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The Effect of Peer Presence on Adolescent Risk-Taking Behaviors

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ABSTRACT

The emergence of risk-taking in adolescence, which can have life altering implications such as teenage pregnancy, car accidents, or drug overdoses, has been attributed to several different aspects of development including increased reward sensitivity and immature cognitive control contingent on motivation. Recent psychological research also indicates that adolescent risk-taking increases in the presence of peers. It remains unclear, however, whether this peer effect on risk-taking is attributable to amplified reward sensitivity or is a more general effect of experimenter expectancy and social desirability. This study builds upon this research using a computerized risk-taking task with stimuli that illustrate the probabilities of negative and positive outcomes. We manipulated whether and how participants interacted with a peer while completing the task, with alone, peer present, and virtual peer conditions, as well as the experimenter expectancies conveyed to the participant, with risk-seeking versus risk-aversion instructions. We hypothesized that peer presence would interact with perceived experimenter expectations; specifically, we predicted that peer and virtual peer presence would increase risk-taking, but only in the risk-seeking instructions condition. Results from a university undergraduate sample indicated a main effect of win-to-loss probability on behavior, and a main effect of social context on risk behavior. The results suggested that peer presence increases adolescent risk-taking in both physically present and virtual peer conditions, and that manipulating experimenter expectancies may contribute to differences in risk-taking during laboratory risk-taking assessments.

Key Words: risk-taking, peer influence, adolescence

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The Effect of Peer Presence on Adolescent Risk-Taking Behaviors

Adolescence is a stage of the lifespan often characterized by impulsive and risky behaviors. Adolescents frequently engage in high-risk activities, including, but not limited to, underage drinking, driving while under the influence of drugs or alcohol, and unprotected sex (Crone & Dahl, 2012; Gardner & Steinberg, 2005). The 2013 National Youth Risk Behavior Survey conducted by the Center for Disease Control discovered that, of the U.S high school students currently sexually active, 41% engage in unprotected sex. These high-risk behaviors have life altering or, in the worst cases, deadly implications, such as teenage pregnancy, car accidents, and drug overdoses. Psychological research aimed at better understanding adolescent risk-taking behaviors suggests that these behaviors are heavily influenced by the presence of peers. Understanding the relationship between peer presence and adolescent risk-taking will lead to better interactions with adolescents, the development of more accurate adolescent drug and alcohol prevention programs, and the strengthening of pre-existing techniques aimed at preventing peer pressure and risky behaviors in adolescence.

Risk-taking involves engaging in behavior where there is a predictable potential for unwanted or negative outcomes (Boyer, 2006; Reyna & Farley, 2006). Studying the development of risk-taking behaviors is essential as these behaviors may lead to undesirable habits and lifestyles in adulthood (Reyna & Farley, 2006). For example, choosing to smoke as an adolescent has the potential to lead to a lifelong nicotine addiction, likewise unsafe sexual activity has the potential to lead to sexually transmitted diseases with lifelong consequences. Often, adolescent risk-taking not only affects the adolescent, but also those around them. For example, driving under the influence of

alcohol creates a life-threatening situation for the driver in addition to any other drivers on the road. It is important to examine and understand what developmental factors play into adolescent risk-taking, so we then might better understand what steps should be taken to prevent such risky behaviors in adolescence (Steinberg, 2015). Efforts to reduce risk-taking behaviors will benefit society as a whole by reducing the changes of the many undesired outcomes of risk-taking and therefore increasing the overall well-being of the society (Steinberg, 2008).

While real-world measurements of behavior are essential and informative, they do not allow analysis of what mechanisms play into an adolescent's decision to engage in or avoid a particular risk. To examine these mechanisms, experimental psychologists have developed risk-taking tasks that intend to capture participant's sensitivity to gains and losses of their choices. For example, spinning a multi-sectioned wheel with varied probability of landing on sections that result in either earned or lost points (Smith, Chein & Steinberg, 2014), driving a virtual car in which further distance driven gives more points, but greater risk of a crash (Gardner & Steinberg, 2005), or pumping a virtual balloon where more pumps increases money earned, but also increases the risk of the balloon popping and all money being lost (Lejuez et al., 2002). The use of these risk-taking tasks has indicated that adolescents and young adults engage in more risk-taking behaviors compared to adults over the age of 25, and that risk-taking among adolescents and young adults increases when they are around their similarly aged peers (Gardner & Steinberg, 2005; Silvas, Chein, & Steinberg, 2016). A similar increase in risk-taking around peers has not been found to occur in adults over 25-years of age. The phenomenon that peers increase adolescent risk-taking, often referred to as the "peer

effect", has been studied in numerous different contexts including risk-taking with exposure to familiar peers (Gardner & Steinberg, 2005), as well as risk-taking with exposure to unfamiliar people of the same age and gender (Weigard, Chein, Albert, Smith, & Steinberg, 2011). Risk-taking in adolescence has also been studied in digital contexts with peer presence through online instant messaging (MacLean, Grier, Henry, & Wilson, 2013). The results from several behavioral risk-taking tasks have supported the peer effect in that adolescents in familiar peer groups, unfamiliar peer groups, and digital peer groups all increased their risk-taking behaviors in the presence of a peer, despite the likelihood of negative consequences being fully specified (Smith, Chein, & Steinberg, 2014).

The increase in adolescent risk-taking in the presence of peers has been attributed to different developmental processes in the adolescent brain and reward preference. Adolescents have been shown to prefer more immediate rewards compared to adults (O'Brien, Albert, Chein, & Steinberg, 2011). Additionally, it has been advocated that adolescent risk-taking is in no part due to ignorance, a lack of knowledge of risk consequences, or an inability to accurately perceive risks (Steinberg, 2007; Reyna & Farley, 2006). An imbalance of cognition and reward sensitivity has been suggested as a potential reason behind increased adolescent risk-taking (Defoe, Dubas, Figner, & van Aken, 2015; Steinberg, 2008). For instance, during adolescence, cognitive control, which is controlled in the dorsal lateral pre-frontal cortex (dlPFC), may be overridden by increased reward sensitivity, found in the ventral striatum or reward processing center of the brain (Defoe et al., 2015; Steinberg, 2008). Increased adolescent risk-taking may be the result of two brain systems; the socio-emotional system and the cognitive control

system, interacting with each other and combining to increase risk taking (Steinberg, 2008; Shulman et al., 2016; Evans & Stanovich, 2013; Casey, Getz, & Galvan, 2008). Changes in the socio-emotional system may increase reward sensitivity, indicated by increased activation of the ventral striatum. Functional magnetic resonance imaging (fMRI) scans have shown increased activity in the ventral striatum during peer risk-taking tasks. These changes in reward sensitivity developmentally emerge before cognitive control, which suggests that reward sensitivity may overpower cognitive control and therefore increase risk-taking behaviors. In theory, developmental changes in the ventral striatum, which amplify reward sensitivity, occur before the cognitive control system is fully-developed. Changes in both the cognitive control system and socio-emotional system are often associated with changes due to puberty, such as hormonal changes and maturation (Steinberg, 2008; Steinberg, 2016; Casey et al., 2008).

In relation to the proposed heightened reward sensitivity in adolescence, Shulman and Cauffman (2013) suggest that reward bias in judgment peaks in late adolescence, and contend that rewards are viewed more favorably by adolescents compared to adults, which may contribute to heightened risk-taking. Contrary to the beliefs that increased risk-taking in adolescents is due to increased activation in the ventral striatum and lack of cognitive control, increased adolescent risk-taking could potentially be attributed to adolescent's increased flexibility in cognitive control which is contingent on motivational aspects (Crone & Dahl, 2012). Crone and Dahl (2012) suggest that because social rewards like peer acceptance are often very important in adolescence and potentially the most salient reward to them, adolescents then may have greater motivation to achieve such rewards. Therefore, the flexibility in adolescents' cognitive control systems may

respond to this motivation with more impulsive and risky behavior in order to gain the social or peer rewards.

Adolescents' motivation to obtain peer rewards, specifically social acceptance and their desire to avoid rejection may lead to higher rates of conformity, which may also contribute to the peer effect on risk-taking behaviors in adolescence (Knoll, Magis-Weinberg, Speekenbrink, & Blakemore, 2015). According to Utech and Hoving (1969), adolescents are more likely to conform to peers than any other age group, and this conformity significantly increases from childhood to adolescence, as conformity to parental guidelines gradually decreases. When adolescents were asked to rate various behaviors or tasks on their level of risk, adolescents were more likely than any other age group to change their ratings of risk, to match ratings of previous adolescents (Knoll et al., 2015). The implications of such findings are vast, and suggest another possible role peers play in the peer effect on adolescent risk-taking.

To summarize, the increase in adolescent risk-taking has been attributed to increased reward sensitivity, conformity, and motivation to obtain peer rewards. We built upon the previous research and attributions, by suggesting that the increase in adolescent risk-taking with exposure to peers may also be influenced by experimenter demands and social desirability. Experimenter expectations and demand characteristics are often controlled by the experimenter to eliminate the potential change in a participant's behavior in response to understanding what the experimenter aims to find. Orne (1962) suggested that participants strive to be good participants and try to do what is expected of them in hopes to benefit the experiment. By manipulating the proposed expectations

placed on the participant, we examined the interaction between experimenter expectancies and peer presence.

Previous research suggests that peer presence always increases risk-taking in adolescence. However, we propose that peer presence may increase risk-taking because the experimental instructions indicate to do so; risk-taking is the behavior expected of them, as defined by the instructions they are given. Would an experimenter explicitly stating that a task is measuring risk aversion cause risk-taking to decrease, or would peer presence still increase risk-taking despite the aversion condition? Participants conform to experimenter expectations because they want be a good participant (Orne, 1962; Nichols & Maner, 2008). Their motivation to be a good participant is most likely driven by their desire to be accepted by those around them, the need to belong (Baumeister & Leary, 1995), and their conditioned obedience to authority (Miller, Collins, & Brief, 1995). As stated before, peer rewards are considered to be the most salient to adolescents; their behavior is often motivated by obtaining peer rewards, most commonly acceptance, and avoiding peer punishments, most commonly rejection (Crone & Dahl, 2012). In response, we contended that adding the additional peer component to the already explicitly stated experimenter expectations would increase adolescents' desire to adhere to the expectations because of their increased motivation to achieve acceptance. This increased desire to adhere to the expectation would, in theory, increase or decrease risk-taking in the presence of peers, depending on the expectations of the experimenter. We predicted this change in risk-taking would most likely occur in adolescents more than adults, because of the salience of peer rewards in adolescence (Crone & Dahl, 2012). In theory,

adding a peer component would further increase an adolescent's desire for acceptance, because that reward is so important in adolescents.

We suggested that adolescents would change their risk-taking behavior, either to be more or less risky, based on the experimenter expectancies conveyed to them. For instance, when the experimental expectancy of risk aversion was conveyed to the participant we predicted that peers would cause participants to be more risk averse. The same goes for when the experimental expectancy of risk-taking was conveyed to the participant; we predicted that peers would cause participants to engage in more risky behavior. Since peer rewards, the desire for acceptance and the urge to avoid rejection, are not as important in adulthood, as they are in adolescence (Crone & Dahl, 2012), we hypothesized that adult risk-taking would not be as influenced by experimental expectancies and peer presence. We specifically hypothesized that if an experimenter subtly conveyed that the task was designed to examine risk taking, then participants, especially those who completed the task in the presence of a peer, would engage in more risk-taking behaviors, but when an experimenter subtly conveyed that the task is designed to examine risk aversion, then participants, and again especially those who completed the task in the presence of a peer, would engage in less risk-taking behaviors.

The Probabilistic Gambling Task (PGT) is a "wheel of fortune" type task where participants choose whether or not to spin a wheel based on the probability of it stopping in sections that specify positive versus negative outcomes (Burnett, Bault, Coricelli, & Blakemore, 2010; Smith et al., 2014). The different sections of the wheel indicate a certain result. For example, each wheel consists of three colored sections: green, red, or gray. Landing on a green section indicates a win, red indicates a loss, and the gray section

is neutral neither win nor loss. Participants have the option to either play or pass on a wheel. Once a participant chooses to "play", the wheel spins and then lands on one of the three different colored sections. The use of the PGT has indicated that adolescents still increase risk-taking in the presence of peers even when the probability of a negative outcome occurring is clearly stated (Smith et al., 2014).

The current experiment used a modified version of the PGT used in the Smith, Chein, and Steinberg (2014) study. The version of the PGT used by Smith et al., (2014) did not include an animated spinning wheel, but rather a picture of a wheel followed by another picture of a wheel with blurred colors, and then a final picture of the wheel with an arrow that indicated the outcome. The PGT was modified to include a more animated spinning wheel, which we argued, might lead to more anticipation of a reward or punishment. The current experiment also varied the way in which participants interacted with a peer while completing the task. In addition, the study manipulated the experimental expectancies conveyed to the participant. We hypothesized that the different conditions of peer presence would have varying effects on risk-taking behaviors. Specifically, we hypothesized that manipulating the perceived experimental expectations would potentially change the effect of the peer on risk-taking behaviors.

A modified version of the PGT was used in this research, which implemented a virtual peer condition. This condition allowed participants to receive instant messages from a peer while they completed the task. The virtual peer condition aimed to create an environment similar to a digital one that many adolescents and young adults interact through every day. Text messaging and social media sites such as Facebook and Twitter have become immensely popular forms of peer interaction in the past decade.

Understanding the implications of a virtual peer effect on risk-taking are important in understanding the peer effect on risk-taking as a whole. It is important to examine how different peer contexts affect risk-taking in adolescence. By comparing three conditions, alone, actual peer, and virtual peer, we investigated how much influence each condition has on risk-taking. The research aimed to answer three questions: Are adolescents more susceptible to risk-taking with exposure to a physically present peer or with a virtually present peer? Or are the effects on risk-taking the same in both conditions? Does explicitly stating either risk-taking or risk-aversion instructions cause a change in risk behavior around peers?

Method

Participants

Participants were 166 students (94 female, 72 male), all between the ages of 18-23-years (M_{age} = 19.22-years, SD = 2.34), recruited from Psychology courses at Georgia Southern University using online participant recruitment software. An additional three participants were run but excluded from the reported analyses, two of them because they were more than three standard deviations above the mean age, and a third due to experimenter error. All participants received class credit for their participation in the study. Participants were then randomly assigned to receive either a risk-taking (N = 85, 44 female, 41 male) or risk-aversion (N = 81, 50 female, 31 male) instruction set and then to the additional three conditions: peer (N = 54, 31 female, 23 male), virtual peer (N = 58, 31 female, 25 male), or alone (N = 55, 30 female, 25 male).

Stimuli

In each trial of the task, participants were shown a "spinner wheel" with sectors of the wheel differently colored (i.e., a "wheel of fortune" like stimulus), (See Figure 1 in Appendix A). The different colored sectors represented the probability of gaining 10 points (green), losing 10 points (red), or neither gain nor loss (gray). Each trial had a different proportion of each of the three outcomes (i.e., colors) and participants chose to either "play or pass" the wheel by pressing either the 1 or 2 key on the number pad of a keyboard. Six different win-to-loss ratios were portrayed on wheels throughout the game, these included: 1.5, 1.0, 0.81, 0.67, 0.50, and 0.33. For example, a wheel with a 1.5 win-to-loss ratio was 37.5% green, 12.5% red, and 50% gray. The neutral or gray section of the wheel was always either 10% or 50% of the wheel. When a participant chose "play" the wheel spun and then landed on one of the colored sections, contingent on the win-to-loss probability of that wheel. We operationalized risk-taking as choosing to spin the wheel when the probability of losing is greater than the probability of winning. The participant's response and reaction time were recorded. Participants completed several practice trials and then two blocks of seventy-two trials, which resulted in a total task time of about twenty to thirty minutes.

Procedure

During the study, participants were randomly assigned first to receive one of two instruction sets: risk-taking or risk aversion. Participants who were assigned to the risk-taking instruction set were told by the experimenter that they were participating in the "Risk-Taking Game" and that the experimenter was "interested in seeing how risky people are while playing the game". Participants who were assigned to the risk aversion

instruction set were told by the experimenter that they were participating in the "Play-it-Safe Game" and that the experimenter was "interested in seeing how cautious people are while playing the game". Participants were then randomly assigned to an additional three conditions: peer, virtual peer, or alone. Participants in the "peer condition" completed the task in pairs, with a physically present peer at adjacent computers. Participants were able to see each other's computer screens and their peer's score was clearly visible. Participants in the "virtual peer condition" completed the task with intermittent instant messages. Participants were told that another participant, who had arrived earlier than them, was set up down the hall and would be able to see their screen. They were told that either Michael (male participants) or Jennifer (female participants) would have the option to send them messages. The message box was personalized to include the name of the assumed observer on all incoming messages. During the trials, periodic messages were programmed to appear on the screen contingent on the results of the task. For example, after landing on red, the message, "oops," appeared, or after landing on green, the message, "excellent," appeared. Various messages were also programmed to appear after a participant chose to pass, such as, "safe move". Periodic neutral messages also appeared, such as, "I wonder how much longer" or, "this game is cool". In the third condition, participants completed the task alone.

Results

The mean proportion of "play" responses for each participant served as the primary measure in each of the analyses. Preliminary analyses showed no significant difference in responses in participants who completed the PGT in the peer or virtual peer conditions, in any of the win-to-loss ratio conditions, for either instruction set condition

(all $t \leq 1.43$, $p \geq .156$). Given that there was no significant difference between the peer and virtual peer conditions, these two conditions were combined into one all inclusive peer group to further analyze the difference between the alone and peer conditions. A 2 x 2 x 6 mixed model analysis of variance (ANOVA) was conducted with social context (alone, peer) and instruction set (risk-taking, play-it-safe) as between-subject variables and win-to-loss probability (1.5, 1.0, 0.81, 0.67, 0.50, 0.33) as a within-subjects variable. There was a main effect of win-to-loss probability, $F(5,990) = 442.45$, $p < .001$, $\eta_p^2 = .805$; in that as the probability of winning decreased, so did the number of play responses (see Figure 1 in Appendices B and C). There was also a main effect of social context, $F(1,162) = 4.83$, $p = .029$, $\eta_p^2 = .029$; in that those who completed the task in a peer condition chose to play more often than those who completed the task alone. The main effect of instruction set was not significant, $F(1,162) = .112$, $p = .739$, $\eta_p^2 = .001$. The interaction between social context and win-to-loss probability was not significant, $F(5,990) = 1.52$, $p = .186$, $\eta_p^2 = .046$, (see Figure 1 in Appendix B).

Following the precedent of Smith, Chein, & Steinberg (2014), independent *t*-tests were run to further examine the effect of social context at the three riskiest win-to-loss probabilities (0.33, 0.50, and 0.66). For those given risk-seeking instructions, participants in the peer conditions chose to play more frequently than those in the alone condition, though this difference was non-significant in the 0.33 win-to-loss ratio trials, $t(83) = -1.61$, $p = .112$, it was significant in the 0.50 win-to-loss probability trials, $t(83) = -2.03$, $p = .046$, and marginally significant in the 0.66 win-to-loss probability trials, $t(83) = -1.93$, $p = .057$ (See Figure 1 in Appendix B). In comparison, there were no significant differences in those who completed the task in a peer condition compared to those who

completed it alone for any of the three riskiest win-to-loss probabilities, within the "Play-it-Safe" instruction set (all $t \leq .117$, $p \geq .382$), (See Figure 1 in Appendix C).

Discussion

The results indicate that the participants understood the task and used the win-to-loss probabilities to decide whether or not to spin the wheel. Participants played more frequently when the win-to-loss ratio was greater, or when the probability of a loss was less. As supported by Smith, Chein and Steinberg (2014), it is important to create and implement laboratory risk-taking tasks that accurately display both the levels of risk and reward associated with the task.

We hypothesized that the different conditions of peer presence would have varying effects on responses during the PGT, and that manipulating the perceived experimental expectations would potentially change the effect of the peer on these responses. The results support our hypothesis; in that there was a significant difference between the alone and peer conditions. As predicted, participants who completed the PGT with a peer engaged in more risk behavior (played more) compared to those who completed the PGT alone.

Based upon previous research that highlighted the importance of peer rewards in adolescence (Crone & Dahl, 2012), research concerning the desire of participants to be good participants (Orne, 1962; Nichols & Maner, 2008), and research pertaining to obedience to authority (Baumeister & Leary, 1995; Miller et al., 1995), we suggested that an increase in risk-taking in the presence of peers, especially in a laboratory setting, may be the result of the participant's desire to be a good participant and obey the researcher. The current study aimed to examine this by creating two instruction sets, one risk-seeking

and the other risk-aversion. The results did not specifically support our hypothesis and indicated no difference between those who completed the PGT with risk-seeking or risk-aversion instruction set. However, within the riskiest trials there was a difference between the alone and peer conditions for the risk-taking instruction set, but not for the risk aversion set. Participants who completed the task in a peer condition with risk-seeking instructions, chose to play more during two of the riskiest trials (0.50, & 0.66 win-to-loss ratio), compared to those who completed the task alone. This difference was not found in participants who completed the PGT with risk-aversion instructions for any of the three riskiest trials. The lack of difference in risk behaviors within the risk-aversion instruction group, but the alone versus peers condition difference in risk behaviors within the risk-taking instruction group, suggests that experimenter demands and experimenter expectancies may influence participants tendency to engage in certain risk behaviors in laboratory risk-taking tasks.

We speculate that perhaps the instructions may have mitigated the effects of the peer conditions for those who completed the PGT with risk-aversion instructions, but not for those who completed the task with risk-taking instructions. The implications of these results are important as it suggests the magnitude of the role that experimenter expectancies may play in these laboratory risk-taking type tasks. It is important to acknowledge this influence and work to ensure that laboratory risk-taking tasks are a valid measure are able to reliably generalize real-life risk-taking situations.

To further examine the interaction of peer rewards and experimenter demands, we suggest creating a more concrete and tangible way of expressing the different instruction sets to the participants. The primary way of portraying these instruction differences to the

participant was through verbally spoken instructions from the researcher to the participant at the beginning of the experiment. Participants were either told "You will be participating in a Risk-Taking Game, and "we are interested in seeing how risky people are when they play the game" or "You will be participating in a Play-it-Safe Game, and "we are interested in seeing how cautious people are when they play the game." Since the difference between the two groups was not significant, we suggest implementing more distinct methods of expressing the intended instructions to the participants.

It is also important to examine the nonexistent difference between the peer and virtual peer conditions that led us to combine these groups for further analysis. With the exception of a couple of more recent laboratory studies aimed at examining the peer effect on adolescent risk-taking, most laboratory studies have implemented a physically present peer condition only. The absence of difference between the peer and virtual peer conditions in the current study suggests that a virtual peer experience may be just as influential towards risk behaviors as an experience with a physically present peer. This suggestion seems to be consistent with modern trends as more children and adolescents increasingly engage with their peers virtually, through text messaging, online messaging, and on social media. The implications of this finding indicate that programs aimed at preventing risky behaviors in adolescence should consider the influence of physically present peers as well as virtual peers.

Limitations

Due to the nature of the study and time constraints, we were only able to recruit participants through undergraduate psychology courses at Georgia Southern University.

Previous research has suggested that the peer effect on risk-taking occurs only in adolescents and young adults ages 11-25 (Gardner & Steinberg 2005). While the mean age of participants (M_{age} =19.22) in this study falls into that age range, it would be advantageous to explore the implications of this study using a developmental population. For future research, we suggest recruiting adolescents from local middle and high schools in hopes of investigating the peer effect on risk-taking in a more adolescent-based setting.

Conclusion

The current experiment examined risk-taking in undergraduate Psychology students at Georgia Southern University within different instruction sets and modes of peer presence. We implemented a more animated and realistic version of the probabilistic gambling task than has been used before, virtual peer condition, and separate instruction sets. It is immensely important to understand the relationship between peer presence and adolescent risk-taking as it will lead to better interactions with adolescents, the development of more accurate adolescent drug and alcohol prevention programs, and strengthen pre-existing techniques aimed at preventing peer pressure and risky behaviors in adolescence. In addition, understanding the relationship between experimenter expectancies and the peer effect on risk-taking could contribute to more valid and reliable research in the future.

References

Baumeister, R.F, & Leary, M.R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin,117(*3), 497-529. doi: 10.1037/0033-2909.117.3.497

Boyer, T.W. (2006). The development of risk-taking: A multi-perspective review. *Developmental Review, 26,* 291-345. doi:10.1016/j.dr.2006.05.002

Burnett, S., Bault, N., Coricelli, G., Blakemore, S.J. (2010). Adolescents' heightened risk-seeking in a probabilistic gambling task, *Cognitive Development, 25*(2), 183-196, doi: 10.1016/j.cogdev.2009.11.003.

Casey, B.J., Getz, S., & Galvan, A. (2008). The adolescent brain. *Developmental Review, 28* (1), 62-77.

Crone, E.A., & Dahl, R.E. (2012). Understanding adolescence as a period of social–affective engagement and goal flexibility. *Nature Reviews Neuroscience*, *13*, 636-650. doi:10.1038/nrn3313

Defoe, I. N., Dubas, J. S., Figner, B., & van Aken, M. G. (2015). A meta-analysis on age differences in risky decision making: adolescents versus children and adults. *Psychological Bulletin*, *141*(1), 48-84. doi:10.1037/a0038088

Evans, J.S.B.T., & Stanovich, K.E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives of Psychological Science*, *8*(3), 223-241. doi: 10.1177/1745691612460685

Gardner, M., & Steinberg, L. (2005). Peer influence on risk taking, risk preference, and risky decision making in adolescence and adulthood: An experimental study. *Developmental Psychology, 41*(4), 625-635. doi: 10.1037/0012-1649.41.4.625

Knoll, L. J., Magis-Weinberg, L., Speekenbrink, M., & Blakemore, S. (2015). Social Influence on Risk Perception During Adolescence. *Psychological Science*,

Lejuez, C. W., Read, J. P., Kahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., Strong, D. R., & Brown, R. A. (2002). Evaluation of a behavioral measure of risk taking: The Balloon Analogue Risk Task (BART). *Journal of Experimental Psychology: Applied, 8*(2), 75-84

MacLean, R.R., Grier, C.F., Henry, S.L., & Wilson, S.J. (2013). Digital peer interactions affect risk taking in young adults. *Journal of Research on Adolescence, 24* (4), 772-780. doi: 10.1111/jora.12093

Miller, A. G., Collins, B. E., & Brief, D. E. (1995). Perspectives on obedience to authority: The legacy of the Milgram experiments. *Journal of Social Issues*, *51*(3), 1-19. doi:10.1111/j.1540-4560.1995.tb01331.x

Nichols, A. L., & Maner, J. K. (2008). The Good-Subject Effect: Investigating Participant Demand Characteristics. *Journal of General Psychology*, *135*(2), 151-165.

O'Brien, L., Albert, D., Chein, J., & Steinberg, L. (2011). Adolescents prefer more immediate rewards when in the presence of their peers. *Journal of Research on Adolescence, 21*(4), 747-753. doi: 10.1111/j.1532-7795.2011.00738.x

Orne, M.T. (1962). On the social psychology of the psychological experiment: With particular reference to demand characteristics and their implications. *American Psychologist,17*(11), 776-783, doi:10.1037/h0043424

Reyna, V. F., & Farley, F. (2006). Risk and Rationality in Adolescent Decision Making: Implications for Theory, Practice, and Public Policy. *Psychological Science in the Public Interest*, *7*(1), 1-44.

Shulman, E. P., & Cauffman, E. (2013). Reward-biased risk appraisal and its relation to juvenile versus adult crime.*Law And Human Behavior*, *37*(6), 412-423. doi:10.1037/lhb0000033

Shulman, E.P., Smith, A.R., Silva, K., Icenogle, G., Duel, N., Chein, J., Steinberg, L. (2016). The dual systems model: Review, reappraisal, and reaffirmation. *Developmental Cognitive Neuroscience, 17*, 103-117.

Silva, K., Chein, J., & Steinberg, L. (2016). Adolescents in peer groups make more prudent decisions when a slightly older adult is present. *Psychological Science*. doi:10.1177/0956797615620379

Smith, A., Chein, J., & Steinberg, L. (2014). Peers increase adolescent risk taking even when the probabilities of negative outcomes are known. *Developmental Psychology, 50*(5), 1564-1568. doi: 10.1037/a0035696

Steinberg, L. (2007). Risk taking in adolescence: New perspectives from brain and behavioral science. *Current Directions in Psychological Science, 16*(2), 55-59. doi: 10.1111/j.1467-8721.2007.00475.x

Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review, 28*, 78-106. doi: 10.1016/j.dr.2007.08.002

Steinberg, L. (2015). How to improve the health of American adolescents. *Perspectives on Psychological Science, 10*(6), 711-715. doi: 10.1177/1745691615598510

Utech, D. A., & Hoving, K. L. (1969). Parents and peers as competing influences as competing influences in the decisions of children of differing ages. *Journal of Social Psychology*, *78*(2), 267-274.

Weigard, A., Chein, J., Albert, D., Smith, A., & Steinberg, L. (2014). Effects of anonymous peer observation on adolescents' preference for immediate rewards. *Developmental Science*, *17*(1), 71-78. doi: 10.1111/desc.12099

Appendix A

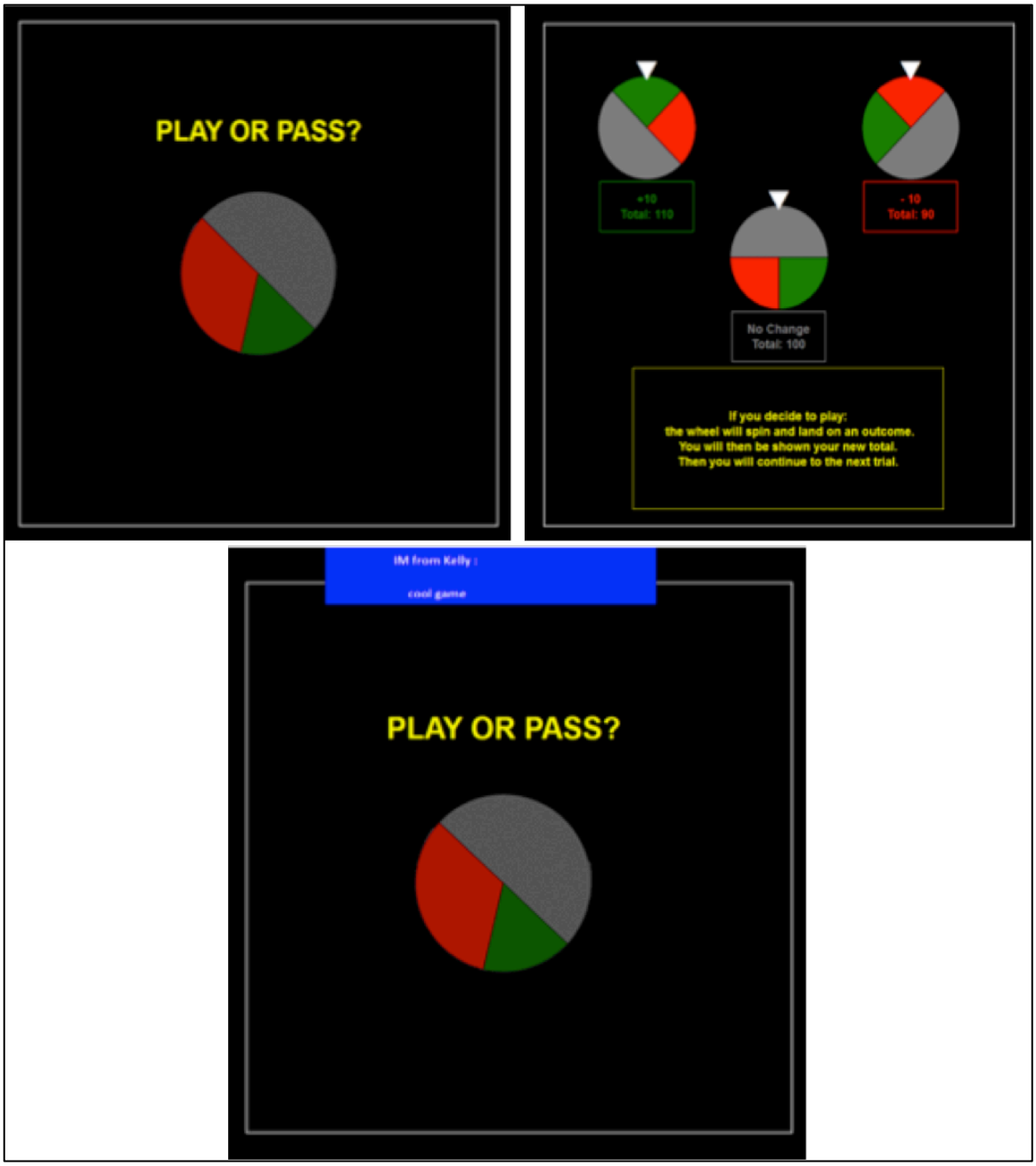

Figure 1. The Probablistic Gambling Task. Participants chose to either "play" or "pass". If "play" is selected, the wheel spins to land on either green (win), red (loss), or gray (neutral) based on the win-to-loss probability. In the virtual peer condition, messages were programmed to randomly appear, contingent upon the participants actions.

Appendix B

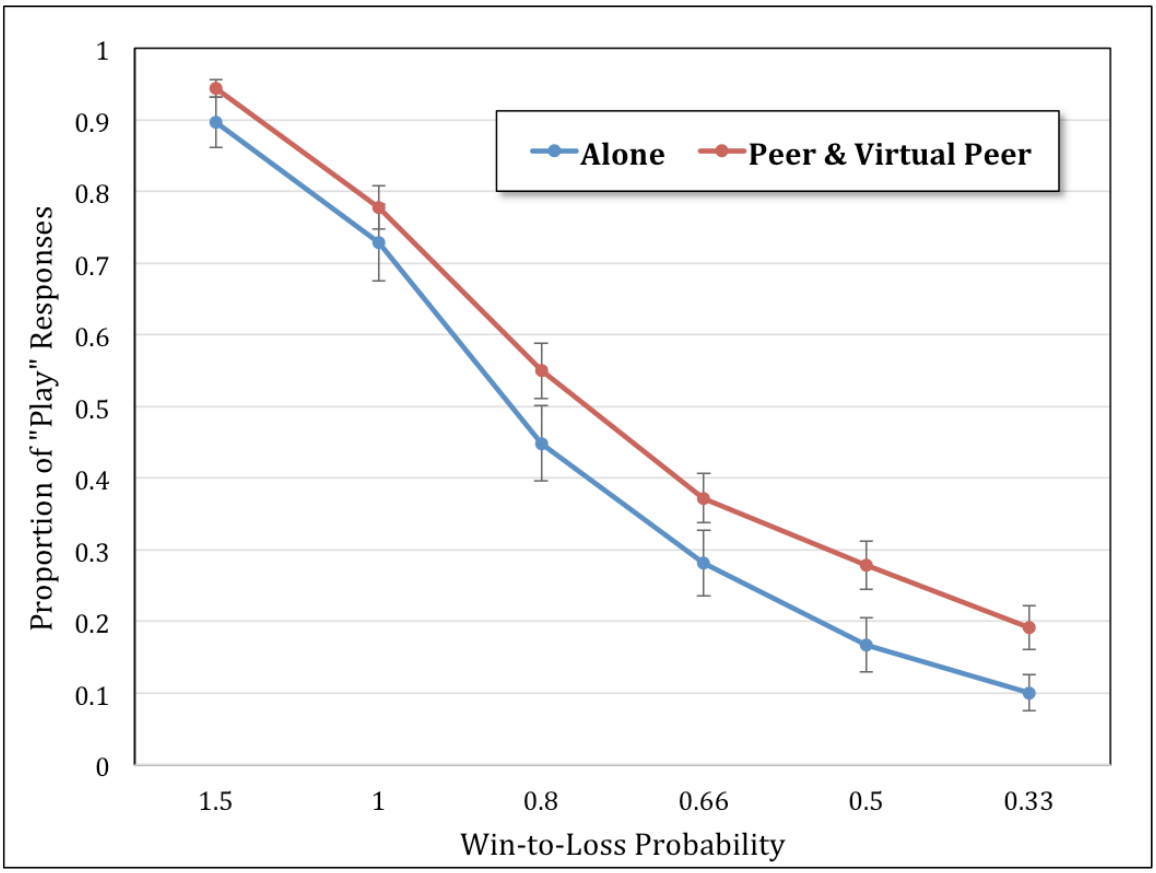

Figure 1. Proportion of plays for each win-to-loss probability and social context within the risk-taking instruction set. Participants in the peer and virtual peer conditions played more often, especially on the riskiest trials, compared to those who completed the task alone.

Appendix C

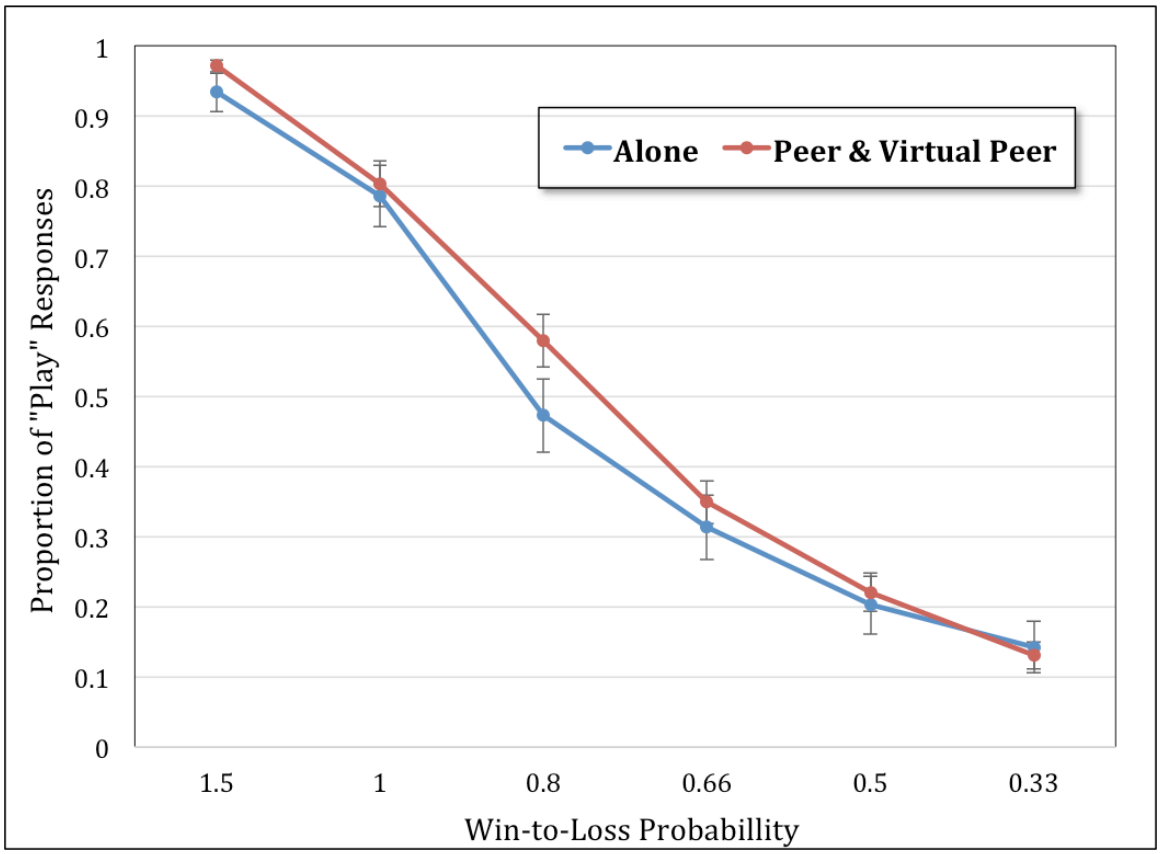

Figure 1. Proportion of plays for each win-to-loss probability and social context within the risk-aversion instruction set. Participants in the peer conditions did not differ from those in the alone condition.