood, I tend to get into situations that could cause me problems.
4. Unfinished tasks really bother me. (R)
5. I like to stop and think things over before I do them. (R)
6. When I feel bad, I will often do things I later regret in order to make myself feel better now.
7. Once I get going on something I hate to stop. (R)
8. Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.
9. I quite enjoy taking risks.
10. I tend to lose control when I am in a great mood.
11. I finish what I start.
12. I tend to value and follow a rational, "sensible" approach to things. (R)
13. When I am upset I often act without thinking.
14. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.
15. When I feel rejected, I will often say things that I later regret.
16. I would like to learn to fly an airplane.
17. Others are shocked or worried about the things I do when I am feeling very excited.
18. I would enjoy the sensation of skiing very fast down a high mountain slope.
19. I usually think carefully before doing anything. (R)
20. I tend to act without thinking when I am really excited.

(R) – Reverse scored

Subscales:
(Negative) Urgency: 6, 8, 13, 15
(Lack of) Perseverance: 1, 4, 7, 11
(Lack of) Premeditation: 2, 5, 12, 19
Sensation-Seeking: 9, 14, 16, 18
(Positive) Urgency: 3, 10, 17, 20

Cyders, M. A., Littlefield, A. K., Coffey, S., & Karyadi, K. A. (2014). Examination of a short english version of the UPPS-P impulsive behavior scale. *Addictive Behaviors, 39*(9), 1372-1376. doi:10.1016/j.addbeh.2014.02.013

Lynam, D.R. (2013). Development of a short form of the UPPS-P Impulsive Behavior Scale. Unpublished Technical Report.

Young Adult Rejection Sensitivity Questionnaire (RSQ-18)

A) Please rank on a scale of 0 (not all anxious) to 6 (extremely anxious) how concerned or anxious you would feel about asking a friend or significant other for each request below.

B) Please rank on a scale of 0 (not all likely) to 6 (extremely likely) your friend or significant other would be to honor your request.

1. You ask someone in class if you can borrow his/her notes.
2. You ask your significant other to move in with you.
3. You ask your parents for help in deciding what programs to apply to.
4. You ask someone you don't know well out on a date.
5. Your boyfriend/girlfriend has plans to go out with friends tonight, but you really want to spend the evening with him/her, and you tell him/her so.
6. You ask your parents for extra money to cover living expenses.
7. After class, you tell your professor that you have been having some trouble with a section of the course and ask if he/she can give you some extra help.
8. You approach a dose friend to talk after doing or saying something that seriously upset him/her.
9. You ask someone in one of your classes to coffee.
10. After graduation you can't find a job and you ask your parents if you can live at home for a while.
11. You ask a friend to go on vacation with you over Spring Break.
12. You call your boyfriend/girlfriend after a bitter argument and tell him/her you want to see him/her.
13. You ask a friend if you can borrow something of his/hers.
14. You ask your parents to come to an occasion important to you.
15. You ask a friend to do you a big favor.
16. You ask your boyfriend/girlfriend if he/she really loves you.
17. You go to a party and notice someone on the other side of the room, and then you ask them to dance.
18. You ask your boyfriend/girlfriend to come home to meet your parents.

Downey, G., & Feldman, S. I. (1996). Implications of rejection sensitivity for intimate relationships. *Journal of Personality and Social Psychology, 70*(6), 1327-1343. doi:10.1037/0022-3514.70.6.1327

Resistance to Peer Influence Scale

For each question, decide which sort of person you are most like — the one described on the right or the one described on the left. Then decide if that is "sort of true" or "really true" for you, and mark that choice. For each line mark only ONE of the four choices.

Really True for Me	Sort of True for Me				Sort of True for Me	Really True for Me
❑	❑	Some people go along with their friends just to keep their friends happy.	BUT	Other people refuse to go along with their friends want to do, even though they know it will make their friends unhappy.	❑	❑
❑	❑	Some people think it's more important to be an individual than to fit in with the crowd.	BUT	Other people think it is more important to fit in with the crowd than to stand out as an individual.	❑	❑
❑	❑	For some people, it's pretty easy for their friends to get them to change their mind.	BUT	For other people, it's pretty hard for their friends to get them to change their mind.	❑	❑
❑	❑	Some people would do something that they knew was wrong just to stay on their friends' good side.	BUT	Other people would not do something they knew was wrong just to stay on their friends' good side.	❑	❑
❑	❑	Some people hide their true opinion from their friends if they think their friends will make fun of them because of it.	BUT	Other people will say their true opinion in front of their friends, even if they know their friends will make fun of them because of it.	❑	❑
❑	❑	Some people will not break the law just because their friends say that they would.	BUT	Other people would break the law if their friends said that they would break it.	❑	❑
❑	❑	Some people change the way they act so much when they are with their friends that they wonder who they "really are".	BUT	Other people act the same way when they are alone as they do when they are with their friends.	❑	❑
❑	❑	Some people take more risks when they are with their friends than they do when they are alone.	BUT	Other people act just as risky when they are alone as when they are with their friends.	❑	❑
❑	❑	Some people say things they don't really believe because they think it will make their friends respect them more.	BUT	Other people would not say things they didn't really believe just to get their friends to respect them more.	❑	❑
❑	❑	Some people think it's better to be an individual even if people will be angry at you for going against the crowd.	BUT	Other people think it's better to go along with the crowd than to make people angry at you.	❑	❑

Scoring instructions: Score each item from 1 to 4 (reading left to right on the instrument). Reverse-score items 2, 6, and 10. Sum the scores for valid responses and divide by the number of valid items. It is recommended that at least 7 items have valid responses.

Steinberg, L., & Monahan, K. C. (2007). Age differences in resistance to peer influence. *Developmental Psychology, 43*(6), 1531-1543. doi:10.1037/0012-1649.43.6.1531

Appendix B – Research Ethics Board (REB) Approval

Ryerson University Research Ethics Board

To: Jessica Sutherland
Psychology

Re: REB 2017-239: Does social rejection increase susceptibility to peer influence?: An exploration of social rejection, physiological stress, and peer influence on risk-taking in adolescence and young adulthood

Date: July 27, 2017

Dear Jessica Sutherland,

The review of your protocol REB File REB 2017-239 is now complete. The project has been approved for a one year period. Please note that before proceeding with your project, compliance with other required University approvals/certifications, institutional requirements, or governmental authorizations may be required.

This approval may be extended after one year upon request. Please be advised that if the project is not renewed, approval will expire and no more research involving humans may take place. If this is a funded project, access to research funds may also be affected.

Please note that REB approval policies require that you adhere strictly to the protocol as last reviewed by the REB and that any modifications must be approved by the Board before they can be implemented. Adverse or unexpected events must be reported to the REB as soon as possible with an indication from the Principal Investigator as to how, in the view of the Principal Investigator, these events affect the continuation of the protocol.

Finally, if research subjects are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and approvals of those facilities or institutions are obtained and filed with the REB prior to the initiation of any research.

Please quote your REB file number (REB 2017-239) on future correspondence.

Congratulations and best of luck in conducting your research.

Dr. Patrizia Albanese, PhD
Chair, Ryerson University Research Ethics Board

Appendix C – Correlation Matrices

Correlations – Demographics, Measures, Physiological Stress, and Driving Outcomes (Intersections)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Age	-	.761**	-.057	.140	.018	.034	-.057	-.028	-.170*	-.249**	-.140	-.245**	-.036	-.010	-.114	-.010	.126	-.053	-.005	-.007	-.021	-.003
2. Years Driving	.761**	-	.056	.274**	.070	.034	.111	-.198*	-.251**	-.067	-.093	-.203*	-.214**	.004	-.030	.020	.203*	-.161*	-.119	-.097	-.001	-.024
3. Peer Status	-.057	.056	-	.189*	-.038	.219**	.384**	.031	-.055	.292**	.264**	.069	-.001	-.257**	.074	.058	.077	-.034	-.109	-.102	-.025	.003
4. Social Acceptance	.140	.274**	.189*	-	-.103	-.091	-.092	-.020	.107	-.092	.056	.036	.050	-.051	-.030	.217**	.020	-.011	-.043	-.046	.031	-.056
5. Peer Driving	.018	.070	-.038	-.103	-	.321**	.118	.075	-.152	.076	.044	.040	-.097	-.197*	.061	.033	.057	-.063	-.007	-.069	-.007	.027
6. BSSS Sum	.034	.034	.219**	-.091	.321**	-	.375**	.024	-.275**	.162*	-.341**	.070	.136	-.775**	-.390**	-.136	-.027	-.020	.015	-.063	-.009	.012
7. SINTB	-.057	.111	.384**	-.092	.118	.375**	-	.216**	.012	.141	-.284**	.425**	.190*	-.271**	-.250**	-.166*	-.063	.007	.008	-.052	-.006	.004
8. BFNE	-.028	-.198*	.031	-.020	.075	.024	.216**	-	.559**	.090	-.188*	.090	.319**	-.145	-.279**	-.146	.055	-.011	-.085	.076	-.013	-.004
9. RSQ1 Sum	-.170*	-.251**	-.055	.107	-.152	-.275**	.012	.559**	-	.049	-.034	.122	.260**	.114	-.096	-.159*	-.030	-.039	-.007	.067	-.009	-.014
10. RSQ2 Sum	-.249**	-.067	.292**	-.092	.076	.162*	.141	.090	.049	-	.183*	-.069	-.257**	-.078	-.019	-.075	.093	-.212**	-.185*	-.207**	-.006	-.026
11. SUPPSP (NU)	-.140	-.093	.264**	.056	.044	-.341**	-.284**	-.188*	-.034	.183*	-	-.057	-.275**	.329**	.659**	.194*	.178*	-.212**	-.191*	-.157*	.036	-.027
12. SUPPSP (LPer)	-.245**	-.203*	.069	.036	.040	.070	.425**	.090	.122	-.069	-.057	-	.471**	-.182*	-.053	-.018	-.222**	.107	.192*	.101	.088	-.025
13. SUPPSP (LPre)	-.036	-.214**	-.001	.050	-.097	.136	.190*	.319**	.260**	-.257**	-.275**	.471**	-	-.176*	-.210**	-.125	-.079	.164*	.087	.185*	.009	.008
14. SUPPSP (SS)	-.010	.004	-.257**	-.051	-.197*	-.775**	-.271**	-.145	.114	-.078	.329**	-.182*	-.176*	-	.430**	.166*	.060	.008	-.010	.041	.000	-.022
15. SUPPSP (PU)	-.114	-.030	.074	-.030	.061	-.390**	-.250**	-.279**	-.096	-.019	.659**	-.053	-.210**	.430**	-	.011	.079	-.072	-.110	-.072	.017	.009
16. BPM	-.010	.020	.058	.217**	.033	-.136	-.166*	-.146	-.159*	-.075	.194*	-.018	-.125	.166*	.011	-	.040	-.026	.060	-.126	.062	-.067
17. Acceleration (M)	.126	.203*	.077	.020	.057	-.027	-.063	.055	-.030	.093	.178*	-.222**	-.079	.060	.079	.040	-	-.632**	-.628**	-.411**	-.166*	.133
18. Acceleration (SD)	-.053	-.161*	-.034	-.011	-.063	-.020	.007	-.011	-.039	-.212**	-.212**	.107	.164*	.008	-.072	-.026	-.632**	-	.329**	.759**	.326**	-.316**
19. Speed (M)	-.005	-.119	-.109	-.043	-.007	.015	.008	-.085	-.007	-.185*	-.191*	.192*	.087	-.010	-.110	.060	-.628**	.329**	-	.244**	.152	-.101
20. Speed (SD)	-.007	-.097	-.102	-.046	-.069	-.063	-.052	.076	.067	-.207**	-.157*	.101	.185*	.041	-.072	-.126	-.411**	.759**	.244**	-	.268**	-.276**
21. Lane Pos. (M)	-.021	-.001	-.025	.031	-.007	-.009	-.006	-.013	-.009	-.006	.036	.088	.009	.000	.017	.062	-.166*	.326**	.152	.268**	-	-.955**
22. Lane Pos. (SD)	-.003	-.024	.003	-.056	.027	.012	.004	-.004	-.014	-.026	-.027	-.025	.008	-.022	.009	-.067	.133	-.316**	-.101	-.276**	-.955**	-

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Correlations – Demographics, Measures, Physiological Stress, and Driving Outcomes (Straight Drives)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Age	-	.753**	-.083	.116	.034	.013	-.059	-.029	-.172*	-.261**	-.148	-.251**	-.065	.006	-.101	.058	-.023	.013	.021	-.112	-.109	-.079
2. Years Driving	.753**	-	.040	.263**	.092	.030	.123	-.210**	-.261**	-.074	-.104	-.197*	-.209**	-.003	-.010	.067	-.088	.163*	.052	-.032	-.176*	-.164*
3. Peer Status	-.083	.040	-	.211**	-.061	.213**	.405**	.059	-.021	.298**	.244**	.127	.120	-.279**	.081	.083	-.029	.059	.054	-.048	.022	.015
4. Social Acceptance	.116	.263**	.211**	-	-.135	-.125	-.115	-.022	.102	-.034	.107	.035	.054	-.017	.012	.263**	-.023	.050	.047	.033	-.057	-.127
5. Peer Driving	.034	.092	-.061	-.135	-	.349**	.138	.005	-.210**	.041	-.001	.037	-.081	-.207**	.074	.000	-.021	.131	.131	-.024	.031	-.093
6. BSSS Sum	.013	.030	.213**	-.125	.349**	-	.396**	-.015	-.322**	.137	-.371**	.078	.143	-.781**	-.373**	-.098	-.039	.085	.194*	-.113	.009	-.023
7. SINTB	-.059	.123	.405**	-.115	.138	.396**	-	.180*	-.054	.130	-.281**	.406**	.204*	-.292**	-.243**	-.181*	-.023	.084	.051	.060	.025	-.006
8. BFNE	-.029	-.210**	.059	-.022	.005	-.015	.180*	-	.582**	.117	-.167*	.114	.344**	-.115	-.279**	-.114	-.048	-.036	-.014	-.024	.106	-.091
9. RSQ1 Sum	-.172*	-.261**	-.021	.102	-.210**	-.322**	-.054	.582**	-	.103	.008	.112	.251**	.159*	-.098	-.167*	-.024	-.032	-.031	-.021	.012	-.117
10. RSQ2 Sum	-.261**	-.074	.298**	-.034	.041	.137	.130	.117	.103	-	.186*	-.017	-.203*	-.082	-.045	-.035	-.055	-.085	-.189*	-.056	.034	-.052
11. SUPPSP (NU)	-.148	-.104	.244**	.107	-.001	-.371**	-.281**	-.167*	.008	.186*	-	-.005	-.222**	.328**	.663**	.189*	.032	-.060	-.206*	-.065	.181*	.159*
12. SUPPSP (LPer)	-.251**	-.197*	.127	.035	.037	.078	.406**	.114	.112	-.017	-.005	-	.485**	-.175*	-.026	.022	.013	.060	.058	.047	.248**	.053
13. SUPPSP (LPre)	-.065	-.209**	.120	.054	-.081	.143	.204*	.344**	.251**	-.203*	-.222**	.485**	-	-.190*	-.181*	-.055	.047	.085	.176*	.001	.170*	.002
14. SUPPSP (SS)	.006	-.003	-.279**	-.017	-.207**	-.781**	-.292**	-.115	.159*	-.082	.328**	-.175*	-.190*	-	.395**	.127	.082	-.169*	-.204*	.042	-.086	.021
15. SUPPSP (PU)	-.101	-.010	.081	.012	.074	-.373**	-.243**	-.279**	-.098	-.045	.663**	-.026	-.181*	.395**	-	.007	.066	.044	-.100	.078	.084	.201*
16. BPM	.058	.067	.083	.263**	.000	-.098	-.181*	-.114	-.167*	-.035	.189*	.022	-.055	.127	.007	-	-.035	.011	.015	-.005	.048	.063
17. Acceleration (M)	-.023	-.088	-.029	-.023	-.021	-.039	-.023	-.048	-.024	-.055	.032	.013	.047	.082	.066	-.035	-	-.138	-.358**	.340**	.092	.227**
18. Acceleration (SD)	.013	.163*	.059	.050	.131	.085	.084	-.036	-.032	-.085	-.060	.060	.085	-.169*	.044	.011	-.138	-	.282**	.541**	.083	-.086
19. Speed (M)	.021	.052	.054	.047	.131	.194*	.051	-.014	-.031	-.189*	-.206*	.058	.176*	-.204*	-.100	.015	-.358**	.282**	-	-.194*	-.223**	-.362**
20. Speed (SD)	-.112	-.032	-.048	.033	-.024	-.113	.060	-.024	-.021	-.056	-.065	.047	.001	.042	.078	-.005	.340**	.541**	-.194*	-	.211**	.208**
21. Lane Pos. (M)	-.109	-.176*	.022	-.057	.031	.009	.025	.106	.012	.034	.181*	.248**	.170*	-.086	.084	.048	.092	.083	-.223**	.211**	-	.259**
22. Lane Pos. (SD)	-.079	-.164*	.015	-.127	-.093	-.023	-.006	-.091	-.117	-.052	.159*	.053	.002	.021	.201*	.063	.227**	-.086	-.362**	.208**	.259**	-

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Appendix D - Linear Mixed Effects Tables

Table D-1

Linear mixed effects models for Controls versus Social Acceptance/Social Rejection on driver performance in intersections

			b	*SE*	*p*
Acceleration (Mean)					
	Model 1				
		Control vs Acc/Rej	0.0048	0.048	.9210
	Model 2				
		Control vs Acc/Rej	0.0059	0.047	.9017
		Age	-0.0609	0.034	.0846
		Years driving	0.0734	0.031	.0229*
		Gender	-0.0554	0.047	.2472
	Model 3				
		Control vs Acc/Rej	-0.2110	0.096	.0317*
		Age	-0.0930	0.037	.0155*
		Years driving	0.0867	0.033	.0109*
		Gender	-0.0738	0.048	.1294
		Condition x Age	0.0755	0.033	.0476*
		Condition x Years driving	-0.0209	0.033	.5293
		Condition x Gender	0.0581	0.048	.2308
Acceleration (SD)					
	Model 1				
		Control vs Acc/Rej	0.1173	0.049	.0200*
	Model 2				
		Control vs Acc/Rej	0.1254	0.051	.0171*
		Age	-0.0044	0.037	.9056
		Years driving	-0.0414	0.033	.2252

		Gender	-0.0494	0.051	.3358
	Model 3				
		Control vs Acc/Rej	0.0546	0.104	.6044
		Age	-0.0333	0.041	.4204
		Years driving	-0.0157	0.036	.6662
		Gender	-0.0650	0.052	.2223
		Condition x Age	0.0674	0.041	.1063
		Condition x Years driving	-0.0671	0.036	.0695
		Condition x Gender	0.0509	0.052	.3378
Speed (Mean)					
	Model 1				
		Control vs Acc/Rej	-0.0684	0.241	.7777
	Model 2				
		Control vs Acc/Rej	-0.0817	0.242	.7365
		Age	0.2609	0.173	.1383
		Years driving	-0.2942	0.158	.0672
		Gender	0.5806	0.238	.0176*
	Model 3				
		Control vs Acc/Rej	0.5008	0.500	.3211
		Age	0.3478	0.196	.0814
		Years driving	-0.3276	0.174	.0651
		Gender	0.6113	0.253	.0187*
		Condition x Age	-0.1951	0.196	.3243
		Condition x Years driving	0.0444	0.174	.8000
		Condition x Gender	-0.0929	0.253	.7150
Speed (SD)					
	Model 1				
		Control vs Acc/Rej	0.1477	0.085	.0882
	Model 2				

	Control vs Acc/Rej	0.1308	0.086	.1360
	Age	-0.0831	0.063	.1930
	Years driving	0.0120	0.057	.8330
	Gender	-0.0692	0.086	.4240
Model 3				
	Control vs Acc/Rej	-0.1267	0.178	.4792
	Age	-0.1532	0.069	.0302*
	Years driving	0.0651	0.060	.2877
	Gender	-0.0629	0.088	.4785
	Condition x Age	0.1563	0.069	.0271*
	Condition x Years driving	-0.1233	0.060	.0467*
	Condition x Gender	-0.0345	0.088	.6971
LP (Mean)				
Model 1				
	Control vs Acc/Rej	-0.0494	0.036	.1792
Model 2				
	Control vs Acc/Rej	-0.0473	0.036	.1950
	Age	0.0170	0.026	.5199
	Years driving	-0.0230	0.023	.3384
	Gender	0.0689	0.036	.0603
Model 3				
	Control vs Acc/Rej	0.0525	0.074	.4858
	Age	0.0381	0.029	.1956
	Years driving	-0.0365	0.025	.1610
	Gender	0.0802	0.037	.0364*
	Condition x Age	-0.0498	0.029	.0923
	Condition x Years driving	0.0310	0.025	.2326
	Condition x Gender	-0.0373	0.037	.3238
LP (SD)				
Model 1				

	Control vs Acc/Rej	0.1490	0.058	.0116*
Model 2				
	Control vs Acc/Rej	0.1399	0.052	.0085*
	Age	-0.0289	0.038	.4543
	Years driving	0.0194	0.034	.5776
	Gender	-0.0290	0.052	.5808
Model 3				
	Control vs Acc/Rej	0.0089	0.110	.9350
	Age	-0.0535	0.042	.2140
	Years driving	0.0335	0.037	.3760
	Gender	-0.0440	0.054	.4230
	Condition x Age	0.0576	0.042	.1810
	Condition x Years driving	-0.0299	0.037	.4290
	Condition x Gender	0.0501	0.054	.3610

Table D-2

Linear mixed effects models for Controls versus Social Acceptance/Social Rejection on driver performance during straight drive segments

		b	*SE*	*p*
Acceleration (Mean)				
Model 1				
	Control vs Acc/Rej	0.0172	0.013	.1930
Model 2				
	Control vs Acc/Rej	0.0182	0.013	.1701
	Age	0.0059	0.009	.5349
	Years driving	-0.0162	0.008	.0644
	Gender	0.0091	0.013	.4856
Model 3				
	Control vs			

		Acc/Rej	-0.0101	0.027	.7115
		Age	0.0016	0.010	.8751
		Years driving	-0.0144	0.009	.1263
		Gender	0.0127	0.013	.3571
		Condition x Age	0.0090	0.010	.3960
		Condition x Years driving	-0.0020	0.009	.8305
		Condition x Gender	-0.0126	0.013	.3607
Acceleration (SD)					
	Model 1				
		Control vs Acc/Rej	-0.0287	0.032	.3771
	Model 2				
		Control vs Acc/Rej	-0.0088	0.024	.7211
		Age	-0.0395	0.018	.0321*
		Years driving	0.0651	0.016	.0001*
		Gender	-0.0145	0.024	.5563
	Model 3				
		Control vs Acc/Rej	0.0422	0.051	.4191
		Age	-0.0325	0.020	.1115
		Years driving	0.0628	0.017	.0008*
		Gender	-0.0168	0.026	.5203
		Condition x Age	-0.0151	0.020	.4558
		Condition x Years driving	0.0014	0.017	.9341
		Condition x Gender	0.0089	0.026	.7333
Speed (Mean)					
	Model 1				
		Control vs Acc/Rej	-0.3686	0.258	.1580
	Model 2				
		Control vs Acc/Rej	-0.2544	0.264	.3397
		Age	-0.0714	0.192	.7117

		Years driving	0.0764	0.174	.6626
		Gender	-0.5124	0.263	.0558
	Model 3				
		Control vs Acc/Rej	-0.4261	0.562	.4516
		Age	-0.0936	0.218	.6703
		Years driving	0.0827	0.193	.6697
		Gender	-0.5033	0.281	.0786
		Condition x Age	0.0476	0.218	.8285
		Condition x Years driving	-0.0003	0.193	.9986
		Condition x Gender	-0.0386	0.281	.8913
Speed (SD)					
	Model 1				
		Control vs Acc/Rej	0.1878	0.139	.1812
	Model 2				
		Control vs Acc/Rej	0.2260	0.130	0.0870
		Age	-0.0870	0.094	0.3603
		Years driving	0.0543	0.085	0.5284
		Gender	0.2684	0.129	0.0422*
	Model 3				
		Control vs Acc/Rej	0.5344	0.270	.0528
		Age	-0.0549	0.105	.6029
		Years driving	0.0511	0.092	.5838
		Gender	0.2582	0.135	.0616
		Condition x Age	-0.0686	0.105	.5160
		Condition x Years driving	-0.0239	0.092	.7976
		Condition x Gender	0.0463	0.135	.7335
LP (Mean)					
	Model 1				
		Control vs Acc/Rej	0.0027	0.025	.9130

	Model 2			
	Control vs Acc/Rej	0.0015	0.024	.9503
	Age	0.0201	0.018	.2688
	Years driving	-0.0286	0.016	.0844
	Gender	0.0726	0.024	.0044*
	Model 3			
	Control vs Acc/Rej	0.0140	0.052	.7900
	Age	0.0217	0.020	.2929
	Years driving	-0.0291	0.018	.1132
	Gender	0.0743	0.026	.0064*
	Condition x Age	-0.0038	0.020	.8527
	Condition x Years driving	0.0004	0.018	.9823
	Condition x Gender	-0.0055	0.026	.8350
LP (SD)				
	Model 1			
	Control vs Acc/Rej	-0.0318	0.020	.1214
	Model 2			
	Control vs Acc/Rej	-0.0309	0.019	.1220
	Age	0.0077	0.014	.5925
	Years driving	-0.0243	0.013	.0655
	Gender	0.0294	0.019	.1383
	Model 3			
	Control vs Acc/Rej	-0.0622	0.041	.1385
	Age	0.0058	0.016	.7192
	Years driving	-0.0257	0.014	.0764
	Gender	0.0282	0.020	.1797
	Condition x Age	0.0042	0.016	.7950
	Condition x Years driving	0.0065	0.014	.6500
	Condition x Gender	0.0033	0.020	.8723

Table D-3

Linear mixed effects models for Social Acceptance vs Social Rejection on driver performance in intersections

			b	*SE*	*p*
Acceleration (Mean)					
	Model 1				
		Acc/Rej	0.0285	0.045	.5290
	Model 2				
		Acc/Rej	0.0090	0.041	.8285
		Risky/Risk-Averse	0.0898	0.044	.0444*
		Age	-0.0098	0.030	.7447
		Years driving	0.0479	0.028	.0998
		Gender	-0.0297	0.043	.4960
	Model 3				
		Acc/Rej	0.0312	0.085	.7152
		Risky/Risk-Averse	0.0924	0.045	.0418*
		Age	-0.0111	0.031	.7268
		Years driving	0.0435	0.032	.1876
		Gender	-0.0514	0.049	.3041
		Acc/Rej x Risky/Risk-Averse	-0.0039	0.045	.9304
		Acc/Rej x Age	0.0130	0.031	.6844
		Acc/Rej x Years driving	-0.0263	0.032	.4245
		Acc/Rej x Gender	-0.0120	0.049	.8103
Acceleration (SD)					
	Model 1				
		Acc/Rej	-0.0886	0.060	.1484
	Model 2				
		Acc/Rej	-0.0652	0.056	.2516

	Risky/Risk-Averse	-0.1683	0.059	.0076*
	Age	0.0202	0.040	.6220
	Years driving	-0.0509	0.039	.1994
	Gender	0.0126	0.058	.8317
Model 3				
	Acc/Rej	-0.0973	0.276	.7270
	Risky/Risk-Averse	-0.1718	0.062	.0096*
	Age	0.0141	0.044	.7518
	Years driving	-0.0455	0.045	.3267
	Gender	0.0019	0.139	.9880
	Acc/Rej x Risky/Risk-Averse	0.0497	0.062	.4334
	Acc/Rej x Age	0.0190	0.044	.6707
	Acc/Rej x Years driving	-0.0233	0.045	.6139
	Acc/Rej x Gender	0.0179	0.139	.8985
Speed (Mean)				
Model 1				
	Acc/Rej	-0.4230	0.296	.1608
Model 2				
	Acc/Rej	-0.3960	0.297	.1912
	Risky/Risk-Averse	-0.4610	0.317	.1545
	Age	0.1067	0.215	.6238
	Years driving	-0.1909	0.207	.3624
	Gender	1.1849	0.625	.0654
Model 3				
	Acc/Rej	0.7851	1.342	.5623
	Risky/Risk-Averse	-0.4662	0.304	.1352
	Age	0.1625	0.216	.4571
	Years driving	-0.3055	0.222	.1784
	Gender	1.2103	0.677	.0826
	Acc/Rej x Risky/Risk-Averse	0.4163	0.304	.1808
	Acc/Rej x			

	Age	0.2345	0.216	.2853
	Acc/Rej x Years driving	-0.1045	0.222	.6426
	Acc/Rej x Gender	-1.0984	0.677	.1138
Speed (SD)				
Model 1				
	Acc/Rej	-0.1828	0.105	.0911
Model 2				
	Acc/Rej	-0.1318	0.094	.1731
	Risky/Risk-Averse	-0.3310	0.101	.0023*
	Age	-0.0269	0.068	.6970
	Years driving	0.0068	0.066	.9186
	Gender	-0.0855	0.199	.6698
Model 3				
	Acc/Rej	-0.0281	0.468	.9525
	Risky/Risk-Averse	-0.3374	0.106	.0033*
	Age	-0.0203	0.075	.7898
	Years driving	0.0026	0.078	.9729
	Gender	-0.0301	0.237	.8996
	Acc/Rej x Risky/Risk-Averse	0.0770	0.106	.4749
	Acc/Rej x Age	-0.0284	0.075	.7358
	Acc/Rej x Years driving	0.0284	0.078	.7180
	Acc/Rej x Gender	-0.0523	0.237	.8269
LP (Mean)				
Model 1				
	Acc/Rej	-0.0119	0.036	.7415
Model 2				
	Acc/Rej	-0.0099	0.037	.7921
	Risky/Risk-Averse	-0.0413	0.039	.3057
	Age	-0.0150	0.027	.5816
	Years driving	0.0024	0.026	.9248
	Gender	0.0992	0.078	.2146

	Model 3			
	Acc/Rej	0.1240	0.182	.5005
	Risky/Risk-Averse	-0.0390	0.041	.3508
	Age	-0.0068	0.029	.8168
	Years driving	-0.0106	0.030	.7255
	Gender	0.1104	0.091	.2374
	Acc/Rej x Risky/Risk-Averse	0.0037	0.041	.9278
	Acc/Rej x Age	0.0037	0.029	.9100
	Acc/Rej x Years driving	0.0042	0.030	.8895
	Acc/Rej x Gender	-0.1001	0.091	.2832
LP (SD)				
	Model 1			
	Acc/Rej	-0.0074	0.046	.8740
	Model 2			
	Acc/Rej	-0.0241	0.038	.5310
	Risky/Risk-Averse	-0.0004	0.040	.9900
	Age	0.0011	0.027	.9670
	Years driving	0.0057	0.026	.8310
	Gender	0.0179	0.079	.8240
	Model 3			
	Acc/Rej	-0.1564	0.185	.4050
	Risky/Risk-Averse	0.0002	0.042	.9960
	Age	-0.0016	0.030	.9570
	Years driving	0.0124	0.030	.6900
	Gender	0.0314	0.093	.7390
	Acc/Rej x Risky/Risk-Averse	-0.0433	0.042	.3140
	Acc/Rej x Age	0.0078	0.030	.7960
	Acc/Rej x Years driving	0.0083	0.030	.7890
	Acc/Rej x Gender	0.0518	0.093	.5840

Table D-4

Linear mixed effects models for Social Acceptance vs Social Rejection on driver performance during straight drive segments

			b	*SE*	*p*
Acceleration (Mean)					
	Model 1				
		Acc/Rej	-0.0164	0.013	.2360
	Model 2				
		Acc/Rej	-0.0124	0.014	.3860
		Risky/Risk-Averse	-0.0052	0.015	.7300
		Age	0.0097	0.010	.3420
		Years driving	-0.0158	0.009	.1110
		Gender	0.0023	0.015	.8780
	Model 3				
		Acc/Rej	-0.0179	0.029	.5410
		Risky/Risk-Averse	-0.0073	0.015	.6310
		Age	0.0066	0.010	.5430
		Years driving	-0.0091	0.011	.4200
		Gender	0.0062	0.017	.7170
		Acc/Rej x Risky/Risk-Averse	0.0098	0.015	.5230
		Acc/Rej x Age	-0.0013	0.010	.9030
		Acc/Rej x Years driving	0.0034	0.011	.7620
		Acc/Rej x Gender	0.0206	0.017	.2360
Acceleration (SD)					
	Model 1				
		Acc/Rej	0.0524	0.030	.0878
	Model 2				
		Acc/Rej	-0.0503	0.028	.0825

	Risky/Risk-Averse	-0.0349	0.030	.2525
	Age	-0.0482	0.020	.0236*
	Years driving	0.0695	0.019	.0010*
	Gender	-0.0027	0.029	.9259
Model 3				
	Acc/Rej	0.0366	0.059	.5435
	Risky/Risk-Averse	-0.0328	0.031	.3027
	Age	-0.0503	0.022	.0303*
	Years driving	0.0704	0.023	.0042*
	Gender	-0.0121	0.035	.7305
	Acc/Rej x Risky/Risk-Averse	-0.0295	0.031	.3525
	Acc/Rej x Age	0.0105	0.022	.6399
	Acc/Rej x Years driving	-0.0102	0.023	.6592
	Acc/Rej x Gender	0.0071	0.035	.8390
Speed (Mean)				
Model 1				
	Acc/Rej	0.3445	0.307	.2680
Model 2				
	Acc/Rej	0.4275	0.311	.1805
	Risky/Risk-Averse	-0.5675	0.332	.0956
	Age	-0.0713	0.226	.7539
	Years driving	0.1797	0.217	.4127
	Gender	-0.4552	0.327	.1723
Model 3				
	Acc/Rej	-0.0424	0.653	.9490
	Risky/Risk-Averse	-0.5736	0.343	.1040
	Age	-0.1376	0.243	.5760
	Years driving	0.2326	0.251	.3610
	Gender	-0.6103	0.382	.1190
	Acc/Rej x Risky/Risk-Averse	-0.0543	0.343	.8750
	Acc/Rej x			

	Age	0.3218	0.243	.1950
	Acc/Rej x Years driving	-0.2674	0.251	.2940
	Acc/Rej x Gender	0.1484	0.382	.7000
Speed (SD)				
Model 1				
	Acc/Rej	-0.1616	0.157	.3096
Model 2				
	Acc/Rej	-0.1615	0.155	.3049
	Risky/Risk-Averse	-0.1743	0.166	.3009
	Age	-0.1422	0.112	.2133
	Years driving	0.0661	0.108	.5455
	Gender	0.3307	0.163	.0496*
Model 3				
	Acc/Rej	-0.3579	0.325	.2788
	Risky/Risk-Averse	-0.1589	0.171	.3596
	Age	-0.1163	0.121	.3439
	Years driving	0.0217	0.125	.8634
	Gender	0.3449	0.190	.0790
	Acc/Rej x Risky/Risk-Averse	-0.1268	0.171	.4640
	Acc/Rej x Age	0.0521	0.121	.6694
	Acc/Rej x Years driving	0.0082	0.125	.9481
	Acc/Rej x Gender	-0.1475	0.190	.4444
LP (Mean)				
Model 1				
	Acc/Rej	-0.0156	0.024	.5290
Model 2				
	Acc/Rej	-0.0165	0.023	.4860
	Risky/Risk-Averse	-0.0106	0.025	.6742
	Age	0.0166	0.017	.3355
	Years driving	-0.0263	0.016	.1147
	Gender	0.0704	0.024	.0069*

	Model 3			
	Acc/Rej	-0.0228	0.046	.6293
	Risky/Risk-Averse	-0.0085	0.024	.7304
	Age	0.0275	0.017	.1244
	Years driving	-0.0387	0.017	.0382*
	Gender	0.0904	0.027	.0022*
	Acc/Rej x Risky/Risk-Averse	-0.0080	0.024	.7458
	Acc/Rej x Age	-0.0164	0.017	.3519
	Acc/Rej x Years driving	0.0269	0.017	.1431
	Acc/Rej x Gender	-0.0440	0.027	.1174
LP (SD)				
	Model 1			
	Acc/Rej	-0.0106	0.016	.5234
	Model 2			
	Acc/Rej	-0.0040	0.014	.7859
	Risky/Risk-Averse	-0.0052	0.015	.7420
	Age	0.0093	0.010	.3876
	Years driving	-0.0180	0.010	.0887
	Gender	0.0324	0.015	.0436*
	Model 3			
	Acc/Rej	-0.0269	0.030	.3897
	Risky/Risk-Averse	-0.0071	0.016	.6644
	Age	0.0094	0.011	.4184
	Years driving	-0.0163	0.011	.1766
	Gender	0.0400	0.018	.0333*
	Acc/Rej x Risky/Risk-Averse	0.0121	0.016	.4597
	Acc/Rej x Age	0.0027	0.011	.8152
	Acc/Rej x Years driving	0.0056	0.011	.6386
	Acc/Rej x Gender	0.0004	0.018	.9817

Table D-5

Linear mixed effects models of physiological stress on driver performance in intersections

			b	*SE*	*p*
Acceleration (Mean)					
	Model 1				
		BPM	-0.0045	0.003	.1620
	Model 2				
		BPM	0.0007	0.003	.8140
		BFNE	0.0031	0.004	.4780
		RSQ Scale 2	0.0040	0.003	.2520
		Social acceptance	0.0122	0.012	.3380
	Model 3				
		BPM	-0.0378	0.021	.0791
		BFNE	0.0162	0.034	.6441
		RSQ Scale 2	-0.0363	0.024	.1488
		Social acceptance	-0.0643	0.086	.4608
		BPM x BFNE	-0.0001	0.000	.7340
		BPM x RSQ Scale 2	0.0004	0.000	.1037
		BPM x Social acceptance	0.0008	0.000	.3718
Acceleration (SD)					
	Model 1				
		BPM	-0.0020	0.003	.5570
	Model 2				
		BPM	-0.0041	0.004	.3183
		BFNE	0.0003	0.005	.9519
		RSQ Scale 2	-0.0112	0.004	.0209*
		Social acceptance	-0.0031	0.016	.8511
	Model 3				
		BPM	0.0394	0.026	.1476

	BFNE	-0.0089	0.044	.8406
	RSQ Scale 2	0.0499	0.031	.1198
	Social acceptance	-0.0482	0.108	.6575
	BPM x BFNE	0.0000	0.000	.8621
	BPM x RSQ Scale 2	-0.0006	0.000	.0544*
	BPM x Social acceptance	0.0004	0.001	.6779
Speed (Mean)				
Model 1				
	BPM	0.0270	0.014	.0715
Model 2				
	BPM	0.0248	0.019	.2100
	BFNE	-0.0074	0.025	.7700
	RSQ Scale 2	-0.0212	0.019	.2940
	Social acceptance	0.0047	0.073	.9480
Model 3				
	BPM	-0.1638	0.117	.1685
	BFNE	0.0275	0.192	.8868
	RSQ Scale 2	-0.1027	0.137	.4586
	Social acceptance	-1.1124	0.557	.0504*
	BPM x BFNE	-0.0003	0.002	.8685
	BPM x RSQ Scale 2	0.0009	0.001	.5419
	BPM x Social acceptance	0.0122	0.006	.0479*
Speed (SD)				
Model 1				
	BPM	-0.0155	0.005	.0073*
Model 2				
	BPM	-0.0134	0.006	.0513*
	BFNE	0.0059	0.008	.5099
	RSQ Scale 2	-0.0175	0.007	.0169*
	Social acceptance	0.0040	0.025	.8732
Model 3				
	BPM	-0.0284	0.045	.5332

	BFNE	0.0637	0.072	.3854
	RSQ Scale 2	-0.0188	0.051	.7184
	Social acceptance	-0.2609	0.183	.1595
	BPM x BFNE	-0.0006	0.000	.4298
	BPM x RSQ Scale 2	0.0000	0.000	.9820
	BPM x Social acceptance	0.0028	0.001	.1488
LP (Mean)				
Model 1				
	BPM	0.0059	0.002	.0313*
Model 2				
	BPM	0.0030	0.002	.2710
	BFNE	-0.0015	0.003	.6750
	RSQ Scale 2	-0.0005	0.002	.8620
	Social acceptance	0.0014	0.010	.8950
Model 3				
	BPM	-0.0326	0.017	.0618
	BFNE	-0.0412	0.028	.1511
	RSQ Scale 2	-0.0238	0.020	.2411
	Social acceptance	-0.0527	0.071	.4601
	BPM x BFNE	0.0004	0.000	.1532
	BPM x RSQ Scale 2	0.0002	0.000	.2309
	BPM x Social acceptance	0.0005	0.000	.4460
LP (SD)				
Model 1				
	BPM	-0.0060	0.004	.1520
Model 2				
	BPM	0.0010	0.001	.5660
	BFNE	0.0006	0.002	.7780
	RSQ Scale 2	0.0011	0.001	.5440
	Social acceptance	-0.0003	0.006	.9640
Model 3				
	BPM	-0.0079	0.0122	.5190
	BFNE	-0.0008	0.019	.9660

	RSQ Scale 2	-0.0080	0.013	.5640
	Social acceptance	-0.0084	0.049	.8660
	BPM x BFNE	0.0000	0.000	.9250
	BPM x RSQ Scale 2	0.0001	0.000	.5000
	BPM x Social acceptance	0.0000	0.000	.8670

Table D-6

Linear mixed effects models of physiological stress on driver performance in straight drive segments

		b	*SE*	*p*
Acceleration (Mean)				
Model 1				
	BPM	0.0005	0.000	.5360
Model 2				
	BPM	-0.0003	0.001	.7112
	BFNE	-0.0010	0.001	.4592
	RSQ Scale 2	-0.0014	0.001	.2002
	Social acceptance	-0.0011	0.004	.7855
Model 3				
	BPM	-0.0028	0.006	.6620
	BFNE	0.0077	0.011	.4840
	RSQ Scale 2	-0.0055	0.007	.4810
	Social acceptance	-0.0136	0.031	.6670
	BPM x BFNE	-0.0000	0.000	.4260
	BPM x RSQ Scale 2	0.0000	0.000	.6040
	BPM x Social acceptance	0.0001	0.000	.6900
Acceleration (SD)				
Model 1				
	BPM	0.0002	0.001	.8768
Model 2				

		BPM	-0.0010	0.002	.6250
		BFNE	-0.0017	0.003	.5746
		RSQ Scale 2	-0.0016	0.002	.5007
		Social acceptance	0.0047	0.008	.5844
	Model 3				
		BPM	-0.0020	0.013	.8780
		BFNE	-0.0319	0.021	.1480
		RSQ Scale 2	0.0036	0.015	.8180
		Social acceptance	0.0291	0.062	.6450
		BPM x BFNE	0.0003	0.000	.1660
		BPM x RSQ Scale 2	-0.0000	0.000	.7500
		BPM x Social acceptance	-0.0002	0.000	.6950
Speed (Mean)					
	Model 1				
		BPM	-0.0109	0.015	.4910
	Model 2				
		BPM	-0.0129	0.021	.5426
		BFNE	0.0034	0.031	.9129
		RSQ Scale 2	-0.0474	0.025	.0662
		Social acceptance	0.0512	0.090	.5741
	Model 3				
		BPM	-0.0917	0.129	.4818
		BFNE	-0.4347	0.207	.0386*
		RSQ Scale 2	-0.0631	0.150	.6750
		Social acceptance	0.5142	0.600	.3946
		BPM x BFNE	0.0048	0.002	.0339*
		BPM x RSQ Scale 2	0.0002	0.001	.8926
		BPM x Social acceptance	-0.0050	0.006	.4348
Speed (SD)					
	Model 1				
		BPM	0.0089	0.009	.3481
	Model 2				

	BPM	0.0005	0.011	.9643
	BFNE	-0.0117	0.017	.5018
	RSQ Scale 2	-0.0111	0.013	.4181
	Social acceptance	0.0040	0.049	.9358
Model 3				
	BPM	0.0419	0.073	.5680
	BFNE	0.0579	0.118	.6260
	RSQ Scale 2	0.0331	0.085	.6990
	Social acceptance	-0.1191	0.343	.7300
	BPM x BFNE	-0.0007	0.001	.5450
	BPM x RSQ Scale 2	-0.0004	0.000	.5940
	BPM x Social acceptance	0.0013	0.003	.7180
LP (Mean)				
Model 1				
	BPM	0.0002	0.001	.1490
Model 2				
	BPM	-0.0018	0.001	.2770
	BFNE	0.0017	0.002	.5250
	RSQ Scale 2	0.0003	0.002	.8690
	Social acceptance	-0.0017	0.007	
Model 3				
	BPM	-0.0157	0.010	.1303
	BFNE	0.0159	0.016	.3326
	RSQ Scale 2	-0.0182	0.011	.1262
	Social acceptance	-0.0246	0.046	.6012
	BPM x BFNE	-0.0001	0.000	.3988
	BPM x RSQ Scale 2	0.0001	0.000	.1136
	BPM x Social acceptance	0.0002	0.000	.6233
LP (SD)				
Model 1				
	BPM	0.0009	0.001	.3671
Model 2				
	BPM	0.0015	0.001	.1261

	BFNE	-0.0014	0.001	.3245
	RSQ Scale 2	-0.0006	0.001	.5727
	Social acceptance	-0.0071	0.004	.1020
Model 3				
	BPM	0.0045	0.006	.9640
	BFNE	0.0014	0.010	.4680
	RSQ Scale 2	-0.0012	0.007	.8840
	Social acceptance	0.0155	0.029	.5990
	BPM x BFNE	-0.0000	0.000	.7680
	BPM x RSQ Scale 2	0.0000	0.000	.950
	BPM x Social acceptance	-0.0002	0.000	.4390

Appendix E – Experimental Scripts

Script: Does social rejection increase susceptibility to peer influence?
Control condition

Approx. Duration: Questionnaires – 30 minutes (done at home/prior to attending lab)
Experimental – 35 minutes

Tools needed:

1. Participant's study ID number/SONA ID to ensure questionnaire matches experimental data
2. BioPAC gels/sensors, 2 wireless trackers, BioPAC machine
3. Laptop, connected to BioPAC script
4. Consent forms
5. Brief demographics questionnaire
6. Road sign responses answer form
7. Basic road rules driving test forms
8. Wipes and Kleenex
9. Pens
10. Folder
11. Copy of script

Prior to participant arrival:

1. Ensure all questionnaires/forms are present
2. Ensure all technical needs are present/working (BioPAC materials, driving simulator)
3. Ensure participant has completed pre-study questionnaires

When participant arrives:

1. Check government-issued ID to verify birthdate

<u>WHEN STUDY BEGINS</u>

Thank you for coming in today and agreeing to participant in our study. Today you'll be part of a study looking at how people make driving decisions when they're either driving with a passenger or they're driving alone, and whether stress might influence driver decision-making. Let's go through the consent form first and I'll explain what you'll be doing today.

Since it's just you today, you'll be alone in the car. We'll need to set up our stress measurement device on you including these finger sensors, which will measure sweat levels on your skin and your pulse. We will also need to put these three small sensors on your collarbone and torso. It doesn't hurt and is not invasive at all, but you do need to try and keep it as stable as possible, so we'll attach it to whichever hand is your non-dominant hand. We'll put it on you once we're finished this consent process and we'll remove it right before you start driving. We just need to collect baseline physiological information, so you'll have full range of movement once you're actually driving.

Before we get to the driving part, you'll complete a brief questionnaire about demographics and your driving history and experience, do two tasks assessing road sign knowledge, and do a quick test of your road rules knowledge.

Then it's time to drive the car! You'll complete a simulated drive. It takes about 15 minutes, and it will look just like being on a real road – there are road signs, other cars, and pedestrians. So you'll have to drive as if you were in the 'real world.' There is also an eye-tracking device on the dashboard of the car. It's completely non-invasive and measures where you, the driver, are looking while you're driving. I'll explain a bit more at the end about why we're using this device.

Once you're finished the simulated drive, we'll do a quick debrief and then you are done. Overall, the study will take about 40 minutes. Any questions so far?

As you can see, the tasks aren't too risky and we don't anticipate you experiencing anything that you wouldn't normally in your every day life. However, sometimes people can feel a bit motion sick or nauseous in a driving simulator. If that occurs, just let us know and we can take a break or end the study completely. As a research participant, you can stop the study at any point, not answer any questions you don't want to, and not do any tasks you don't feel comfortable with. You can remove your consent at any time and you'll still receive full credit/payment for the study. If you have any questions at any point, please ask for help.

Your data are also completely confidential and stored in our locked lab on a password-protected computer drive. Your name only appears on your consent form and contact information, and we use unique study identifiers for each participant so we do not have any way of figuring out who's who when we're looking at the data.

Any questions so far? When you're ready, you can review this consent form and sign on the consent line if you are comfortable remaining in the study.

[When participant is done signing their consent forms, rip off the study details to give to them – only keep the signed last page]

Great – let's get started. I'll just need to get you hooked up to our BioPAC stress measurement device.

1. **Put on BioPAC device + demographic questionnaire**

These sensors will stay on your torso and fingers until you get in the car. It needs to be still, so do your best to keep stable and don't move it around too much.

[Put on gel and finger sensors; assist with torso sensors and/or provide diagram for participant to place them on themselves; ensure participant is comfortable]

You can still use your other hand to record answers. I'll just get you to fill out this questionnaire quickly about your driving history and experiences.

[Hand out driving + demographic questionnaire, as well as pens]

2. **First task: naming road signs (5 minutes)**

Alright – looks like everything is working and you can get started on your first task.

You'll look through this list of 20 road signs and identify what they mean. If you aren't sure, you can take a guess; if you're really not sure, you can leave it blank. Just write your answer in the space provided next to each sign.

3. **Second task: completing driving/road rules quiz (5 minutes)**

All done? Great – I'll take your response sheet.

Your next task is to complete a driving and road rules quiz. These are the rules according to the Ontario Highway Traffic Act. Like before, do your best to answer each question and if you aren't sure, take a guess or leave it blank.

When you're ready, you can get started and let me know when you're done.

4. **Remove BioPAC devices**

Great, I'll take your response sheet from you.

We can also remove the finger device now too, so let's get that off of you before you get in the car.

[Remove BioPAC device; offer wipes/Kleenex to participant]

5. **Participant gets into driver's seat (15 minutes)**

Ready to drive now, *[Participant]?* You can swap seats when you are ready and get comfortable in the driver's seat. You'll run through several road scenes, a few minutes each, and you can take a quick break in between them. If you need a longer one, just let us know.

[Participant runs through driving scenes, taking periodic breaks]

6. **Debrief**

Thank you for coming in today. As promised, you'll receive *[$20 OR 1.5 credits*] for your participation. Before you leave, I'll let you know a bit more about the study.

So how was the study for you? Any immediate thoughts?

So, at the beginning of the study we told you that we were interested in how passengers in the car can affect driver stress and decision-making. But actually, we had different goals for the study.

This research study is actually looking what situational and interpersonal factors influence risky driving when a peer is present in the car compared to when people drive alone. Here's how we did this.

The two tasks you did earlier were distractor tasks. We don't actually need these data for anything, it was purely to buy time to establish baseline levels of stress. However, when participants complete this study with a partner, they work on the first task together and then, their partner, who is actually a research assistant working with me, is instructed to either appear happy to work together on the next task or to request to work alone. That is, the partner accepts or rejects them.

We manipulated whether participants feel accepted or rejected, because we think that this might influence how they drive with a passenger who has accepted or rejected them. Do they take more risks when they want to try and re-gain acceptance after rejection? Or, do people take fewer risks when they feel socially accepted? In order to compare the effects of a peer on driving behaviour, we have to compare it to people who drive alone. This is the part of the study that you were a part of today.

Next, I give the partner a chance to drive the simulator before letting the participant take over. I have the partner drive the car in order to demonstrate a particular driving style. In addition to manipulating whether they are accepted or rejected, I also manipulated what type of driver the partner is. I instruct them to drive in either a risk-accepting or a risk-averse manner. So they might drive especially fast, or maybe they are very cautious while on the road. This is on purpose, and I manipulated driving style to see if driving style changes depending on whether someone was previously accepted or rejected by their partner. For example, when people are rejected and desire to get back into someone's good graces, do they also drive in a risk-averse way if they have just witnessed it?

Does all of this make sense so far? Again, since you drove alone, you are acting as a control group to compare the partner effects to, but I want to explain everything so you know what the study is all about.

Finally, we had you wear physiological data collection tools because I want to know if stress has an effect on a peer's ability to influence behaviour. Prior research has demonstrated that peers seem to induce a stress response when people think they are being evaluated or observed. We think that being rejected, in particular, will be stressful for participants. We also know that stress can compromise decision-making, so you may drive in ways that are inconsistent with how you'd drive when you are alone if you are feeling more stress. So, we anticipate that driving alone may not be especially stressful, but we have to compare both groups to determine this effect.

We are doing this study because we are interested in determining what makes some individuals more susceptible to the influence of their peers. For example, why do some people use drugs or alcohol, commit crime, or drive dangerously with their friends around, but not when they are alone? This study is the first to incorporate multiple known peer-related influences on risk behaviour, such as peer status and stress.

However, sometimes being deceived like this can be upsetting or stressful, so we have provided the contact information for the campus counseling centre which is free and accessible for all Ryerson students. You can take this full debriefing form, which will tell you about the study and our research questions, and has our contact information as well in case you'd like more details later.

Now that you know our true goals, how are you doing? Do you have any more questions at this point?

If you are okay with remaining in the study, then we will need you to re-sign a consent form now that you know the true nature of our study. If you'd like to remain in the study, please take your time to review and sign this consent form. It is very similar to the one you signed earlier, it just states the true nature of our study.

[pause; ensure participant feels okay and is comfortable before they leave]

[rip off the debrief information and give to participant; only keep the signed portion of the debrief form]

One final request from us is that you refrain from discussing the study you participated in today, especially the true nature of our research questions. If other people find out about what we're really looking at, this will affect our data collection and ultimately, our results. So please do not share the details of our study with other people in your classes who might participate this semester.

Thank you again for coming in! Good luck with your semester.

Script: Does social rejection increase susceptibility to peer influence?
Confederate condition

Approx. Duration: Questionnaires – 30 minutes (done at home/prior to attending lab)
Experimental – 45 minutes

Tools needed:

1. Participant's study ID number/SONA ID to ensure questionnaire matches experimental data
2. BioPAC gels/sensors, 2 wireless trackers, BioPAC machine
3. Laptop, connected to BioPAC script
4. Consent forms

5. Brief demographics questionnaire
6. Road sign responses answer form (for partner task)
7. Basic road rules driving test forms (for post-acceptance/rejection task)
8. Manipulation check questionnaires (confederate driving style, perception of acceptance/rejection from confederate)
9. Peer status questionnaire
10. Wipes and Kleenex
11. Pens
12. Folder
13. Copy of script

Prior to participant arrival:

1. Ensure all questionnaires/forms are present
2. Ensure all technical needs are present/working (BioPAC materials, driving simulator)
3. Ensure participant has completed pre-study questionnaires

When participant arrives:

1. Check government-issued ID to verify birthdate

WHEN STUDY BEGINS

Thank you both for coming in today and agreeing to participate in our study. Today you'll be part of a study looking at how people make driving decisions when they're driving with a passenger or alone, and whether stress might influence driver decision-making. Let's go through the consent form first and I'll explain what you'll be doing today.

Since there are two of you today, you'll be working together in the passenger condition. Obviously two people cannot drive at the same time, so you'll complete two tasks together, and then one of you will drive the car while the other is a passenger. We always just randomly decide before participants arrive who will be the driver, so today it looks like *[insert participant's name/point to participant*] will be the driver, and *[insert confederate's name/point to confederate]* will be the passenger.

Does that work for both of you? Don't worry *[to confederate]*, we'll give you a couple of minutes to try the simulator too!

What this means, then, is that we'll need to set up our stress management device on you *[to participant]* As the driver, we'll hook you up to this finger device, which will measure sweat levels on your skin and your pulse. We will also need to put these three small sensors on your collarbone and torso. It doesn't hurt and is not invasive at all, but you do need to try and keep it as stable as possible, so we'll attach it to whichever hand is your non-dominant one. We'll put it on you once we're finished this consent process and we'll remove it right before you start driving. We just need to collect baseline physiological information, so you'll have full range of movement once you're actually driving.

Before we get to the driving part, you'll work together on two tasks and complete a couple of really quick questionnaires by yourself. First, you'll go through a bunch of road signs and work together to identify what they mean. We'll give you an answer sheet to record your responses on. You can take your time with it and discuss your responses. Once you're finished, we'll need you to complete a quiz about driving laws and road rules in Ontario. Again, you can work on this together, and take your time. Once you're finished these partner tasks, you'll complete a brief questionnaire about working with your partner, and this one you'll do entirely alone.

Then, it's time to drive the car! *[To confederate]* We'll give you a couple of minutes to try out the simulator since people always think it's cool and want to try it, and it will also give you both a chance to get used to the feeling of a driving simulator. Then you'll switch seats with *[participant]* and *[participant]*, you'll complete a simulated drive. It takes about 15 minutes, and it will look just like being on a real road – there are road signs, other cars, and pedestrians. So you'll have to drive as if you were in the 'real world.' There is also an eye-tracking device on the dashboard of the car. It's completely non-invasive and measures where you, the driver, are looking while you're driving. I'll explain a bit more at the end of the study about why we're using this device.

Once you're finished the simulated drive, we'll ask you both to complete one last final quick questionnaire about how you drove in the simulator, and then you're done! Overall, the study will take about 45 minutes. Any questions so far?

As you can see, the tasks aren't too risky and we don't anticipate you experiencing anything that you wouldn't normally in your every day life. However, sometimes people can feel a bit motion sick or nauseous in a driving simulator. If that occurs, just let us know and we can take a break or end the study completely. As a research participant, you can stop the study at any point, not answer any questions you don't want to, and not do any tasks you don't feel comfortable with. You can remove your consent at any time and you'll still receive full credit/payment for the study. If you have any questions at any point, please ask for help.

Your data are also completely confidential and stored in our locked lab on a password-protected computer drive. Your name only appears on your consent form and contact information, and we use unique study identifiers for each participant so we do not have any way of figuring out who's who when we're looking at the data.

[In partner condition] We won't ask you to reveal any personal information about yourself beyond your first name, so we can correctly identify you, and we do ask you to keep any information you happen to learn about your partner today confidential as well.

Any questions so far? When you're ready, you can review these consent forms and sign on the consent line if you are comfortable remaining in the study.

[When participants are done signing their consent forms, rip off the study details to give to them – only keep the signed last page]

Great – let's get started. *[Participant]*, I'll just need to get you hooked up to our BioPAC stress measurement device.

1. **Put on BioPAC device + demographic questionnaire**

These sensors will stay on your torso and fingers until you get in the car. It needs to be still, so do your best to keep stable and don't move it around too much.

[Put on gel and finger sensor; ensure participant is comfortable]

You can still use your other hand to record answers, it doesn't matter which one of you does the writing down – you can decide between each other.

[Confederate/participant debate who will write down the answers while experimenter checks that BioPAC is working and recording]

I'll just get you both to fill out this questionnaire quickly about your driving history and experiences.

[Hand out driving + demographic questionnaire, as well as pens]

2. **First task: naming road signs (5-10 minutes)**

Alright – looks like everything is working and you can get started on your first task.

You'll look through this list of 20 road signs and identify what they mean. If you aren't sure, you can take a guess; if you're really not sure, you can leave it blank. Just write your answer in the space provided next to each sign.

You can work together and discuss what you think they mean. When you've decided on an answer, write it down. If you want to work out of order, that's fine too.

> *[Confederate alternates being sure of a sign's meaning and being unsure; alternates between agreeing with participant's answer and disagreeing politely]*
>
> > Acceptance condition: *[Confederate alternates being sure of a sign's meaning and being unsure; generally agrees with participant's answers and disagreeing politely on some]*
> >
> > Rejection condition: *[Confederate alternates being sure of a sign's meaning and being unsure; disagrees with participant's answers and expresses doubt that they are correct]*

All done? Great – I'll take your response sheet.

3. **Second task: completing driving/road rules quiz (5-10 minutes)**

Your next task is to complete a driving and road rules quiz. These are the rules according to the Ontario Highway Traffic Act. Like before, do your best to answer each question and if you aren't sure, take a guess or leave it blank.

When you've decided on an answer, write it down. If you want to work out of order, that's fine too. And just like the last time, you can work together.

> Acceptance condition: *[Confederate smiles and nods at participant]*
>
> Rejection condition: *[Confederate interrupts and states, "Um, actually, I'd rather work alone on this one instead, can I do that?]*
>
> *[Experimenter stumbles, gives a funny look, and says, "Oh - okay, sure – here is another copy for you"]*

When you're ready, you can get started and let me know when you're done.

4. **Manipulation check: working with their partner**

Great. Before we move on to the car, I just have two quick questionnaires for both of you to fill out, and it will be confidential, so please answer as honestly as you can.

[Participant and confederate receive manipulation check (perception of acceptance/rejection) and peer status forms]

5. **Confederate tries driving for 2 minutes**

We know most people are excited to try the simulator, so *[Confederate]*, did you want to get in the driver's seat for a few minutes and see how it works?

[Confederate gets into the car and adopts Risk-Accepting or Risk-Averse driving style]

> Risk-Accepting: *[Confederate does not do up seatbelt, remarks on how much it feels like a real car, immediately speeds up as soon as simulator turns on and expresses excitement, brakes quickly at red light]*
>
> Risk-Averse: *[Confederate does up seatbelt, remarks on how much it feels like a real car, slowly speeds up as soon as simulator turns on and expresses caution over navigating a new place, brakes early at red light]*

6. **Participant gets into driver's seat (15 minutes)**

Ready to drive now, *[Participant]?* You can swap seats when you are ready and get comfortable in the driver's seat. You'll run through several road scenes, a few minutes each, and you can take a quick break in between them. If you need a longer one, just let us know.

We can also remove the finger device now too, so let's get that off of you before you get in the car.

[Remove BioPAC device; offer wipes/Kleenex for their fingers]

[Participant runs through driving scenes, taking periodic breaks]

7. **Manipulation check: partner's driving style**

Great job. How are you feeling after being in the simulator?

Before we let you go, I have one last quick questionnaire for you to fill out. Like before, please be as honest as you can, and let me know when you're finished.

8. **Debrief**

Thank you both for coming in today. As promised, you'll each receive *[$20 OR 1.5 credits*] for your participation. Before you leave, I'll let you know a bit more about the study.

So how was the study for you? Any immediate thoughts?

So, at the beginning of the study we told you that we were interested in how passengers in the car can affect driver stress and decision-making. But actually, we had different goals for the study.

This research study is actually looking what situational and interpersonal factors influence risky driving when a peer is present in the car compared to when people drive alone. Here's how we did this:

- *[Acceptance condition]* The two tasks you did together were used to get you talking and getting to know each other a bit. We don't actually need these data for anything, it was purely to have you interact with each other. However, when I presented the second road rules task to you and your partner was happy to work with you, this was done on purpose – *[confederate's name]* is actually working with me and is not a real participant. They were instructed to smile and seem happy with you again on the next task. I had them do this in order to make you feel accepted by them. In actuality, the road rules task was merely to facilitate this interaction and we do not actually need the data from it.

- *[Rejection condition]* The first task you did together was used to get you talking and getting to know each other a bit. We don't actually need these data for anything, it was purely to have you interact with each other. However, when I presented the second road rules task to you and your partner decided they didn't want to work with you, this was done on purpose – *[confederate's name]* is actually working with me and is not a real participant. They were instructed to state that they didn't want to work with you on the next task. I had them do this in order to make you feel rejected by them. In actuality, the road rules task was merely to facilitate this interaction and we do not actually need the

data from it. **It is important for you to know that you were never actually rejected today – *[confederate]* was following the script and did not actually dislike or not want to work with you.**

- We manipulated whether participants feel accepted or rejected, because we think that this might influence how they drive with a passenger who has accepted or rejected them. Do they take more risks when they want to try and re-gain acceptance after rejection? Or, do people take fewer risks when they feel socially accepted?

Next, I gave *[confederate]* a chance to drive the simulator before letting you take over. As you maybe guessed by now, we did not randomly select you to be the driver today – it was always going to be you. I had them drive the car in order to demonstrate a particular driving style. In addition to manipulating whether you were accepted or rejected, I also manipulated what type of driver *[confederate]* was. I instructed them to drive in either a risk-accepting or a risk-averse manner. So, you may have noticed that they seemed to drive especially fast, or maybe they were very cautious while on the road. This was done on purpose, and I manipulated driving style to see if your driving style changes depending on whether you were previously accepted or rejected. For example, when people are rejected and desire to get back into someone's good graces, do they also drive in a risk-averse way if they have just witnessed it?

Does all of this make sense so far?

You also completed a few questionnaires today and they are all important pieces of data that we are collecting. The first one, about your driving history, is so we can get a sense of what type of driver you are before you came in today. We also asked you to answer questions about your partner's level of attractiveness, friendliness, etc. because we think that when your partner has more positive traits or you feel more positively towards them, you might be more motivated to comply with their driving style, and being rejected or accepted by them might then mean different things.

The other two brief questionnaires about how accepted you felt by them and about their driving style were manipulation checks – we used them to determine if we were successful at making you feel accepted/rejected, and if you picked up on their driving style.

Finally, we had you wear physiological data collection equipment because I want to know if stress has an effect on a peer's ability to influence behaviour. Prior research has demonstrated that peers seem to induce a stress response when people think they are being evaluated or observed. We think that being rejected, in particular, will be stressful for participants. We also know that stress can compromise decision-making, so you may drive in ways that are inconsistent with how you'd drive when you are alone if you are feeling more stress.

We are doing this study because we are interested in determining what makes some individuals more susceptible to the influence of their peers. For example, why do some people use drugs or alcohol, commit crime, or drive dangerously with their friends around, but not when they are alone? This study is the first to incorporate multiple known peer-related influences on risk behaviour, such as peer status and stress.

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Now that you know our true goals, how are you doing? Do you have any more questions at this point?

If you are okay with remaining in the study, then we will need you to re-sign a consent form now that you know the true nature of our study. If you'd like to remain in the study, please take your time to review and sign this consent form. It is very similar to the one you signed earlier, just states the true nature of our study.

[pause; ensure participant feels okay and is comfortable before they leave]

[rip off the debrief information and give to participant; only keep the signed portion of the debrief form]

One final request from us is that you refrain from discussing the study you participated in today, especially the true nature of our research questions. If other people find out about what we're really looking at, this will affect our data collection and ultimately, our results. So please do not share the details of our study with other people in your classes who might participate this semester.

Thank you again for coming in! Good luck with your semester.

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