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**THE ROLE OF DIFFERENTIAL OUTCOMES ON GAMBLING
BEHAVIOUR**

A thesis
submitted in partial fulfilment
of the requirements for the degree
of
Master of Applied Psychology
at
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by
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Abstract

This research is based on the conduction of a series of experiments that systematically occurred based on participants performance on a gambling simulation. In Experiment 1, a Roulette simulation allowed the manipulation of the probability that a win would occur after a bet on red or black. First year psychology students (N=18) participated for extra course credit and were randomly assigned to one of three experimental conditions (Group 1a started with \$100 credit, experienced 70% probability of a win on red and 10% probability of a win on black with red and black results being drawn evenly; Group 2a experienced the same conditions as Group 1a except for a higher starting credit of \$500; Group 1c started with \$500 credit, experienced 100% probability of a win on red and a 0% probability of a win on black with red and black numbers being drawn equally). Results showed that the majority of participants did not match betting behaviour to reinforcement outcomes. In Experiment 2 the simulation was simplified. Group 2a experienced 70% probability of a win on red and 10% probability of a win on black with both red and black numbers being drawn equally; Group 2b experienced 100% probability of a win on red and 0% probability on black with 90% of numbers drawn by the computer being red and 10% black; Group 2c had 75% probability of winning on red and 25% probability of a win on black with 75% of results drawn being red and 25% being black. Results show that participants gambling behaviour was roughly proportional to the amount of reinforcement received on each colour, demonstrating reinforcer control over participant's behaviour, so called matching. These differing results are then discussed in relation to the possible implications for future research.

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Last, but most defiantly not least, I want to thank my amazing family and whanau. Thank you so much for believing in me through what at times has been a stressful time of my life. Your enduring patience and support has been amazing, I could not have done it without you all.

Dedication

I would like to dedicate this thesis to my parents, Murray and Denise. This thesis is not just a result of my hard work but also yours. Thank you for working so hard to ensure I always have had the best opportunities to allow me to succeed in everything I have done. I would not have been able to achieve this without your constant support and belief in me. Thank you for giving my sisters and me a remarkable upbringing on Great Barrier Island, it has allowed me to become resilient to life's challenges. This thesis is a testimony to your hard work.

Table of Contents

Dedication	iv
List of Figures	vii
List of Tables.....	viii
List of Appendices	ix
Introduction.....	1
Social risk factors for gambling	3
A cognitive understanding of gambling.....	4
Learning theory	7
Gambling as choice/operant behaviour.....	8
Computer simulations used to study gambling	11
Purpose of this research	13
Method Group 1a	14
Participants.....	14
Apparatus, materials and setting	14
Procedure.....	14
Results Group 1a.....	16
Summary of Group 1a results	19
Method Group 1b	19
Participants.....	19
Apparatus, materials and setting	19
Procedure.....	19
Results Group 1b.....	20
Summary of Group 1b results	23
Method Group 1c	23
Participants.....	23

Apparatus, materials and setting	23
Procedure.....	24
Results Group 1c	24
Summary of Group 1c results	28
Discussion of Experiment One.....	29
Method Group 2a	34
Participants.....	34
Apparatus, materials and setting	34
Procedure.....	34
Results Group 2a.....	35
Summary of Group 2a results	39
Method Group 2b	39
Participants.....	39
Apparatus, materials and setting	39
Procedure.....	40
Results Group 2b.....	40
Summary of Group 2b results	44
Method Group 2c	45
Participants.....	45
Apparatus, materials and setting	45
Procedure.....	45
Results Group 2c	46
Summary of Group 2c results	49
Discussion of Experiment 2	50
General Discussion.....	52
References	54

List of Figures

Figure 1: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 1a.	17
Figure 2: Scatter plot for each participant in Group 1a showing the proportion of bets placed on red during each of the ten trial blocks across the session.....	18
Figure 3: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 1b.	21
Figure 4: Scatter plot for each participant in Group 1b showing the proportion of red bets in each of the ten trial blocks across the session.	22
Figure 5: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 1c.	26
Figure 6: Scatter plot for each participant in Group 1c showing the proportion of bets placed on red in each of the ten trial blocks across the session.....	27
Figure 7: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 2a.	37
Figure 8: Scatter plot for each participant in Group 2a showing the proportion of bets placed on red in each of the ten trial blocks during the session.	38
Figure 9: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 2b.	42
Figure 10: Scatter plot for each participant in Group 2b showing the proportion of bets placed on red in each of the ten trial blocks during the session.	43
Figure 11: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 2c.	47
Figure 12: Scatter plot for each participant in Group 2c showing the proportion of bets placed on red in each of the ten trial blocks during the session.	48

List of Tables

Table 1: The proportion of bets placed on red for the first and last third of trials for each participant in Group 1a.....	16
Table 2: The proportion of bets placed on red for the first and last third of trials for each participant in Group 1b.	20
Table 3: The number of bets placed on red for the first and last third of trials for each participant in Group 1c.	24
Table 4: The proportion of bets placed on red for the first and last third of trials for each participant in Group 2a.....	36
Table 5: The proportion of bets placed on red for the first and last third of trials for each participant in Group 2b.	40
Table 6: The proportion of bets placed on red for the first and last third of trials for each participant in Group 2c.....	46

List of Appendices

Appendix A: Informed consent form.....	62
Appendix B: Questionnaire.....	63
Appendix C: Instructions for Experiment 1.....	64
Appendix D: Information sheet for participants.....	65
Appendix E: Course credit form.....	66
Appendix F: Raw data of each participant on disk.....	67

Introduction

Everyday life is made up of numerous choices and our behaviour is shaped by the outcomes of these choices which in turn affect our future decisions. We often know what the outcome of each choice is in advance; this allows us to make decisions that are best for both the present and the future. When the outcome is not known two choices can be made, to act despite not knowing the consequence or not act at all. When the person doesn't know the outcomes of an action then this behaviour is referred to as risky. Impulsive and risky choices are made under conditions of uncertainty, which means that they are engaging in behaviour without knowing the outcome and hence consequence of that behaviour. A good example of behaviour that involves not knowing the outcomes is gambling as a recreational activity. This is when money is wagered on an outcome, for example, lotto, black jack, pokies and roulette.

In the period from 2009 to 2010 New Zealanders spent \$1.9 billion on all forms of gambling (The Department of Internal Affairs, 2008). Approximately 2% of New Zealand's adult population are problem gamblers (Mason & Arnold, 2007) with Maori people being over represented in this group (Abbott, Volberg & Ronnberg, 2004; Morrison, 2004). The money spent on gambling is not necessarily from the person's own pocket, problem gamblers often commit crimes to support their gambling. In Australia, out of a sample of 102 offenders in a correctional facility 34.5% had a form of problem gambling according to SOGS (Southern Oaks Gambling Screen); of this group 45.7 % had offended to fund their gambling (Lahn, 2005). Problem gambling puts a strain on non-profit

organisations. In 2005 37% of people who used food banks as their primary food source were either problem gamblers or lived with someone who gambled (Wynd, 2005). The consequence of gambling behaviour not only affects the individual but also their families and wider community. Gambling is a risky behaviour with high cost consequences. The following will look at a few of these costs and the impact of them on the community.

A negative consequence of problem gambling is that a problem gambler has an increased risk of engaging in domestic violence, otherwise known as intimate partner violence (IPV). In a Canadian study with 248 problem gamblers 55.6% reported initiating IPV and 25.4% of the problem gamblers reported committing severe IPV (Korman, Collins, Dutton, Dhayanathan, Littlan-Sharp & Skinner, 2008). In a survey of 286 women, who were admitted to the Emergency Department for IPV, this correlation was again confirmed with the risk being higher if the partner was also a problem drinker (Muelleman, Denotter, Wadmann, Trann & Anderson, 2002). The relationship between gambling and IPV has been examined in a New Zealand context using a cohort of Pacific Island families. A concern raised by Schluter, Abbott and Bellringer (2008) is that, after accounting for problem drinking, no association was found between these two factors in New Zealand. Although limitations were noted that could impact this finding, alcohol has been shown to be factor associated with IPV on its own which raises the question as to whether the relationship between problem gambling and IPV is due to gambling, alcohol or a combination (Schluter et al, 2008).

Social risk factors for gambling

Research suggests that each ethnic group has a different risk of developing problem gambling at different times. It is not clear what causes this difference but low socioeconomic status is a significant factor. Worldwide, minority ethnic groups tend to have a household income that puts them in this lower socioeconomic status (Welte, Barnes, Weiczorek, Tidwell & Parker, 2004). For example, in New Zealand Maori and Pacific Island people have a three to six fold increased risk of developing a gambling problem in comparison to their Caucasian counterparts (Abbot & Volberg, 2000) and over represented in the lower socioeconomic status (Chapple, 2000).

A factor that is associated with lower socioeconomic status that has been found to increase a person's risk of developing problem gambling is a lower level of formal education (el Guebaly, Patten, Currie, Williams, Beck, Maxwell & Wang, 2006; Petry, 2005). A proposed reason for why lower education increases a person's risk is that people with lower education base their decisions on their emotional arousal, whereas people with a higher education tend to base decisions on information (Evans, Kemish & Turnbull, 2004). This may be why a person may continue to gamble as they are basing their decisions on the emotional arousal that they experience from gambling despite financial and other losses.

A further factor that has been shown to increase a person's chance of developing problem gambling is their residential location. Lower socioeconomic areas have been shown to have a higher number of gambling outlets, indicating that people in these regions are at higher risk (Welte et al., 2004). In New Zealand almost half (48%) of non-casino gambling machines are found in areas of highest

deprivation, that is in residential areas that are decile 8 or lower (Francis group, 2009). It is unclear to say whether this is the case because a person who lives in close proximity to a gambling outlet is more likely to become a problem gambler, if the person likes gambling then they are more likely to move to be near the outlet for convenience (for example a person living next to a race track if they like betting on horses) or whether the outlets are placed in these areas to increase financial gain as they are amongst people who are at higher risk of gambling.

The relationship between location, socioeconomic status, education level and gambling is a complex relationship. In summary it is important to know that this relationship is largely established by correlation and the exact causal relationship amongst these factors remains unclear; most people who are classified as in the lower socioeconomic status are not problem gamblers. Recognition of social risk factors is important to understanding problem gambling, however, it does not allow us to understand how the individual person develops problem gambling behaviour. In order to gain a better understanding of problem gambling from an individualistic point of view, the cognitive theory of problem gambling will now be covered.

A cognitive understanding of gambling

The most developed theory to explain pathological gambling is cognitive theory (Ferland, Ladouceur & Vitaro, 2002). The main assumption behind cognitive theory, as to why and how people continue to gamble, lies in erroneous beliefs. It is thought that erroneous beliefs lead the gambler to believe they have control over the game because they do not understand the concept of randomness

and that they believe they are able to predict the next outcome. This belief leads them to think that they can beat the game by developing strategies that increases their chance of winning (Caron & Ladouceur, 2003; Ferland et al., 2002). In the majority of cases this is not true, each bet or trial is independent of the next and hence these strategies have no effect on the outcome. Trying to gain an understanding of whether a person has faulty beliefs provides some difficulty as a belief is not directly observable and relies on self-report. It has been argued one way to investigate beliefs is by listening to a person's verbalizations or speech. In a cognitive understanding these verbalizations are taken as products of, or evidence for beliefs, and are considered a way to quantify the erroneous beliefs severity. Various questionnaires, such as the Gamblers' Beliefs Questionnaire (GBQ) (Steenbergh, 2002), are also designed to try and test for erroneous beliefs.

Research has examined whether there is a difference in erroneous beliefs between pathological gamblers and non-pathological gamblers by asking them to speak aloud while gambling. In one study, participants were classified as pathological gamblers if they met the requirements of the SOGS and as non-pathological gamblers if they did not. Whilst playing a slot machine participants were asked to verbalize what they were thinking. Verbalizations were either categorized as erroneous beliefs or other verbalizations. It was found that there was no significant difference in the number of erroneous beliefs verbalized during gambling between these two groups (Ladouceur, 2004). The notion that erroneous beliefs are also verbalized at a high rate by non-gamblers is supported by Ladouceur, Paquet and Dube (1996) who looked at the number of erroneous verbalizations in first year university students. Using the concept of tossing a coin, participants were asked to create a random list of what 100 coin tosses

would look like, in other words they were asked to create a random list of heads or tails. High rates of erroneous verbalizations were emitted by the students regarding the relationship between the previous events and the next event, suggesting erroneous beliefs prevented them from understanding that each event is independent of the next (Ladouceur et. al. 1996).

Questionnaires have also been used as a tool to assess any difference in erroneous beliefs between non pathological gamblers and pathological gamblers. A battery of questionnaires was administered to 166 gamblers who were recruited from various locations. Participants were either classified as pathological (N=73) or non-pathological gamblers (N=93) according to SOGS. Results showed that pathological gamblers scored a significantly higher measure on illusion of control compared to non-pathological gamblers. In addition participants who reported to prefer skill games, such as horse betting, scored significantly higher than those who preferred to play chance games (for example, lotto) (Myrseth, Brunborg & Eidem, 2010).

The gamblers fallacy, also referred to as the principle of “maturity of chances” (Clotfelter & Cook, 1993) is a well recognised concept within gambling literature that is based on faulty beliefs. The gamblers fallacy is “arguing that because a chance event has had a certain run in the past, the probability of its occurrence in the future is significantly altered” (Damer, 2009, p.186). A good example of the gamblers fallacy is of a coin toss. If heads were flipped five times in a row, it would be thought that the chances of a tails occurring next would be increased, whereas the odds stay the same as each toss is independent of the next.

Correcting erroneous beliefs about a person's control over chance games, for example pokies and roulette, is the focus of cognitive treatment (Ladouceur, Sylvain, Latarte, Giroux & Jaques, 1998; Ladouceur, Sylvain, Boutin, Lachance, Doucet & Lebland, 2003). Cognitive based treatment is broken into four components; understanding the concept of randomness, understanding the erroneous beliefs held by the gambler, awareness of inaccurate perceptions and cognitive correction of erroneous perceptions. Cognitive treatment of pathological gambling has been shown to be successful with the majority of people no longer meeting diagnostic criteria for pathological gambling and that these results are maintained over a period of time (Ladouceur et al., 1998; Ladouceur et al., 2003). The success of this therapeutic practice is taken as evidence of the cognitive theories explanation of problem gambling, that erroneous beliefs are the central cause.

A Cognitive theory of problem gambling is based on erroneous beliefs, which is suggested to be the core cause of problem gambling. What cognitive theory does not tell us is how these verbal behaviours are formed and under what conditions. One branch of psychological work that focuses on the development of new behaviour is learning theory, especially the use of reinforcement and punishment in the establishment of behaviours.

Learning theory

Learning theory argues that behaviour is maintained by its consequences, otherwise known as reinforcement; an event which follows a response that increases the likelihood that the organism will make the response in the future.

The simplest pattern of reinforcement is continuous reinforcement (when every response receives reinforcement). Continuous reinforcement is often used to shape new behaviour before switching to an intermittent or partial reinforcement schedule. Intermittent or partial reinforcement is when a response gets reinforced after a specified or averaged amount of time or number of responses. Behaviour that is controlled by an intermittent reinforcement schedule is more resistant to extinction than behaviour on a continuous reinforcement schedule. This means that behaviour that receives reinforcement every now and then is more likely to continue when reinforcement ceases. It is thought by some that gambling behaviour is controlled by a *variable ratio* (VR) schedule of reinforcement (when a response is reinforced after an average number of non-reinforced responses) (Skinner, 1957). The use of this reinforcement schedule in gambling can lead to problematic gambling, though not intentional, as it can create a feeling of potentially missing out on a win if the next bet is not placed. Schedules of reinforcement are frequently used in research based on learning theory to examine the development and maintenance of behaviour.

Gambling as choice/operant behaviour

One way of understanding why someone behaves in the manner that they do is by viewing all behaviour as a choice and trying to identify what maintains these choices. In this view choice behaviour is the allocation of responses across alternatives, “ for the measure of choice is just the ratio of the simple outputs for the alternative responses” (Herrnstein, 1970, p. 253). In behaviourism choice is not intended to imply the concept of free will but is a term that acknowledges that there are multiple response alternatives available at one time to an organism

(Fantino & Logan, 1979). Behaviour under the control of a reinforcement schedule serves a purpose to the organism, which is emitting the response functions as a way of receiving reinforcement whether this is food, money or timeout. A way of conceptualizing why a person may choose to engage in gambling is to look at it as an operant behaviour.

Operant behaviours are classified by their function on the environment and are grouped in operant classes; behaviours grouped under one class may differ in form but the purpose or outcome of these behaviours are the same. Studying operant behaviour traditionally involves the organism manipulating some form of equipment so that their response can be easily quantified (Lattal & Perone, 1998) allowing the research hypothesis to be scientifically tested. The use of operant response devices in experimental conditions with humans is not a new phenomenon; original human operant research was conducted with psychiatric patients in hospital settings (Holz, Azrin & Ayllon, 1963; Herman & Azrin, 1964). An outcome of looking at the way responses are allocated to each option is being able to assess if the subject is maximising or matching their rate of behaviour to reinforcement, this occurs when the organism allocates more responses to the richer schedule (de Villers, 1977). In experimental settings it also allows the researcher to see whether the organism is sensitive to reinforcement changes by examining if the rate of behaviour changes to match to reinforcement amount if the schedules are switched on either side. By being able to get the subjects behaviour to shift to the side that delivers the most reinforcement, control of behaviour is being demonstrated. Schedules of reinforcement are also used to test theories of behavioural development such as the 'big win'.

One of the proposed reasons why some people who gamble become pathological gamblers and others do not, is that they experience an early big win in their gambling career (Weatherly, Sauter & King, 2004). In comparison to social gamblers pathological gamblers are more likely to report experiencing a big win earlier in their gambling career as well as reporting experiencing medium sized wins every now and then; social gamblers reported experiencing next to no wins early on (Turner, Zangeneh & Littman-Sharp, 2006). While the big win may make sense on face value it is important to take into consideration that these findings are retrospective and cannot be confirmed experimentally. Experimental research (Brandt & Pietras, 2008; Weatherly Sauter & King, 2004; Young, Wohl, Matheson, Beaumann & Anisman, 2008) has examined this theory of problem gambling development. The results of the above research places the big win as a cause of the development of problem gambling under question, the results of this research is discussed below.

Four groups of participants with little or no gambling experience played a computer simulated slot machine for course credits and the chance of getting cash. The 1st group received a big win on the 1st play, the 2nd group got a large win on the 5th play, the 3rd group got smaller wins on the 2nd and 5th play, and the 4th group received no wins. They found that when participants were given the chance to quit the game, the 1st group was the first to quit the simulation play (Weatherly et. al, 2004). This supports a behavioural model of gambling in that when the participant receives rewards on an intermittent schedule their behaviour is less resistant to extinction. In addition it has also been found that participants who experienced an early large win gambled for a shorter period of time on a

simulation slot machine than participants who had received smaller wins that equated to the overall amount (Brandt & Pietras, 2008; Young et al, 2008).

Human operant research has traditionally been confined to limited research areas but one way of investigating new areas is using animals. Recently a animal model of gambling behaviour has been developed using operant research that demonstrates the rats show the same pattern of response latencies after a win, loss or near win trials as humans (Peters, Hunt & Harper, 2010; Weatherly & Derenne, 2007). The advancement of technology also allows us to study a wider range of behaviour in a controlled experimental fashion. The use of simulations, in particular computer simulations in gambling research, has allowed researchers to overcome previous hurdles, these hurdles are discussed below.

Computer simulations used to study gambling

For various reasons it is not always possible to use real gambling equipment for the purpose of research. For legal, commercial and ethical reasons it is very difficult, if not near impossible to use real gambling equipment in the natural setting or experimental setting to conduct research. This is because it would be possible for the participant to leave with less of their own money, which is unethical, and payoff rates could not be controlled. Modern technology has allowed researchers to overcome this hurdle by developing simulations of various forms that allow the researcher to control and manipulate various factors to look at their relationship to gambling behaviour.

One of the most common simulations used is a pokie/ slot machine. Several studies have utilized simulation slot machines to look at how a big win

verse smaller intermittent wins effects duration of play by controlling how much and when a person receives a win (e.g., Weatherly et al., 2004; Young et al., 2008; Brandt & Pietras, 2008). A computer simulated slot machine was also used by Weatherly and Brandt (2004) to look at the relationship between payback percentages, cost of each bet placed and how much the participant bet. MacLin, Dixon and Hayes (1999) created a computerized slot machine simulation that was later used by Dixon and Schreiber (2002) to collect data from university students who played the simulation, such as latencies between wins and the next bet, to show that this data could be collected in order to try and understand patterns of behaviour in gambling. Roulette simulations have also been used to try and understand more about gambling behaviour. Benhsain, Taillefer and Ladouceur (2004) utilized a roulette simulation to investigate whether reminders about the independence of events, while participants played roulette, would affect the number of erroneous beliefs emitted by participants. They found that in the group receiving reminders the participants were more likely to bet less and quit the game earlier whereas the no reminder group played for longer and bet more (Benhsain et al, 2004). Another roulette simulation was employed to study the relationship between frequency of wins and irrational thinking (Ladouceur, Gaboury, Dumont & Rocheete, 1988) and found no correlation between frequency of wins and frequency of irrational verbalizations.

An issue that is raised in the utilization of simulations for human operant work is the use of points as reinforcement. Whilst points allow for immediate delivery of reinforcement and are the most convenient form of reinforcement for humans their reinforcing value is recognised as less than other forms such as money (Galizio & Buskist, 1988; Kollins, Newlands & Critchfield, 1997).

However, it has been shown that perceptual consequences are successful at reinforcing behaviour using computer simulations (Sumpter & McEwan, 2003).

What is lacking in the above studies using roulette is the recording of actual data about each game including individual events of behaviour and the machines outcomes for the gambling session. A previous roulette simulation has been created to record this sort of data (MacLin & Dixon, 2004) but has been utilized less in comparison to other forms of gambling. A video poker simulation developed by Dixon, MacLin and Hayes (1999) was later utilised by Dixon and Schreiber (2002) to collect such data using undergraduate students. This simulation and the type of data that was able to be gathered demonstrate that it is possible to collect data which supports a behavioural model.

Purpose of this research

The purpose of the current research is to add to the present pool of research on gambling from a behavioural perspective by being able to demonstrate reinforcer control of participants betting behaviour. It was hypothesised that participants would bet more frequently on the colour which received proportionally more wins than the other colour, resulting in behaviour that resembles matching. It was expected that participants would bet evenly between the two colours at the start of the experimental session but over time as they experience the higher proportion of wins on red their betting would shift towards increasing the frequency of bets placed on red.

Method Group 1a

Participants

Participants were six first year psychology students from The University of Waikato (1 Male and 5 Female) who ranged in age from 18 to 22 years old (M= 19.8 years). Students volunteered to be participants and were recruited through advertisement on the students' class website. Informed consent was given before the participant began the experiment. Participants were able to get one course credit for participation, a copy of the research results was offered. This experiment had received approval from the School of Psychology's Human Research Ethics Committee (Ref: 10:17).

Apparatus, materials and setting

Participants received printed information about the research, an instruction sheet, course credit form and an informed consent form; copies of these forms can be found in the Appendix A to D. After participants finished playing the roulette simulation they answered a brief questionnaire about their age, sex and ethnicity and gambling experience. The research room measured 2.5m by 3.2m and had a desk top computer. The Roulette simulation used for this research was programmed at The University of Waikato and was delivered via the internet.

Procedure

On arrival to the research room participants sat down in front of the computer and were handed an information sheet, instructions, consent form, course credit form and the brief questionnaire. Participants were instructed to read

the information sheet, the instructions and ask any questions before signing the consent form. Participants were asked to fill out the other forms after they finished playing the roulette simulation. They were told that the researcher would be leaving the room but if the participant had any questions the researcher would be waiting outside, the researcher then left.

Participants started the game with \$100 nominal credit; this was explained to participants at the start of the experiment. For Group 1a the roulette simulation was set by the researcher so that 50% of all the numbers drawn by the computer were red and 50% black. A bet on a red number had a 70% probability of resulting in a win when the computer drew a red number, whereas a bet placed on a black number only had a 10% probability of a win when a black number was drawn by the computer. For the purpose of this study, bets could only be placed on the specific numbers but not on any of the side bets. Participants could only make a bet of \$5 at a time. If the bet resulted in a loss then the \$5 was removed from the participant's credit, if it was a winning bet the participant was credited with \$20. When the roulette wheel spun a sound of the ball moving around the wheel was made and lasted for 6 seconds. Sounds also accompanied chips being taken or added as the result of the spin. To ensure the volume was the same for all participants the volume was adjusted to the maximum setting of the computer before the participant arrived. All sounds were played through the internal PC speaker. Participants played the simulation for 45 minutes. Once the experimental session ended the researcher then debriefed the participant.

Results Group 1a

Table 1 shows the proportion of responses on red numbers in the first and last third of trials. This comparison of proportions allows any difference between the numbers of bets placed at the start and end of the session to be recognised.

Table 1: The proportion of bets placed on red for the first and last third of trials for each participant in Group 1a.

Participant	Total number of bets	Proportion of red bets in first third	Proportion of red bets in last third
8196	129	0.35	0.53
8211	181	0.6	0.48
8194	177	0.69	0.51
8198	177	0.85	0.98
8200	25	0.17	0.23
8192	70	0.77	0.37

A paired samples t-test was conducted to compare the proportion of bets placed on red in the first third and last third of trials in the session. The proportion of red bets in the first third ($M = 0.57$, $SD = 0.26$) was not significantly different than the last third ($M = 0.51$, $SD = 0.25$), $t(5) = 0.61$, $p = 0.57$.

To determine if the participant's allocation of behaviour was matching reinforcement amount, the proportion of bets on red and the proportion of wins on

red were then plotted against each other on a scatterplot (see Figure 1). To test if there was any change in play due to reinforcement over time, the proportion of red bets in each ten trial block across the session was plotted (see Figure 2).

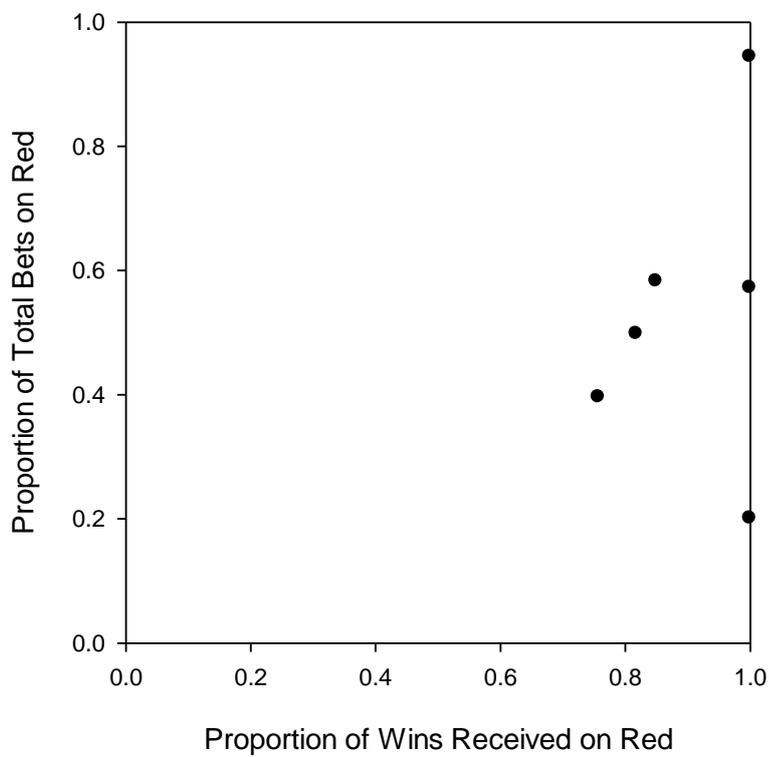


Figure 1: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 1a.

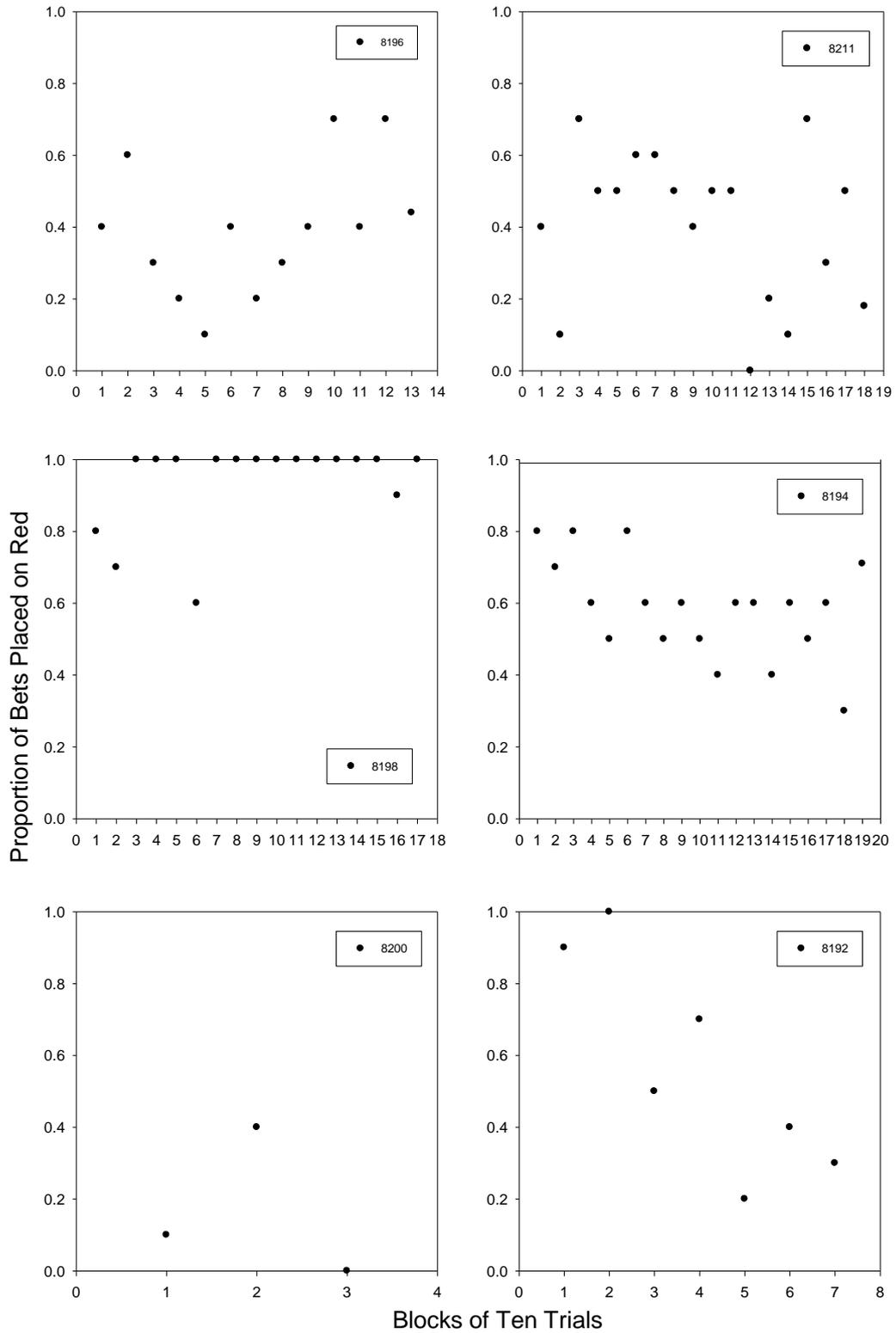


Figure 2: Scatter plot for each participant in Group 1a showing the proportion of bets placed on red during each of the ten trial blocks across the session.

Summary of Group 1a results

No significant difference was found between the proportion of bets placed on red numbers in the first and last third of trials for the entire session, indicating no reinforcer control developing over the participant's behaviour across the session, this lack of reinforcer control is seen in Figure 1 and Figure 2. Participant 8200 and 8192 ran out of credit early in the session, consequently a second condition was created with a higher starting credit so that sessions would run for a longer amount of time allow time for any effect of the higher probability of a win on red numbers to influence the frequency of bets placed on red to develop. All other variables for Group 1b were kept the same as Group 1a so any difference between groups could be put down to a higher starting credit.

Method Group 1b

Participants

The participants were seven first year psychology students from The University of Waikato (1 Male and 6 Female) who ranged in age from 18 to 49 (M=31.4 years). The recruitment procedure was the same as for Group 1a.

Apparatus, materials and setting

As previously in Group 1a.

Procedure

Procedure for Group 1b was the same as Group 1a for the exception of the starting credit amount. Participants in Group 1b started the game with \$500 credit.

Results Group 1b

The same analyses were carried out for Group 1b as Group 1a. Table 2 shows the proportion of bets placed on red numbers in the first and last third of trials for each participant.

Table 2: The proportion of bets placed on red for the first and last third of trials for each participant in Group 1b.

Participant	Total number of bets	Proportion of red bets in first third	Proportion of red bets in last third
8216	155	0.98	1
8205	146	0.48	0.46
8213	188	0.5	0.4
8230	168	0.46	0.45
8232	173	0.54	0.53
8235	183	0.48	0.49
8246	158	0.72	1

The difference between the proportion of bets placed on red in the first third of trials ($M = 0.59$, $SD = 0.19$) and the last third of trials ($M = 0.62$, $SD = 0.26$) was not significant, $t(6) = -0.54$, $p = 0.61$.

The proportion of total play on red and the proportion of wins on red were then plotted against each other on a scatterplot to compare the overall proportion of play on red compared to the proportion of wins received on red for the entire session (see Figure 3). As in Group 1a any trend of play that could be observed was examined by plotting the proportion of bets placed on red in each ten trial block as a function of consecutive blocks across the entire session (see Figure 4).

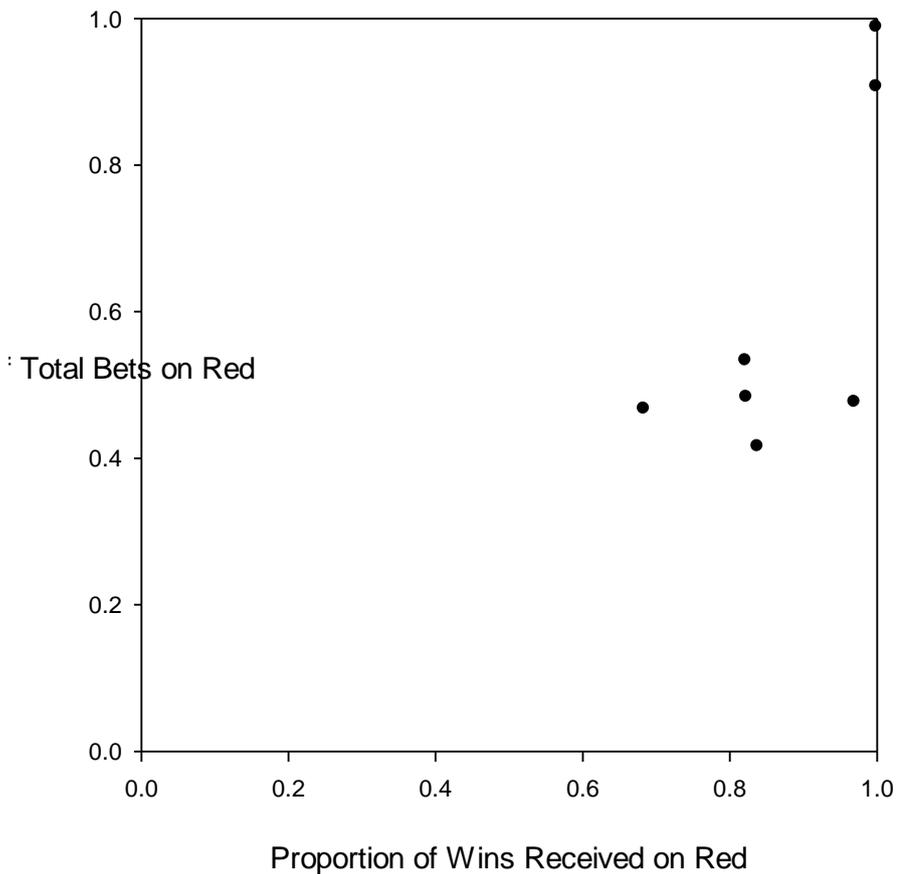


Figure 3: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 1b.

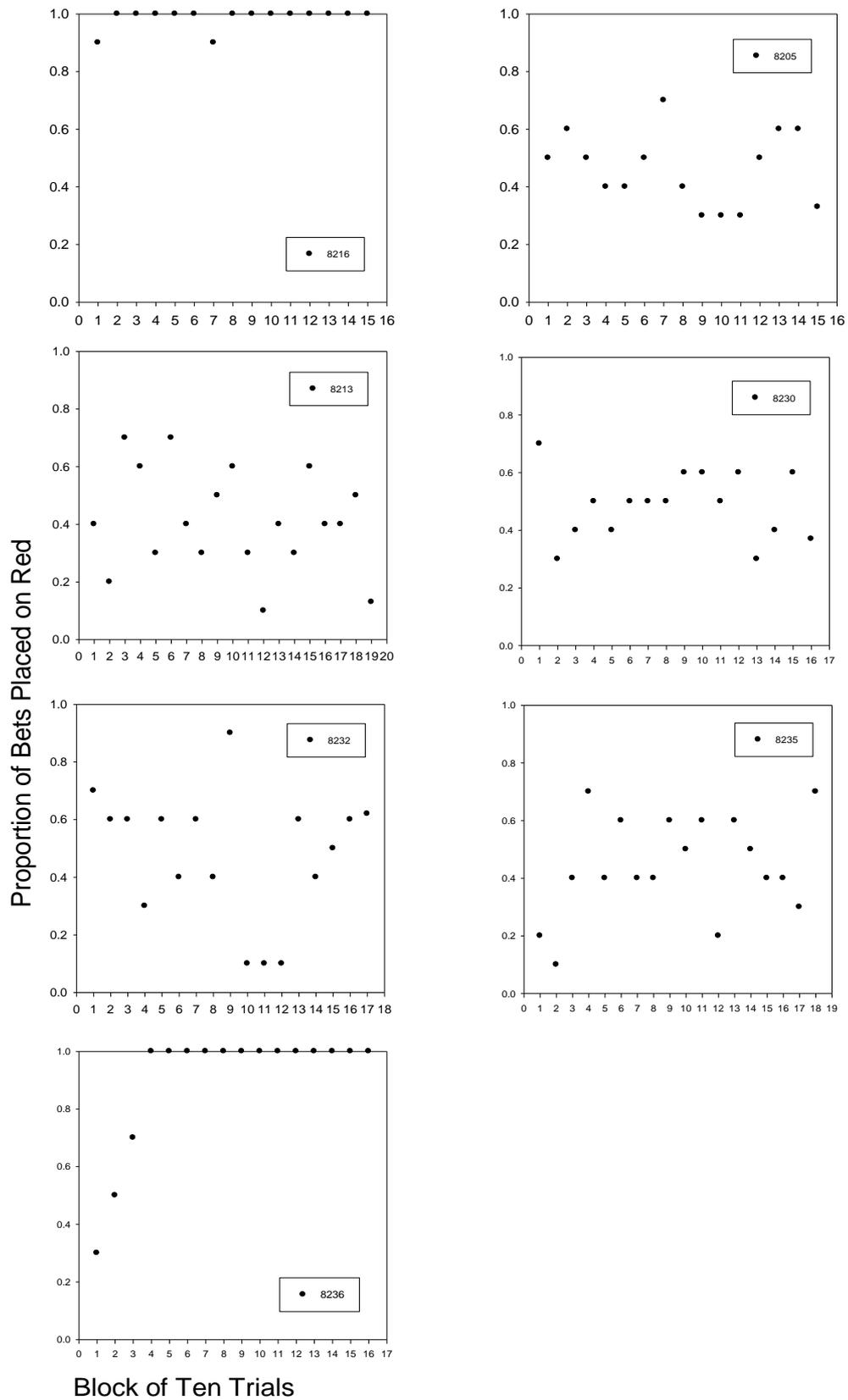


Figure 4: Scatter plot for each participant in Group 1b showing the proportion of red bets in each of the ten trial blocks across the session.

Summary of Group 1b results

Group 1b experienced the same conditions as Group 1a except for an increased starting credit of \$500. No significant difference was found between the proportions of bets placed on red in the first third vs. the last third of trials for the entire session. As shown in Figure 3 and Figure 4 participant's behaviour, in general, did not demonstrate reinforcer control as their behaviour did not shift towards betting more frequently on red. A potential reason for the observed behaviour is the difference in wins received on each colour was not large enough. To investigate if this could be a contributing factor to the lack of control over participant's behaviour a third experimental condition was created to test if a 100% probability of winning on red and a zero probability of winning on black would allow for reinforcer control.

Method Group 1c

Participants

The participants were five first year psychology students from The University of Waikato (2 Male and 3 Female) who ranged in age from 18 to 55 (M = 29.4 years). Recruitment and informed consent was the same as for previous groups.

Apparatus, materials and setting

The materials, apparatus and setting used for Group 1c are the same used by the two previous groups and copies can be found in Appendix A-E.

Procedure

The procedure for Group 1c was the same as Group 1b apart from the following changes. For Group 1c the roulette simulation was set by the researcher so that 50% of all the numbers drawn by the computer were red and 50% black. A bet on a red number had a 100% probability of resulting in a win, whereas a bet placed on a black number had a 0% probability of a win.

Results Group 1c

As in Group 1a and Group 1b, the proportion of red bets placed on each trial for the first and last third of trials for the entire session for each participant was calculated. These proportions can be found in Table 3.

Table 3: The number of bets placed on red for the first and last third of trials for each participant in Group 1c.

Participant	Total number of bets	Proportion of red bets in first third	Proportion of red bets in last third
8223	158	0.48	0.46
8221	141	0.53	0.32
8226	176	0.54	0.56
8225	174	0.43	0.33
8228	159	0.72	0.68

A comparison of the proportion of red bets in the first third of trials ($M = 0.54$, $SD = 0.11$) and the proportion of red bets in the last third of trials ($M = 0.47$, $SD = 0.15$) showed no significant difference, $t(4) = 1.75$, $p = 0.15$.

The proportion of total play on red and the proportion of total wins on red, calculated in the same manner as Group 1a and 1b were then plotted against each other on a scatterplot to look at the relationship between the two variables (see Figure 5). To examine any pattern in play the proportion of bets placed on red in each ten trial block across the session was plotted (see Figure 6).

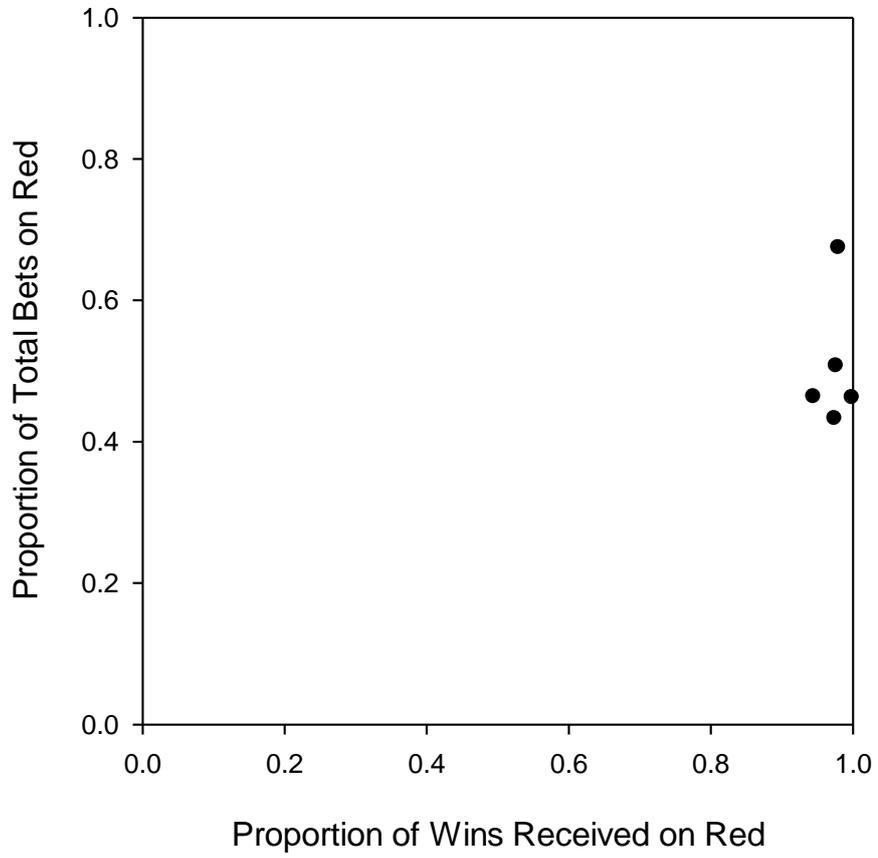


Figure 5: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 1c.

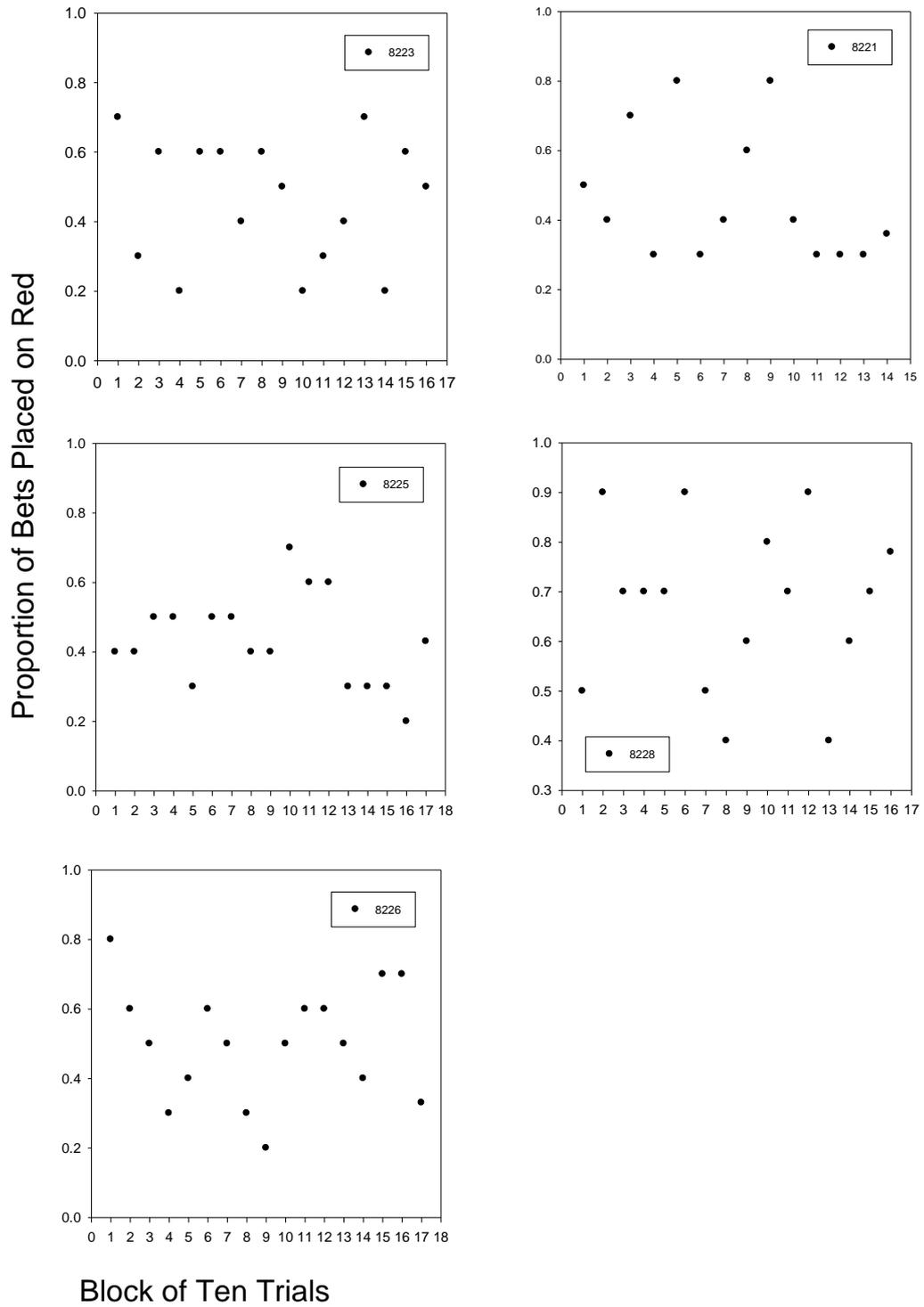


Figure 6: Scatter plot for each participant in Group 1c showing the proportion of bets placed on red in each of the ten trial blocks across the session.

Summary of Group 1c results

As seen in Figure 5 and Figure 6, increasing the probability that red will win and decreasing the probability that a black number will win had no significant effect in controlling participant's behaviour. A possible reason for these results was that the participant was observing what number the win occurred on rather than what colour the number was when the win occurred. An additional factor is whether the wins were salient enough to control subsequent behaviour. In order to address these possible issues a new version of the roulette simulation was created to see if gambling behaviour can be controlled using a simpler simulation in a new series of experiments.

Discussion of Experiment One

The current experiment aimed to gain a better understanding of gambling by viewing it as operant behaviour which is under the control of its consequences. In Experiment 1 a series of conditions (Group 1a, 1b and 1c) allowed participants to bet on individual numbers on a Roulette simulation for 45 minutes. Despite the probability of a win on each colour being manipulated so a win was more probable after a bet on red numbers, participants did not bet more frequently on red. This was not what was expected. Based on previous research on schedules of reinforcement it was expected that participants would bet more frequently on red numbers than black but this was clearly not the case.

A possible reason for the results obtained in the first series of experiments is that the winning trials were not salient enough to distinguish them from non-winning trials. When a win did occur, the differences were the pin appearing on the same number as the participant bet, the overall credit total rose on the tally and instead of the sounds of chips being taken away a 'win' noise was made. Whilst these design features do make the two sorts of trials different it is possible that these differences were not obvious enough to make a win "standout" or be discriminable. In human operant research where instructions, self-instructions and verbalised rules for responding are present, reinforcement changes behaviour due to its informative function not motivational function (Svartdal & Mortensen, 1993). If wins/reinforcement were salient enough it would be expected that participants would start to bet more frequently on red numbers and match their behaviour in relation to the amount of wins received on each colour. These results

indicate that the reinforcement participants received was not adequate in its form to inform participants which behaviour they had engaged in was correct. Human operant research has shown that it is possible for control over a non-salient or reinforced aspect of behaviour to be demonstrated whilst rules govern a salient aspect of a behaviour, for example participants responding on a visual discrimination received reinforcement dependent on the force they used to press the button rather than on whether they correctly discriminated between two images as they were told (Svardtal, 1991; Svardtal & Mortensen, 1993). In the current research it is possible that participant's behaviour was being governed by previous rules regarding gambling strategies and that wins were inadequate at reinforcing the preceding behaviour and hence not increasing the frequency of bets placed on red.

An additional factor in this experiment which may have lead to the inability to demonstrate reinforcer control over participant's behaviour is the use of points as reinforcement. The use of real money brings along with it ethical concerns that are best avoided by using another means of reinforcement and hence why points were used. Points are the most common form of reinforcement used in human operant research mainly due to their convenience but not for their high reinforcing value, but despite this it is apparently possible to gain reinforcer control using points (Galizo & Buskist, 1988). A comparison of research that used points which were able to be exchanged for money against research that employed other means of reinforcement were found to be less effective in gaining reinforcer control (Kollins, et al., 1997). Participants in the current research were not able to exchange the points they had gained at the end of the session for cash or other rewards which suggests that without this extra step the points would be even less

effective. Whilst the use of points allows for fast delivery of reinforcement after the required correct response, the delay until the points could be exchanged for money or other item may decrease their effectiveness as a reinforcer (Galizio & Buskist, 1988). Regardless of how many points participants left the experimental session with or if the session finished early they were still able to gain one extra course credit which is added to their course mark at the end of the semester. In short, participants were rewarded for participating in the experiment but not effectively differentially rewarded for their performance. As a result they completed the task but behaviour was not influenced by the outcomes.

The unexpected lack of impact of the probability of a win on red on the frequency of bets placed on red shown by Experiment 1 is not the only experimental work that has shown surprising results. In a study to investigate the role of accurate/ inaccurate rules regarding roulette whilst participants played a roulette simulation showed that despite reinforcement density being manipulated participants still followed rules regardless of their accuracy (Dixon, Hayes & Abon, 2000). Whilst the current experiment only gave the participants a set of accurate instructions as to how to play the game, and not inaccurate/ accurate rules about roulette. When participants in this study entered the experiment they brought with them sets of rules regarding gambling that they had previously been exposed to. Despite participants in all three experimental conditions coming in contact with the configured higher reinforcement on red numbers, participants did not start to bet more frequently on red (see Figure 2,4 & 6), suggesting that they might be following previously gained rules despite their inaccuracy. Rule following despite opposing contingencies has also been found in non-gambling tasks (Hayes, Brownstein, Zettle, Rosenfard & Korn, 1986; Hayes, Brownstein &

Haas, 1986). Whilst this study did not set out to assess the effect of previously gained rules about gambling on a current gambling session, this may be worth future research.

Cognitive explanations of gambling behaviour suggest that erroneous beliefs about gambling events, such as gamblers fallacy, are why some individuals become problem gamblers. In other words the verbalizations a person makes about their behaviour is taken to be the cause of their problem gambling, not the environment and contingencies surrounding the behaviour. The core erroneous belief held accountable in problem gambling is the gambler's fallacy (Tversky & Kahneman, 1971; Tversky & Kahneman, 1974). A person who is said to possess this belief lacks the ability to understand and/or apply the concept of randomness to events that are independent of each other (for example, Ladouceur et. al. 1996). A design feature of the first simulation was a small table on the upper right side of the screen that showed the numbers that the computer had previously drawn. It is possible that participants were choosing where to place their bet based on what had previously been drawn on the basis that numbers which had not been drawn recently had an increased chance that they will be drawn next and win; a pattern of play that would be consistent with the gamblers fallacy. Previous research has shown that when previous results are available to a person they are more likely to choose numbers that have not been drawn recently and make their choice based on this despite their being no correlation between the two events. A study on the analyse of numbers chosen in the New Jersey 'Pick 3' lottery game over five years showed that ticket buyers are less likely to choose winning numbers in the following weeks after that number won (Terrell, 1994). It is plausible that in the current research this behaviour was occurring. One reason that has been proposed

as to why people act this way is a belief in the ‘law of small numbers’. This is when a person believes that a small sample of outcomes should resemble a large population, for example believing heads and tails should be even in a small sample of coin tosses (Robin, 2002; Robin & Vaynos, 2009). In the current experiment the small table showing the previously drawn numbers is a small sample of the larger population. If participants were basing their choices on what could be seen in the table shown on the screen, and not on the outcomes of the bets, then it could be said that the participants were demonstrating behaviour that matches the ‘law of small numbers’. The concept of the gamblers fallacy may very well be a contributing reason as to why the obtained results were not what were expected. While this offers an explanation as to why an increased probability of winning on red did not affect the frequency of bets placed on red it is important to note that this current research was not designed to test this theory and is only put forward here as a tentative explanation of the current results.

The aim of Experiment 1 was to demonstrate control over participants betting behaviour by manipulating the probability of a win after a bet on red numbers, however, the results showed no effect between the probability of a win after betting on red and the frequency of bets placed on red. Possible reasons as to why this occurred came down to design factors. In order to address and rule out the software design factors discussed above a second experiment was run using a modified version of the roulette simulation.

Method Group 2a

Participants

Participants of this group were four first year psychology students from The University of Waikato (4 Female) who ranged in ages from 20 to 29 years old (M= 23.7 years). Students volunteered to be participants and were recruited through advertisement on the students' class website. Informed consent was given before participation. Participants received one extra course credit for their participation. This experiment had received approval from the School of Psychology's Human Research Ethics Committee (Ref: 10:17).

Apparatus, materials and setting

Participants were given a consent form, a course credit form and a brief questionnaire; these forms are the same versions of the ones used for the above groups. The second Roulette simulation used for the experiment was again designed by The University of Waikato's technician and was delivered via the internet.

Procedure

On arrival to the research room participants sat down in front of the computer and were handed a consent form, a course credit form and the brief questionnaire. Participants were instructed to read the forms and ask any questions before signing the consent form. The participants were informed that the researcher would be leaving the room but if they had any questions whilst they

were playing the simulation that they would be waiting outside the room, the researcher then left the room.

Participants started off the game with \$500 credit. For Group 2a the roulette simulation was set by the researcher so that 50% of all the numbers drawn by the computer were red and 50% black. Each bet placed was an individual trial. A bet on red had a 70% probability of resulting in a win, whereas a bet placed on black only had a 10% probability of a win. For the purpose of this condition, bets could only be placed on red or black, no numbers or side bets could be selected. No real money was used. All participants could only make a fixed bet of \$5. If the bet resulted in a loss then the \$5 was removed, if it was a win \$20 was credited. When a winning bet occurred the participant had to 'drag' the won chips to their total credit pile. When the roulette wheel spun a sound was made of the ball moving around the wheel. Sounds also accompanied chips being taken or added as the result of the spin. To ensure the volume was the same for all participants the volume was adjusted to the maximum setting of the computer before the participant arrived and all sounds were played through the internal PC speaker. Participant's played the simulation for 45 minutes. The researcher then debriefed the participant.

Results Group 2a

As for previous groups the number of bets placed on red in the first and last third of trials was calculated to see if participant's behaviour was driven to betting on red more frequently.

Table 4: The proportion of bets placed on red for the first and last third of trials for each participant in Group 2a.

Participant	Total number of bets	Proportion of red bets in first third	Proportion of red bets in last third
8320	284	0.04	0
8322	266	0.53	0.65
8323	265	0.5	0.5
8324	279	0.43	0.66

A paired sample t-test was conducted to compare the proportion of red bets in the first third of trials and the proportion of red bets in the last third of trials. The proportion of red bets in the first third of trials ($M = 0.37$, $SD = 0.23$) was not significantly different to the proportion of red bets in the last third ($M = 0.45$, $SD = 0.31$), $t(3) = 1.24$, $p = 0.29$.

As in previous groups the relationship between the proportion of wins received on red and proportion of total play on red was compared (see Figure 7) as well as the proportion of bets placed on red in each consecutive ten trial block across the session, to examine any trend in play (see Figure 8).

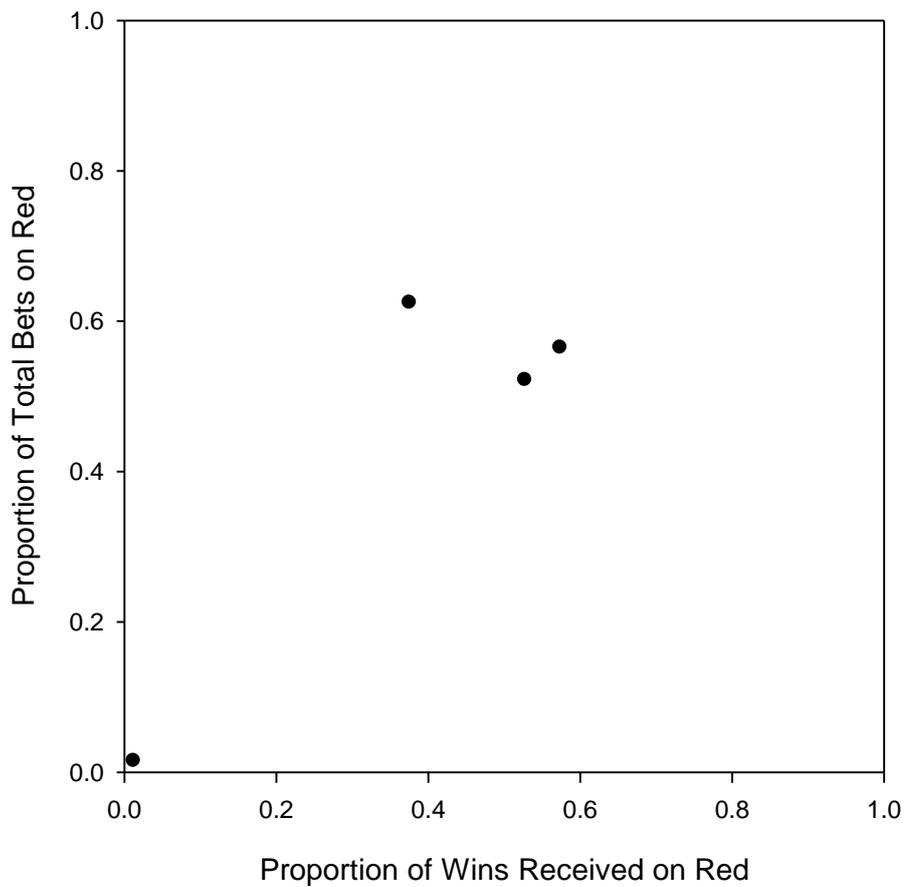


Figure 7: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 2a.

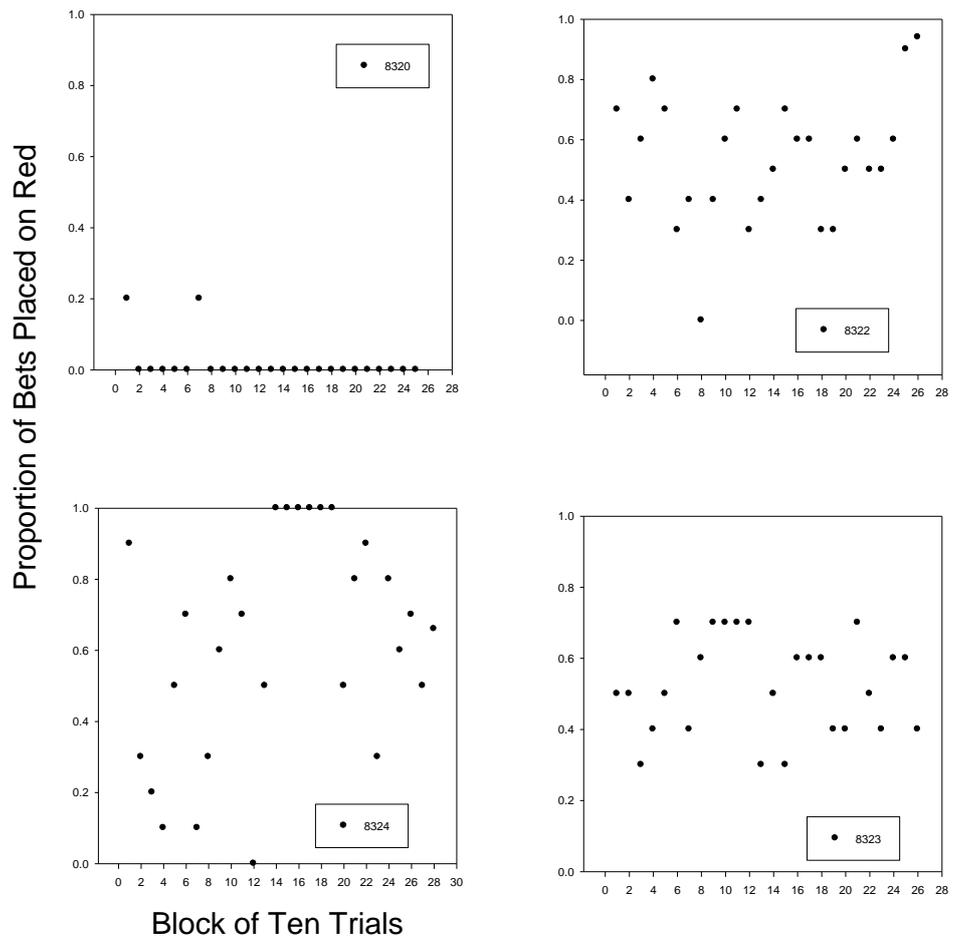


Figure 8: Scatter plot for each participant in Group 2a showing the proportion of bets placed on red in each of the ten trial blocks during the session.

Summary of Group 2a results

The purpose of Group 2a was to determine if changes to the Roulette simulation would allow the increased proportion of wins on red influence participants betting. The same proportions were used as Group 1b so any difference could be attributed to the simulation. A comparison between the number of bets placed on red in the first third and the last third of trials for the entire session showed that there was no significant difference in the proportion of bets placed on red between the first and last third of trials. As seen in Figure 7, all four participants matched play on red to the proportion of wins received on red, indicating that participants are matching behaviour to reinforcement with the new simulation. Like Group 1b, no overall trends in play can be seen. To examine if participants would exclusively bet on red a more extreme condition was created.

Method Group 2b

Participants

Participants were 5 first year psychology students from The University of Waikato (1 Male and 4 Female) who ranged in age from 18 to 40 (M = 25 years). Recruitment procedure was the same as previous groups.

Apparatus, materials and setting

As previously in Group 2a.

Procedure

The procedure for Group 2b was the same as Group 2a apart from the changes listed below. For Group 2b the roulette simulation was set so that 90% of the numbers drawn by the computer were red and 10% black. A bet on red had a 100% probability of resulting in a win, whereas a bet placed on a black number had a 0% probability of a win.

Results Group 2b

The proportion of red bets placed on each trial for the first and last third of trials for the entire session for each participant was calculated and these are given in Table 5.

Table 5: The proportion of bets placed on red for the first and last third of trials for each participant in Group 2b.

Participant	Total number of trials	Proportion of red bets in first third	Proportion of red bets in last third
8309	277	0.93	1
8310	241	0.91	0.99
8311	225	0.87	1
8313	232	0.88	1
8321	193	0.73	0.55

A comparison between the proportion of bets placed on red in the first third of trials ($M = 0.86$, $SD = 0.08$) and last third of trials ($M = 0.91$, $SD = 0.2$) showed no significant difference, $t(4) = .76$, $p = 0.48$. The overall proportion of play on red and the proportion of wins received on red were then plotted against each other on a scatterplot to look at any relationship between play and wins on red (Figure 9). The proportion of bets placed on red in each consecutive 10 trial block was also plotted to determine any pattern in play (see Figure 10).

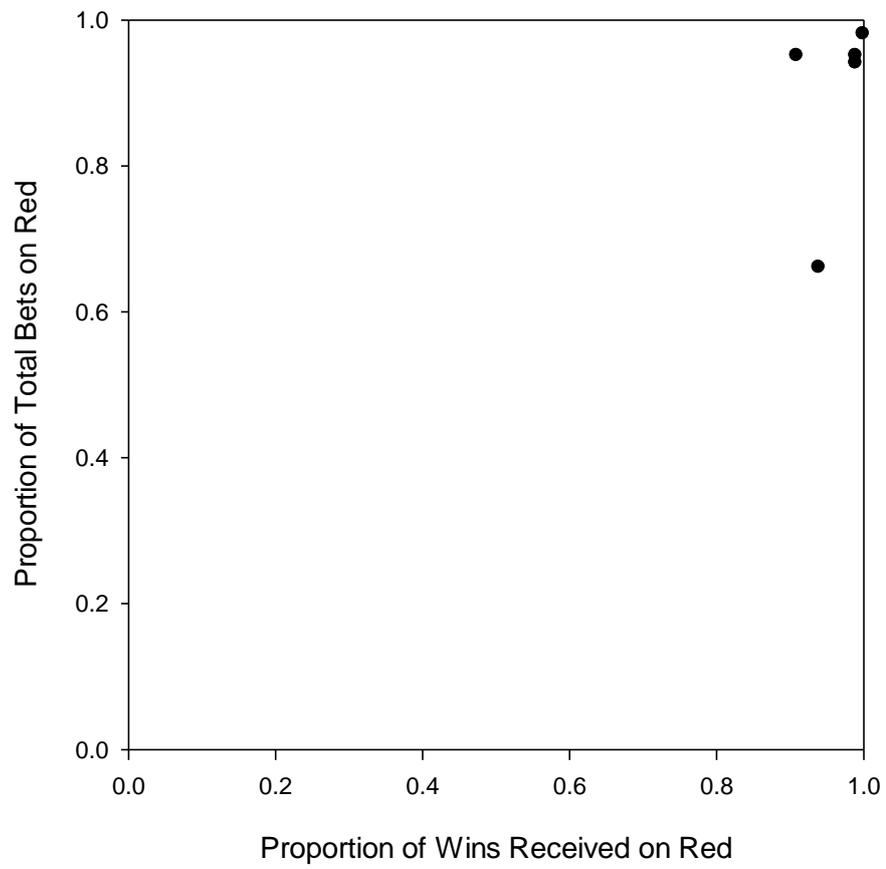


Figure 9: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 2b.

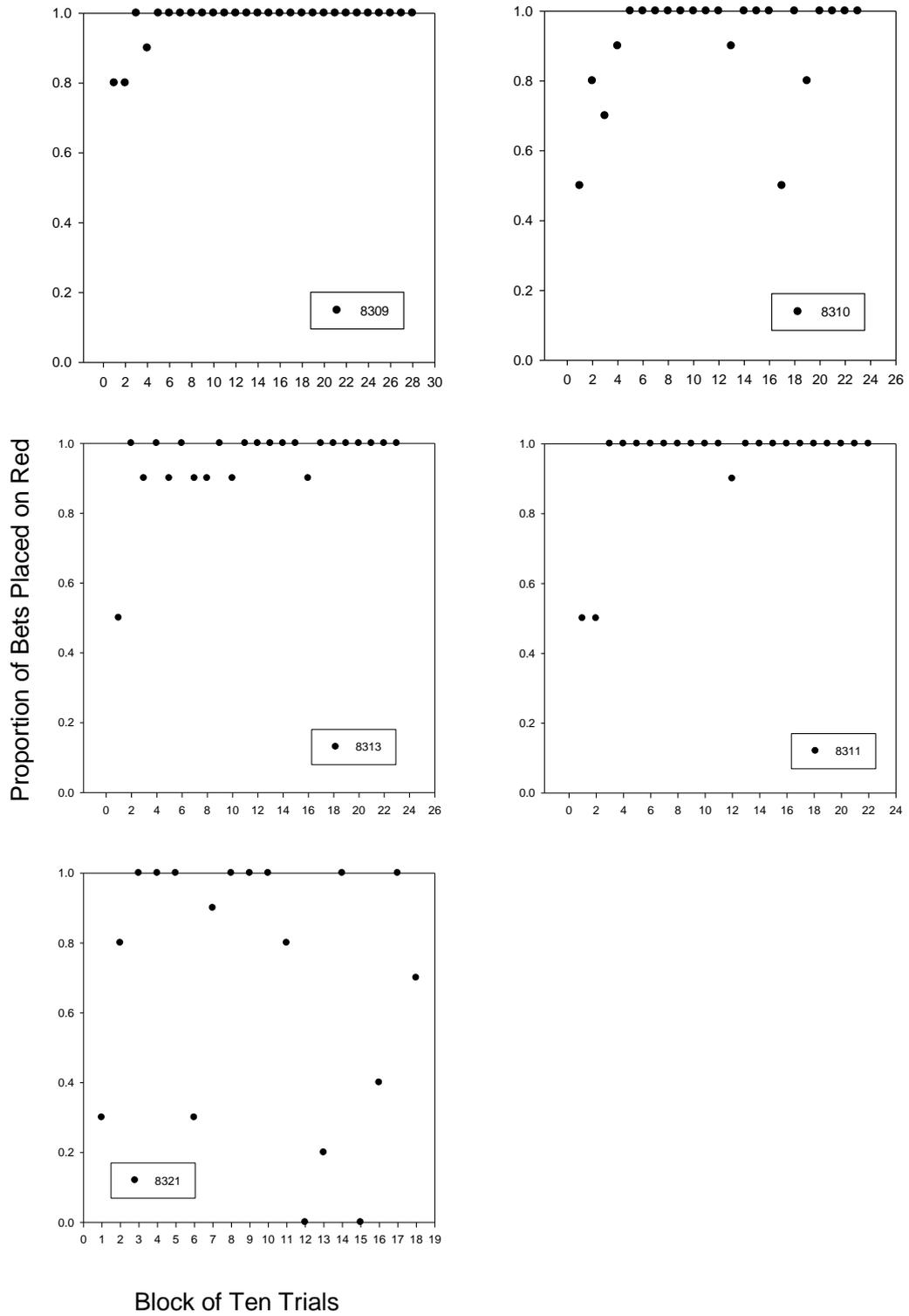


Figure 10: Scatter plot for each participant in Group 2b showing the proportion of bets placed on red in each of the ten trial blocks during the session.

Summary of Group 2b results

The purpose of Group 2b was to see if a more extreme condition would drive participants to bet exclusively on red. There was no significant difference between the proportion of bets placed on red in the first and last third of trials across the sessions. The majority of participants (four out of five) betting on red matched the amount of wins (reinforcement). In contrast to previous groups participants pattern of play looks like what was expected if reinforcement is being received exclusively on one side (with the exception of Participant 8228). This is seen by participants starting to bet exclusively on red after a short period of time in the experimental session whilst making the odd bet on black. The results of this group suggest that participant's behaviour can be driven to bet more exclusively on one option using the new version of the roulette simulation and more extreme conditions. The aim of the next condition was to determine at what point control of behaviour could still be gained by using the same simulation as Group 2a and 2b by titrating the proportion of colours drawn by the computer and the probability a bet on each colour could win.

Method Group 2c

Participants

Participants of this group were five first year psychology students from The University of Waikato (2 male and 3 female) who ages ranged from 19 to 24 years old ($M = 21.4$ years). Recruitment and informed consent was carried out in the same manner as previous groups.

Apparatus, materials and setting

The setting, materials and apparatus used for Group 2c were the same as Group 2a and 2b.

Procedure

The procedure for Group 2c was the same as Group 2a apart from the changes listed below. For Group 2c the roulette simulation was set by the researcher so that 75% of all the numbers drawn by the computer were red and 25% black. Each bet placed was an individual trial. A bet on red had a 75% chance of resulting in a win when a red was drawn, whereas a bet placed on a black number had a 25% chance of a win when a black was drawn.

Results Group 2c

The proportion of red bets placed on each trial for the first and last third of trials for the entire session for each participant was calculated. These proportions can be found in Table 6.

Table 6: The proportion of bets placed on red for the first and last third of trials for each participant in Group 2c.

Participant	Total number of bets	Proportion of red bets in first third	Proportion of red bets in last third
8325	272	0.64	0.99
8327	250	0.57	0.54
8328	69	1	0.96
8329	254	0.68	0.75
8330	236	0.72	0.9

No significant difference was found between the proportion of bets placed on red in the first of trials ($M = 0.72$, $SD = 0.17$) and the last third of trials ($M = 0.83$, $SD = 0.19$), $t(4) = 0.21$, $p = 0.22$.

As in previous groups the overall proportion of play on red and the proportion of wins received on red were then plotted against each other on a scatterplot to look at any relationship between play and wins on red (see Figure 11), in addition the proportion of bets in each ten trial block across the entire session was plotted so that any pattern in play could be seen for each participant in the group (see Figure 12).

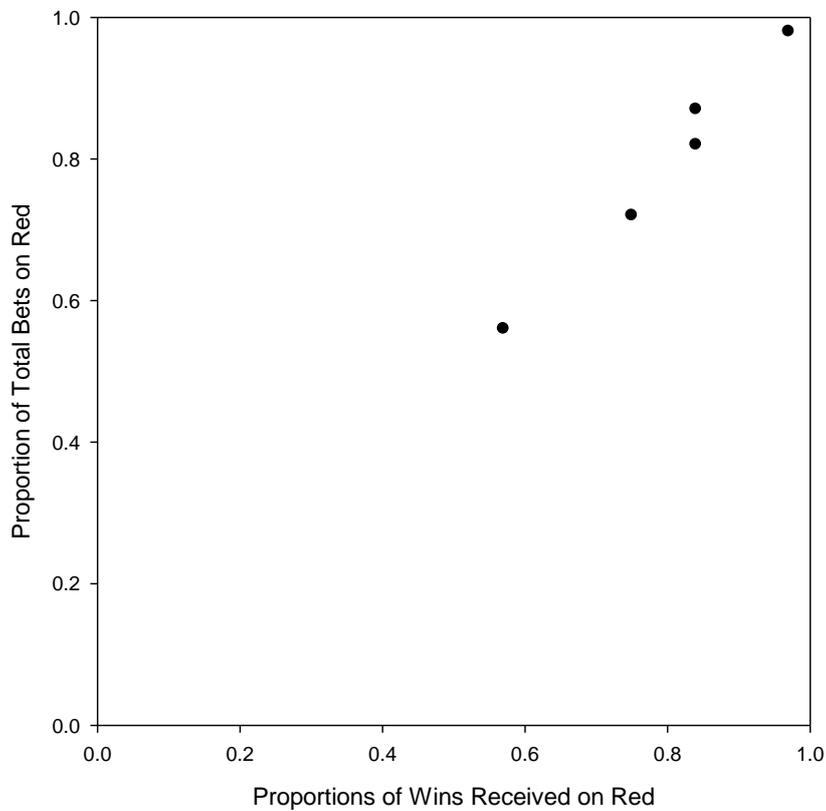


Figure 11: The proportion of total bets on red numbers versus the proportion of wins received on red numbers for all participants in Group 2c.

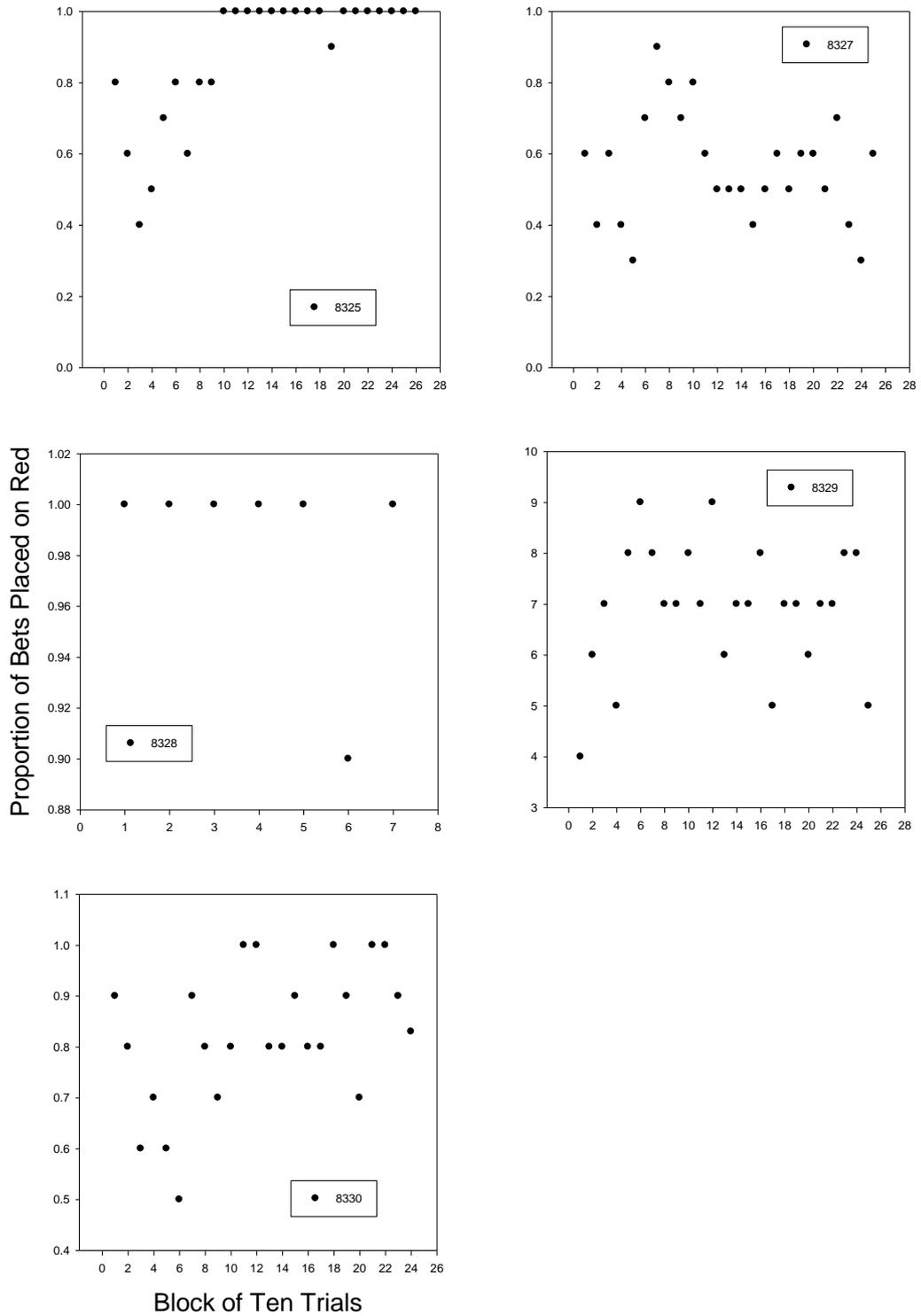


Figure 12: Scatter plot for each participant in Group 2c showing the proportion of bets placed on red in each of the ten trial blocks during the session.

Summary of Group 2c results

The purpose of Group 2c was to see if the control of participants behaviour, shown by participants matching their betting behaviour to the colour the majority of wins occurred on, in Group 2a and Group 2b could be achieved using different probabilities of a win across each colours. A comparison between the proportions of bets placed on red in the first third of trials and the proportion of bets placed on red in the last third of trials showed no significant difference. As seen in Figure 11 all participants betting behaviour matched the amount of reinforcement/ wins received on each colour. This shows that control can be demonstrated under current experimental conditions. Participant 8328 experienced the full session length but did not bet as frequently as other participants, which is why it is likely that they had a higher proportion of wins from red than other participants. Participants in Group 2c showed two betting patterns; they either started of betting lower on red but were driven to bet exclusively on red as they experienced the condition of receiving more reinforcement or bet more frequently on red but still placed bets on black to match the lesser amount of reinforcement received for this.

Discussion of Experiment 2

The results of Experiment 1 showed no relationship between the increased probability of receiving a win after betting on red and the frequency of bets placed on a red number, possible reasons for this came down to design features of the simulation. In order to determine if these factors affected the results of Experiment 1, Experiment 2 was designed using a modified simulation. Modifications included the removal of the previous results table, participants only able to bet on red or black and not numbers receiving additional sounds when a winning bet occurred and making the participant drag their winnings using the computer mouse onto their total points tally. Control of participants betting behaviour is demonstrated in this experiment which is shown by participants matching the frequency they bet on red to the overall proportion of wins received after betting on red.

To determine if the changes in results could be put down to design factors Group 2a was created. Conditions of this experimental group were kept the same as Group 1b in Experiment 1 apart from the use of the new simulation. Results of Group 2a showed that all four participants matched their total betting behaviour on red to the overall proportion of wins received on red (as seen in Figure 7); these results were confirmed in following conditions Group 2b and Group 2c which indicates that the design features that were removed from the simulation used in Experiment 1 impeded the effect of the higher probability of receiving a win on red on participants' betting behaviour.

The aim of group 2b was to extend the results found in Group 2a by increasing the probability of a win to an extreme (90% chance of a win after a bet on red) to determine if reinforcer control was strong enough to shift participants betting exclusively to red. As seen in Figure 9, participants matched their betting to the overall proportion of win received on red, showing that it is possible to gain such control over behaviour using the current simulation. When participants betting pattern was examined (see Figure 10) it can be seen that on the odd trial a bet on black was emitted, this was expected because participants would be sampling the other available schedule to see if contingencies had changed.

General Discussion

The most utilized simulation in gambling behaviour research is the slot machine. The majority of this research has examined participants verbal behaviour surrounding gambling (for example, Benhsadin et. al. 2004; Ladouceur et. al.1988) but not each event or behaviour and how manipulation of independent variables effects the actual behaviour. The current research extends the previous research done by Maclin et al. (1999) and Dixon and Schreiber (2002) by demonstrating it is possible to study gambling from a behavioural point of view by utilizing the details about each behaviour recorded by the experimental simulation. This allows any change in behaviour to be accurately recorded and independent variables to be reliably manipulated.

Experiment 1 showed surprising results with no impact of a higher probability of winning after a bet on red on the frequency of bets placed on red. Factors that may have lead to this unexpected result seemed to relate to the design of the simulation. In order to determine if these design factors affected the results a modified simulation was created. A series of experimental conditions in Experiment 2 demonstrated that it is possible to gain reinforcer control over participants betting behaviour. What is unclear from the above research is which design factor or factors inhibited reinforcer control. This is an important area for future research as it could have significant implications for the understanding of what controls gambling behaviour and further more implication for the treatment of problem gambling. One of the discussed factors that may have inhibited reinforcer control was the previous results table that may have been contributing

to the gamblers fallacy or other rules regarding gambling that the participants had already been exposed to. A possible implication of this is that if monetary reinforcement was stopped, the gambling behaviour would theoretically be under extinction, however, if the person had been rule following which prevented the reinforcer controlling their behaviour, extinction would have no impact.

An area that needs further investigating is the impact of rules given to participants in relation to the effect of the experimental contingencies in place. It has been shown that when participants are provided with reminders about the independence of events whilst gambling they decrease the frequency of erroneous verbalizations and their 'motivation' to play decreases (Benhsain et al, 2004). It could be plausible that if participants are reminded about this independence it lead to them disregarding previously gained rules allowing the experiencing contingencies in place to govern their behaviour.

The present research demonstrates that it in operant research there is a difference between task compliance and control of the behaviour by consequences. This research shows that the consequences need to be large enough that they are detectable. It also shows that it is possible and imperative for research to be carried out from a behavioural point of view to extend the current knowledge base about what governs and maintains gambling behaviour so that the costs of this behaviour can be reduced.

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Appendix A

Informed consent form signed by each individual participant

University of Waikato

Psychology Department

CONSENT FORM

PARTICIPANT'S COPY

Research Project: The role of differential outcomes in gambling persistence

Name of Researcher: Krystal Staples

Name of Supervisors: Dr James McEwan and Dr Lewis Bizo

I have received an information sheet about this research or the researcher has explained the study to me. I have had the chance to ask any questions and discuss my participation with other people. Any questions have been answered to my satisfaction.

I agree to participate in this research project and I understand that I may withdraw at any time without any penalty. If I have any concerns about this project I may contact the convenor of the Research and Ethics Committee (Dr Robert Isler, phone: 838 4466 ext. 8401, email r.isler@waikato.ac.nz).

Participant's name: _____ Signature: _____ Date: _____

Appendix B

Questionnaire that participants answered regarding previous gambling behaviour

Please complete the following questions

Age: _____ Sex: M/F Ethnicity: _____

- Have you ever gambled before? (This includes lotteries)
- If you have gambled before, how often do you gamble?
- In the past, what have your reasons been for gambling? Eg. Social activity, wanting to win.
- Have you ever gambled to try and win money that you have lost in a previous gambling session?

Appendix C

Instructions participants in Experiment 1 received

Instructions:

When you sit down in front of the computer the roulette simulation will already be on the screen. For the purpose of this study you are only able to place a bet on the numbers .You are also only able to make a fixed bet of \$5.

To make a bet, move the computer mouse to where you would like to place your bet and click. You should see a chip being placed on the number you selected. Once this has happened click with the mouse on the 'spin' button.

You will then see the ball being dropped into the roulette wheel, it will stop automatically. The number drawn will appear on the upper right hand side of the computer screen. A pin will also appear on the roulette table to show you the number that has been drawn.

If your bet is a winning bet you will receive credit, if it is not a winning bet your chip will be taken away.

You may then continue to place another bet.

Once the session has finished a note will appear on the screen telling you the session is finished and to see the supervisor. When this happens please get the researcher.

Appendix D

Information sheet participants received.

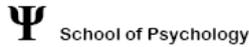
Information about research:

My name is Krystal Staples, I'm a masters student in the School of Psychology. As a part of my masters thesis I'm doing research on gambling behaviour, I'm supervised by Dr Lewis Bizo and Dr James McEwan. The aim of the research is to find out more about various factors that can contribute to gambling behaviour. The research being carried out has received ethics approval from the School of Psychology Ethics committee. If you choose to be a part of this research you would be required to play a game of simulated roulette on a computer. No real money is used. The maximum amount of time this game will take is 45 minutes, so overall the research will take one hour. Your involvement in the research is voluntary. At any stage of the research you may withdraw without any penalty. Your identity will not be recorded with your results and all of the results will be made completely anonymous before they are reported in my thesis or any other format, such as a research paper or conference presentation. If you are a first year PSYC102 or PSYC103 student you will receive 1% extra credit towards your overall course mark.

Appendix E

Course credit form used for each participants.

Research Participation: Course Credit Form



Students in PSYC102 or PSYC103 can gain up to 4% for each of these courses by participating in research run by staff members and graduate students (only). For each hour of participation students can earn 1%, with a maximum of 8 hours (4 hours for each course).

The researcher will give a full explanation of what is being tested and a brief description of the research before (or after) the student takes part. If you have any objections to this scheme, please tell your tutor or course coordinator.

- (1) Students may earn a maximum of 4% for each of the PSYC102 **and** PSYC103 courses.
- (2) Students are required to allocate (using the form below) their course credits to one of these courses. This may not be changed once the form is submitted.
- (3) The possible 4% will be added to the student's final course mark, but the 4% cannot be used to **pass** the course. For example, it cannot be used to increase a final grade from a D to a C.
- (4) Experimenters are to hand their section of each research participation form to the **PSYC103 Coordinators (Rm JK1.03)** by no later than **the last Friday of Semester A**, for Semester A courses and to the **PSYC102 Coordinators (Rm JK2.01)** by no later than **the last Friday of Semester B**, for Semester B courses. Tauranga students should hand them to the **Tauranga Psychology Tutors (Rm WIND V113)** by the same dates.

Student's copy

Student's Name: _____ **ID:** _____
Surname First Name Initial
Number of Hours Participation: _____ **Credit Points:** _____
Credits to be allocated to (indicate the number of credits in the corresponding boxes):
PSYC103A PSYC103A TGA PSYC102B PSYC102B TGA
Researcher's Name: _____ **Signature:** _____
Name of Project Supervisor (if different from above): _____

Experimenter's Copy

Student's Name: _____ **ID:** _____
Surname First Name Initial
Number of Hours Participation: _____ **Credit Points:** _____
Credits to be allocated to (indicate the number of credits in the corresponding boxes):
PSYC103A PSYC103A TGA PSYC102B PSYC102B TGA
Researcher's Name: _____ **Signature:** _____
Name of Project Supervisor (if different from above): _____

EXPERIMENTERS PLEASE NOTE THAT IT IS YOUR RESPONSIBILITY TO HAND THIS SECTION OF THIS FORM IN BY THE DUE DATE

Appendix F

Raw data of each participant on disk.