Adolescents’ Susceptibility to Maternal and Peer Influence

DISSERTATION

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

in Psychology and Social Behavior

by

April Gile Thomas

Dissertation Committee:
Professor Elizabeth Cauffman, Chair
Professor Chuansheng Chen
Professor Peter Ditto

2017
DEDICATION

To my husband and daughter,

thank you for your unwavering faith in me.

Your support has kept me going on the hardest days.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF FIGURES</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>vi</td>
</tr>
<tr>
<td>CURRICULUM VITAE</td>
<td>vii</td>
</tr>
<tr>
<td>ABSTRACT OF THE DISSERTATION</td>
<td>ix</td>
</tr>
<tr>
<td>CHAPTER 1: INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Social Facilitation Theory</td>
<td>2</td>
</tr>
<tr>
<td>Influence of Peers</td>
<td>3</td>
</tr>
<tr>
<td>Influence of Parents</td>
<td>5</td>
</tr>
<tr>
<td>Resistance to Parental and Peer Influence</td>
<td>7</td>
</tr>
<tr>
<td>Measuring Resistance to Social Influence</td>
<td>9</td>
</tr>
<tr>
<td>Predictors of Susceptibility to Social Influence</td>
<td>13</td>
</tr>
<tr>
<td>The Present Study</td>
<td>19</td>
</tr>
<tr>
<td>CHAPTER 2: METHOD</td>
<td>24</td>
</tr>
<tr>
<td>Study Overview</td>
<td>24</td>
</tr>
<tr>
<td>Participants</td>
<td>25</td>
</tr>
<tr>
<td>Procedures</td>
<td>29</td>
</tr>
<tr>
<td>Measures</td>
<td>32</td>
</tr>
<tr>
<td>CHAPTER 3: PLAN OF ANALYSIS</td>
<td>39</td>
</tr>
<tr>
<td>CHAPTER 4: RESULTS</td>
<td>42</td>
</tr>
<tr>
<td>Aim 1</td>
<td>42</td>
</tr>
<tr>
<td>Aim 2</td>
<td>44</td>
</tr>
<tr>
<td>Aim 3</td>
<td>46</td>
</tr>
<tr>
<td>Aim 4</td>
<td>46</td>
</tr>
<tr>
<td>CHAPTER 5: DISCUSSION</td>
<td>50</td>
</tr>
<tr>
<td>Susceptibility to Social Influence Across Development</td>
<td>52</td>
</tr>
<tr>
<td>Relationship Factors</td>
<td>54</td>
</tr>
<tr>
<td>Limitations and Strengths</td>
<td>55</td>
</tr>
<tr>
<td>Conclusions</td>
<td>57</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>59</td>
</tr>
<tr>
<td>APPENDIX A: Modifications on Inventory of Parent and Peer Attachment - Revised</td>
<td>66</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Representation of Social Influence Condition by Risk-Taking Task</td>
<td>25</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Representation of Participant Breakdown</td>
<td>27</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Representation of BART Task</td>
<td>36</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Representation of the Stoplight Game</td>
<td>38</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Moderated Effect of Maternal Hostility by Direct Combined Influence Condition on Stoplight Risk Index</td>
<td>49</td>
</tr>
</tbody>
</table>
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Demographic Distribution by Condition</td>
<td>28</td>
</tr>
<tr>
<td>Table 2.1</td>
<td>Two-way Analysis of Covariance for BART Risk Taking as a Function of Indirect Influence Condition and Age Group</td>
<td>43</td>
</tr>
<tr>
<td>Table 2.2</td>
<td>Means, Standard Deviations, and n for BART Risk Score as a Function of Indirect Influence Condition and Age Group</td>
<td>43</td>
</tr>
<tr>
<td>Table 3.1</td>
<td>Two-way Analysis of Covariance for Stoplight Risk Index as a Function of Direct Influence Condition and Age Group</td>
<td>45</td>
</tr>
<tr>
<td>Table 3.2</td>
<td>Means, Standard Deviations, and n for Stoplight Risk Index as a Function of Direct Influence Condition and Age Group</td>
<td>45</td>
</tr>
<tr>
<td>Table 4</td>
<td>Moderated Multiple Regression Analysis Summary for Direct Influence Condition, Maternal Hostility, and Interaction of Condition by Hostility, Controlling for Ethnicity and Relationship Factors, Predicting Stoplight Risk Index</td>
<td>48</td>
</tr>
</tbody>
</table>
ACKNOWLEDGMENTS

I would like to express my deepest gratitude to my mentor, Dr. Elizabeth Cauffman, for her guidance and wisdom over the past six years. I am forever grateful for the many lessons I have learned from her.

I would like to thank my committee members, Professor Chuansheng Chen and Professor Peter Ditto, for their expert advice on this project.

I would like to thank the organizations that provided funding to this project, including the American Psychological Association, the University of California, Irvine (UCI) Undergraduate Research Opportunities Program, and the UCI School of Social Ecology.

I would also like to acknowledge the research assistants and participants who helped make this study possible.

Finally, I would like to express my very great appreciation to my laboratory manager, Nina Ozbardakci. The success of this study is due in large part to her hard work, dedication, and attention to detail.
CURRICULUM VITAE

April Gile Thomas

EDUCATION
2007 B.S. in Psychology, Wichita State University
2011 M.S. in Human Development and Family Studies, Colorado State University
2017 Ph.D. in Psychology & Social Behavior, University of California, Irvine

HONORS & AWARDS
2017 American Psychological Association Dissertation Research Grant
2017 American Psychology-Law Society Grant-In-Aid
Spring 2017 Social Ecology Dean’s Dissertation Writing Fellowship
2016-2017 UCI Graduate Student Mentoring Award
2015-2016 UCI Graduate Student Mentoring Award
2015 Microsemi Graduate Research Fellowship
2014-2015 UCI Graduate Student Mentoring Award
2013-2014 UCI Graduate Student Mentoring Award
2012-2013 UCI Graduate Student Mentoring Award
2011-2012 UCI Graduate Student Mentoring Award
2011-2012 Graduate Opportunity Diversity Fellowship
2007 Graduated Magna Cum Laude from WSU

PUBLICATIONS
*Authors are listed alphabetically as all authors contributed equally.*


*Authors are listed alphabetically as all authors contributed equally.


ABSTRACT OF THE DISSERTATION

Adolescents’ Susceptibility to Maternal and Peer Influence

By

April Gile Thomas

Doctor of Philosophy in Psychology and Social Behavior
University of California, Irvine, 2017
Professor Elizabeth Cauffman, Chair

Adolescence is a time of heightened risk taking and vulnerability to social influence. Research has demonstrated the effects of social influence on adolescents’ risk taking; however, most research has focused on the effects of peer influence, with less known about the direct effects of parental influence on adolescent risk. The present study uses an experimental design to examine the effect of indirect and direct maternal and peer influence on adolescents’ risk taking on two behavioral tasks.

Adolescent participants were recruited from Orange County, CA via flyer distribution and snowball sampling. Participants (N=97) were eligible for the study if they spoke fluent English, aged 13-14 or 16-17 years, and had an English-speaking mother or female guardian and English-speaking friend of the same grade and gender who were willing to complete the study with the participant. Participants were randomly assigned to complete the study in one of four conditions: alone, with their friend, with their mother, or with both their friend and mother. Laboratory sessions were completed at the University of California, Irvine campus. Participants completed two behavioral tasks (one under conditions of indirect influence and one under
conditions of direct influence) to assess the effects of maternal and peer influence on adolescent risk behavior, as well as a battery of self-report assessments.

Although no effect of indirect maternal or peer influence was observed in the present analyses, results indicate that direct negative influence from mothers or friends increased adolescents’ risk taking. Adolescents in the mother-only and friend-only conditions took more risks than adolescents in the no influence condition; however, there were no differences in risk behavior when both the mother and friend were present. The effect of social influence on adolescent risk was consistent between the two age groups. Maternal hostility moderated the effect of direct influence on adolescents’ risk behavior, such that mothers who were perceived as more hostile had less influence over adolescents’ risk taking than mothers who were perceived as less hostile. These findings reveal that adolescents’ mothers and friends serve as highly influential figures and both have the capacity to increase adolescents’ engagement in risky behavior.
INTRODUCTION

Adolescents engage in a number of health risk behaviors that contribute to their morbidity and mortality, including risky driving, unprotected sex, and the use of illegal substances (Kann et al., 2016). In fact, adolescence represents the period of development in which individuals engage in the greatest risk-taking (Steinberg, 2008). It is no coincidence that adolescence also marks the period when individuals are the most vulnerable to social influence (Steinberg & Monahan, 2007), as susceptibility to social influence is a strong predictor of risk behavior (Monahan, Steinberg, & Cauffman, 2009). The link between social influence and risk taking is thought to be more prevalent during adolescence in part due to normative neurological developments that occur during the transition from childhood to adulthood, leaving adolescents with a heightened sensitivity to social stimuli (Nelson, Leibenluft, McClure, & Pine, 2005), during a time when their impulse control abilities are still immature (Albert, Chein, & Steinberg, 2013).

Human brains undergo what has been termed a “social reorganization” during adolescence, in which peers are seen as especially rewarding (Chein, Albert, O’Brien, Uckert, & Steinberg, 2011) and ostracism is experienced as particularly distressing (Sebastian, Viding, Williams, & Blakemore, 2010). In fact, research suggests that individual differences in neural responses to social exclusion are predictive of susceptibility to social influence, with adolescents with higher neural reactivity to social exclusion demonstrating the greatest susceptibility to peer influence on risk taking (Falk et al., 2014). These neurological changes are observed behaviorally as well, as adolescents tend to take greater risks in the presence of peers than when alone (Gardner & Steinberg, 2005); this phenomenon is not observed during adulthood,
suggesting the ability to resist peer influence develops during the transition from adolescence to adulthood (Steinberg & Silverberg, 1986). Social influence may also affect adolescents’ risk behavior by changing how adolescents perceive risk, as research finds that adolescents view risky situations as less risky if others rate them as less risky (Knoll, Magis-Weinberg, Speekenbrink, & Blakemore, 2015). The present study seeks to examine the effect of social influence from mothers and close friends on adolescents’ risk behavior across two periods of adolescent development.

Social Facilitation Theory

The understanding that others can affect one’s behavior is not a new concept. Rather, Tripplett (1897) first noted this phenomenon in the late 1800s, with his observation that cyclists performed better when competing against others, as compared to when they competed against a clock. The idea that performance is enhanced by the presence of the others has been termed “social facilitation” (Allport, 1920). However, research on this topic suggests that the presence of others affects behavior in distinct ways depending on a variety of factors, such as task difficulty, with presence of others improving task performance in some situations and impairing it in others (Allport). Whereas prior work explored this phenomenon among co-actors (i.e., those who performed the same tasks alongside one another), later work suggested that the effects of social facilitation may also vary depending on the type of social presence, with distinctions between the “mere presence” of observers, an evaluative audience, and competing and non-competing co-actors (Dashiell, 1930). Numerous theories emerged that attempted to explain the process by which social facilitation occurs; however, no single theory has yet to account for the complexity of this phenomenon and the variety of situations with which it can take place (Aiello & Douthitt, 2001). One theorist (Goffman, 1959) proposed that others affect one’s performance due to a
desire for self-preservation. Baumeister (1982) expanded on this, suggesting that individuals may change their behavior in the presence of others or conform due to a motivation to please others or to uphold the impression others have of you. It is this type of social facilitation that the present study focuses on. In addition to numerous other factors (such as context and relationship to others), aspects of the individual can affect the degree to which social facilitation occurs (Aiello & Douthitt). The remainder of this paper will discuss social facilitation and conformity within the period of adolescence, as individuals in this developmental stage appear to be particularly vulnerable to social effects.

**The Influence of Peers**

Adolescence marks a period of significant growth and development. During this time, adolescents develop autonomy from their parents and begin to form their own identity (Steinberg & Silverberg, 1987). As adolescents develop independence from their parents, they begin to spend more time with their peers. Peers’ salience in adolescents’ lives also increases during this time (Brown & Larson, 2009). Given the importance of peers to adolescents, it’s not surprising that adolescents are highly influenced by their peers.

Peer influence refers to peer effects that occur as a result of socialization or conformity to the behaviors and attitudes of one’s peer group, rather than selection (i.e., the tendency to be similar to one’s peer group as a result of pre-existing characteristics that were selected for). One way that peers have been found to socialize adolescent behavior is through what has been termed “peer contagion,” a type of influence that takes place outside of one’s awareness (Dishion & Tipsord, 2011). In a prime example of peer contagion, adolescents’ substance use was influenced by their exposure to their friends’ online pictures of partying or drinking alcohol on social media sites such as MySpace or Facebook six months earlier (Huang et al., 2014). Both selection and
socialization processes contribute to adolescent risk behavior; therefore, it is important for
correlational studies to decipher which processes are responsible for adolescents’ and peers’
shared risk behavior. For example, research suggests both selection and socialization contribute
to similarities in adolescents’ and peers’ alcohol use, but only selection explains similarities in
adolescents’ and peers’ tobacco usage (Kiuru, Burk, Laursen, Salmela-Aro, & Nurmi, 2010).
Advanced methodologies, such as longitudinal social-network modeling, help researchers
distinguish between selection and peer influence effects when experimental study designs are not
possible. For instance, researchers examining peer effects on adolescent weapon carrying among
male Latino adolescents living in New York City found an effect of peer socialization, such that
association with weapon-carrying peers at time one was associated with increases in adolescents’
own weapon-carrying one year later (Dijkstra et al., 2010).

Experimental designs, such as those used in the present study, provide an ideal means for
examining peer effects by revealing effects that are truly a result of conformity rather than
selection. Several experimental studies have demonstrated the effects of peer influence on
adolescent behavior. One of the most frequently cited studies of peer influence was conducted by
Gardner and Steinberg (2005) and examined the effects of peer influence on the risky driving
behavior of adolescents, young adults, and adults. This research found that participants who
completed a risky driving task with two same-aged peers took more risks than those who
completed the same task alone; this finding was particularly strong for adolescent and young
adult participants (Gardner & Steinberg, 2005). Not all peer influence leads to an increase in
risky or deviant behavior, however. Experimental evidence suggests that peers can influence
adolescents to engage in prosocial behavior as well, as adolescents taking part in a public goods
game were found to allocate more coins to the group (i.e., prosocial behavior) when they
experienced prosocial feedback from peers, and allocate more coins to themselves (i.e., antisocial behavior) when they experienced antisocial feedback (van Hoorn, van Dijk, Meuwese, Rieffe, & Crone, 2016). Similarly, in a study of pedestrian road-crossing decisions, adolescents were susceptible to both positive and negative influence (Pfeffer & Hunter, 2013). Specifically, adolescents’ who watched video clips of different road-crossing sites with a positive peer (i.e., encouraging cautious decisions) were found to identify safe road-crossings more frequently than adolescents who watched video clips with a negative peer (i.e., encouraging unsafe decisions) or no peer; likewise, adolescents who were accompanied by a negative peer identified the fewest safe road-crossings (Pfeffer & Hunter, 2013).

In sum, it is evident that peers play a large role in the lives of adolescence and greatly affect their behavior. Considerable research demonstrates that peers can have both positive and negative effects on adolescent behavior. Less research, however, has explored how parents directly influence adolescents.

**The Influence of Parents**

Although peers become more influential during the adolescent years, parents continue to have a strong influence over their children during this time (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000; Steinberg, 2001). Research suggests that parents may influence their adolescent children in matters more long-term in nature, such as by passing on moral values and fostering ambitions; peers, on the other hand, seem to influence adolescents’ day-to-day decisions about matters such as the types of clothes they wear or music they listen to (Smetana, Campione-Barr, & Metzger, 2006).

The majority of research on the effects of parental influence on adolescents has focused on parents’ indirect influence of their child’s behavior, rather than direct instruction. Some of
this indirect influence takes the form of modeling or socialization. For example, a study by Kong, Camenga, and Krishnan-Sarin (2012) revealed that adolescents’ who have at least one parent who smokes cigarettes have greater difficulty abstaining from smoking. Similarly, research demonstrates that the amount of time that parents spend on computers and the types of activities they use while on the internet predict adolescents’ computer time and Internet activities (Vaala & Bleakley, 2015). Thus, research suggests that adolescents tend to engage in the same behaviors they witness their parents engaging in. Parents have also been shown to indirectly influence the behavior of their adolescent children through the transmission of their own values and beliefs. For example, parents’ supportive views of physical activity are associated with adolescents’ greater engagement in physical activity (Trost, Sallis, Pate, Freedson, Taylor, & Dowda, 2003). Likewise, adolescents’ perceptions of their parents’ approval of high-risk drinking are associated with adolescents’ greater negative alcohol-related consequences (Rulison, Wahesh, Wyrick, & Dejong, 2016). Finally, parents may also indirectly influence their adolescent child’s behavior through their monitoring and supervision. Research consistently finds that low parental monitoring is associated with greater adolescent antisocial behavior (Ary, Duncan, Duncan, & Hops, 1999; Barnes, Hofman, Welte, Farrell, & Dintcheff, 2006).

In summary, parents remain an important source of influence throughout adolescence. Parents’ influence can occur through a variety of mediums, such as socialization and modeling, value transmission, and monitoring. Although most research on parental influence has focused on indirect forms of influence, it is likely that parents also influence their adolescent children in direct ways as well. However, few studies exist which examine the direct effects of parental influence on adolescent behavior.
Resistance to Parental and Peer Influence

It is clear that parents and peers are highly influential figures for adolescents. However, during the transition from childhood to adulthood, individuals grow in their ability to resist such influence. Research on the developmental patterns of resistance to parental and peer (or relatedly, conformity or susceptibility to social influence) is extremely limited. Of the studies that have examined these constructs across development, findings have been mixed; suggesting that resistance to social influence may be context specific. Individuals tend to demonstrate variable patterns of development of resistance to peer influence depending on whether the influence is neutral, negative, or positive.

First, research on conformity to neutral or general peer influence will be reviewed. In a seminal study of developmental differences in conformity, Berndt (1979) found that self-reported conformity to neutral peer influence did not vary across grade (as examined cross-sectionally among youth in grades 3, 6, 9, and 12). Clasen and Brown (1985) also found no grade-level differences when comparing conformity to peer norms (in dress, grooming, musical tastes, etc.) among rural adolescents in grades 7 to 12; however, they found that conformity decreased linearly across grades for urban youth. Likewise, using a U.S. sample, Steinberg and Monahan (2007) found that the ability to resist neutral peer influence develops linearly between the ages of 14 and 18, with little change in the ability to resist peer influence prior to age 14 and after age 18. Yet, when the same measure was used with a Dutch sample, the developmental period was expanded, as resistance to peer influence was found to increase from age 10 through age 18 (Sumter, Bokhorst, Steinberg, & Westenberg, 2009). Additional research reveals a third pattern of development for conformity to neutral influence. For example, Brown, Clasen, and Eicher (1986) found an inverted U-shaped trend for neutral conformity to peer influence using Berndt’s
original self-report measure across grades 6 through 9 among urban youth, but not rural youth. Similarly, studies using the Asch (1951) social conformity paradigm with ambiguous stimuli demonstrate an inverted U-shaped pattern across development, with conformity to peer influence peaking in early adolescence and declining into adulthood (Costanzo & Shaw, 1966; Iscoe, Williams, & Harvey, 1963); however, in studies using unambiguous stimuli, conformity is shown to decrease over time (Bishop & Beckman, 1971; Walker & Andrade, 1996).

Although evidence appears mixed with regards to conformity for neutral peer influence across age, there is greater clarity when examining development patterns of conformity to negative peer influence for deviant acts (such as smoking, drinking, or engaging in delinquent behavior) and conformity to positive influence. Research indicates that the ability to resist negative peer influence follows a curvilinear pattern of development, such that susceptibility to influence from one’s peers increases from childhood through middle adolescence and decreases from middle to late adolescence (Berndt, 1979; Brown, 1986; Steinberg & Silverberg, 1986). That is, susceptibility to peers’ negative influence appears to peak during middle adolescence. Finally, susceptibility to the positive influence of peers does not appear to change across adolescence but instead remains stable from childhood through late adolescence (Berndt, 1979; Pfeffer, 2013).

Only one study has examined developmental differences in adolescents’ conformity to parental influence. Berndt (1979) finds that individuals’ conformity to positive parental influence remains fairly stable from childhood through late adolescence; conformity to neutral parental influence, however, declines steadily across this time. At this time, it is unknown how adolescents’ resistance to negative parental influence changes across development.
Measuring Resistance to Social Influence

It is noteworthy that, with the exception of the studies using the Asch paradigm, the aforementioned studies utilized self-report measures of predicted responses to hypothetical influence; therefore, any conclusions about the development of susceptibility to social influence are limited to adolescents’ perceptions of their own susceptibility to social influence. One problem with using this approach is that individuals’ may not be aware of their implicit susceptibility to social influence, particularly when such influence is covert in nature. Individuals’ subjective appraisals of their own susceptibility to social influence are, therefore, likely affected by personal biases and inaccurate estimation. Use of performance-based measures can help to address these limitations.

New research has begun to implement these types of performance-based measures to assess the effects of social influence on adolescents’ risk behavior. For example, Prinstein, Brechwald, and Cohen (2011) behaviorally evaluated adolescents’ susceptibility to peer influence by simulating an Internet chat room and calculating changes in adolescents’ responses before versus during the chat room interaction as an index of peer influence susceptibility. Adolescent participants were made to believe that they were interacting with high- or low-status classmates from their own school in the chat room; however, they were actually interacting with electronic confederates. Results indicated that adolescents’ behavior was influenced more by high-status confederates than low-status confederates. Further, adolescents who demonstrated high susceptibility to social influence during the chat room task were found to also be susceptible to their best-friends’ deviancy, as evidenced by significant associations between friend’s deviancy at baseline and their own deviancy eighteen months later (controlling for baseline deviancy). Using a similar paradigm, Widman, Choukas-Bradley, Helms, & Prinstein (2016)
examined how early adolescents responded to hypothetical scenarios about sexual risk behavior both during a private pretest assessment and a later Internet chat room simulation with e-confederates who were believed to be peers. Susceptibility to peer influence was calculated as the difference between adolescents’ responses to the sexual scenarios from the independent pretest to the public chat room. This study demonstrated a significant effect of peer influence on risky behavior, with 78% of adolescents providing riskier responses during the peer influence condition (i.e., chat room) than during the private assessment (Widman et al., 2015).

Performance-based approaches have also been used to assess adolescents’ susceptibility to parental influence. Telzer, Ichien, and Qu (2015), for example, explored the effects of maternal presence on adolescents’ risk behavior during a computerized driving task and found that adolescents made fewer risky decisions when their mothers were present than when they were alone. Mothers did not offer advice or feedback to their adolescent during the task; rather, they simply stated that they were observing them during the task. Use of performance-based measurement is particularly important in these types of situations where social influence is indirect or covert, rather than experienced as an overt social pressure.

As the developmental pattern of adolescents’ ability to resist social influence varies depending upon whether such influence is from parents or peers, it is important to also consider whether adolescents show increased vulnerability to one source of influence over the other at any given developmental period. In the first study to include performance-based measures of both parental and peer influence within a single study, Welborn, Lieberman, Goldenberg, Fuligni, Galván, & Telzer (2015) found that adolescents showed more behavioral change as a result of parental influence than peer influence. This study assessed susceptibility to social influence from parents and unknown peer schoolmates among 19 Mexican-American students in late-
adolescence (Mean age = 17.56). Participants were asked to make initial ratings of several images on a scale from 0 to 100 several weeks ahead of time. Later, participants were presented with images for which their rating was at least 20 points higher or 20 points lower from the ratings of their parents or peers. Participants underwent a series of trials in which they were shown images with no feedback (control trials), feedback in the form of the parent’s rating, or feedback in the form of a peer rating, and were asked to re-rate the images following such feedback. Compared to control trials, participants made more rating changes in conditions of social influence (i.e., parent feedback or peer feedback trials). In comparing rating changes between parent and peer trials, participants were found to show greater susceptibility to influence from parents than from peers (Welborn et al., 2015).

Although this study takes an important first step in comparing parental and peer influence on adolescent behavior, much remains unknown about this phenomenon. It is important to identify the gaps remaining in the literature following this study. First, the sample used by Welborn and colleagues (2015) consists only of late adolescents. Because the ability to resist social influence is a skill that develops over time, it is important to examine these constructs among adolescents at varying stages of development. Second, due to the ethnic makeup of this sample (i.e., Mexican-American), there is also the potential that cultural factors may have affected the results. Mexican-American culture tends to endorse familism, “a set of normative beliefs espoused by Latino populations that emphasize the centrality of the family unit” (Germán, Gonzales, & Dumka, 2009). Additional research using a larger sample with greater ethnic diversity will be important for demonstrating the generalizability of these findings. Third, this study examines only one type of social influence (neutral). Research suggests that the ability to resist social influence may vary depending upon the type of social influence in question (i.e.,
positive, negative, or neutral; Berndt, 1979). Finally, although this study included both parental and peer influence conditions within a single study, it did not include parental and peer influence within a single condition. That is, participants were never exposed to both parental and peer ratings simultaneously. It is unclear how adolescents’ behavior may be affected by social influence when they experience conflicting influence from multiple sources at the same time.

The present study seeks to advance upon this prior work by comparing adolescents’ susceptibility to multiple types of influence (i.e., neutral, positive, and negative) and multiple sources of influence (i.e., parents and peers). The prior study demonstrated that adolescents tend to be more susceptible to influence from their parents than their peers under neutral conditions where they could take their time and were not faced with conflicting influence. However, it is possible that these results may differ when adolescents are forced to make more emotionally salient decisions in the heat of the moment when influence is conflicting. Additionally, whereas the prior study examined adolescents’ susceptibility to their parents versus unknown peers from their school, the present study seeks to compare adolescents’ susceptibility to their mother versus their close friend. Research indicates that relationship factors (such as closeness of the relationship) may be just one of many factors that affect susceptibility to social influence, as outlined in the subsequent section. The present dissertation seeks to tease apart these various factors in order to understand adolescents’ susceptibility to social influence in a more nuanced manner.
Predictors of Susceptibility to Social Influence

The degree to which one individual can influence another varies considerably depending upon a number of factors, including characteristics of the influencer (e.g., age, social status, etc.), characteristics of the relationship between the two individuals (e.g., relationship quality, attachment, etc.), and the context of the influence (i.e., indirect versus direct).

Characteristics of the influencer.

Research exploring how characteristics of the influencer affect the level of influence that is experienced by another person also represents a new, but growing, area of study. One factor that appears to matter greatly in predicting one’s susceptibility to social influence is the age of the influencer. New evidence suggests that the magnitude of the effect of social influence depends not only upon the age of the participant (Steinberg & Monahan, 2007), but also upon the age of the social influence group (Knoll, Magis-Weinberg, Speekenbrink, & Blakemore, 2015). In a study examining the effects of general social influence on the risk perceptions of young adolescents and adults, 563 participants ranging in age from 8-59 years rated the riskiness of a variety of different situations (e.g., driving without a seatbelt, crossing a street while texting). For each situation, participants were shown how a social-influence group (either a group of teenagers or a group of adults) rated the same situation before being given the opportunity to rate the situation again. The results reveal that all participants, regardless of age, conformed to the social influence responses to some degree; however, the magnitude of conformity declined with age, with a 33% change in risk ratings for children (ages 8-11) as compared to a 7% change in risk for adults (ages 26-59). Interestingly, the magnitude of this effect also depended upon the age of the social influence group. Compared to all other age groups, young adolescents (ages 12-14) were more influenced by the social influence group consisting of teenagers than by the group
consisting of adults. All other age groups (children, young adults, and adults) were more influenced by the adult social influence group (Knoll et al., 2015). This is in line with previous research suggesting susceptibility to peer influence peaks at approximately age 14 (Berndt, 1979).

A second characteristic of the influencer that is proving to be a valuable predictor of susceptibility to social influence is the distinction of whether the influencer is known or unknown to the individual. New evidence suggests that individuals are more likely to be influenced by people they know than by strangers. For example, when comparing the effect of social observation by a friend versus an unknown peer on adolescents’ performance on a relationship reasoning task, Wolf, Bazargani, Kilford, Dumontheil, and Blakemore (2015) found that adolescents’ performance was slower and less accurate in the friend-present conditions than in the unknown peer-present conditions. This finding has been echoed in the work of Hope, Ost, Gabbert, Healey, and Lenton (2008), who find that individuals are more likely to conform to misinformation from their friends or romantic partners than from strangers. While these studies indicate that adolescents are more vulnerable to influence from known, rather than unknown, sources, they do not elucidate how adolescents distinguish between influence from multiple well-known sources. These findings highlight the importance of comparing adolescents’ susceptibility to social influence from two well-known sources and suggest that relationship factors may play a role in distinguishing which influencers adolescents are most vulnerable to.

**Relationship quality.**

It has been argued thus far that individuals tend to be more vulnerable to influence from those who are well known to them than to influence from strangers. Similarly, it is likely that the magnitude of influence varies depending on relationship quality. Yet, empirical tests of this
assumption have produced mixed results. In a longitudinal examination of peer influence on adolescent substance use, friendship quality was found to moderate the effect of peer substance use on adolescent’s own substance use (Urburg, Luo, Pilgrim, & Degirmencioglu, 2003). Specifically, among friends rated low in relationship quality, peers’ influence was weak and peer substance use did not affect the target adolescents’ substance use (Urburg et al., 2003). On the other hand, when friendship quality was rated as high, adolescents were more likely to conform to the substance using behavior of their peers (Urberg et al., 2003). However, a second study has found almost opposite results. Poulin, Dishion, and Hass (1999) found that friendship quality has no effect on whether close friend’s delinquency influences youths’ own delinquency across time. Of note, there were high levels of disagreement between the friendship quality ratings of antisocial youths and their close friends. A review by Berndt (2002) reveals that at present, despite several theories suggesting that relationship quality should affect the magnitude of social influence on adolescent behavior, empirical studies examining this topic are lacking. Definitive evidence documenting the affect of relationship quality on adolescents’ vulnerability to social influence is needed.

The above mentioned research suggests that relationship quality may affect adolescents’ susceptibility to influence from a particular source by making adolescents more responsive to influence from sources with whom they have good relationships. However, some research indicates that relationship quality may also affect adolescents’ susceptibility to social influence to other sources, such that poor relationship quality with one source may increase the effect of influence from other sources. For example, adolescents who have a negative relationship with their parents tend to be more strongly influenced by their peers (Savin-Williams & Berndt, 1990; Taubman-Ben-Ari & Katz-Ben-Ami, 2012). Likewise, high relationship quality with one source
may reduce the effect of influence from other sources. For example, adolescents who view their parents as more caring and warm tended to be less vulnerable to peer influence (Smorti, Guarnieri, & Ingoglia, 2014; Mounts & Steinberg, 1995). Additional research by Steinberg and Silverberg (1986) supports this assertion, finding that adolescents’ autonomy from parents and autonomy from peers are inversely related, such that adolescents who had the highest levels of autonomy from their parents demonstrated the least autonomy from their peers.

**Attachment security.** In addition to other dimensions of relationship quality mentioned above, adolescents’ attachment security with parents and peers may also serve to make them more or less vulnerable to social influence from these individuals. Attachment theory asserts that the earliest attachment relationships are formed between the infant and caregiver, as the helpless infant is completely dependent upon the caregiver for its survival (Bowlby, 1969/1982, 1973, 1978, 1980). Attachment theory suggests that the responsiveness of the caregiver and the experience of the attachment relationship, whether secure, anxious/ambivalent, anxious/avoidant, or disorganized, creates mental representations or “working models” for how to think and behave in future relationships, through the process of internalizing norms (Ainsworth, Blehar, Waters, & Wall, 1978). Bowlby (1969/1982) theorized that these early working models lay the foundation for future relationship expectations, such as later relationships with peers and romantic partners (Shaver & Hazan, 1994).

**Attachment in adolescence.** Attachment is extremely salient in infancy and early childhood; however it continues to serve as a foundation for relationship formation across the lifespan. As children mature, their attachment system matures as well. During middle childhood the attachment system becomes more generalized and attachment behaviors, such as proximity-seeking or safe-haven behaviors, begin to take place in various relationships, leading to an
overall feeling of attachment security or insecurity that is not tied to a specific relationship (Mayseless, 2005). Middle childhood marks a developmental stage when children begin to form close attachments to individuals other than their parents or primary caregiver (Ainsworth, 1989). As a person progresses into adolescence, the bonds to peers become strengthened. As children mature into young adults, they redirect their attachment focus from the primary caregiver to others.

During adolescence, the individual begins to develop his or her own identity (Erikson, 1989) by experimenting with various personalities and “trying on” different social groups to see where he or she fits in. A child’s initial identity is built upon beliefs passed down from parents. In order to develop an individual identity, separate from the identity formed during childhood, the adolescent must explore and experiment with different beliefs and values. During the transition into adolescence, individuals begin to form close relationships with peers. The secure base established by the parent relationship helps the adolescent test out these new relationships by preparing the individual with a mental representation, which offers individuals a set of norms or expectations that serve to guide them through new situations.

During this stage of development, adolescents face the challenge of developing autonomy and creating one’s own unique identity while maintaining attachment to parents (Ainsworth et al., 1978). Individuals who have a secure attachment to a caregiver are more prepared for the transition to adolescence because they possess a working model that is trusting of others and capable of forming new relationships, which provides a sense of confidence for the individual to explore new relationships (Bowlby, 1978). The secure base plays a critical role in giving the adolescent comfort and a sense of safety to freely explore the surrounding world (Bowlby, 1978). Through having a secure attachment to parents, the adolescent is afforded the opportunity to
experiment with potential identities while having an emotional “safe base” to return to. Studies have shown that youth who have been identified as securely attached tend to demonstrate higher levels of self-esteem and confidence than youth who are insecurely attached (Eliciker, Englund, & Sroufe, 1992). Thus, youth who feel comfortable in new situations and are not afraid to meet new people can likely attribute their confidence to a secure attachment relationship.

Research reveals that positive attachment relationships between parents and adolescents are associated with greater autonomy and peer relationship competency (Bell, Forthun, & Sun, 2000; Parker & Benson, 2004), as well as greater social skills (Allen, Marsh, McFarland, McElhaney, & Land, 2002). Autonomous decision-making refers to the ability to resist influence from others in one’s choices and this term has often been used as synonymous with resistance to social influence (Steinberg & Silverberg, 1986). Therefore, attachment security may provide a foundation for the development of important skills that are critical to the development of resistance to peer influence.

**Contextual factors.**

Just as individuals may be more or less susceptible to influence depending upon the source of the influence, they may also be more or less susceptible depending upon the context of the influence. The magnitude of influence may vary depending upon whether the influence is direct (overt) or indirect (covert), or is positive, neutral, or negative in valence. Although most susceptibility research has focused on influence that is direct (verbalized directly to the participant), some studies find that indirect influence can also have important effects on behavior. For example, a study by Weigard, Chein, Albert, Smith, and Steinberg (2014) found that adolescents’ decision making is impaired by peer observation, even when the peer is unknown to the adolescent and not physically present. Simply telling adolescent participants that
they were being observed by a same-aged, same-gendered peer in the next room led participants to display a greater preference for immediate rewards on a delay-discounting task.

A recent study directly compared the effects of indirect and direct peer influence on adolescent and young adult smoking. Using a sample of daily smokers between the ages of 16-24 years, Harakeh and Vollebergh (2012) found that indirect peer influence (in which a peer confederate smoked in front of the target participant) was significantly associated with the number of cigarettes the target participant smoked. Interestingly, direct peer influence (in which a peer confederate offered a cigarette to the target participant) was not significantly associated with the number of cigarettes smoked by the target participant. Thus, passive peer influence was found to be a stronger source of influence over young adult smoking than active peer pressure. The proposed study seeks to extend these findings by examining the effects of indirect and direct peer and parental influence on adolescent risk taking behavior.

The Present Study

Although considerable research has focused on the topic of parental and peer influence on adolescents’ risky behavior, a great deal remains unknown. Decades of research reveal that both parents and peers serve as powerful sources of influence on adolescent behavior, broadly speaking. However, relatively few studies have directly examined adolescents’ susceptibility to these two sources of influence simultaneously and no studies have experimentally assessed the effects of such influence on adolescents’ risk-taking behavior. Prior research suggests that the ability to resist peer influence for antisocial acts develops in a curvilinear pattern, with greatest susceptibility to influence during middle adolescence (Berndt, 1979; Steinberg & Silverberg, 1986), whereas resistance to general peer influence improves linearly from ages 10 to 18 years (Steinberg & Monahan, 2007). However, these studies have relied on adolescents’ self-reports of
expected responses to hypothetical situations. Further, no study has examined adolescents’ resistance to negative parental influence across development.

It is clear that numerous contextual factors affect how adolescents experience social influence. Although addressing all potential factors is beyond the scope of the study, the present dissertation seeks to provide some clarity regarding which sources of influence adolescents are more vulnerable to (i.e., mothers/female guardians or close friends) and how this differs at two stages of development (i.e., middle and late adolescence). The present research seeks to advance prior work by using a performance-based measure of social influence to compare adolescents’ susceptibility to maternal and peer influence at varying periods of development using experimental methods. The present study assesses how adolescents’ susceptibility to social influence varies across two periods of development (i.e., middle and late adolescence) and across two sources of social influence (i.e., mothers and friends). This will be explored across two types of influence (i.e., direct and indirect). Further, this study examines how characteristics of the influencer, relationship factors, and context affect adolescents’ susceptibility to maternal and peer influence. In doing so, the proposed study seeks to address the following aims:

Aim 1. Examine the effect of indirect maternal and peer influence on adolescents’ risk taking behavior across two stages of adolescent development.

The first aim seeks to 1) demonstrate whether there are differences in the risk taking behavior of those youth exposed to no indirect influence (control) as compared to indirect influence from a friend or mother and 2) examine whether there are developmental differences in how indirect maternal or peer influence affects adolescents’ risk taking behavior across two age categories (middle adolescence and late adolescence).
Hypothesis 1a: There will be a significant effect of indirect influence condition on risk taking during the BART task, such that participants in the mother condition will display less risk taking than those in any of the remaining three social influence conditions (i.e., no influence, friend, combined). Participants in the combined condition will display the second highest level of risk, those in the solo condition displaying the third highest level of risk, and those in the friend condition displaying the greatest level of risk.

Hypothesis 1b: Across conditions, older adolescents will display greater risk taking than younger adolescents.

**Aim 2. Examine the effect of direct maternal and peer influence on adolescents’ risk taking behavior across two stages of adolescent development.**

The second aim seeks to 1) demonstrate whether there are differences in the risk taking behavior of those youth exposed to no direct influence (control) as compared to direct influence from a friend or mother and 2) examine whether there are developmental differences in how direct maternal or peer influence affects adolescents’ risk taking across two age categories (middle adolescence and late adolescence).

Hypothesis 2a: There will be a significant effect of direct influence condition on risk taking during the Stoplight Task, such that participants in the no influence condition will display less risk taking than those in any of the remaining social influence conditions (i.e., friend, mother, risky mother/cautious friend, and cautious mother/risky friend). Participants in the cautious friend/risky mother condition will display the second lowest level of risk, followed by those in the risky mother/cautious friend condition, mother condition, and those in the friend condition displaying the greatest level of risk.
Hypotheses 2b: There will be a significant age by condition effect on risk taking during the Stoplight Task. Within the no influence condition, older adolescents will display greater risk taking than younger adolescents. Within the friend influence condition, older adolescents will display greater risk taking than younger adolescents. Within the maternal influence condition, younger adolescents will display less risk taking than older adolescents. Within the risky mother/cautious friend condition, older adolescents will display greater risk taking than younger adolescents. Within the cautious mother/risky friend condition, younger adolescents will display less risk taking than older adolescents.

Aim 3. Directly compare whether adolescents are more susceptible to direct influence from their mother or friend.

The third, and primary aim, of the study seeks to 1) compare whether maternal or peer influence has a stronger effect on adolescents’ risk taking behavior, and 2) determine whether this varies based on developmental stage.

Hypothesis 3: Younger adolescents will demonstrate greater susceptibility to maternal influence than older adolescents. Across the two conditions, younger adolescents will demonstrate greater risk taking in the risky mother/cautious friend condition than in the peer risk/cautious mother condition. Within the risky mother/cautious friend condition, younger adolescents will take greater risks than older adolescents. Within the cautious mother/risky friend condition, older adolescents will take greater risks than younger adolescents.

Aim 4. Examine the effect of relationship characteristics on adolescents’ resistance to simultaneous conflicting direct influence from a parent and peer.
The final aim seeks to determine whether characteristics of adolescents’ relationships with their mothers and friends affect the degree to which adolescents are influenced by one particular source of influence over the other.

Hypothesis 4a: Adolescents with better maternal relationship quality (operationalized as low hostility, high warmth, stronger attachment) will display greater susceptibility to maternal influence than adolescents with poorer maternal relationship quality.

Hypothesis 4b: Adolescents with better friendship quality (operationalized as low hostility, high warmth, and stronger attachment) will display greater susceptibility to friend influence than adolescents with poorer friendship quality.
METHOD

Study Overview

In order to examine developmental differences in resistance to social influence during adolescence, participants across two age categories [middle adolescence (13-14 years) and late adolescence (16-17 years)] were administered two behavioral tasks and a battery of self-report assessments. To manipulate social influence, participants were randomly assigned to complete the study in one of four social influence conditions: solo (i.e., control/no influence condition), friend influence, mother/female guardian influence, or combined influence (i.e., simultaneous competing influence from the friend and mother/female guardian). During social influence conditions, participants completed the behavioral tasks with their assigned social partner/s (i.e., mother and/or friend) sitting beside them. Participants assigned to the solo condition, on the other hand, completed the tasks independently.

Two behavioral tasks were used to assess participants’ risky behavior during indirect and direct social influence. All participants completed both tasks. During the first task, the Balloon Analogue Risk Task, social partners exerted indirect, neutral influence by silently observing the participant throughout the task. Social partners were instructed to pay attention to the task but not to offer any verbal or nonverbal feedback to the participant. In the second task, the Stoplight Game, social partners exerted direct influence that was either positive or negative in valence depending upon the social influence condition. During this task, social partners offered verbal feedback and advice directly to the participant about how to perform during the task. In mother influence and friend influence conditions, social partners were instructed to exert direct negative influence (i.e., encouraging greater risk behavior during the task). In the combined influence
condition, mothers and friends gave contradictory feedback across counterbalanced conditions. Specifically, half of all participants in the combined influence condition received negative (i.e., pro-risk) feedback from their mother while they received positive (i.e., anti-risk) feedback from their friend. The other half of participants in the combined influence condition received positive influence from their mother while they received negative influence from their peer. A graphical depiction of social influence by condition and task can be viewed in Figure 1.

Figure 1. Representation of Social Influence Condition by Risk-Taking Task

Participants

Participants for this study were recruited via two methods. The majority of recruitment was conducted using flyer distribution at community locations throughout Orange County. In
these cases, interested individuals could either leave their contact information with a research assistant (who would follow up with them via phone or email at a later time to determine eligibility) or take a flyer and contact the research team themselves. The second type of recruitment was snowball sampling, in which current participants referred their friends to the study. In these instances, the referred individuals were contacted by a research assistant, who described the study and determined the individual’s eligibility if he or she expressed interest in participating. Prospective participants were considered eligible for participation in the study if they: 1) were between 13-14 or 16-17 years of age, 2) were fluent in English, 3) had an English-speaking friend of the same grade and gender who would be willing to participate in the study if necessary, 4) had a mother or female guardian who was fluent in English and would be willing to participate in the study if necessary, and 5) had transportation to the University for the laboratory session. Contact information was received for a total of 413 individuals. Of these individuals, 118 declined participation, 104 were ineligible, 94 were non-responsive, and 97 target participants completed the study (see Figure 2). There were a total of 51 peer participants and 56 mother/female guardian participants. Of the female guardians, 97.9% were the biological mother of the target participant.
Eligible participants were randomly assigned to one of four social influence conditions using stratified random assignment to ensure an equal distribution of participants by gender and age group (i.e., middle and late adolescence). Descriptive information about participants by condition can be found in Table 1. The sample was racially and ethnically diverse, representing the demographics of the recruitment location.
Table 1

*Demographic Distribution by Condition (N=97)*

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
<th>Race</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Solo</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Friend</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Mother</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Risky mother/ Cautious friend</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Cautious mother/ Risky friend</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>65</td>
</tr>
</tbody>
</table>
Procedures

Written parental consent was obtained for each participant and minor social partner prior to the laboratory session. Participants and social partners were contacted the day before their scheduled laboratory session to confirm the session date, time, and location. All laboratory sessions took place at the University of California, Irvine in a private room. Trained research assistants administered all laboratory sessions. For sessions involving participants assigned to the solo condition, one research assistant administered the session; for all other conditions, two research assistants administered the session. One research assistant obtained youth assent from the target participant in the laboratory room while the second research assistant obtained assent from the social partners in the hallway. While in the hallway, the research assistant also provided the social partners with the following private instructions about the laboratory tasks.

“\textit{When we go back in the room, ___ (target participant's name) will play two games. The first game is a balloon game. During this game, you will sit next to ___ and watch him/her play. It is very important that you remain silent during this task and do not offer any feedback about ___’s performance. This includes non-verbal feedback, such as gestures, facial expressions, or body language. Please pay attention while he/she plays the game, but try to avoid having any type of response. Does that make sense? Verbal confirmation is received by the research assistant at this time. Then, when ___ has finished the balloon game, he/she will play a car racing game. During the game, ___ will encounter several traffic lights and will need to make decisions about whether to stop at them. We are going to tell ___ that the goal of the game is to get to the destination as quickly as possible. However, your goal is to try to get ___ to run more lights/stop at}
more lights (depends on condition) during the game. You may choose what to say to get ____ to run the lights/stop at the lights but please make sure you only make comments that encourage ____ to run the lights/discourage ____ from running the lights. This depends on condition; each social partner is only instructed to give one type of advice. While we ask you to say whatever you think will most strongly encourage/discourage him/her to run the lights/stop at lights, please do not physically intervene in the game. Also, it is important that you only speak in English and speak loudly enough for us to hear you. It is really important that we are able to hear you because we keep track of the number of comments you make. Based on how well you do at getting ____ to (run the lights/stop at the lights), you can earn money. Do you have any questions about this? Research assistant answers any questions the social partner/s has/have. We are trying to see how much you can affect ____’s behavior during the game. It is important that you don’t tell ____ what we’ve told you out here. We are going to tell him/her that you are allowed to help him/her with the game but he/she will not know that we’ve given you instructions about what advice to give.”

Following these instructions, research assistants asked the social partners questions to verify their understanding of the instructions. After social partners’ understanding of the instructions was assessed, social partners were brought into the laboratory room with the target participant and were asked to sit beside the participant at the desk such that all participants (i.e., target and social partner/s) faced the computer screen. The instructions for the first task (i.e., the Balloon Analogue Risk Task) were read aloud by the research assistant prior to the participant beginning the task and social partners were instructed to remain silent during the task.
Upon completion of task one, the second task (i.e., the Stoplight Game) begins after the instructions are read aloud. In this task, participants were informed that their social partners could help them during this task under the guise that the social partner/s could earn money based on the target participant’s performance. Target participants were not aware that the social partners had been given instructions about what type of advice to give during the task. During each task, research assistants completed fidelity checks to document social partner compliance with instructions. In instances of non-compliance, research assistants attempted to remind social partners how to behave during the task without letting the target participant know by holding up a small sign that depicted the instructions. Following completion of both tasks, participants were offered candy as a “prize” for their performance on the tasks and informed that they had earned an additional $5 for their performance. Social partners were informed that they earned $5 because of their assistance in helping the target participant perform well on the task. These incentives were provided as a way of encouraging task fidelity. However, in reality, all participants and social partners received these incentives regardless of their performance.

After completion of the behavioral tasks, participants and social partners each completed a web-based questionnaire (either on a tablet or a computer) about a variety of domains. Social partners were seated away from the target participant in an effort to maintain privacy of all parties and encourage honest responding. After all participants completed their questionnaire, they received a debriefing by the research assistants that described the true nature of the study. Following the debriefing, participants were given the option to have their data removed from the study if they so desired. Participants and social partners were asked to provide contact information for any individuals they knew who might be interested in participating in the study.
If referrals were made, participants were reminded by the research assistants about the importance of keeping the true nature of the study hidden.

**Measures**

Participants completed two behavioral tasks, followed by a computer-administrated questionnaire about multiple domains of functioning and life experiences.

**Demographics.** Participants self-reported on several demographic characteristics, including their self-identified gender, birthdate (used to calculate participant’s age), and race/ethnicity. Race/ethnicity was dummy-coded as White and non-White, with White as the reference group. Gender was also dummy-coded, with Male as the reference group.

**Relationship characteristics.** Several dimensions of relationship characteristics were assessed in the questionnaire. These dimensions include relationship quality, attachment, duration of relationship, and frequency of contact. For each assessment, participants reported their perceptions of the relationship with the social partner/s.

**Relationship quality.** Relationship quality was assessed using an adapted version of The Quality of Relationships Inventory (QRI: Conger, Ge, Elder, Lorenz, & Simons, 1994) called the Relationship Warmth/Hostility Assessment. The measure was used to assess the affective tone of each participant’s relationship with his or her target parent or peer. Nine items assessed the degree of warmth in the relationship (e.g., “How often does your mother let you know she really cares about you?”) and twelve items assessed the degree of hostility (e.g., “How often does your mother get angry at you?”). Participants were asked to respond on a 4-point Likert scale ranging from “Always” to “Never.” The nine items assessing warmth are averaged to create a warmth subscale in which higher scores indicate a more supportive and nurturing relationship ($a_{mother}=.919$, 9 items; $a_{peer}=.903$, 9 items). The twelve items assessing hostility are averaged to
create a subscale of relationship hostility in which higher scores indicate a more negative and abusive relationship ($\alpha_{mother}=.784$, 12 items; $\alpha_{peer}=.747$, 12 items). The adapted measure has been used in prior studies (The Pathways to Desistance) and demonstrated acceptable fit on a confirmatory factor analysis, as well as high internal consistency across time points (> .80).

**Attachment to social partner.** Attachment in the social relationship was assessed using an adapted version of the Inventory of Parent and Peer Attachment-Revised for Children (IPPA-R; Gullone & Robinson, 2005; based on the original Inventory of Parent and Peer Attachment by Armsden & Greenberg, 1987). The original 60-item self-report questionnaire was modified to simplify wording to promote comprehension among younger participants (differences between original and revised items can be found in Appendix A). This assessment asks participants to rate the degree to which a variety of statements about their relationship with their parents and peers are true for them. This assessment was adapted for the present study to only feature the mother/female guardian or friend relationship specifically (rather than parents and peers more generally). Participants in the social influence conditions completed this assessment about their social partner specifically; participants in the no influence condition completed this assessment about their mother and their best friend. Participants responded on a 3-point Likert scale with the following response categories: ‘always true,’ ‘sometimes true’ and ‘never true.’ Several items were reverse-coded such that higher scores indicate a stronger attachment. A score of overall attachment to the mother/female guardian was calculated as the sum of all maternal attachment items ($\alpha=.933$, 25 items). Similarly, a score of overall attachment to the peer was calculated as the sum of all peer attachment items ($\alpha=.927$, 25 items). The IPPA-R demonstrates good internal consistency for all variables and convergent validity, as the total Parent Attachment score is strongly positively correlated with the dimension of Care ($r=0.73$, $p<.001$) and moderately
negatively correlated with the dimension of Overprotection ($r = -0.51, p < .01$) on the Parental Bonding Instrument (Gullone & Robinson, 2005).

**Risk behavior.** Two behavioral tasks were used to assess participants’ risk behavior under different conditions of social influence (e.g., indirect and direct influence). All participants completed both tasks.

**Balloon Analogue Risk Task.** Risk behavior was assessed using the Balloon Analogue Risk Task-Youth (BART-Y: Lejuez, Aklin, Daughters, Zvolensky, Kahler, & Gwadz, 2007; modified from the original BART Lejuez et al., 2002) during conditions of indirect social influence. This computerized task attempts to model real-world risk taking behavior by presenting the participant with opportunities to balance the probability of reward versus loss. Participants are presented with a computerized balloon and given the chance to earn points by pumping the balloon through clicking a button. Participants are instructed that points may be exchanged for prizes at the end of the testing session. The youth version of the BART differs from the original only in that participants are awarded points (to be exchanged for prizes) instead of money. The youth task has been shown to have similar reliability and validity as the original BART (Lejuez et al., 2007). This task demonstrates good test-retest reliability ($r = .77$; White, Lejuez, & de Wit, 2008) and split-third reliability ($>.70$; Lejuez et al., 2002). Further, the task has been found to demonstrate convergent validity, in that it is related to self-reported risk-taking behaviors from middle adolescents to young adults (Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005).

To play the balloon game, participants were informed that for every click of the button, the balloon would inflate slightly more and points would be added to a tally counter on the screen. However, at a given threshold (unknown to the participant), the balloon would become
over-inflated and will pop – at which point, the counter would be reduced to zero and the participant would lose all of his or her points for that trial (as depicted in Figure 3). Thus, each click of the button exerts both an opportunity for greater reward, but also a risk of losing everything. Participants were given the chance to “cash out” their winnings at any time, thus ending that trial (also depicted in Figure 3). In cases where the balloon popped before the participant had cashed out, the winnings were lost. Participants participated in 20 trials of this task. Balloon breakpoints ranged from 1-8, 1-32, or 1-128 pumps. That is, for a 1-128 breakpoint, the probability that a balloon would pop on the first pump is 1/128, the probability for the second pump is 1/127, etc.

Participants completed this task in one of the four conditions outlined in the procedures description (i.e., solo, friend influence, mother influence, or conflicting influence/combined). In order to exert indirect social influence, social partners were instructed to observe the participant during the task but to remain silent throughout this task (as described in the procedures section). A primary risk score was calculated for each participant as the average number of pumps on unexploded balloons, with higher scores indicating greater risk taking.
Stoplight Game. Risk behavior was assessed using the Stoplight Game (Steinberg, Albert, Cauffman, Banich, Graham, & Woolard, 2008; based on a modification of the “Chicken” game used by Gardner & Steinberg, 2005) under conditions of direct influence. The Stoplight Game is a computerized driving simulation in which participants are asked to “drive” a car to a designated location as quickly as they can. The computer screen depicts a road with the participant’s vantage point as behind the wheel of the car (as shown in Figure 4). A clock is visible on the computer screen to show the participant how much time has elapsed during the game; sounds of a clock ticking are audible to the participant throughout the game. Music is also played during the game to simulate the car radio. Prior to the start of the task, a trained research assistant provides instructions and a demonstration of the game to the participants. Participants are informed that they can earn more money on the task based on how fast they arrive at the

Figure 3. Representation of BART Task (image courtesy of medicalxpress.com)
destination. Participants cross 32 intersections during this task and are forced to make decisions about whether and when to stop the car (by pressing the space bar) when they encounter a yellow traffic signal. Participants are informed that they cannot control the speed of the car and that the brakes only work after the traffic signal has turned yellow. Participants are told they can stop at the yellow traffic signal and wait for the light to turn green (costing a time delay of 3 seconds) or attempt to cross the intersection. Crossing the intersection successfully allows the participant to escape the time delay; however, if the light turns red while the participant is crossing the intersection, the car may crash in which case the participant will face a 6 second time delay. Crashes are accompanied by an image of a broken windshield on the computer screen and the sound of squealing tires and a loud crash. This task is advantageous because it offers a real-world scenario for assessing risk behaviorally, as compared to assessing participants’ perceptions of how they would respond to hypothetical risky situations (as previous research on adolescent susceptibility to social influence has previously relied upon).

Participants completed this task in one of the four conditions outlined in the procedures description (i.e., solo, friend influence, mother influence, or conflicting influence/combined). In order to exert direct social influence, social partners were instructed to offer verbal feedback or advice to the participant to either encourage or discourage risk taking, depending upon condition (as described in the procedures section). A risk index is calculated as the number of intersections in which the participant crashed or attempted to run through the intersection and the light turned red divided by the total number of intersections the participant faced that had an opportunity to make a decision about whether or not to brake (i.e., intersections with a yellow or red light). Higher values on the risk index reflect greater risky behavior during the task. The Stoplight
Game has demonstrated criterion validity, as it has been found to correlate with adolescents’ real-life antisocial risk behavior (Gardiner, 2013).

Figure 4. Representation of the Stoplight Game (image credit: Albert, Chein, & Steinberg, 2013)
PLAN OF ANALYSIS

Fidelity reports from the behavioral tasks were reviewed to ensure that social partners followed task instructions. Cases in which more than one quarter of a social partner’s task advice did not follow task instructions (e.g., if a social partner encouraged risk taking when he or she was supposed to discourage risk taking or vice versa) were flagged as potentially problematic. This resulted in three cases being removed from analyses involving the Stoplight Risk Index (i.e., Aims 3-5). Data were missing from one case on the Stoplight Task due to a computer glitch when saving the task data. None of the data for the BART task were problematic.

Bivariate correlations were examined to determine whether the anticipated covariates (e.g., age, gender, and race/ethnicity) were associated with each of the dependent variables of interest (e.g., risk taking on the BART and Stoplight Tasks). Gender was not associated with either outcome variable; therefore, it was not controlled for in any of the present analyses. Race/ethnicity was positively correlated with the Stoplight Risk Index ($r=.262, p=.010$) such that White adolescents took more risks than non-White adolescents; race/ethnicity was not correlated with the BART Risk Score. Age group was positively associated with the BART Risk Score ($r=.341, p=.001$) such that older adolescents took more risks than younger adolescents; however, this was not found in the Stoplight Game. Age group and race/ethnicity were controlled for in all subsequent analyses involving the two key outcome variables of interest. The BART Risk Score was not associated with the Stoplight Risk Index.

The main effects of indirect and direct maternal and peer influence on adolescents’ risk behavior in each of the two tasks were evaluated using independent factorial analyses of covariance, controlling for age group and race/ethnicity. Age was examined as a moderator of
the effect of social influence condition on adolescent risk behavior on each of the two tasks (i.e., BART and the Stoplight Game). The F-test of significance was used to assess the main and interaction effects. When the F value is greater than 1, more variation occurs between groups than within groups. The assumptions of normality were assessed through visual inspection of histogram plots of each dependent variable. Skewness and kurtosis values were in the acceptable range for the Stoplight Risk Index (Skewness=.419, Kurtosis=-.059) and the BART Risk Score (Skewness=.569, Kurtosis=.219). Homogeneity of variance was confirmed in each analysis using the Levene statistic; therefore, Tukey’s HSD tests were used to examine post-hoc differences between groups when a significant group difference was found.

Finally, moderation analyses were conducted using linear regression to examine the interactive effect of relationship factors (i.e., maternal and peer attachment, warmth, and hostility) on the association between social influence condition and adolescent risk, controlling for race/ethnicity. Independent maternal and peer models were run separately for each relationship factor. This research question sought to specifically compare the effect of relationship quality on adolescents’ susceptibility to maternal and peer influence when adolescents were faced with a decision about whether to follow advice from their mother or friend, but not both. Therefore, these analyses were conducted within the two combined conditions only (condition was dummy coded). A matrix scatterplot was constructed for each analysis to verify that the independent variables were linearly associated with the dependent variable. A residual scatterplot was examined for each analysis to confirm that the data met the assumption that the errors were normally distributed and the variance of the residuals was constant.
In analyses where no significant differences were observed, a post-hoc sensitivity power analysis was conducted using the program \textit{G*Power} (Erdfelder, Faul, & Buchner, 1996) to establish whether the present design yielded enough power to detect a significant effect. In all cases of non-significant findings, power analyses revealed the study was underpowered to detect small effects due to the limited sample size (N=97) in the present study. The present sample size is sufficient to detect large effects ($f > .36$) using ANCOVA, at the recommended .80 level (Cohen, 1988).
RESULTS

Aim 1. Examine the effect of indirect social influence on adolescents’ risk taking behavior across two stages of adolescent development.

A factorial analysis of covariance was performed to examine the main effects of indirect influence condition and age group on adolescents’ risk taking during the BART task, controlling for race/ethnicity (coded as White or non-White). This was examined by comparing risk scores from adolescents across the four experimental conditions (e.g., solo, mother, friend, and combined) and two age groups (e.g., middle adolescence and late adolescence). No differences in risk taking were observed between the four indirect influence conditions (p=.433); therefore, the null hypothesis of no differences in risk taking between conditions could not be rejected. However, there was a main effect of age on risk taking during the BART \( [F(1,88)=9.985, p=.002, \text{partial } \eta^2=.102] \) such that older adolescents engaged in higher mean levels of risk taking (i.e., pumping the balloon) than younger adolescents. Additionally, this analysis also examined the interaction effect of indirect influence and age group on the BART Risk Score, controlling for race/ethnicity. However, as shown in Table 2.1, this interaction was not significant (p=.760). Table 2.2 displays the means and standard deviations of the BART Risk Score (i.e., average number of pumps on unexploded balloons) as a function of condition and age.
Table 2.1

Two-way Analysis of Covariance for BART Risk Taking as a Function of Indirect Influence Condition and Age Group

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>BART Risk Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>1</td>
<td>172.95</td>
<td>1.276</td>
<td>.262</td>
<td>.014</td>
</tr>
<tr>
<td>Age Group</td>
<td>1</td>
<td>1353.571</td>
<td>9.985</td>
<td>.002</td>
<td>.102</td>
</tr>
<tr>
<td>Condition</td>
<td>3</td>
<td>125.179</td>
<td>.923</td>
<td>.433</td>
<td>.031</td>
</tr>
<tr>
<td>Age Group*Condition</td>
<td>3</td>
<td>53.015</td>
<td>.391</td>
<td>.760</td>
<td>.013</td>
</tr>
<tr>
<td>Error</td>
<td>88</td>
<td>135.565</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2.2

Means, Standard Deviations, and n for BART Risk Score as a Function of Indirect Influence Condition and Age Group

<table>
<thead>
<tr>
<th></th>
<th>Ages 13-14 years</th>
<th>Ages 16-17 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
</tr>
<tr>
<td>Solo</td>
<td>11</td>
<td>24.07</td>
</tr>
<tr>
<td>Friend</td>
<td>6</td>
<td>20.80</td>
</tr>
<tr>
<td>Mother</td>
<td>8</td>
<td>25.10</td>
</tr>
<tr>
<td>Combined</td>
<td>17</td>
<td>20.29</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>22.27</td>
</tr>
</tbody>
</table>
Aim 2. Examine the effect of direct maternal and peer influence on adolescents’ risk taking behavior across two stages of adolescent development.

A factorial analysis of covariance was performed to examine the main effects of direct influence condition and age group, as well as the interaction between the two on adolescents’ risk behavior on the Stoplight Task, controlling race/ethnicity (statistics are shown in Table 3.1). A statistically significant difference was found among the five conditions of direct influence (e.g., solo, mother, friend, risky mother/cautious friend, and cautious mother/risky friend) on adolescents’ Risk Index on the Stoplight Task \( F(4,82)=6.946, p<.001, \eta^2_p=.253 \). Pairwise comparisons indicate that adolescents in the friend only condition engaged in more risk than those in the solo \( (p<.001) \), risky mother/cautious friend \( (p<.001) \), and cautious mother/risky friend \( (p<.001) \) conditions. Likewise, adolescents in the mother only condition displayed a similar pattern of findings by engaging in greater risk-taking than adolescents in the solo \( (p=.002) \), risky mother/cautious friend \( (p=.006) \) and cautious mother/risky friend \( (p=.005) \) conditions. No differences were observed in the risk scores of those in the mother only and friend only conditions \( (p=.380) \). Similarly, no differences in risk taking were observed between those in the no influence condition and either of the combined conditions (risky mother/cautious friend \( p=.856 \); cautious mother/risky friend \( p=.903 \)). A significant effect of race/ethnicity on risk was also found, such that White adolescents tended to take greater risks on the Stoplight task than non-White adolescents \( (p=.027) \). However, there was no main effect of age group \( (p=.318) \) and the interaction between age and condition was not significant \( (p=.871) \), therefore, the null hypothesis of no age group differences in the effect of direct influence on adolescents’ risk taking cannot be rejected. Means and standard deviations among the five conditions and two age categories are shown in Table 3.2.
Table 3.1

Two-way Analysis of Covariance for Stoplight Risk Index as a Function of Direct Influence Condition and Age Group

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>Partial η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoplight Risk Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>1</td>
<td>.159</td>
<td>5.099</td>
<td>.027</td>
<td>.059</td>
</tr>
<tr>
<td>Age Group</td>
<td>1</td>
<td>.031</td>
<td>1.010</td>
<td>.318</td>
<td>.012</td>
</tr>
<tr>
<td>Condition</td>
<td>4</td>
<td>.216</td>
<td>6.946</td>
<td>.000</td>
<td>.253</td>
</tr>
<tr>
<td>Age Group*Condition</td>
<td>4</td>
<td>.010</td>
<td>.309</td>
<td>.871</td>
<td>.015</td>
</tr>
<tr>
<td>Error</td>
<td>82</td>
<td>.031</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.2

Means, Standard Deviations, and n for Stoplight Risk Index by Direct Influence Condition and Age Group

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th></th>
<th>Ages 13-14 years</th>
<th>Ages 16-17 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>n</td>
</tr>
<tr>
<td>Solo</td>
<td>26</td>
<td>.367</td>
<td>.189</td>
<td>11</td>
</tr>
<tr>
<td>Friend</td>
<td>15</td>
<td>.600</td>
<td>.206</td>
<td>6</td>
</tr>
<tr>
<td>Mother</td>
<td>17</td>
<td>.566</td>
<td>.177</td>
<td>7</td>
</tr>
<tr>
<td>Risky mother/ Cautious friend</td>
<td>18</td>
<td>.363</td>
<td>.158</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
<td>.4412</td>
<td>.202</td>
<td>41</td>
</tr>
</tbody>
</table>

Note: This table represents the means and standard deviations of the Risk Index on the Stoplight Task. The Risk Index is calculated as the number of intersections in which the participant crashed or attempted to run through the intersection and the light turned red divided by the total number of intersections the participant faced that had an opportunity to make a decision about whether or not to brake (i.e., intersections with a yellow or red light).
Aim 3. Directly compare whether adolescents are more susceptible to direct influence from a parent or peer.

The primary aim of the study sought to explore how adolescents behaved when they received contradictory influence from their mother and friend simultaneously. To examine whether adolescents’ demonstrated greater susceptibility to influence from their friend or mother, an independent samples t-test was performed among adolescents in the two combined conditions only (i.e., risky mother/cautious friend and cautious mother/risky friend). An analysis of covariance revealed no significant differences in the mean risk scores of adolescents in the risky mother/cautious friend condition and the cautious mother/risky friend conditions, controlling for age group and race/ethnicity ($p=.907$). That is, adolescents in the combined conditions engaged in similar levels of risk behavior regardless of whether they received encouragement or discouragement of risk taking by their mother or friend.

A factorial analysis of covariance evaluated whether adolescents’ susceptibility to maternal and peer influence during conditions of conflicting, simultaneous influence varied by age group, controlling for race/ethnicity. No significant age by condition effect was found ($p=.985$); however, there was insufficient power to detect an effect (observed power$^b=.050$).

Aim 4. Examine the effect of relationship characteristics on adolescents’ resistance to simultaneous conflicting direct influence from a parent and peer.

Finally, a series of multiple regression analyses were performed to examine whether relationship factors affected whether adolescents’ were more susceptible to influence from their mother or friend. In order to assess the way adolescents behave when they are faced with conflicting, simultaneous advice, these analyses were conducted only among adolescents in the two combined conditions. First, the effect of each of the maternal relationship qualities on the
association between condition and risk behavior was examined independently. Maternal hostility was found to moderate the effect of condition on risk taking \( \beta = .443, t(25) = 2.105, p = .045 \), controlling for ethnicity, peer relationship factors (e.g., hostility, warmth, and attachment), and maternal warmth and attachment (as shown in Table 4). Therefore, the significant interaction can be interpreted such that the effect of direct influence condition on adolescents’ risk during the Stoplight Game varied depending on maternal hostility. This interaction can be classified as a cross-over interaction, such that the relation between maternal hostility and risk during the Stoplight Game was negative for youth in the risky mother/cautious friend condition (i.e., higher hostility was associated with lower risk scores) and positive for youth in the cautious mother/risky friend condition (i.e., higher hostility was associated with higher risk scores). The overall model accounted for approximately 25% of the variance in adolescent risk behavior on the Stoplight Task \( R^2 = .248 \). The interaction was probed by calculating the simple slopes of risk on influence condition at high (+1SD) and low (-1SD) levels of maternal hostility; however, neither slope was significantly different from 0. Within-group regression analyses were conducted to determine the effect of maternal hostility for each direct influence condition. The association between maternal hostility and risk score was non-significant \( (B = -.280, p = .260) \) for the risky mother/cautious friend condition; however, there was a trend-level positive association between maternal hostility and risk score for the cautious mother/risky friend condition \( (B = .468, p = .058) \). No significant interactions were observed using maternal warmth or maternal attachment as a moderator of the effect of condition on risk during the Stoplight Task.

Finally, to determine whether the association between direct influence condition and adolescent risk taking varied as a function of friend relationship quality, moderation analyses were performed using three relationship factors (e.g., hostility, warmth, and attachment). None of
the three indicators of friend relationship quality produced a significant interaction effect, suggesting that relationship quality does not appear to affect adolescents’ susceptibility to peer influence.

Table 4

*Moderated Multiple Regression Analysis Summary for Direct Influence Condition, Maternal Hostility, and Interaction of Condition by Hostility, Controlling for Ethnicity and Relationship Factors, Predicting Stoplight Risk Index (N=35)*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>β</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race/Ethnicity</td>
<td>.032</td>
<td>.949</td>
<td>-0.099</td>
</tr>
<tr>
<td>Peer Attachment</td>
<td>-0.006</td>
<td>.132</td>
<td>-0.013</td>
</tr>
<tr>
<td>Peer Warmth</td>
<td>0.057</td>
<td>.336</td>
<td>-0.062</td>
</tr>
<tr>
<td>Peer Hostility</td>
<td>-1.64</td>
<td>.345</td>
<td>-0.515</td>
</tr>
<tr>
<td>Maternal Attachment</td>
<td>0.000</td>
<td>.955</td>
<td>-0.009</td>
</tr>
<tr>
<td>Maternal Warmth</td>
<td>0.057</td>
<td>.592</td>
<td>-0.160</td>
</tr>
<tr>
<td>Maternal Hostility</td>
<td>-1.834</td>
<td>.071</td>
<td>-3.834</td>
</tr>
<tr>
<td>Condition</td>
<td>0.004</td>
<td>.949</td>
<td>-0.111</td>
</tr>
<tr>
<td>Maternal Hostility*Condition</td>
<td>0.443</td>
<td>.045</td>
<td>0.010</td>
</tr>
</tbody>
</table>

*Note: Model controls for ethnicity, peer relationship factors, and maternal relationship factors. Race is dummy coded (White is the reference group). Condition is dichotomized such that Cautious Mother/Risky Friend is the reference group.*
Figure 5. Moderation Effect of Maternal Hostility by Direct Combined Influence Condition on Stoplight Risk Index

Note: Maternal hostility has been mean-centered.
DISCUSSION

Considerable research has acknowledged the effects of peer influence on adolescent risk behavior, demonstrating that adolescents tend to take greater risks in the presence of peers than when alone (Albert & Steinberg, 2011; Albert, Chein, & Steinberg, 2013). The results of the present analyses indicate quite clearly that the link between social influence and adolescent risk taking extends beyond peer influence to include maternal influence as well. Specifically, while mother’s positive influence has previously been found to reduce adolescent risk-taking (Telzer, Ichien, & Xu, 2015), this is the first study to directly examine the association between negative maternal influence and adolescent risk behavior. Findings indicate that mothers are capable of influencing their adolescent children to engage in risky behavior, as adolescents whose mothers/female guardians encouraged risk-taking were found to take more risks than adolescents who received no influence. Similarly, direct negative peer influence was found to also increase adolescent risk behavior (as compared to adolescents in the control condition, who did not receive influence).

Although this research reveals that mothers and friends are able to negatively influence adolescents’ risky behavior, the present findings suggest that positive influence can weaken the effect of such negative influence. That is, adolescents who experienced positive and negative influence simultaneously were no more likely to engage in risk behavior than those adolescents who experienced no influence at all. Further, adolescents who experienced both positive and negative influence were less likely to engage in risk taking than adolescents who only experienced negative influence. Essentially, these results demonstrate that positive influence can provide a buffer against the effects negative influence. This appears to be true regardless of
whether the positive influence comes from a mother or a friend. It is possible that when adolescents are faced with competing influences, they become overwhelmed by the conflicting information they are receiving and are unable to process. An alternate explanation is that adolescents may be more likely to doubt the validity of the information they are being presented from one source if it is contradicted by a second source. Regardless of the reason, it appears that when adolescents receive inconsistent advice from two sources they chose to ignore the advice and follow their own instincts instead.

Despite the evidence for the effects of direct influence on adolescent risk behavior during the Stoplight Game, the present study found no support for the effect of indirect influence on risk taking during the Balloon Analogue Risk Task. However, comparisons between these types of influence can not be made in the present study, given the use of distinct tasks to measure these effects. The risk behavior of adolescents who received indirect social influence (i.e., experienced the presence and observation of another individual during the BART task) from a mother, friend, or both their mother and friend did not differ from that of adolescents in the no influence condition. Research on the effects of indirect influence on adolescent behavior and decision-making has been mixed. Some evidence suggests indirect peer influence impacts adolescents’ risky decisions (O’Brien, Albert, Chein, & Steinberg, 2011; Chein, Albert, O’Brien, Uckert, & Steinberg, 2011), whereas other research has found that indirect influence does not affect adolescent behavior (Reynolds, MacPherson, Schwartz, Fox, & Lejuez, 2014; Pfeffer & Hunter, 2013). However, this may be due to differences in the operationalization of “indirect” influence. Studies that produced a significant effect of indirect peer influence permitted peers to speak to the participant during the task (although they were instructed to avoid comments that might intentionally bias behavior), whereas studies that did not find an effect required peers to remain
silent and only observe during the task. For example, in their study of peer influence effects, Chein and colleagues (2011) permitted peers to make comments about the participant’s performance on the task and their beliefs about how the participant would perform on the task. While this type of influence may not directly instruct adolescents to perform in a certain way, it represents more than simply the presence of peers (as it has sometimes been described) and therefore is not an equal comparison to the present study, which required social partners to remain silent throughout the task. The study by Reynolds and colleagues (2014) provides a more direct comparison, as this study implemented the same procedure (i.e., peer observation without verbal or non-verbal feedback) to compare the effects of no influence, indirect influence, and direct influence using the BART (the same task used to assess indirect influence effects in the present study). Although Reynolds and colleagues (2014) found adolescents in the direct (i.e., encouraging risk) condition took more risks than those in the solo condition, they found no differences in risk taking between youth in the solo and indirect (i.e., silent observation) conditions. The lack of support for the effects of indirect peer influence in the present study and other studies that have operationalized “peer presence” similarly suggests the need for consistency among researchers in the definition of peer presence and indirect social influence, as there appears to be an important distinction between silent and non-silent social observation.

Susceptibility to Social Influence Across Development

Contrary to the study’s hypothesis, adolescents’ susceptibility to influence did not appear to vary across development. This was true both when examining the effects of indirect influence, as well as of direct influence. This finding is not consistent with prior research, which has produced age differences in susceptibility to peer influence during the transition from childhood to adulthood (Steinberg & Monahan, 2007; Sumter, Bokhorst, Steinberg, & Westenberg, 2009).
There are several potential explanations for why age differences did not emerge in the present study. First, the small sample size may have hindered the ability to detect age effects. Second, prior research demonstrating age differences in susceptibility to social influence has largely been conducted using self-report measures. The present study is one of only a handful of studies to examine developmental differences in adolescents’ ability to resist social influence using a performance-based measure of social influence susceptibility. Of studies employing a performance-based measure, findings have been mixed. For example, Gardner and Steinberg (2005) explored the association between age and resistance to peer influence on a risk-taking task among adolescents (aged 13-16), young adults (aged 18-22), and adults (aged 24 and older) and found that peer influence effects on risk taking were stronger for adolescents and young adults than for adults. However, it is important to note that the age groups in the Gardner and Steinberg (2005) study differ from those in the present sample. Whereas their study compared adolescents to adults, the present study examines two periods within adolescence. Longitudinal research comparing parents’ and peers’ influence on smoking behavior of individuals from 6th to 11th grade revealed that adolescents’ susceptibility to peer influence and parent influence did not vary across grade level (Chassin, Presson, Sherman, Montello, & McGrew, 1986). Therefore, it is possible that developmental differences in susceptibility to social influence do not exist within the periods of adolescence used in the present study and a wider age range is needed to detect age differences that may exist. Examination of the plots of the mean risk scores by condition and age suggests a pattern of interaction may exist for participants in the peer condition and mother conditions, with peers demonstrating somewhat higher levels of influence than mothers during early adolescence, but similar levels of influence during late adolescence; however, these differences were not significant in the present sample.
**Relationship Factors**

It is somewhat reassuring that adolescents in the present study were not uniformly influenced by one source of influence (i.e., mother or friend) over another. Rather, relationship factors appeared to affect who adolescents were more influenced by. Maternal hostility emerged as a key factor that affected adolescents’ susceptibility to their mothers’ influence, more so than maternal warmth or attachment. That is, negative relationship aspects seem to have a greater effect on adolescents’ susceptibility to influence than positive relationship aspects. One possible explanation for the larger effect of maternal hostility is that maternal hostility reflects active and overt conflict in the parent-child relationship, whereas lack of warmth and poor maternal attachment tend to reflect more covert or subconscious parenting practices. Alternately, one could speculate that the larger effect of hostility (as compared to other aspects of the maternal relationship) could be reflective of the notion that mothers are traditionally seen as warm and caring. Maternal hostility violates social norms and may be less expected, and perhaps, therefore, more detrimental to the parent-child relationship as a result. What is more, maternal hostility only seemed to affect adolescents’ risk taking when mothers encouraged caution and did not affect adolescents’ risk taking when mothers encouraged risk. Therefore, hostile mothers may be less able to influence their adolescent children to avoid risky behavior than mothers who are less hostile. This finding has important practical implications, as it suggests that mothers who yell and call their children names are in a poorer position to protect their children from risk, as their adolescent children will be less likely to heed their warnings. If mothers wish to have a stronger influence over their adolescent children, they should be careful to minimize their own hostility toward their children.
Surprisingly, peer relationship quality did not appear to affect adolescents’ susceptibility to peer influence. Adolescents with high quality friendships were just as influenced by their friend as adolescents with poor friendship quality. This is inconsistent with some prior research, which suggests that positive friendship quality tends to increase adolescent conformity for some behaviors (reviewed by Brechwald & Prinstein, 2011), such as substance use (Urberg, Luo, Pilgram, & Degirmencioglu, 2003) and prosocial behavior (Barry & Wentzel, 2006). However, this finding is consistent with other research, which has found no effect of friendship quality on peer deviancy training (Poulin, Dishion, & Hass, 1999). Researchers have recognized the need for further research on this topic, as few studies have explore the effects of relationship quality on adolescents’ susceptibility to peer influence (Berndt, 2002).

Limitations and Strengths

In spite of this study’s many strengths, it is limited in ways that may have implications for the external validity of the study. First, the sample was gathered using convenience sampling, rather than random sampling. One consequence of this method is the potential for sampling bias. Second, the final sample represents less than one quarter of the original pool of potential participants. Considering the high volume of potential participants who were nonresponsive, it is likely that this study was affected by response bias. Finally, the sample size was relatively small and therefore the power to detect effects was limited, particularly for more complex analyses (such as interaction effects). Replications of this study with larger sample sizes are needed.

This study was also limited in its ability to draw comparisons between direct and indirect influence, as these constructs were assessed using two different and uncorrelated tasks. The decision to use separate tasks was made in an effort to avoid practice effects from having participants complete the same task multiple times. Prior research has demonstrated practice
effects on the BART task when examining the effects of peer influence (Reynolds, MacPherson, Schwartz, Fox, & Lejuez, 2014). It will be useful for future research to explore whether these findings (or lack of findings for indirect influence) carry over to different tasks and situations.

The study was also limited in its ability to examine developmental differences due to the cross-sectional nature of the study design. Future research should be conducted longitudinally, using age as a continuous variable. In an effort to limit the sample size needed, the present study focused specifically on maternal influence and influence from a friend from the same grade and gender. Additional research should examine different sources of influence (e.g., fathers, siblings, romantic partners, and teammates) and explore how influencer-characteristics (e.g., age, gender, race, and status) affect adolescents’ susceptibility to social influence.

Among the strengths of the present study was the use of random assignment to experimental conditions, which served to limit extraneous variables and improve the internal validity of the study. Internal validity was also strengthened by the fact that the study sessions were completed in a laboratory setting, as it minimized external factors that could have unintentionally affected the results. The most noteworthy strength of the present study pertains to the measurement of the key constructs. Specifically, the present study advances prior research by utilizing a performance-based measure of susceptibility to social influence. This is one of only few studies to do so, as the majority of research on this construct has been conducted using self-report measures. Self-reports of susceptibility to social influence may yield less accurate information, as some aspects of social influence occur outside an individual’s conscious awareness and may be subject to bias.
Conclusions

Overall, this study supports the notion that mothers and female guardians continue to play an important role in the lives of their adolescent children. A wealth of research has asserted the effect of peer influence during adolescence (which is also found in the present study), but fewer studies have focused on the direct effects of maternal influence during this time period. Although past research has demonstrated that mothers can have a positive influence on their adolescents’ decisions and behavior (Telzer, Ichien, & Qu, 2015), the present study demonstrates that mothers can also influence them in a negative manner – specifically, to engage in risky behavior. Prior research on the negative influence of parents has largely been correlational in nature; however, the present study is the first to show through an experimental design that mothers can influence their adolescent children to take greater risks. Furthermore, these results underscore the important role of relationship quality in adolescents’ susceptibility to social influence, as mothers with better relationships with their adolescent children had a greater influence in reducing their risk behavior. Although this finding suggests that developing a high quality parent-child relationship may serve to strengthen parents’ influence over their adolescent child’s behavior, it also brings awareness to the fact that parental influence is not always positive. Rather, adolescents can be negatively influenced by the important adults in their life; such negative influence can lead adolescents to engage in risky behavior. While the present study examined the effects of maternal influence on adolescents’ risky driving, associational studies suggest these findings might extend to broader domains, such as substance use (Andrews, Hops, & Duncan, 1997; Pentz, Shin, Riggs, Unger, Collison, & Chou, 2014) and delinquency (Loeber & Stouthamer-Loeber, 1986; Farrington, Jolliffe, Loeber, Stouthamer-Loeber, & Kalb, 2001).
Parents, and mothers especially, should be aware of the potential influence they hold over the actions and behaviors of their adolescent children.

Yet, although these findings reveal that both mothers and friends are capable of influencing adolescents to take risks, they also show that positive influence can serve to buffer the effects of negative influence. When adolescents in the present study experienced encouragement and discouragement of risk taking at the same time, they were no more likely to engage in risk behavior than adolescents who experienced no influence. This finding has important implications for prevention and intervention, as it suggests that positive sources of influence may serve to reduce adolescents’ involvement in risky behavior. Mentoring programs, such as Big Brothers Big Sisters, in which adolescents develop a close relationship with a positive role model, may serve to reduce some of the effects of negative social influence. Future research should explore how relationships with important adults (i.e., coaches, mentors, and teachers) affect adolescents’ susceptibility to negative social influence.
References


Analogue Risk Task (BART), *Journal of Experimental Psychology: Applied, 8*(2), 75-84. doi: 10.1037//1076-898X.8.2.75

Lejuez, Aklin, Daughters, Zvolensky, Kahler, & Gwadz, 2007


Lejuez, Aklin, Daughters, Zvolensky, Kahler, & Gwadz, 2007


Appendix A – Modifications on Inventory of Parent and Peer Attachment-Revised

Original items

**Parent Attachment Items**

I feel my parents are successful as parents.

I have to rely on myself when I have a problem to solve.

I like to get my parents’ point of view on things I’m concerned about.

I feel it’s no use letting my feelings show.

My parents sense when I’m upset about something.

Talking over my problems with my parents makes me feel ashamed or foolish.

I get upset easily at home.

When we discuss things, my parents consider my point of view.

My parents trust my judgment.

My parents encourage me to talk about my difficulties.

I don’t know whom I can depend on these days.

When I am angry about something, my parents try to be understanding.

My parents don’t understand what I’m going through these days.

I can count on my parents when I need to get something off my chest.

I feel that no one understands me.

If my parents know something is bothering me, they ask me about it.

**Peer Attachment Items**

I like to get my friends’ point of view on things I’m concerned about.

My friends sense when I’m upset about something. When we discuss things, my friends consider my point of view.

Talking over my problems with my friends makes me feel ashamed and foolish.

My friends encourage me to talk about my difficulties.
I feel the need to be in touch with my friends more often.

My friends don’t understand what I’m going through these days.

I feel alone or apart when I am with my friends.

I feel my friends are good friends.

When I am angry about something, my friends try to be understanding.

My friends are concerned about my well-being.

I can count on my friends when I need to get something off my chest.

It seems as if my friends are irritated with me for no reason.

I tell my friends about my problems and troubles.

If my friends know something is bothering me, they ask me about it.

**Revised item (where changed)**

My parents are good parents.

I can depend on my parents to help me solve a problem (R)

I like to get my parents’ view on things I’m worried about.

It helps to show my feelings when I’m upset (R).

My parents can tell when I’m upset about something.

I feel silly or ashamed when I talk about my problems with my parents.

I easily get upset at home.

When I talk about things with my parents they listen to what I think.

My parents listen to my opinions.

My parents support me to talk about my worries.

I don’t know who I can depend on.

When I am angry about something, my parents try to understand.

My parents understand my problems (R).

I can count on my parents when I need to talk about a problem.
No one understands me.
If my parents know that I am upset about something, they ask me about it.
I like to get my friends’ opinions on things I’m worried about.
My friends can tell when I’m upset about something.
When we talk, my friends listen to my opinion.
I feel silly or ashamed when I talk about my problems with my friends.
My friends support me to talk about my problems.
I feel the need to be around my friends.
My friends don’t understand my problems.
I do not feel like I belong when I am with my friends.
My friends are good friends.
When I am angry about something, my friends try to understand.
My friends care about the way I feel.
I can count on my friends to listen when something is bothering me.
My friends get annoyed with me for no reason.
If my friends know that I am upset about something, they ask me about it.

(R) refers to revised items that are scored in reverse to their equivalent item on the original IPPA.