

Underlying Cognitions in Children's Gambling Behavior: Can they be Modified?

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ABSTRACT *Research examining cognitive perceptions among children has suggested the importance of perceived skill and luck in initiating and maintaining gambling behavior. Using an experimentally manipulated gambling paradigm modifying rates of reinforcement the results suggest, in general, that one can modify these cognitions. More importantly, the results from the gambling task were found to generalize to multiple forms of gambling and were maintained over a relatively short period of time. The modifications of these perceptions appear to be easier for younger children (age 10 vs 12), with differential effects being found for boys and girls. The results are discussed in light of our current prevention initiatives and programs.*

There are ample empirical findings and clinical reports that excessive gambling represents a serious problem for a number of individuals. While occasional gambling does not necessarily constitute a serious problem, excessive and compulsive gambling has become a growing social problem with adverse psychological, sociological and economic consequences. The rising popularity of gambling is not exclusive to any particular age group, socio-economic status, culture, or gender. With the increasing availability of new and diverse forms of both government-owned and regulated gambling, there remains a concern that underage children will engage in multiple forms of gambling activities designated for adults. Our best estimates are that between 3–6% of adolescents exhibit very serious gambling problems and another 10–15% remain at-risk for the development of serious gambling problems (Derevensky and Gupta, 2004; Haroon and Derevensky, 2002; Jacobs, 2004; National Research Council, 1999; Shaffer and Hall, 1996).

While a number of theoretical perspectives have sought to explain problem gambling including personality, social learning, learning and psychoanalytic theories (see Abbott *et al.*, 2004; Gupta and Derevensky, 2004; Haroon and Derevensky, 2002; and Petry, 2005 for a comprehensive description of these theoretical approaches), the cognitive perspective has been reported to be central in understanding the individual's perseverance to gamble despite persistent failure (Ladouceur and Walker, 1996). Sharpe and Tarrier's (1993) cognitive behavior theory model suggests that gambling behavior is initially reinforced by intermittent monetary rewards and concomitant elevated levels of physiological arousal. This reinforces the initial gambling behavior to be sustained for a sufficient amount of time so that associations become formed through classical

conditioning. The gambling environment subsequently becomes associated with a heightened state of arousal, all of which become associated with a set of gambling-related cognitions, including the erroneous perception that personal skill influences the outcome of random events and the acceptance of monetary losses will soon be replaced by gains. While in gambling situations, the outcome is often beyond the individual's control, gamblers frequently make an attribution of personal causation. They perceive an *illusion of control* (Langer, 1975; Langer and Roth, 1975) whereby wins are attributed to skill and losses to bad luck.

A growing body of research has focused on cognitive biases that promote and maintain gambling behavior (see Abbott *et al.*, 2004 for a comprehensive review). Much of the cognitive research is based on the premise that frequent gamblers hold a set of erroneous beliefs or cognitions, irrational thoughts and misperceptions. The underlying assumption is that the motivational component of the gambling activity, namely the hope of overall monetary gain and the desire to beat the game, combines with these faulty cognitions and illusions of control that propel the individual to continue to gamble despite repeated losses and adversity (Ladouceur *et al.*, 1988; Ladouceur and Walker, 1996; Petry, 2005).

Research aimed at determining children's cognitive perceptions of how much skill and luck are involved in gambling (Derevensky *et al.*, 1996) has focused broadly on gambling in general. It remains unclear whether children's perceptions of skill and luck vary as a function of a particular game of chance and whether or not these perceptions can be modified. Given the importance of cognitive perceptions and its relationship to gambling behavior the present study sought to examine whether these cognitions could be modified through a manipulation of reinforcement contingencies on a gambling task. More specifically, this study seeks to determine whether children's cognitive perceptions of the amount of skill and luck involved in gambling can be modified as a function of experimentally manipulated reinforcement schedules.

Method

Participants

The sample consisted of 174 children (90 females; 84 males) from grades 5 ($n = 93$) and 7 ($n = 81$) selected from six low and middle class SES English schools in the greater Montreal region. Children ranged in ages from 10 to 13 ($M = 11.30$ years; $SD = 1.00$; M for grade 5 = 10.57, $SD = 0.50$; M for grade 7 = 12.32, $SD = 0.50$). Self-report data revealed that 84.5% of the youth in this study reported that they had gambled at least once in the past year ($n = 147$), while 20.1% reported that they gambled a minimum of once a week or more ($n = 35$).

Instruments

Gambling activities questionnaire. Participants completed a modified *Gambling Activities Questionnaire (GAQ)* (Gupta and Derevensky, 1996), composed of 15 questions that ascertained the frequency and type of gambling activities in which individuals participated.

Cognitive Perceptions Questionnaire (CPQ). This questionnaire consisted of 10 questions pertaining to participants' perceptions of the extent to which skill and

luck are involved in various games of chance as well as several non-gambling activities (e.g. achievement in school, various sports activities). Children rated on a 7-point Likert scale the amount of skill and luck they believe is required to be successful in the following: video-games, blackjack, school, gambling in general, a high/low card cutting game, winning the lottery (i.e. 6/49), baseball, roulette, swimming, and slots.

Gambling Task

The gambling activity was an IBM computer generated card-cutting game, entitled 'high/low' developed by Breen and Zuckerman (1996). The overall effect of the game is comparable to cutting a deck of cards with all the 8s removed. The player is required to predict whether the next card to be drawn will be from a designated group of *high* cards (i.e. 9, 10, Jack, Queen, King, Ace) or *low* cards (i.e. 2, 3, 4, 5, 6, 7). This game contained an equal number of high and low cards (establishing a 50% probability of receiving a high or low card when randomly presented); the design simulates a real card-cutting task; and the program was attractive, colourful, readily understandable and interactive.

The computer program initially prompts the individual, 'Do you want to bet high or low?' After responding the computer then prompts, 'How much do you want to bet?' After entering the amount wagered the deck is cut, one card is displayed and the participant is informed as to whether or not they had won. Following the tenth trial, the computer prompts the player, 'Do you want to continue?' The player indicates his/her desire to continue prior to each subsequent trial. A graphic depiction of different colored chips is displayed after each trial in order to visually represent the amount of money that has been accumulated or lost. Finally, and most importantly, this computer-generated gambling program can be modified to reward the participants at a predetermined ratio over a series of trials enabling the manipulation of the odds of success across participants. A data file for each participant is developed including the total number of hands played, amount and type of bet for each trial, delta bet for each trial (the amount a current bet deviated from the previous bet), final balance, and average wager per trial.

Groups

Children were randomly distributed into four groups; three experimental groups and a control group. In the first experimental group ($n = 44$), the payout rate was pre-established at 90%; the second group's ($n = 43$) payout rate was 50%; and the third group's ($n = 42$) payout was 10%. The control group ($n = 45$) did not play the task and was included in order to rule out the possibility that any changes in the ratings of perceived skill and luck involved in the tasks could be due to extraneous factors.

Procedure

The GAQ and the CPQ (pre-test of their cognitions concerning level of skill and luck involved in each of the activities) were presented by research assistants. Individuals in the experimental group then played the computer task, in which the odds of success varied as a function of the experimental group. Because

of ethical constraints, children did not play with real money; rather they were provided with a computerized bankroll of CND\$300 and given the incentive of winning prizes proportionate to their overall winnings. After playing, children were given the amount they won over the initial CND\$300 in play money.

The following standardized instructions were presented:

You will be playing a game called high/low. In this game you must guess whether the next card to be drawn from a deck of cards will be high or low. The low cards are 2 through 7 and the high cards are 9 through the ace, including all face cards (Jack, Queen, and King). There are no 8s in this deck.

You will play 2 practice trials and then begin the game for real. The computer will first ask you if you want to bet high or low. Type 'H' for high, or 'L' for low. It will then ask you how much you want to bet. You will be playing with CND\$1, CND\$10, and CND\$25 chips but can bet any amount between CND\$1 and CND\$100. The computer will then show you the amount you have bet and ask you if it is okay. You may type 'Y' for yes or 'N' for no, if you wish to change your bet. The computer will display the card that has been selected, you will then be told if you have won or lost, and it will display how much money you have left. You will play at least 10 times and then you will have a choice of whether or not you wish to continue. You can play for a maximum of 10 minutes.

You will begin the game with CND\$300 and the goal is to end up with as much money as you can. The amount you win over the CND\$300 that you began with will be placed into a draw to win prizes. There are three draws; a draw of CND\$10 McDonald's certificates, CND\$20 McDonald's certificates and CND\$30 movie gift certificates. Remember, the more money you make the greater your chances are of winning one of these prizes.

Each participant played the game for a maximum of 10 minutes, until their bankroll was depleted, or they wished to terminate.

The study incorporated a repeated measures design that seeks to establish whether any changes in underlying cognitions of skill and luck are sustained over time. Pre-test measures were assessed prior to the experimental task. Following the computer task, participants completed the CPQ (first post-test). In order to measure the extent to which any effects were maintained over time, participants completed the CPQ 1 week after playing (second post-test), and then again 4 weeks later (third post-test).

Results

Initial Cognitive Perceptions

The experimental design enabled the investigation of children's perception of the amount of perceived skill and luck involved in various forms of gambling and non-gambling activities. Examining the ratings of the amount of skill and luck involved in various activities at the pre-test measure, using a 7-point Likert scale, ranging from 1 (none at all) to 7 (a lot), provides an interesting look at children's cognitive perceptions (see Table 1). The initial ratings revealed that while children

Table 1. Perceived skill and luck for all activities: pre-treatment for the entire sample

	High/low	Gambling in general	Lottery	Blackjack	Roulette	Slot machines
Skill	3.33	4.50	2.76	4.20	3.05	2.49
Luck	5.74	5.73	6.19	5.17	5.93	6.01
	Baseball	Video-games	School	Swimming		
Skill	6.06	5.52	6.53	6.33		
Luck	3.46	3.72	3.07	2.62		

Range: 1–7.

perceive that gambling activities require a substantial amount of skill in general, and more skill for blackjack, they also believe luck is heavily involved. Participants also noted that skill-based activities (e.g. baseball, videogames, school achievement and swimming) involved considerably more skill and less luck.

Modification of Cognitive Perceptions

To determine the effects of the manipulation of schedules of reinforcement on children's cognitive perceptions about gambling two general categories were created from the ten existing activities. The first is combined gambling activities (high/low task, gambling in general, lottery, blackjack, roulette and slot machines) and the second category being non-gambling activities (baseball, video-games, school and swimming). This second grouping of non-gambling activities, all of which are skill-based, served as a control. Wagering on the high/low activity was included as the children played this game as part of the experimental manipulation. Other gambling activities were included in the measure of cognitions in order to assess whether any changes due to playing the high/low game might generalize to children's perceptions of other gambling activities.

Group Differences

High/low. For the high/low task, no statistically significant main effect of group was noted for ratings of skill nor did they differ statistically over time (see Figure 1). However, a look at the trends suggests that both the control and 10% groups decreased over time. Interestingly, the 90% group also decreased their perception of the amount of skill involved from the pre-test to post 1 and post 2 before increasing again at post 3. For these children, it is possible that the experience of being consistently successful led them to doubt that the task could contain as much skill as originally imagined. A look at the luck ratings suggests a trend that decreases in perceived skill are often accompanied by increases in perceptions of luck.

While the means indicate that for the 90 and 10% groups playing the high/low task skill ratings decreased over time, planned comparisons revealed a significant group effect on skill ratings for the 10% groups, $F(3, 144) = 3.78, p < 0.01$, on the high/low task. Of particular interest was that the skill ratings for children in the 10% group decreased significantly from the pre-test to the second and third post-tests. It is important to note that for the 10% group, the greatest mean decreases in perceived skill occurred between the pre-test and the third post-test. Interestingly,

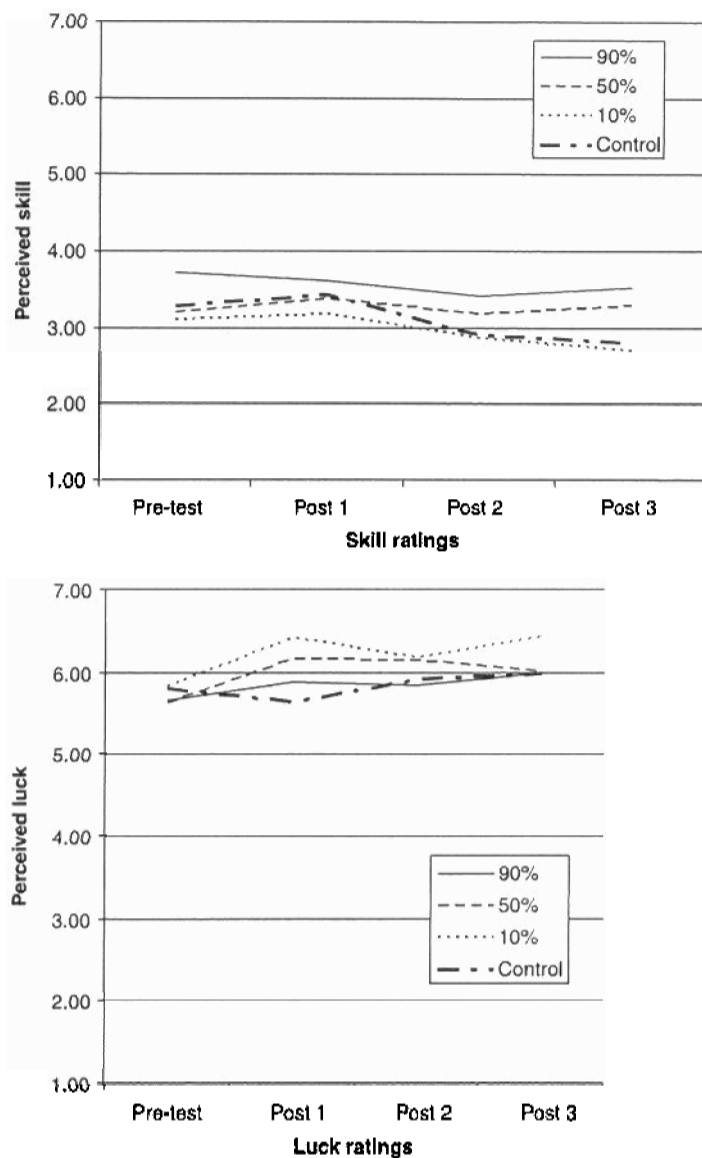


Figure 1. Ratings of skill and luck for the high/low task

no statistically significant decrease in skill ratings is noted for the 90% and control groups. However, it should be noted that a decrease was also noted for the control group.

Combined gambling activities. Planned comparisons revealed a significant effect for group on skill ratings for the 50% group, $F(3, 146) = 5.65, p < 0.01$, and for the 10% group, $F(3, 146) = 5.69, p < 0.001$ between pre-test and post-test 3, with perceived skill ratings decreasing over time. Interestingly, no significant changes in skill ratings were noted for the 90% and control groups (Figure 2). It appears as

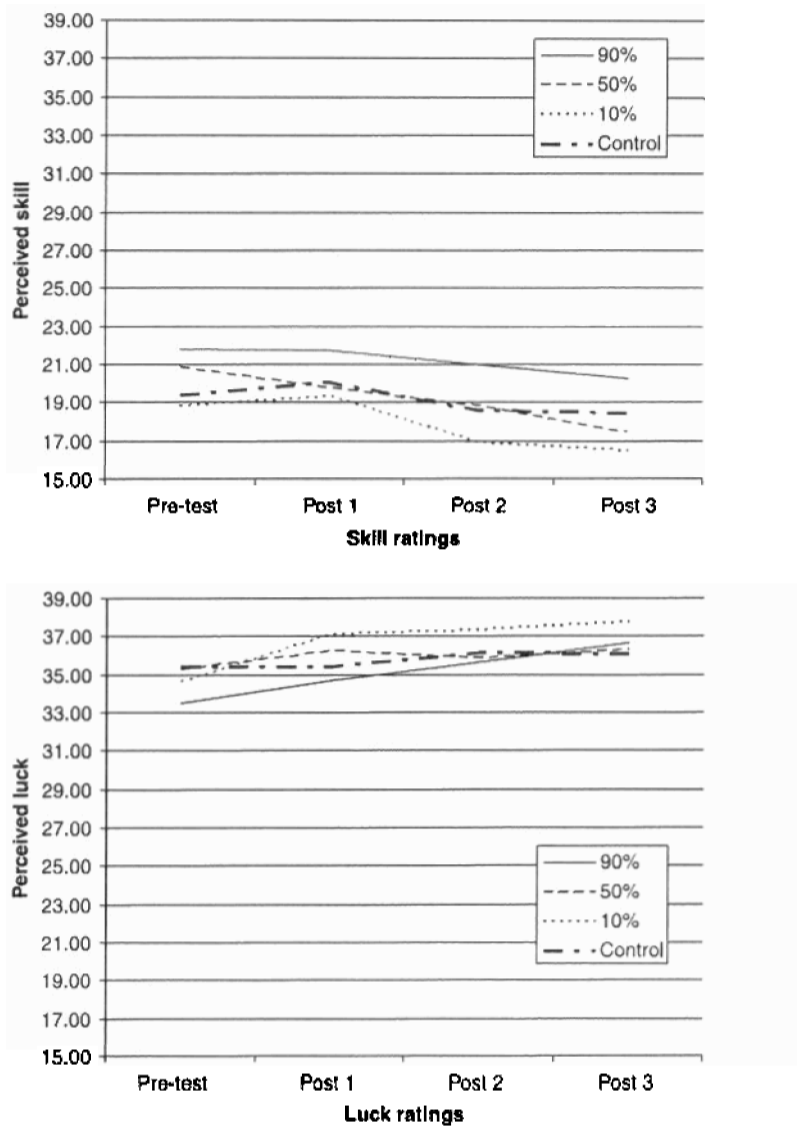


Figure 2. Ratings of skill and luck for the combined gambling activities

if being intermittently reinforced on the task as well as experiencing successive losses were able to induce modifications in children's perceptions of the amount of skill involved in gambling. A significant main effect of group on luck ratings for the combined gambling activities, $F(9, 346) = 1.95, p < 0.05$ was found. A closer look at the planned comparisons indicates that for the 10% group, luck ratings increased significantly over time from the pre-test to the first, second, and third post-tests. It is interesting to note that the greatest mean difference occurred between the pre-test and the last post-test, indicating that this increase in perceived luck involved in combined gambling activities becomes more exaggerated over time. While not statistically significant, the 50% group also

increased their perceptions of luck with the greatest mean increase observed between the pre-test and last post-test. Further, for the 90% group, luck ratings also increased significantly over time from the pre-test to the first, second and third post-tests, $F(3, 142) = 5.73, p < 0.01$, with increasing changes being maintained over time. No significant changes were found for the control group.

Combined non-gambling activities. For the non-gambling tasks, no significant effect of group was noted nor did they differ across time, with all groups revealing the importance of skill over luck in these skill-based activities (mean for all groups being higher on skill (24.52) than luck (12.88) (range of scores

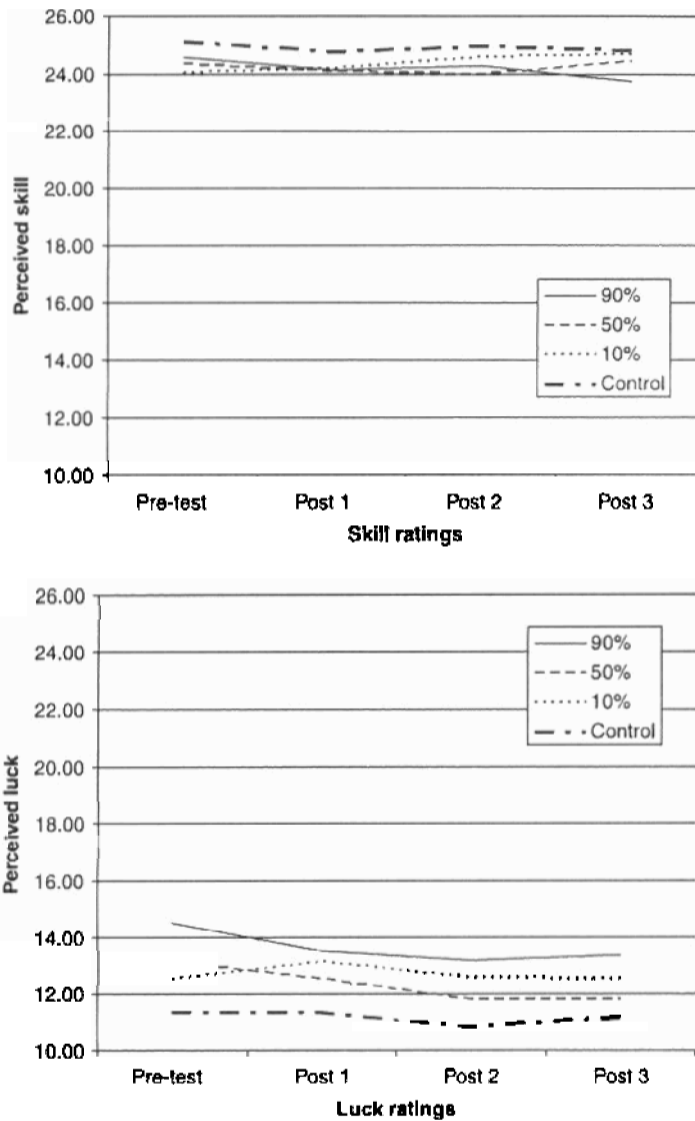


Figure 3. Ratings of skill and luck for the combined non-gambling activities

Table 2. Summary of results of group differences for the gambling tasks

		High/low	Combined gambling activities	Gambling in general	Black-jack	Lottery	Slot machines	Roulette
Skill	90	↓	↓	↓*	↓*			↓*
	50	↓	↓*	↓*				
	10		↓*					
	C		↓					
Luck	90	↑	↑*	↑	↑*	↑*	↑*	
	50	↑*	↑	↑*	↑*	↑	↑	
	10	↑*	↑*		↑*	↑	↑	
	C							

Note: C = control group.

*Significant at the $p < 0.05$ level

being 4–28) (see Figure 3). Thus, playing the task and the experience of differential patterns of reinforcement, as expected, did not significantly alter children's perceptions of the amount of skill and luck involved in non-gambling activities.

A summary of the results for the group differences on the various gambling activities, by activity, is provided in Table 2. It is important to note that this table illustrates general cognitive changes from the pre-test to any of the three post-tests.

Overall, the results indicate that cognitive perceptions were modified as a function of the group condition. The experience of loss in the high/low task led to decreases in perceived skill involved in gambling activities and increases in the amount of perceived luck for both the 10% and 90% groups. It may well be that children in the 90% group realized they were not only skillful but lucky as well. These changes were generalized to other forms of gambling as change was noted in perceptions of skill and luck involved in gambling in general, combined gambling activities, blackjack and roulette for the 50% and 10% groups.

Gender Differences

Combined gambling activities. Planned comparisons yielded a significant interaction of gender by group on skill ratings for the gambling tasks. Females in the 50% group decreased their skill ratings significantly from the pre-test to the third post-test, $F(3, 1,440) = 5.02$, $p < 0.01$. Similarly, females in the 90% group decreased their skill ratings from the pre-test to the third post-test, $F(3, 144) = 3.49$, $p < 0.05$. For males, the only significant cognitive changes were for those in the 10% group, who decreased skill ratings from pre-test to the third post-test ($p < 0.05$). Perhaps for males to change their cognitive perceptions of the amount of skill involved in gambling activities, the more extreme losing condition of the 10% group was necessary, whereas the 50% group condition was sufficient to induce a cognitive change for the females (see Table 3).

Final Balance

As one would expect, the results from a one-way ANOVA indicate that the final balances varied significantly as a function of group, $F(2, 126) = 63.40$, $p < 0.001$. Tukey HSD *post hoc* analyses indicated that the group that was reinforced 90% of the

Table 3. Gender differences in ratings of skill and luck for the combined gambling activities

		Skill ratings				Luck ratings			
		Pre-test	Post 1	Post 2	Post 3	Pre-test	Post 1	Post 2	Post 3
90%	Female	21.73	22.73	20.36	18.38	33.52	34.10	35.97	36.75
	Male	21.95	20.73	21.68	22.21	33.55	35.31	35.37	36.58
50%	Female	24.30	23.03	21.73	19.85	35.13	37.10	36.73	36.90
	Male	17.38	16.43	15.88	14.98	35.48	35.38	35.05	35.63
10%	Female	18.29	19.44	16.48	16.50	34.65	37.52	37.72	37.72
	Male	19.36	19.21	17.29	16.49	34.59	36.67	36.85	37.82
Control	Female	22.95	23.72	22.42	22.77	33.89	33.89	33.88	32.74
	Male	15.80	16.39	14.82	14.16	36.98	36.98	38.46	39.38

Range: 6–42

time had significantly higher final balances ($M = \text{CND}\$712.05$, $SD = \text{CND}391.76$) than both the groups that won 50% ($M = \$319.97$, $SD = 129.16$) and 10% of the time ($M = \$118.77$, $SD = 111.91$). Further, the group that won 50% of the time had significantly greater final balances than those that won 10% of the time. Further analyses indicated that the final balances did not differ significantly between children who reported gambling and those who do not, nor were there any developmental or gender differences noted.

Betting Patterns

Average bets placed per hand. The computer program calculated the average bet placed per hand for each participant. From this analysis it was possible to examine whether there were any differences in betting patterns as a function of group, whether differences existed as to past gambling experience, as well as to determine if there were any developmental or gender differences. It is important to note that the present distribution is skewed. Although the sample was randomly assigned to the various groups, there was large variability in the average bets placed per hand and in some cases the standard deviations were greater than the mean.

The results of a one-way ANOVA indicate that average bets placed per hand varied significantly as a function of group, $F(2, 126) = 4.02$, $p < 0.05$. More specifically, Tukey HSD *post hoc* analyses indicate that the group that was reinforced 90% of the time had significantly greater average bets per hand ($M = \$25.40$, $SD = 22.98$) than the group that won only 10% of the time ($M = \$14.78$, $SD = 11.57$). Thus, it appears that larger amount of their bankroll were wagered on each subsequent bet in order to win prizes.

Further analyses indicate that there was a significant gender difference in the average bets placed per hand, $t(119) = -2.44$, $p < 0.05$. More specifically, males had greater average bets ($M = \$23.70$, $SD = 19.25$) than females ($M = \$16.06$, $SD = 16.00$). Further, the average bets placed per hand did not differ significantly

Table 4. Percent average bets for each group over time

Percentage average bet	First period		Second period		Third period	
	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD
90% group	5.88	1.34	5.45	1.41	4.68	2.23
50% group	5.17	1.35	7.56	1.43	7.10	2.26
10% group	3.61	1.37	9.55	1.45	22.33	2.28

as a function of whether participants had previously reported gambling and there were no significant developmental differences.

Percent average bet. The fact that the 90% group had significantly higher average bets per hand may be due to the fact that they had more money as they were winning 90% of the time, while the 10% group was losing rather consistently (see Table 4). Thus, to control for this effect, a formulation of percent *average bet* was computed. For each trial, an average-percent bet was computed for each participant, which was equivalent to the amount wagered as a percentage of the total remaining bankroll. This was then added across trials and averaged over the number of hands each participant played. The percentage average bet represents the amount of money each child wagered per hand as a function of their total balance. For example, if a participant had a bankroll of \$100.00 and on the next hand he/she bet \$5.00, the percent average bet for that particular hand was equal to 5.0%.

The results of a one-way ANOVA indicate that there was a significant effect of group on the percent average bet, $F(2, 126) = 8.48, p < 0.01$. Tukey HSD *post hoc* analyses indicate that the group who won only 10% of the time had significantly greater percent average bets ($M = 12.56\%$, $SD = 13.71$) than the group who won 90% ($M = 4.85\%$, $SD = 3.55$) and more than the group that won 50% of the time ($M = 6.65\%$, $SD = 7.03$). Thus, the results from the average bets placed suggest that when participants had a greater amount of money, they continued to increase their bets. However, when considering the relative amount of money children had, the 10% group was wagering a significantly greater percentage of their total earnings on each hand than the other two groups. Nevertheless, it is important to remember that participants were not wagering their own money.

A significant gender difference in the percent average bet, $t(124) = -2.07, p < 0.05$ was also found. More specifically, males tended to wager a greater percentage of the money remaining on each trial ($M = 9.75\%$, $SD = 9.86$) than females ($M = 6.30\%$, $SD = 9.05$), independent of group inclusion. Further analyses indicate that the percent average bet did not vary as a function of whether participants gambled previously and no developmental differences were noted.

The results indicated a significant group effect for the percent average bet in the overall game. Further analyses sought to determine whether the percent average bets placed varied at different points of time during playing behavior for each of the groups. Breaking down the total playing time into periods provides a closer look at how each of the groups changed their betting patterns over time. For each participant, the overall playing time was broken down into thirds (33%) as some of the participants only played ten hands and it would not have been meaningful

to divide the time periods any further. This made it possible to determine the average bets placed per hand in the first, second and third periods of the game and allowed an analysis of changes in betting patterns over time for each of the groups.

A repeated measures analysis indicated a significant effect of group over time in the percent average bets placed per hand, $F(4, 250) = 11.67, p < 0.001$. Tukey HSD *post hoc* analyses indicate that while there were no differences in the groups during the first and second thirds of game playing behavior, there were group differences in the final period of play. More specifically, in the last portion of the game, the group that was winning 10% of the time wagered a greater percentage of their remaining bankroll per hand ($M = 22.33\%$, $SD = 2.28$) than individuals in the groups that were winning 90% ($M = 4.68\%$, $SD = 2.22$) and 50% of the time ($M = 7.10\%$, $SD = 2.26$).

Planned comparisons also indicate that for the group who won 10% of the time, the percent average bets placed per hand differed significantly across the three periods of game-playing, $F(2, 125) = 35.31, p < 0.001$. More specifically, there was a linear increase in the percent average bets placed per hand from the first to the final trimester of the game. In the first trimester of playing, the 10% group bet, on average, 3.61% of their total bankrolls on each hand. In the second trimester they wagered 9.55% of their total balances on each hand, whereas in the final trimester of the game children in this group were wagering 22.33% of their remaining money, on average, for each hand. No significant differences were noted in the betting patterns across time for individuals in the 90 and 50% groups. It appears as if only the group of children that is losing consistently is betting a greater proportion of their money on each hand as the game progressed. This may be suggestive of an increase in chasing behavior in the last portion of the game.

Decision to stop. After the tenth trial of the game, participants were given the choice of whether or not they wished to continue before each subsequent trial. Of the entire sample, 26.8% of the children decided to stop playing. No significant differences were noted in the percentage of children who decided to stop as a function of group or children's past gambling experience. Further, no developmental or gender differences were noted. However, examining group differences indicates an interesting linear increase in the percentage of children in each group who chose to stop playing from the 90% (18.2%) to the 50% (29.3%) to the 10% group (33.3%), with the greatest percentage of those who elected to terminate the game being in the 10% group.

Discussion

Previous research suggests that children perceive a great deal of both skill and luck to be involved in gambling in general and suggests that children are irrational in the belief that skill plays such a significant role (Derevensky *et al.*, 1996). The present study expands upon these findings as it assessed gambling in general as well as various gambling activities, and in doing so illuminates differences in cognitive perceptions concerning different activities. Children revealed a belief that a greater amount of skill was involved in blackjack than in the other gambling activities such as high/low, lottery, roulette, and slot machines. Although the present results confirmed that children appear to exert an illusion of control and believe much skill is involved in gambling in general, they also perceive a difference in gambling tasks that incorporate varying degrees of skill and luck. For

instance, blackjack is a game that involves a certain degree of skill (e.g. using laws of probability), whereas slot machines, lottery (scratch tickets and draws), and high/low are solely due to chance. Children appeared to notice this difference as skill ratings were lowest for the gambling tasks where the outcome involved pure random chance events.

This study also investigated whether children's perceptions of the amount of skill and luck involved in various gambling activities could be altered as a function of varying reinforcement schedules (odds of success) they experience on a gambling task, whether any changes would generalize to other forms of gambling and non-gambling activities, and if cognitive changes would be maintained over time. The results indicate that the experience of losing consistently decreased perceived skill involved in the high/low activity and significantly increased the amount of perceived luck involved. Children in both the 50% and 10% groups increased their ratings of luck and decreased ratings of skills; however, only in the extreme case of loss (i.e. the 10% group) were these cognitive changes maintained over time. These results confirm the belief that children who experience lower probability of success in this task would modify their cognitions such that ratings of perceived luck would increase. This is in accordance with the theory of cognitive dissonance in that children who experienced losses on the gambling task decreased their perceptions of the amount of skill involved and adopted a more luck-oriented attitude. The results provide further empirical support for the model proposed by Abt *et al.* (1985), who postulated that the outcome of a gambling session is critical in that a gambler compares it to his/her established set of cognitive rules about the game, which produces a state of consistency or dissonance. If the outcome of the task is inconsistent with their beliefs, a state of cognitive imbalance is produced and the gambler can change their betting patterns, leave the situation, or alter their set of cognitive rules. The current findings suggest that for children, the outcome of the task appears to foster a sense of cognitive dissonance with previously stated beliefs, which ultimately leads to cognitive change. The children in the losing condition demonstrated cognitive changes that were maintained over time. The outcome of a gambling task is powerful in its effect on children's cognitions and the present results suggest that using an interactive computer game in which the outcome is experimentally manipulated may be an effective way of modifying children's cognitive perceptions about gambling.

The question then becomes whether these cognitive changes are found in other activities beside the game played (high/low). If, as the data suggests, that children perceive there to be significant skill in blackjack there may well be even stronger effect if the outcome can be manipulated to ensure regular losses. Nevertheless, the current findings suggest that cognitive changes are generalized to other forms of gambling. For gambling in general and the category of combined gambling activities, individuals in the 50% and 10% groups decreased overall ratings and perception of skill and this change was maintained and intensified over time. For individuals in these two groups this decrease in perceived skill was accompanied by a corresponding increase in perception of luck. In accordance with the theory of cognitive dissonance, when comparing the outcome with their sets of cognitive rules, these children decreased their perception of skill involved in the game and adopted a more luck-oriented attitude. It is important to note that only for the 10% group were these increases in perceived luck statistically significant and maintained over testing time.

The results further indicated that ratings for roulette, random intermittent schedules of reinforcement (i.e. the 50% group) generalized to decreases in perceived skill. Further, for blackjack, only the 10% group experienced a decrease in perceived skill, which was maintained over time. A cognitive change in luck ratings was observed for individuals in both the 50 and 10% groups, such that perceptions of luck increased as a result of playing the task. However, only for the group that lost consistently were these changes maintained over time. For lottery and slot machines, games that are solely due to chance, only perceived luck was affected by the experimental manipulation. Increases in ratings of luck were observed for those in the 90%, 50% and 10% groups, yet only those for the 90% group were statistically significant. This may have been due to the fact that for these children, the experience of being highly successful at the game led them to believe that such a high probability of success had to involve more luck than they had initially imagined.

The cognitive changes that were observed in the various gambling tasks confirm the suspicion that modifications in cognitive perceptions as a result of playing the high/low game would generalize to other gambling tasks. The fact that changes were identified for tasks which the children did not actually play is particularly meaningful in terms of prevention. In a prevention program, it is impossible to use every form of gambling in order to change children's erroneous cognitions. Thus, results are important as they suggest that even when children play one particular gambling task, their thoughts and perceptions about other gambling activities change as well. Cognitive change can be generalized, which increases and intensifies the utility of using preventative measures based on cognitive restructuring. The fact that the experience of 10% odds of success led to the greatest amount of cognitive change that was maintained over a longer period of time is significant in terms of planning prevention for children. Preventative measures that make use of this technique of changing the odds in a gambling task to restructure cognitions should ideally place children in an extreme losing condition as this has proven to be more useful than the experience of intermittent reinforcement.

Cognitive behavioral treatment programs for adult and adolescent pathological gamblers, as well as preventative measures, aim to target and correct cognitive distortions associated with specific gambling activities (Derevensky *et al.*, 2004; Gupta and Derevensky, 2004; Petry, 2005; Rugle *et al.*, 2001; Toneatto, 1999a, b). The present results confirm the fact that cognitive restructuring, which is a fundamental component of treatment with adolescent and adult problem gamblers, should also be a necessary component in prevention programs for young children. These preventative measures can be aimed at teaching children objective laws of probabilities and about the randomness and element of chance that is characteristic of most gambling activities. Prevention techniques aimed at modifying cognitive perceptions, if replicated, should be incorporated into interactive prevention tools (McGill University's International Centre for Youth Gambling and High-Risk Behaviors have developed several interactive CD ROM programs for children – *The Amazing Chateau* and *Hooked City* – incorporating such an approach).

The present study included several post-test measures of cognitions in order to determine whether any cognitive changes would be maintained over time. Not only were most changes maintained over testing time, modifications in cognitive perceptions were actually intensified over time, as the greatest mean differences in

ratings of skill and luck were often noted between the pre-test and the last post-test (4 weeks). While 4 weeks is a rather short period of time the results are nevertheless encouraging.

An assessment of the cognitive perceptions concerning non-gambling activities was included as a control measure in order to verify that any changes in cognitive perceptions about gambling tasks would not generalize to non-gambling related activities. As hypothesized, the results indicate that for the non-gambling activities, which are skill-driven, cognitive perceptions of skill and luck did not change as a result of the experimental manipulation. This is a positive indication of the potential productivity of preventative measures aimed at changing children's misperceptions of the amount of skill involved in gambling activities without modifying their perceptions of other non-gambling activities. It is important that cognitive changes generalize to other gambling activities, but not to non-gambling tasks.

With respect to developmental differences, cognitive change occurred more often in younger children with greater magnitude and was more lasting than for older children. Children in grade 5 (mean age = 10.6) changed their perceptions about how much skill and luck are involved in the high/low game, with the losing condition decreasing ratings of skill and increasing the amount of perceived luck. However, for the grade 7 children (mean age = 12.3), no statistically significant changes were noted. For the combined gambling tasks, developmental differences were noted in perceptions of luck. For grade 7 children, perceptions of luck increased for all three experimental groups, whereas for younger children only those in the losing condition increased their belief that the outcome was based upon luck. Older children were more resistant to change whereas for the younger children experiencing poor success induced significant cognitive changes. For gambling in general, perceptions of skill decreased for children in the losing conditions for both grades. It has been well established that as children mature, their cognitive abilities tend to become more sophisticated and differentiated. Prior research on children's cognitions indicated that children exerted an illusion of control (Derevensky *et al.*, 1996; Herman *et al.*, 1998). The present results are promising as they provide evidence that *some* erroneous cognitions may be modified.

The primary gender difference noted was found in the perception for the combined gambling activities as well as for gambling in general. For females, losing 50% of the time was sufficient to induce cognitive change. However, the 10% losing condition was necessary to produce substantial changes in cognitive perceptions to be maintained over time for males. This finding may be due to inherent gender differences in gambling behavior and risk-taking. Much of the gambling literature suggests that gambling is more popular among males than females (Abbott *et al.*, 2004; Derevensky and Gupta, 2004; Hardoon and Derevensky, 2002; Jacobs, 2004; Petry, 2005). The fact that males tend to be greater risk-takers and gamble more than females may explain why the extreme losing condition (i.e. the 10% odds of success group) was necessary to induce the males to change their perceptions about the skill and luck involved in the task. With intermittent reinforcement schedules (i.e. the 50% condition), males continue to believe that they can exert their skill and control the outcome, whereas for females, losing 50% of the time is sufficient to make them doubt their skill in the game and thus perceptions are more readily changed to adopt a more luck-oriented attitude. Prevention initiatives may need to be adjusted and adapted to suit these gender

differences given that males may require different schedules of reinforcement than females to change their thoughts and perceptions about gambling.

Although the authors readily acknowledge that this was a laboratory setting and not a naturalistic study, that only two age groups were included and that the generalizability of the results requires replication, the present study also sought to explore wagering patterns in the high/low task. Using this experimental design, it was possible to examine whether average bets placed per hand varied as a function of the different schedules of reinforcement. The analysis of game playing behavior revealed that the 90% group had significantly greater average wagers per hand than the 10% group. This is not surprising because when individuals were acquiring money, they were risking a greater amount of their earnings on each subsequent bet. However, when examining the amount of money wagered per hand as a percentage of the remaining bankroll, the 10% group had significantly higher average bets (percentage) than the 90% and 50% groups. Thus, when children had a greater amount of money, they continued to increase the size of their wagers. However, when considering the relative amount of money that children had, those in the 10% condition wagered a greater percentage of their bankrolls on each hand than the other two groups, likely trying to recoup their losses – somewhat analogous to chasing behavior.

When playing time was divided into three periods of play, an interesting group difference emerged in betting patterns. While there were no group differences in the first two periods of play, in the final portion of the game the 10% group wagered a greater percentage of their balances per hand than the other groups. Further, only for the 10% group did percent average wagers placed per hand differ significantly across the three periods of play. For children who lost consistently in the high/low task there was a linear increase in percent average wagers placed per hand from the first to the final third of the game. Thus, the 10% group wagered a greater proportion of their money on each hand as the game progressed, which again is more indicative of chasing their losses in the last portion of the game. Interestingly, no significant differences were noted in betting patterns across time for the other two experimental groups.

This study presents an initial evaluation of the effects of experiencing varying schedules of reinforcement on a gambling task on the modifications of cognitive perceptions about gambling. Laboratory studies of gambling behavior have several limitations, particularly concerning the artificiality of the setting. However, the computerized high/low task simulated a real card-cutting game, was attractive, colorful and interactive, and after each hand the amount of winnings was visually displayed in colored chips. Thus, the nature of the task and the gambling scenario were not compromised. As a result of ethical constraints, the children in this research did not use their actual money to gamble with. However, play money was used along with the incentive to win various prizes and it appears as though these incentives were sufficiently motivating. This incentive has been proven successful with children (Gupta and Derevensky, 1996) and adults (Powell *et al.*, 1996).

With the increasing exposure to various forms of gambling and venues at earlier ages, prevention initiatives need to begin early and to be implemented in the elementary school years. The present research has demonstrated that preventative measures would certainly benefit from including a cognitive component, in which interactive computer games could be manipulated so as to induce cognitive change. However, it is important to note that this is only *one* essential component

of a comprehensive prevention program (see Derevensky *et al.*, 2001, 2004a, b for reviews concerning gambling prevention initiatives). Nevertheless, the current results are promising and lend support for their inclusion in our prevention initiatives.

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