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A Behavior Analytic perspective on Gambling Behavior.

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Abstract

Gambling is a complex human behavior where it origin and maintenance factors can be considered from many different theoretical perspectives. Behavior analysis has a pragmatic and contextual perspective on human behavior and sought to explain based on environmental variables. Hence, Article 1 will account for gambling behavior based on established behavioral principles as for example, reinforcement schedules, near-miss effect, verbal behavior, established operations, delayed discounting and contextual cues. Because gambling can lead to devastating consequences gambling both financially and socially, behavioral approaches to gambling treatment will also be discussed. Following, Article 2 contains an empirical study with 30 participants randomly assigned to three groups. The experiment was a replication of earlier studies on contextual cues affect on gambling behavior. The participants were presented with a conditional discrimination procedure where colors and values were established. Earlier studies like Zlomke and Dixon (2006), Hoon, Dymond, Jackson and Dixon (2008) and Revheim (2011) Experiment 2 concluded that gambling behavior was affected by contextual cues. They also implied that the conditional discrimination procedure can manipulate contextual cues and alternate the response allocation during posttests. However, these results have been difficult to replicate. The results in the presented studies imply that the responding during posttests were affected by the reinforcement schedules arranged in the groups and not by the conditional discrimination procedure.

Keywords: gambling behavior, contextual cues, reinforcment schedules, verbal behavior, near-miss effect, conditional discrimination procedure, gambling treatments,delayed discouting

A Behavioral Analytic perspective on Gambling Behavior and Treatments.

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Abstract

Several theories try to explain gambling behavior, as for example: psychoanalytic theory, biomedical theory, psychosocial theory, cognitive theory and behavioral theory. Behavioral analysis differs from the other approaches by seeking to explain gambling behavior based on environmental variables and established behavioral principles. Behavioral literature and research have shown that reinforcement schedules, near-miss effect, delayed discounting and contextual cues may affect the occurrence of gambling behavior. Recent research has shown that there is a reason to believe that verbal behavior, and especially rule-governed behavior, is central in developing and maintaining gambling. When it comes to treating gambling behavior, early behaviorists have used aversion therapy, imaginal desensitization and multimodal behavioral treatments, however there are some ethical and empirical implications concerning these methods. During the recent years, cognitive behavioral treatments (CBT) are considered as the most efficient treatment of gambling behavior. Still, research showing cessation from gambling for a longer period is needed.

Keywords: reinforcement schedules, contextual cues, near-miss effect, verbal behavior, established operations, setting events, delayed discounting, gambling treatments

Addiction is a complex human behavior which is usually defined as repeated destructive behavior with a high risk of relapse (Lyons, 2006). Addiction is a widely used term, and it is said that one can be addicted to drugs, gambling, alcohol, food, exhibitionism, nicotine, gaming and so on. Although gamblers don't inject any substance into the body, gambling addiction has some similarity to substance addiction when it comes to the compulsiveness, loss of control and the continuation of the behavior despite the negative consequences (McCown & Howatt, 2007). Individuals struggling with gambling keep on gambling despite the loss of finances, loss of work and despite the negative effect it has on their family life and social life. Research has also shown that gamblers gains a tolerance and have withdrawal effects similar to substance abusers, and it is claimed that knowledge about one type of addiction therefore increase the knowledge about addiction in general (Lyons, 2006). In the past gambling was considered a personal weakness and lack of moral, and was not considered as a dependence or health problem until it was included in DSM-IV- TR by the American Psychiatric Association in the USA in 1980 (Lyons, 2006). This paper seeks to summarize behavioral theoretical literature and experiments on gambling behavior. Behavioral analytic principles like reinforcement schedules, near-miss effect, contextual cues, established operations, delayed discounting and verbal behavior will be discussed. Literature concerning efficient and ethical treatment methods based on behavioral principles will also be discussed.

Gambling is usually defined as placing a valuable item on an event to hopefully gain more value, where winning is mostly based on chance (Petry, 2005; Whelan, Steenbergh, & Meyers, 2007). A gambling event can take many forms, for example: dices, cards, horse races, in casinos, different sporting events, slot machines, lotteries and roulettes (Petry, 2005). Both American Psychiatric Association (2000) and World Health Organization, (WHO)

(1999) categorize pathological gambling as a habit and an impulse disorder that cannot be classified under other disorders. According to WHO's definition, the gambling behavior is not classified as pathological gambling if the person has some psychiatrical diagnoses that can explain the gambling behavior, for instance if a person with bipolar disorder gambles during a manic period. Gambling is defined as frequent and repeated gambling behavior which in the long run becomes so dominating that it affects the persons work life, family life and social life (WHO, 1999). According to WHO (1999), people with this condition struggle to control their impulse to gamble, they have often gained an enormous debt because of their gambling and often find themselves in a situation where they lie and commit crimes to get money to settle their debt. The American Psychiatric Association (2000) defines pathological gambling according to 10 criteria where at least five of the criteria must be present to get diagnosed.

In Norway, Øren and Bakken (2007) reported that at about 0,7% of the population struggled with gambling. Their research revealed that the "typical" gambler was young men with lower education. These problem gamblers were more prone to depression, anxiety, sleeping problems, drug and alcohol abuse and suicidal thoughts than non-gamblers. About 2,3% of the adult population reported that they had family members that have gambling problems and that the gambling lead to conflicts in the family, isolation and that they were also struggling with depression (Øren & Bakken, 2007). The impact on the gamblers mental health, and the mental health of family and close friends, has made problem gambling into a public health problem (Griffiths, 2004; Shaffer & Korn, 2002). Gambling problems also affect the community. It takes a lot of resources from the community to get gamblers back on track, and the community may also suffer from lack of productivity and crime conducted by the gambler (Fekjær, 2002). Slot machines were therefore banned from public places in Norway in 2007, as an attempt to regulate the gambling market. The banning of slot machines was

considered successful because 2/3 of those in risk of developing pathological gambling declined their gambling and some became categorized as non- gamblers (Øren & Leistad, 2010). The latest research done in Norway shows that approximately 0,6 % of the population in Norway are characterized as problem gamblers and 2,4% are in the risk of developing problem gambling (Pallesen, Hanss, Mentzoni, Molde, & Morken, 2014). Petry (2005) argues that there are about 1-2 % of pathological gamblers worldwide.

Gambling is an activity that many people appreciates and participates in daily, so why is it then that some people lose control and develops an addiction? According to Porter and Ghezzi (2006) there are several theories that attempt to explain gambling behavior, and they have listed; psychoanalytic theory, biomedical theory, psychosocial theory, cognitive theory and behavioral theory as five main theories. Porter and Ghezzi argue that psychoanalytic theory explains gambling behavior as a masochistic behavior where the gambler wants to lose and that the gambler somehow enjoys the guilt and the painful tension from the bet it made until the outcome is known. The behavior viewed is an underlying aggression towards themselves and the need to rebel against authority. The biomedical theory on the other hand views gambling behavior as a symptom of a neurobiological disorder, meaning that there is an organic condition in the body that leads to gambling behavior (Porter & Ghezzi, 2006). According to Porter and Ghezzi, biomedical theory mixes genetics, neurobiology and physiology into their explanation and the belief that gamblers can be treated with petrochemicals as for instance serotonin. Unlike to biomedical theory, psychosocial theory seeks to explain the urge to gamble through the psychosocial history of the gambler. Loss or separations, impulsivity, sensation seeking experience with a big win early in life, the beginning of an intimate relation or the beginning on the edge of professional success, can according to this tradition, be the cause of gambling behavior (Porter & Ghezzi, 2006). The

fourth theory mentioned by Porter and Ghezzi is cognitive theory and is according to the authors the most used theory to explain complex human behavior including gambling behavior. The main belief in this theory is that mental processes affect the way that we feel, think and act. The authors imply that cognitive theory explains gambling behavior as a failure to understand probability of chance and randomness, and that they often have an illusion of control. The last theory listed by Porter and Ghezzi is behavioral theory. Behavioral theory differs from some the other theories by having a more contextual and pragmatic focus on behavior (Grant & Evans, 1994). According to a behavioral analytic view, the behavior is shaped and maintained by the environment. Therefore, one should be able to change unwanted behavior by doing alternations to the environment (Grant & Evans, 1994). From a behavioral economic perspective, addiction might be considered as when the competitive activities, for example socializing or playing football, takes more effort and becomes less rewarding than the gaining in addictive behavior (Rachlin, 1997). From this perspective, the addictive behavior, for example gambling, will be considered more rewarding and easier to engage in than the competitive activity (Rachlin, 1997; Weatherly & Dixon, 2007). Behavioral theory attempts to account for gambling behavior with established behavioral principles, as for example reinforcement schedules, verbal behavior, contextual cues, established operations and delayed discounting (Porter & Ghezzi, 2006).

Gambling addiction is as other addictions, complex, and the etiology to the behavior is probably an interaction of several factors mentioned in the five theories above. It is implied that since there is no substance to trigger changes in the body as in substance addiction, it is a reason to believe that gambling addiction is sustained by powerful reinforcers that lead to physiological changes (Lyons, 2006). It is claimed that the disease model sometimes used to explain both substance and gambling addiction, for instance, biochemical and psychoanalytic

theory (Porter and Ghezzi 2006), is not sufficient to explain gambling behavior (Lyons, 2006). Lyons also argues that behavioral analysis has the principles to explain how learning of destructive behavior may occur and maintain in the repertoire, despite negative outcome, without showing to pathology.

Structural characteristics of the game

Although different games have different characteristics, there are some common structures, for example the event frequencies and payout ratio (Parke & Griffiths, 2006). Behavioral analytic tradition sought to explain gambling behavior based on established behavioral principles, for example reinforcement schedules. The payout ratio and the event frequencies of a game might be viewed as reinforcement for a gambler. A behavior that gets reinforced has an increased probability of being repeated in a similar context (Skinner, 1969). Behavioral analytic research has showed that behavior that is producing reinforcement on an intermitted schedule, meaning to get reinforced now and then, produces a higher level of responding and is harder to remove than behavior that is producing reinforcement continuously (Fester & Skinner, 1957). Win rate on casino games, for instance slot machines are usually intermitted schedules like a random ratio (RR) or variable ratio (VR). With a VR schedule the probability of win increases for each loss, on a RR schedule, on the other hand, each response outcome is entirely independent of the previous response outcome (Dixon, 2000; Haw, 2008a).This makes the delivery of reinforcers, winning, unpredictable for the gambler. The intermitted schedules of reinforcers may therefore be considered as one important characteristic for developing a gambling addiction (e.g.Griffiths, 1999a; Skinner, 1953). It is said *"A particularly effective schedule is at the heart of all gambling devices"*(Skinner, 1969, p. 19). Research has suggested that the participants get affected by the reinforcement schedule while playing electronic gambling machines. Dickerson (1993)

compared low/medium players with high frequency and excessive/ problem players, and reported that the high frequency and excessive/problem players differed from low/medium players in duration and frequency of the play. The high frequency and excessive/ problem players' duration were longer, and they played in a higher frequency, and in compliance with the winning rate of the poker machine. The behavior was controlled by the frequency of the reinforcement schedule of the game, and it is implied that the behavior of the player is based on experience with the game. Dickerson therefore suggested that gambling is a learned activity. The findings of Dickerson were also consistent with earlier findings (e.g.Dickerson, Cunningham, England, & Hinchy, 1991).

The knowledge about intermitted reinforcement schedules effect on behavior has lead to research on different characteristics of the reinforcements, for instance, the magnitude, frequency and the placement of payouts in the game. Research results have indicated that immediate reinforcement is an important variable for maintaining and increasing playing the slot machine (Choliz, 2010). Choliz (2010) conducted an experiment with10 pathological gamblers and reported that the participants that experienced immediate reinforcers played more games than the participants that experienced delayed reinforcers. Although deliverance of reinforces early in the game might be considered as important, the belief that one big win early is sufficient to make a person addictive to gambling was disproved (Weatherly, Sauter, & King, 2004). Weatherly et al. (2004) emphasized that an addiction does not emerge through a one-time event but develops through time. It seems that gambling behavior not only gets affected by the placement of reinforcers during gambling event, but also the magnitude of reinforcers, although the results reported in this research area are ambiguous. Dixon, MacLin, and Daugherty (2006) conducted an experiment on 20 pathological gamblers and reported that their participants preferred frequent but smaller payouts, rather than larger payouts later. The

authors concluded that the frequency of win was a primary factor in maintaining gambling behavior. Meanwhile, studies have also shown that the payback rate, large reinforcement, was considered more important than the frequency of win, indicating that the magnitude of reinforcers were more central in maintaining the gambling behavior than the frequency (Haw, 2008b). According to Haw (2008b) the different results in the two experiments are most likely due to procedural differences in the reinforcement rate. Haw (2008b) argues that reinforcement rate in his experiment was more comparable to the reinforcement schedule of "real" slot machines and therefore suggested that the result for this experiment is more alike a "real" gambling event than Dixon, Jacobs, and Sanders (2006). However, it is also suggested that gambling behavior might be affected differently depending on whether the behavior is reinforced on a RR or VR schedule. The gamblers experience with early wins followed by unreinforced trials, depending on which schedule, may be a factor that can affect the maintenance and increase the gambling behavior (Haw, 2008a). It is, however, not clear if people manage to differentiate between the two schedules during a "real life" gambling event (Haw, 2008a).

Experiencing a win might maintain and increase people's gambling behavior, however, most of time gambling leads to loss. It is suggested that a trial of almost winning may also encourage further play (Ghezzi, Wilson, & Porter, 2006). Near – miss effect might be understood as a stimulus generalization, meaning that the near- miss might be as reinforcing as a real win for the gambler and this makes the gambler continue gambling despite losing (e.g.Delfabbro & Winfield, 1999; Dixon & Delaney, 2006; Griffiths, 1991, 1999b; Reid, 1986). For instance, on a slot machine where three similar symbols lead to a win, two similar symbols may also be considered as reinforcing for the gambler. In a study done by Dixon and Schreiber (2004) all of the 12 participants reported, after a near- miss, that

they almost won, and that they believed that a loss in the near - miss trial was closer to a win than a loss in a non- near -miss trial. The near -miss effect is said to make the gambler" believe" that he will win on the next game and therefore encourage the gambler to carry on gambling.

Another behavioral analytic interpretation of the near- misses effect is that this schedule is functioning as a conditional reinforcer for the gambler that reinforces and maintains the gambling behavior (Skinner, 1953). Research has suggested that for the second reinforcements schedules to function as a conditional reinforcer, it is dependent on the interaction with the primary reinforcement schedule in the variations of rate, temporarily and spatially (Ghezzi et al., 2006; Kelleher, 1966). A study done on gambling behavior has shown that when there is a good balance between the view of near- misses, followed by a win, the participants played more trials (Kassinove & Schare, 2001). Research has also shown that not only the rate of near –misses schedule influence the persistence during slot machine gambling, but that experiencing a winning symbol on the first row might also increase the gambling behavior (Strickland & Grote, 1967). These results support the theory that the near-miss schedule might function as a secondary reinforcement schedule for the gambler. However, Ghezzi et al. (2006) sought to replicate the findings of Kassinove and Schare (2001) and Strickland and Grote (1967) without gaining the same secondary reinforcement effect from the near- miss schedule. According to Ghezzi et al. (2006), although there are reasons to believe that near –misses may function as a conditional reinforcer for the gambler, and thereby influence the gambling behavior, there are too few experiments done to conclude that near –misses are prolonging a gambling event. If the near –misses are purely an example of stimulus generalization, then the high frequency of near- misses should be preferred over low frequency of near –misses, and the low frequency should have showed more resistance to

extinction, something that research has contradicted (Dixon & Delaney, 2006; Kassinove & Schare, 2001). There is a reason to believe that the near – misses provide the gambler with an illusion of control and may be considered as a verbal event (Ghezzi et al., 2006). Verbal behavior will be discussed later in the paper.

While reinforcement schedules are one structural characteristic of a gambling event, it is also a reason to believe that contextual stimuli like light, color, sounds and images may affect gambling behavior (Griffiths, 1993). Thus, several experiments on the effects of contextual stimuli on gambling behavior has been conducted, the results in this area of research have been inconclusive. Zlomke and Dixon (2006) conducted a laboratory experiment where the participants were presented with two computer simulated slot machines, one yellow and one blue. During conditional discrimination training, the colors were correlated with the values of “more than” and “less than” and will then function as contextual cues for choosing during posttest. During posttest Zlomke and Dixon (2006) reported that an average of 81% of the responses were on the slot machine with the “more than” color. They concluded that the conditional discrimination training had lead to a transfer of function, from one stimulus to other stimuli in the same stimuli class, leading to an increased responding. They also argued that the colors functioned as contextual cues for responding, and that this function can be altered through a conditional discrimination procedure. Similar results have been reported from other experiments on the effect of contextual cues and gambling behavior (e.g.Hoon, Dymond, Jackson, & Dixon, 2008; Nastally, Dixon, & Jackson, 2010; Revheim, 2011Experiment 2).These results on contextual cues affect on gambling behavior are also in accordance to other research done on transfer of stimuli function (e.g.Barnes & Keenan, 1993; Dymond & Barnes, 1995). However, other experiments have not managed to get a high increase in the “more than” colored slot machine after conditional discrimination training.

(e.g.Fredheim, Ottersen, & Arntzen, 2008; Revheim, 2011Experiment 1). It is somewhat unclear why there are differences in results conducted in this area of research, but it is most likely due to procedural differences (Fredheim et al., 2008; Revheim, 2011).

To sum up, there is a reason to believe that a structural characteristic of the game, as reinforcement schedules, the near- misses effect and contextual cues affect gambling behavior. Although there are some ambiguous results, these types of research gives us a reason to believe that gambling behavior is not a static and uncontrolled behavior, but that the persistence and maintenance of the behavior get affected by environmental variables. The structural characteristics of the game explain some aspects of gambling behavior, mainly the game of chance where the response cost is low. Slot machines are typical low response cost games, meaning that it takes little effort to engage in the game and that the sequence from bet to outcome is quick (Petry, 2005; Weiner, 1962). Once the pattern of behavior is established, the level of response cost can be increased and still maintain the behavior (Petry, 2005). However, in some games it takes more effort to participate and there is a longer duration of time between placing a bet and the outcome. The theories of structural characteristic may therefore not be sufficient to explain all aspects of gambling behavior. Also, it seems to be that gamblers self- talk concerning the game might be different than non- gamblers. Behavioral researchers have therefore gained more interest in the verbal behavior of pathological gamblers and will hopefully get more knowledge about why some people become gamblers (Dixon & Delaney, 2006; Weatherly & Dixon, 2007).

Verbal behavior and delayed discounting

Verbal behavior was described by Skinner (1957) as an event between two people where the listener mediates the behavior of the speaker. Skinner (1957) also suggested that the speaker and listener could be the same person, as when thinking. In behavioral analysis

tradition one separates between contingency shaped behavior and rule- governed behavior (Skinner, 1969). Contingency shaped behavior is more sensitive to the consequences in the environment and change accordingly (Skinner, 1969). Rule- governed behavior, on the other hand, is when a verbal instruction functions as a discriminative stimulus (S^D) for a response (Skinner, 1969). Skinner (1969) argues that when a rule becomes a S^D for a response, this response might become less sensitive to the consequences in the environment. This theory is supported by research that has also suggested that following a set of rules over time, makes the participants less sensitive to changes in the experimental contingencies, and therefore less adaptive (e.g.Hayes, Brownstein, Haas, & Greenway, 1986; Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986). Although a rule - governed behavior is suggested to be less sensitive to the contingencies, research has indicated that when verbal behavior is shaped by the contingencies, is more efficient and consistent with nonverbal behavior than when instructions are given (Catania, Matthews, & Shimoff, 1982; Catania, Shimoff, & Matthews, 1989). Research has also shown that by shaping the verbal behavior, researchers have been able to alter the participants nonverbal behavior (e.g.Matthews, Catania, & Shimoff, 1985; Shimoff, Matthews, & Catania, 1986). Because of this general knowledge about rule – governed behavior, several behavioral researchers have implied that there should be more focus on how verbal behavior affects gambling behavior (e.g.Dixon & Delaney, 2006; Weatherly & Dixon, 2007). According to this theory of rule- following, there is a reason to believe that rules or strategies about how to gamble might make the gambler less sensitive to the contingencies in the game.

According to Weatherly and Dixon (2007), verbal behavior might influence gambling behavior in two ways, as a S^D or as an establishing operation. As mentioned, Skinner (1969) argued that the rule might function as a S^D for a behavior. A stimuli becomes a discriminate

for a behavior when the behavior has previously been reinforced in the present of the stimulus, a rule is therefore "setting the occasion" for the type of responding that previously have been reinforced in the present of the rule (Schlinger, 1993). Rules that affect gambling behavior might be self- generated utterances or external rules in the gambling context (Weatherly & Dixon, 2007). Self -generated utterances can lead to gambling behavior, despite losing money, because the gambler has a history of following self- generated utterances that have lead to reinforcement in other non -gambling situations (Dixon & Delaney, 2006). Examples of self- generated utterance might be *"If I play this slot machine one more time I will win back my money"* or *"With this new strategy my luck will change*." If this type of utterances gets reinforced by chance, they will get strengthened. Skinner (1957) argues that this types of verbal behavior within the same person might be referred to as self- mands or magic –mands. A type of magic- mands was referred to by Skinner (1948) as superstitious behavior, meaning that the behavior that was reinforced by chance was repeated several times in the "belief" that the behavior produced the reinforcer. A gambler might, for instance, have a lucky caps or t-shirt that he believes helps him to win because he won wearing that clothing once before. Research has also implied that when a chance situation is similar to a skill situation, people will experience some illusion of control and take higher risks (Langer, 1975). An experiment conducted by Ladouceur, Gaboury, Dumont, and Rochette (1988) showed that the participants that experienced both high frequency win and low frequency win both had the same amount of irrational verbalization while playing American roulette. Dixon and Schreiber (2002) reported that participants estimated their chance of winning higher right after a win, implying that they felt a sense of control over the game right after a win, and utterance like *"I am on a role and should continue playing"* might emerge right after a win. As mentioned earlier in the paper, research has shown that near- miss effects can produce utterance about almost winning (Dixon & Schreiber, 2004). Near – misses may therefore, be

viewed not only as stimulus generalization, but as a verbal event that can generate incorrect utterance about the game, that will keep the gambler playing, for example, *"I almost won, if I try one more time I will win"* (Dixon & Delaney, 2006).

Rules affecting the gambling behavior might also be external. External rules are referring to rules in the environment of the gambler, and research has shown that participants can be very sensitive to rules given by the experimenter during an experimental session. Dixon (2000) conducted an experiment to examine how two rules delivered by the experimenter would affect the gambling behavior while playing roulette. When the participants were presented with inaccurate rules about the game, the gambling behavior changed according to the rule. According to Dixon, the participants were betting more chips during the phase with incorrect rules than what they did during the baseline. It was also reported that they had a problem remembering the amount won, lost or wagered during this phase. After a break of one week, the participants were presented with another phase where they got correct rules to follow. The participants changed gambling behavior according to the correct rule, and they were betting fewer chips, and could easier remember how much they had won, lost and wagered during the phase. Dixon concluded with this result that rules affected the participants risk taking and perception of wins and losses during a roulette game. Similar result was reported by Dixon, Hayes, and Aban (2000). The participants that were exposed to inaccurate rules about the game, played for a longer duration, had a higher risk taking and were betting more than the participants that were presented with accurate rules or no rules.

A rule might function as a S^D for a behavior, but it is also suggested to have a function altering affect on the behavior, meaning that the rules alter the function of a stimuli (Schlinger, 1993). A rule that is contingency – specifying stimuli, specifying at least two

events for instance behavior and consequence, can have the same motivational impact on behavior as nonverbal establishing operations (Schlinger, 1993). An establishing operation (EO) are events or situations that may increase a stimuli value as a reinforcer and therefore also increase the probability of a certain behavior to occur (Michael, 1982; Schlinger, 1993). Self – generated utterance might be function altering when there is a temporary delay between the contingency – specifying rule and the behavior, for example, *"I have to get to the casino to win back the money I lost yesterday."* The utterance has increased the value of playing on a slot machines and winning money as a reinforcer for the gambler. It has also evoked behavior that is associated to playing on the slot machine, as for example, driving to the casino. External rules like commercials for a casino or internet gambling sites might also influence gambling behavior. Statements like *"Everybody is a winner at Mike's casino"* or *"The highest win rate in town,*" are referred to as augmenting and might function as EO for the gambler (Hayes, Zettle, & Rosenfarb, 1989). If the gambler wins money according to the statement, the rule automatically gets strengthened.

There are several risk factors for developing gambling behavior, as low socioeconomic status, substance abuse, gender, age, marital status and minority membership, are making some people more prone to develop pathological gambling than others (Petry, 2005). According to Weatherly and Dixon (2007), these risk factors may function as EO and setting events. EO can be viewed as "momentary" and can change quickly, while setting events like getting fired, or moving into a neighborhood that has a casino, are more long lasting events that might affect the occurrence of self – generated utterances (Weatherly & Dixon, 2007). For example, low socioeconomic status increases the need for money to pay bills, which may lead to an utterance like *"If I only win some money my life will be so much easier,"* which again can lead to gambling behavior. Knowledge about the circumstances when gambling

occurs can give information about whether the gambling behavior is maintained by positive reinforcement, for example winning, or negative reinforcement as for instance escape from being confronted with a difficult situation at home (Dixon & Johnson, 2007; Weatherly, 2013). Gambling Functional Assessment (GFA) is a self –report assessment tool that can reveal which contingencies that maintain gambling behavior (Dixon & Johnson, 2007).

As mentioned, there are several EOs that may affect different aspects of the gambling behavior. An important behavioral phenomenon in gambling behavior is discounting of delayed reinforcers. Discounting delayed reinforcers is referred to as choosing smaller but immediate reinforcers instead of larger delayed reinforcers, and can be considered as the opposite of self –control that is often regarded as wanting to wait for the larger delayed reinforcer (Ainslie, 1975; Rachlin & Green, 1972). Research has shown that there is a significant correlation in impulsiveness and the rate of delayed discounting among pathological gamblers, indicating that impulsiveness is an important factor in delayed discounting (Alessi & Petry, 2003). According to research, deprivation is an EO that affects discounting of delayed reinforcers (Giordano et al., 2002). The experiment conducted by Giordano et al. (2002) consisted of 13 opioid- dependent participants on buprenorphine and examined the effect of deprivation on the rate of discounting. The participants were asked to choose between immediate and delayed hypothetical rewards, heroin and money. This was done in both deprived and satiated state. The result was that the participants discounted more during the deprived state than in the satiated state. The result suggested that when a gambler is deprived of the reinforcing event of gambling, might it be the money or the excitement of gambling, the gambler is more prone to accept immediate small reinforcement than waiting for a larger reinforcement later. A study conducted by Dixon, Marley, and Jacobs (2003), reported that gamblers discount the larger but delayed reinforcer more often than non-

gamblers. This implies that gamblers, more than non –gamblers, prefer immediate and less beneficial consequences rather than later and more beneficial consequences. Rachlin (1990) suggested that gamblers discount steeper than non- gamblers because they regard the gambling events as "strings." This theory implies that the rapid discounting of momentary amounts may devaluate previous bets, and that individual losses are not taken in consideration until the next win has happened. The result found in Dixon et al. (2003) is in consistence with other research done on delayed discounting and addictions (e.g.Bickel, Odum, & Madden, 1999; Kirby, Petry, & Bickel, 1999; Odum, Madden, Badger, & Bickel, 2000; Petry, 2001). These results indicate that people with addictions in general are struggling with the same problem, choosing immediate and less beneficial consequences rather than delayed more beneficial consequences. Gamblers are also often said to be "chasing" referring to gamblers going back to the casino to try and win back lost money or to chase the first significant gambling success (McCown & Howatt, 2007). The loss of money one day might function as an EO for going back to the casino to try and win the money back.

Thus, it seems that EOs affect the rate of discounting. Research also implies that the rate of discounting is also sensitive to other variables in the environment. Both the amount of the delayed reinforcers (Green, Myerson, & McFadden, 1997) and the type of reinforcers seemed to affect the rate of discounting (e.g.Bickel et al., 1999; Madden, Bickel, & Jacobs, 1999; Madden, Petry, Badger, & Bickel, 1997). It is reported that contextual cues also affect the rate of discounting (Dixon, Jacobs, et al., 2006; Weatherly, Derenne, & Terrell, 2010), which is in accordance with other studies that suggest that contextual cues are relevant variables in gambling behavior (Hoon, Dymond, Jackson, & Dixon, 2007; Hoon et al., 2008; Zlomke & Dixon, 2006). Research has shown that a person that struggles with several addictions may lead to a larger degree of discounting (Petry, 2001). Research by Petry (2001)

showed that pathological gamblers with substance abuse discounted more steeply than the pathological gamblers without additional issues, but also that the pathological gamblers without substance abuse discounted more than non-gamblers. As mentioned earlier in the paper, gamblers are at risk to develop substance related problems (e.g.Shaffer & Korn, 2002; Øren & Bakken, 2007) and the fact that they might discount at a higher rate is, therefore, important information. Knowledge about different variables affecting the rate of discounting shows that it is not static condition, but can easily be affected by the environment in both positive and negative directions. It may also be beneficial in the understanding of the generating of self –utterances, and how to best treat people with different types of addictions.

The theory of verbal behavior helps to expand the understanding of gambling behavior from a behavioral analytical perspective. However, research showed that many participants fail to recall details about their gambling, making rule following difficult to examine (Dixon & Delaney, 2006). Whether the relationship between gambling behavior and verbal behavior is casual, or a correlation, is therefore not clear (Dixon & Delaney, 2006). Since verbal behavior became a areal of research in the behavioral analytical tradition, there has also been an internal discussion of the conceptual aspects of verbal behavior, which leads to empirical implications (e.g.Dixon & Delaney, 2006; Hayes, Blackledge, & Barnes-Holmes, 2001). However, it is suggested that a sufficient way to detect and register self- generated utterances are trough “talk aloud” procedures (Arntzen, 2008). With this procedure the participants are instructed to say everything they think while they are gambling aloud (Arntzen, 2008; Dixon & Delaney, 2006). This procedure gives the experimenter more insight in the verbal behavior of the participants, but it is at the same time a very time- consuming procedure (Dixon & Delaney, 2006).

Treatment

So behavioral theory suggests that gambling is a learned behavior, and that aspects of the behavior can be explained by established behavioral principles, for instance, intermitted reinforcement, conditional reinforcement schedules, contextual cues and verbal behavior. Based on the knowledge about how the environment affects gambling behavior, early behaviorist therapists focused on altering the environment to change the gambling behavior, with the main goal to reduce the positive reinforcement of gambling behavior (Petry, 2005). Treatment case studies conducted with aversion therapy, multimodal behavioral treatments and imaginal desensitization therapy, reported favorable results (e.g.Colter, 1971; Goorney, 1968; McConaghy, Armstrong, Blaszczynski, & Allcock, 1983).

Aversion therapy was presumably effective but debatable therapy for gambling. The goal with aversion therapy was to punish gambling behavior in the hope to reduce gambling. Often used techniques were giving participants shocks while they were gambling or while they were watching films or photographs about gambling (e.g.Barker & Miller, 1968; Goorney, 1968). Aversion therapy was apparently an efficient and fairly cheap method to cease gambling behavior and prevent relapse (Barker & Miller, 1968), but there are some ethical considerations. In treating an unwanted behavior, one must conduct a risk – benefits analysis by looking at the probability of success, suffering caused by the behavior, length of treatment period and distress caused by the treatment (Bailey & Burch, 2011). Some participants received up to 600-700 shocks during the treatment, and both Barker and Miller (1968) and Goorney (1968) reported that the participants showed signs of distress and aggression during treatment. Barker and Miller (1968) also mentioned that aversion therapy only punished and reduces unwanted behavior without giving the gambler a constructive and adaptive compatible behavior. Based on ethical principles, a behavioral analysis should

always choose behavioral treatment that generates behavioral change through positive reinforcement instead of punishment, so alternative treatments methods that are effective, and that produces less harm should always be chosen (Bailey & Burch, 2011). Also, a behavior analysis should help the participant to develop appropriate and adaptive alternative behavior, and not just eliminate unwanted behavior (Bailey & Burch, 2011).

Imaginal desensitization has also been used to treat pathological gamblers. This is a method were the gamblers learns relaxing techniques and then imagine gambling events that they have been in before and imagined sustaining from gambling (Petry, 2005). McConaghy et al. (1983), conducted a study where 20 participants were randomly assigned to groups, and they compared the effect of imaginal desensitization therapy with aversion therapy on pathological gamblers. After a year follow –up, 70 % of the participants in the imaginal desensitization therapy group were still reducing their gambling behavior, compared to 30% in the aversion therapy group. According to the authors, the result from this study implies that gamblers might be driven by behavior completion mechanisms, which lead to anxiety if not completed. Imaginal desensitization therapy lowers the tension and arousal within the gambler and therefore works better than aversion therapy. This result was supported by McConaghy, Blaszczynski, and Frankova (1991) which compared the imaginal desensitization therapy with aversion therapy, imaginal relaxation and in vivo exposure to gambling on pathological gamblers during a two – nine year follow- up. Of the 120 participants 53% were available during the follow – up. Results reported that 79 % of the participants that had received imaginal desensitization therapy had reduced their gambling, compared to 33 % of the participants in the aversion therapy group and about 53% in the other two groups.

Multimodal behavioral treatments have also been considered an efficient way to treat pathological gambling. Colter (1971) conducted a treatment program where the therapy consisted of giving electric shocks while gambling, attending in other activities that the participant enjoyed, along with making the patient keep track of money used and money won. The participant was also to note the duration of the game and positive and negative associations during gambling. The patient had a relapse after four months, and he went back to the program and sustained from gambling. Although the program seemed successful, the combination of aversion and engraining in new reinforcing activities makes it hard to tell which intervention that had an effect. Other multimodal behavior therapies have focused on developing a controlled gambling behavior instead of complete cessation and reported successful treatment based on strict agreements with the experimenter and spouse and positive verbal reinforcement (e.g.Dickerson & Weeks, 1979; Rankin, 1982). Since there are several variables in the intervention, it may be difficult to say which was the most functional, it can be both the new revealed affection from the wife or the aversion of breaking an agreement.

The case studies mentioned above report that aversion therapy, imaginal desensitization and multimodal behavioral treatment seem effective methods of reducing gambling behavior. However, the sample size in these studies is small, and the fact that there are no comparison groups or control groups may weaken the validity of these results (Brewer, Grant, & Potenza, 2008). Also, according to McConaghy et al. (1991) only 53% of the participants were available during follow –up during the imaginal desensitization study, and in McConaghy et al. (1983) four participants received both imaginal desensitization and aversion treatment before the one year follow –up. Both the lack of attendance during follow –up and the fact that several participants received both treatments may have affected the results on these two studies (Brewer et al., 2008).

During the latest years, the number of traditional behavioral treatments methods for pathological gambling have decreased, and the treatments are now usually based on a combination of behavioral theory and cognitive theory (Raylu & Oei, 2010). While behavioral theory's main focus is changing the gambling behavior, cognitive theory focus on irrational thoughts and failure to understand the probability of chance that the gambler has about the game (Petry, 2005; Raylu & Oei, 2010). Cognitive behavioral treatment (CBT) tries to alter both thoughts and behavior that maintain the gambling behavior and using several treatments techniques as, for instance, *in vivo* exposure, imaginal desensitization, relapse prevention, cognitive therapy, social skill training and problem - solving (Raylu & Oei, 2010). Several studies have reported successful outcome of CBT treatments. Bujold, Ladouceur, Sylvain, and Boisvert (1994) conducted CBT on three pathological gamblers. The CBT included problem solving, cognitive therapy and relapse prevention. The treatment continued until the participants reported a level of control at least eight of 10 on all three components during a four -week program. All three participants ceased gambling as a result of the treatment. They also reported to have more control and to view their problem as less severe. During the six and nine months follow –ups they were still not gambling. This result was supported by Sylvain, Ladouceur, and Boisvert (1997) where 29 pathological gamblers were randomly assigned to either control group, waiting list, or treatment group. According to the authors, 86% of the participants that were in the treatment group were no longer characterized as pathological gamblers after treatment. This result also persisted until the follow-up six and 12 months after. The participants in the treatment group also reported more control and that they perceived their problems as less problematic. Many of the studies done on CBT have been in individual formats (Raylu & Oei, 2010), but Jimenez-Murcia et al. (2007) conducted CBT group therapy. The 290 participants participated in 16 weekly sessions. Each group consisted of 10 to 14 participants. The result showed that 76, 1 % had

ceased gambling at the end of the treatment and 81, 5% during the six months follow- up. These results suggest that CBT is not only efficient as individual therapy, but also as group therapy.

The studies conducted on CBT indicate that a combination of behavioral methods, as for instance problem solving, and cognitive therapy is an effective treatment method. When the gambler experience EOs that usually would make him gamble, the problem- solving skills might help the gambler to develop and choose alternative and constructive behavior. The cognitive therapy sought to break down the "illusion of control". In gaining knowledge and information, the gambler hopefully changes verbal behavior in a more rational term. According to Raylu and Oei (2010), CBT has many advantages compared to other treatment methods. They argued that CBT is short term treatment and can be considered more cost-effective than other treatments. These statements are supported by Cowlishaw et al. (2012) who argues that CBT is the most efficient and the best practice for treating pathological gamblers at this time. As a behavioral analyst, one have an ethical duty to provide patients with the evidenced based treatment that is the most efficient (Bailey & Burch, 2011). However, Cowlishaw et al. (2012) also report some implications with CBT. First of all, the conclusion that CBT is an efficient treatment method is based on studies that have limitations that might affect the outcome of the treatment and overestimate the effect. Second, the studies have only reported relative short time resistant from gambling, the long- term outcome for pathological gamblers receiving CBT is not documented.

Conclusion

Behavior analysts has a pragmatic view on human behavior and seeks to explain gambling behavior based on environmental variables (Grant & Evans, 1994; Hayes & Brownstein, 1986). To be able to do that, the gambling behavior is operationalized, and the

behavior is studied in the context it occurs (Grant & Evans, 1994). Behavior analytic research has shown that the gambling behavior can be explained by behavioral principles as the effect of reinforcement schedules, near – miss effect, contextual cues, verbal behavior, EOs and delayed discounting. Research done on gambling behavior is also consistent with behavioral research on other types of behavior (e.g.Barnes & Keenan, 1993; Bickel et al., 1999; Madden et al., 1997), and research conducted on non-humans (e.g.Fester & Skinner, 1957; Kelleher, 1966). Getting the same results in gambling research as experiments done on other types of behavior and non-humans may increases the general knowledge about behavior. Also, knowing how environmental variables may affect gambling behavior, can give an indication on how environmental variables may affect other types of addictive behaviors (Lyons, 2006). Despite knowledge about variables that affect gambling behavior, it is still difficult to explain why some become gamblers while others don't. Every gambler has their reasons for gambling based on their learning history, and it is difficult to identify and gain full insight of the learning history. However, there are some risk factors that are said to make people more prone to develop gambling behavior, as for example, low socioeconomic status or substance abuse (Petry, 2005). There is a reason to believe that verbal behavior is an important factor in explaining gambling behavior. Gaining information about verbal behavior has proven to be difficult because people struggle to remember why they choose the way that they do. A "Talking Aloud" procedure is therefore suggested t be the most efficient procedure to gain information about verbal behavior (Arntzen, 2008). Future research needs to continue to obtain valid verbal data and to gain more information about how and why some people gamble despite the negative consequences (Arntzen, 2008; Dixon & Delaney, 2006; Weatherly & Dixon, 2007). It is suggested that gambling behavior might be maintained under different circumstances and that knowledge about whether the behavior is maintained by positive or negative reinforcers can be important information (Weatherly, 2013). However,

the contingencies that maintain gambling behavior might be different from the contingencies that lead to gambling in the first place (Weatherly, 2013).

The behavioral analytic literature suggests several different treatments methods for gambling behavior. Early behavioral analytic treatments, as aversion treatment, imaginal desensitization and multimodal behavioral treatments, have reported positive effect in reducing gambling behavior. However, it is implied that there are some empiric implications with these case reports (Brewer et al., 2008) and some ethical considerations. Cognitive behavioral treatment (CBT) is now considered as the most effective treatment for gamblers (Cowlishaw et al., 2012). However, since the reports on the effect of CBT have only showed short term effect, more studies conducted over a longer period is needed (Cowlishaw et al., 2012). According to Cowlishaw and colleagues, future research on CBT should also consider different range of severity of the gambling behavior and different intensity of the treatment.

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Alternation of Response Allocation by Manipulating Contextual Cues.

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Abstract

In the presented experiment, the contextual cues affect on gambling behavior have been investigated. Previous experiments have alternated response allocation on slot machines by manipulating contextual variables through conditional discrimination procedures, which lead to different results. This experiment was a replication of an earlier experiment in this area of research. The present experiment had 30 participants randomly assigned to three groups. All of the participants went through five phases, pretest, conditional discrimination training and test 1, posttest 1, conditional discrimination training and test 2 and posttest 2. The results showed that participants who experienced 80% probability of winning on the "more than" colored slot machine and 20% probability of winning on the "less than" colored slot machine, was the only group where the participants increase their responding on the "more than" colored slot machines. The participants in Group 1 and Group 3, who experienced similar reinforcement schedules on both slot machines during posttests, did not alter response allocation. The result indicates, therefore that the increase in responding on the “more than” colored slot machine in Group 2 might be influenced by the reinforcement contingencies arranged in the group and not solely a result of the conditional discrimination training.

Keywords: gambling behavior, conditional discrimination procedure, reinforcement schedule, transformation of stimulus function, contextual cues

Gambling is an activity that people have enjoyed for decades. Most people gamble now and then, often during social events, but for some gambling develops into an addiction with enormous consequences. Approximately 0,6% of the Norwegian population could be considered as problem gamblers (Pallesen, Hanss, Mentzoni, Molde, & Morken, 2014). According to Pallesen et al. (2014), this is a small decrease in problem gamblers compared to earlier public screenings reports. Despite a decrease, many individuals are still struggling with gambling, and this also affects their families and friends. Petry (2005) argue that pathological gamblers have a prevalence rate of 1-2% worldwide. According to Petry, gambling can be defined as taking a valuable possession and placing it on an event, where the result usually is affected by chance, with a potential to gain a profitable outcome. Because the result is influenced by chance, there is a high risk of losing. In Norway, the Worlds Health Organization (WHO) classification of diseases, ICD 10, are often used to set a mental diagnosis. According to Worlds Health Organization (1994), pathological gambling is classified as an impulse behavior (F63), where pathological gambling (F 63.0) is described as a behavior repeatedly conducted, and that is dominating the person's social life, family life, work, values and commitments. Public research has shown that the mental health and finances of the gamblers family also get affected by the consequence of the gambling (Øren & Bakken, 2007).

Several different types of theories have tried to explain why people continue gambling despite massive losses. Both biomedical theory, psychoanalytical theory, psychosocial theory, cognitive theory and behavioral theory have arguments and facts that give some insight to why this type of behavior occur (Porter & Ghezzi, 2006). According to Porter and Ghezzi, cognitive theory is the main theory for explaining complex human behavior and explains gambling behavior as a misconception or irrational understanding of chance, randomness and

probabilities. Traditionally, the behavioral analysis profession has not focused on gambling behavior, but during the recent years it has been suggested that behavioral principles like reinforcement schedules, verbal behavior, delayed discounting and setting events may contribute to explain this type of complex behavior (e.g.Dixon, 2007; Ghezzi, Lyons, Dixon, & Wilson, 2006; Weatherly & Dixon, 2007). Cognitive psychology and behavioral analysis differ in the philosophy of science, and this has obviously affected the view on complex human behavior and research questions. Behavioral analysis has a more contextual view on behavior than cognitive psychology (Dougher, 1995; Hayes & Brownstein, 1986). Because of this contextual approach, behavioral analyses sought to explain gambling by studying stimuli in the environment and how these may affect the gambling behavior. Behavioral analytical research on gambling behavior has involved a broad range of topics, for instance near miss effects, delayed discounting, contextual cues and verbal behavior (e.g. Dixon, 2000; Dixon, Bihler, & Nastally, 2011; Dixon, Jacobs, & Sanders, 2006; Ghezzi, Wilson, & Porter, 2006; Nastally, Dixon, & Jackson, 2010; Zlomke & Dixon, 2006). Research has shown that contextual stimuli such as sound, names, light, color and familiarity may affect gambling behavior (Griffiths, 1993; Parke & Griffiths, 2006). Information about contextual stimuli and how these may affect gambling behavior could be a valuable supplement to the general knowledge of gambling behavior.

The main experiments in studying environmental stimuli as contextual cues are based on conditional discrimination procedures conducted in laboratory settings (Fredheim, Ottersen, & Arntzen, 2008; Hoon, Dymond, Jackson, & Dixon, 2007, 2008; Zlomke & Dixon, 2006). The purpose of these experiments has been to study if, and how, contextual stimuli may influence gambling behavior, and if a manipulation of such stimuli will alternate the gambling behavior. There is a reason to believe that more information about contextual

stimuli may lead to a better understanding of how environmental stimulus may trigger and affect gambling behavior. This type of information might be helpful in developing efficient treatment methods. However, the behavioral analytic experiments conducted on the effect of contextual cues on gambling behavior have been inconclusive.

The experiments of Zlomke and Dixon (2006), Hoon et al. (2007), Hoon et al. (2008) and Fredheim et al. (2008), all presented their participants with a pretest, at least one conditional discrimination phase and at least one posttest. The contextual cue was colors, yellow and blue. During the pretest, the participants were presented with two slot machines, one yellow and one blue, and the participants had to choose which slot machine they wanted to play on. This was done to uncover if the participants had any preference for one of the colors before the experiment started. Then, during the conditional discrimination procedure the participants were trained on "more than" and "less than" relations where one color was correlated to "more than" and the other color was correlated to "less than". The purpose with the conditional discrimination training was to alter the preference of color according to the "more than" and "less than" cues. After the conditioned discrimination procedure, the participants were presented with a posttest. The posttest contained choosing between yellow and blue slot machines again, to see if the conditional discrimination procedure had affected the preference of color. If a participant's responses were affected by the conditional discrimination procedure, it would most likely alter the response allocation during posttest, meaning that they would have more responses on the slot machine having the "more than" color than on the slot machine with the "less than" color.

The result reported by Zlomke and Dixon (2006) was that the participants allocated on average 81% of their response to the "more than" colored slot machine and 19% to the "less than" colored slot machine during posttest. Zlomke and Dixon (2006) concluded that

contextual stimuli, color, does affect gambling behavior, and that manipulation of contextual stimuli, through a conditional discrimination procedure could alter preferences that again could alter response allocation. The results in Zlomke and Dixon have been supported by Hoon et al. (2007), Experiment 2 and Experiment 3,and Hoon et al. (2008). In Hoon et al. (2008) the participants changed their preference for color from pretest to posttest, and they increased their responding on the "more than" slot machine with an average response allocation of 71 %. This was a little less than Zlomke and Dixon's 81 %, but was still a high increase in responding.

According to Zlomke and Dixon (2006), Hoon et al. (2007) and Hoon et al. (2008), a change in color preference and the increase in the "more than" colored slot machine can be explained by the development of self-rules through the discrimination procedure. They argued that the self-rule had a transformation of stimuli function. According to Hayes, Barnes-Holmes, and Roche (2001), transformation of stimuli function means that a trained stimuli function for one stimulus can be transferred to other members of the same stimuli class giving them the same function without specific training. The stimuli would then function as a contextual cue as to how to respond in the situation. Several researchers have reported the ability for a relation to emerge without specific training but through transfer of stimuli function, and across several functions (e.g. Barnes & Keenan, 1993; DeGrandpre, Bickel, & Higgins, 1992; Dougher, 1998; Dymond & Barnes, 1995; Kohlenberg, Hayes, & Hayes, 1991).

However, there have been some difficulties replicating the results of Zlomke and Dixon (2006) and Hoon et al. (2008). Fredheim et al. (2008) conducted a systematic replication of Zlomke and Dixon. The first experiment in Fredheim et al. did not replicate the findings of Zlomke and Dixon with only four of 12 participants changing their preference for

color from pretest to posttest and increasing their responding on the “more than” colored slot machine during posttest. In Experiment 2, Fredheim et al., gave the participants a more detailed instruction about what to pay attention to during the conditional discrimination procedure. Eight of 12 participants changed preference and increased their responding on the “more than” colored slot machine during posttest in Experiment 2. In comparison with Experiment 1, where they had an average responding of 49% on the “more than” colored slot machine, they had an average responding of 69% on the “more than” colored slot machine in Experiment 2. Although there was an increase in responding to the “more than” colored slot machine, it was not as high increase as reported in Zlomke and Dixon. Fredheim et. al., suggested that the increase of responses on the “more than” colored slot machines during posttest from Experiment 1 to Experiment 2 was a result of the more detailed instructions.

In her master’s thesis, Revheim (2011) tried to replicate the findings of Hoon et al. (2008) also with some mixed results. Revheim conducted several experiments in the master thesis, and Experiment 1, which arranged the same procedure as Hoon et al., did not replicate the result of earlier experiments. Experiment 2, was a systematic replication of Hoon et al. One of the main differences in Revheim Experiment 2 compared to Hoon et al. was the reinforcement schedules during posttest. Hoon et al. used the same reinforcement schedules, 50% probability for a win on both slot machines during posttest, while Revheim had different reinforcement schedules on the slot machines. In Experiment 2, there was 80% probability for a win on the “more than” colored slot machine, and 20% probability for a win on the “less than” colored slot machine. A second difference between Hoon et al. and Revheim Experiment 2 was that the participants in Revheim went through two separate rounds of conditional discrimination training and two posttests. The results in Revheim Experiment 2 showed that the participants changed their preference in color from pretest to posttests. The

average played on the “more than” colored slot machine during posttest 1 was 69%, and the average played on the “more than” colored slot machine while posttest 2 was 79%. These results in Experiment 2 replicated the findings of Hoon et al. and indicated that the manipulation of contextual cues during the conditional discrimination phase affected the response allocation during posttest.

The experiments done on contextual cues and alternation of response allocation through a discrimination procedure have shown different results. There has been some difficulty in replicating the results of Zlomke and Dixon (2006) and Hoon et al. (2008) where the reinforcement schedules are the same on both slot machines during posttest. Fredheim et al. (2008) did not manage to get the same amount of increase as in Zlomke and Dixon or Hoon et al., neither did Experiment 1 in Revheim (2011). Revheim managed to get a high increase of responding on the “more than” colored slot machine during posttest in Experiment 2. In this experiment, there was 80% probability for a win on the “more than” colored slot machine and 20% probability for a win on the “less than” colored slot machine during posttest. It is therefore possible that the participant’s response allocation in Experiment 2 were influenced by the reinforcement schedules arranged in the test, and not solely a result of the training procedures.

The purpose of the presented experiment then, was to try and replicate the findings of Hoon et al. (2008) and Experiment 2 in Revheim (2011). More specifically, the purpose was to see whether the participants would alter their responses allocation after the conditional discrimination training and choose the “more than” colored slot machine instead of the “less then” colored slot machine during posttests. This was measured by the response rate on the “more than” colored slot machine, before and after conditional discrimination training.

Method

Participants.

30 participants, 16 women and 14 men, ages between 24 and 44, were voluntarily recruited through personal contacts. Detailed information about each participant can be seen in Table 1. All of the participants were either student s or full-time workers. Participants 3, 13 and 31 had experience with conditional discrimination training earlier as participants in stimulus equivalence experiments.

Design.

The participants were randomly assigned to three different experimental conditions. Group 1 experienced 50% probability for a win on a random ratio (RR) reinforcement schedule on both slot machines during posttest 1 and posttest 2 which is the same as in Hoon et al. (2008). Group 2 had 80% probability for a win on a RR reinforcement schedule on the slot machine with a “more than” color, and 20% probability for a win on a RR reinforcement schedule on the slot machine with the “less than” color during both posttests. The participants in Group 2 had the same conditions as the participants in Revheim (2011) Experiment 2. Before the slot machines were banned from the Norwegian market, the payback percent was determent by the “Regulation of approval of slot machine” (Justis-og Politidepartement, 1998, nr 853) to a minimum of 78%. Group 3 was conducted to simulate this payback percent and had 80% probability for a win on a RR reinforcement schedule on both slot machines during both posttest1 and posttest 2. The procedures in all three groups were the same as in Revheim Experiment 2 with the “more than” and “less than” colors based on responding during pretest and with reversal in the procedure after posttest 1. The reversal made the experiment both a within - subject and a group design.

Apparatus and settings.

All the experiments were conducted in a laboratory room at the Oslo and Akershus University College. The participants were sitting in a cubicle about 1, 5 x 1, 5 m. The experiment was conducted on an HP laptop with an Intel® Core ™ Duo CPU P8800 @2.66GHz 2.67GHz processor and 32- bit operating system. The laptop screen was 25*37 cm with 1024*768 screen solution. The software program was Maja Study using Visual Basic Net (Dixon & Lab.group) also used in Revheim (2011).

When entering the lab room, the participants were asked to read the information letter which briefly explained the purpose of the experiment, the duration, that their personal information would be protected and that they could withdraw from the experiment at any time and without any consequences. The information was given to the participants again verbally before the experiment started. The participants were also informed that during the experiment they would get information in English on the screen and that this information was also available in Norwegian translation on a piece of paper. The participants were informed that the Norwegian text contained more information than the English text, and they were therefore encouraged to use the Norwegian translation. When the experiment was finished, the participants were debriefed and thanked for their participation.

Experimental phase.

All of the participants went through a screening phase and five experimental phases, pretest, conditional discrimination training and testing 1, posttest 1, conditional discrimination training and testing 2 and posttest 2. The purpose with the slot machine pretest was to uncover any preference for color before the experiment started. The conditional discrimination training and test phases were conducted to try and manipulate the color preference. After the

conditional discrimination phases, the slot machine posttests was conducted. The aim with the posttests was to see if the participants had changed their preference for color in accordance with the conditional discrimination training, implying that the participants would chose to play on the “more than” colored slot machine instead of the “less than” colored slot machine.

Assessment of gambling behavior. All participants went through the SOGS screening program before the actual experiment began. SOGS is a screening program often used to seek out any problem gamblers or pathological gamblers (Lesieur & Blume, 1987). The screening contained questions about the participant’s experience with different gambling activities, and they were asked to rank how often they participated in these activities. There were also various statements about gambling that the participants were asked to rank their agreement. According to Lesieur and Blume a person with 5 points or higher might be considered as a pathological gambler.

The experiment started automatically after the SOGS was conducted and consisted of five phases, slot machine pretest, conditional discrimination training and testing 1, slot machine postest1, conditional discrimination training and testing 2 and slot machine posttest 2.

Slot machine pretest. The purpose of this phase was to reveal any preference for one of the two colors presented, yellow or blue, before the conditional discrimination phase started. The following instruction was displayed on the screen at onset of the pretest:

> *“On the following screen you will see a button in the middle of the screen. When you click on the button with your mouse two slot machines will be revealed. Click your mouse on the slot machine you would like to play and earn as many points as possible.”*

Under the written instruction on the computer, there was a button “Begin”, and the participants’ had to click on the button to go to the next screen. Participants then experienced a screen with two buttons, one yellow and one blue, both labeled “slot machine,” as illustrated in Figure 1. The participants had to choose the preferred slot machine by clicking on the corresponding button. The buttons kept changing sides from left to right for each trial.

Each trial started with the presentation of a slot machine in the middle of the screen, see Figure 2 for illustration. The background color was the color of the button the participant had chosen, for instance blue. On the left- hand side of the slot machine, there was a button “SPIN”. When the participant clicked on it, the slot machine started to twirl for about 4 seconds, and the machine made sounds similar to twirls of a real slot machine. Above the slot machine, there were three squares. These were labeled “Total Credits,” “Amount Bet” and “Amount Won”. All the participants started with 100 credits, and they could only bet and win 1 credit at a time. One credit was removed from the “Total Credit” after each twirl. If a twirl resulted in three identical symbols, it was considered a win, and the participants experienced a fanfare and *“AWSOME…. YOU WIN!!!”* sign under the slot machine. When the participants won, the amount in the “Total Credit” hatch and “Amount Won” hatch was displayed, and the total credit increased equal to the amount won. If the participants lost, the amount in “Total Credit” hatch would decrease with 1 credit. Then participant had to press the “Press HERE to continue” revealed on the left - hand side of the slot machine. They would then return to the “click here” button, and after pressing this button the participants would be presented with the choice between yellow and blue slot machine again. One twirl on the slot machine was one trial, and the pretest consisted of 50 trials. The reinforcement schedule on both slot machines was 50% win on a random ratio schedule, and the amounts of wins were held constant through the whole pretest phase.

The pretest phase was considered as the baseline in this experiment. During the pretest one would detect if the participants had a preference of one colored slot machine based on their response allocation. If the participants showed a 60% or more response allocation to one of the colors, this color was defined as pre-experimental preference. If the participants showed a preference for one of the colors, this color would automatically be set as the "less than" color during the first conditional discrimination training and test phase. This was done to control that the participants didn't choose slot machines based on a "favorite" color. If the participants didn't allocate 60% or more of their responding to one of the slot machines, the software program randomly selected the "more than" and "less than" color for the first relational training and test phase.

Conditional discrimination training and test phase 1. The conditional discrimination training and testing phase was conducted to try and manipulate the preference of color. During this phase the participants had the following instruction available:

> *"During this phase of the experiment you will be presented with two images on the screen. Your job is to choose one of the two images by clicking on it with the mouse. When you are correct, you will receive one point. Incorrect responses will not result in award points. Please try to earn as many points as you can. The more points you earn, the quicker you will finish. It is important that you pay attention to everything presented on the screen since both images and background color can give you important information. There will be parts of the experiment where feedback is not given. The computer is skill keeping track of your responses so continue to do your best. Do you have any questions?"*

Below the instruction, there was a button "Begin" which the participants had to click on to start the phase. Which color to be correlated with "more than" and "less than" value was

based on the pretest. The background color functioned as a contextual cue for which of the stimuli presented on the screen was considered the correct stimuli.

Each trial started with a presentation of the background color. A few seconds later, the choice stimuli was presented, see Figure 3 for illustration. In the training phase, the participants would be presented with three sets of stimuli with three members, coins (1kr, 10kr, 20kr), dices (1,3,6) and spellings of the word "Bingo"(B-I, B-I-N, B-I-N-G-O), see Figure 4. During one trial, two of the members from one set would be presented, for instance, coins 1kr and 10kr. If the "more than" color was in the background, choosing 10kr would have been the correct choice. In doing so, the computer made a cheerful sound and the word *"CORRECT"* was revealed on a white background. The participants would receive one point that was shown in the right corner of the screen for a few seconds. If the participants chose the wrong stimuli, the word *"WRONG"* was displayed on a white background, and an antagonistic sound was presented. No points would be received. When the feedback was presented, the trial ended, and the screen turned white for a few seconds. Following the white screen, a new trial started and the screen turned either yellow or blue. Each block of training and tests consisted of 36 trials and the criterion for proceeding to the test phase was 32 correct responses, meaning that the participants could have 4 wrong choices. If the participants made more than 4 mistakes during the training phase, the training phase started over, and the participant would go through 36 new trials with feedback. The computer would alternate between the background colors, between sets of stimuli for instance coins, and which two stimuli from the sets, for example 10kr and 20 kr or 1 kr and 10 kr would be displayed.

When the mastery criterion was reached, the participants automatically proceeded to the test phase. Here they were presented with new - untrained stimuli. There were three sets with three members in each, notes (50kr, 100kr, 200kr), "poker chips" (25, 100, 500) and

cards (spades 4, spades 9, and spades king), see Figure 4. The participants had to choose between the new stimuli based on the background color but would not receive any feedback in the form of words or points. The test phase also consisted of 36 trials with a criterion of 32 correct responses. If the criterion of 32 correct responses was not met, the participant was reintroduced to the training phase with feedback and a new test phase after that.

Posttest 1. The purpose of this phase was to see if the conditional discrimination procedure had changed the preferences for color from pretest. Participants were at the beginning of posttest presented with the same instruction as during pretest. Posttest 1was similar to pretest, the participants went through the same procedure and had to choose a slot machine to twirl based on the color. The posttest also consisted of 50 trials and the reinforcement schedule was a random ratio schedule, but as a difference to the pretest the slot machine differs in percent of reinforcements. Participants in Group 1 experienced a 50% probability for a win on both slot machines. In Group 2, the “more than” colored slot machine had a probability of 80% to win and the “less than” colored slot machine had a probability of 20% to win. In Group 3, there was an 80% probability for a win on both slot machines. The response allocation of posttest 1 would be compared with the response allocation of pretest to see if the conditional discrimination training had any effect on the participant’s preference of color and the allocation of responses. If the participants didn’t increase their response allocation to the “more than” colored slot machine during posttest 1, the experiment ended. If the participants did increase the allocation of responses to the “more than” colored slot machine, they would proceed to conditional discrimination training and test phase 2.

Conditional discrimination training and test phase 2. The second phase of conditional discrimination training and testing phase was meant as a control condition. The aim was to make sure that the results from posttest 1 was not produced by chance. The

conditional discrimination training and test phase 2 was identical to conditional discrimination training and test phase 1. Except for that the value of the colors yellow and blue was reversed, implying that if blue was the “more than” color in the first conditional discrimination training it automatically became “less than” in this conditional discrimination training and yellow became the “more than”. Otherwise, the phases were similar, the training phase contained the same sets of stimuli, and the test phase contained the same sets of stimuli as in the conditional discrimination training and testing phase 1. As in conditional discrimination training and test phase 1 each block consisted of 36 trials in both training and test, and 32 correct responses was the criterion in both phases.

Posttest 2. During the second posttest, the participants were tested to see if they would allocate more of their responses to the new “more than” colored slot machine trained during the conditional discrimination training and test 2. The response allocation from this phase would be compared with the response allocation in posttest 1 to see if the reversal of the contingencies during the conditional discrimination training and test phase 2 had affected the participant’s response allocation during posttest 2. The participants were presented to the same instruction as before starting pretest and posttest 1. The conditions in posttest 2 were similar to posttest 1, Group 1 had 50% probability for a win on both slot machines, Group 2 had 80% probability for a win on “more than” colored slot machine and 20% probability for a win on “less than” colored slot machine and Group 3 had 80% probability for a win on both slot machines.

Statistical analysis

A One -way ANOVA was conducted on the on responding during posttest 1 and posttest 2.

Results

Table 1 display the SOGS scores all of the 30 participants. The SOGS score of the participants in Group 1 varied from 0 to 0, 3 with an average of 0, 05. In Group 2 the SOGS scores varies from 0 to 0, 3 with an average also of 0, 05. The participants SOGS scores in Group 3 varied from 0 to 0, 3 with an average score of 0, 13. Group 3 differed from the other groups with a higher average score. The average SOGS score of all of the participants was 0,07, meaning that none of the participants showed any form of pathological gambling behavior (Lesieur & Blume, 1987).

A pretest was conducted to reveal if the participants had any pre- experimental color preference. Figure 5 illustrates the response allocation during pretest for the 30 participants. During the pretest, 17 of the 30 participants (57%) showed a preference to one of the color. The preference varied from 60% to 92%, meaning from 10 more responses to 42 more responses on one colored slot machine compared to the other colored slot machine. The 17 participants had an average of 24 more responses on a preferred colored slot machine than on the other colored slot machine. In Group 1, five of the 10 participants showed a preference to one color during pretest (16, 19, 20, 26 and 27). The preference within the group varied from 60% to 80% that was from 10 to 30 more responses on one colored slot machine compared to the other colored slot machine during pretest. The average responding on the preferred colored slot machine in this group was 20 responses more on the preferred color slot machine than on the other colored slot machine. In Group 2, eight of 10 participants showed a preference to one color during pretest (5, 7, 8, 12, 13, 17, 22 and 29). The preference varied from 62% to 84% meaning from 12 responses to 38 responses more on one slot machine compared to the other slot machine. The average responding was 28 more responses on the preferred colored slot machine than the other colored slot machine during pretest. In Group 3,

four of 10 participants had a preference to one colored slot machine (1, 21, 24 and 30). The preference varied from 62% to 92% meaning from 12 more responses to 42 more responses on one slot machine over the other slot machine. The average responding on the preferred colored slot machine during pretest in Group 3 was 21 more responses compared to the other colored slot machine. Group 2 had the highest amount of participants with a pre- experimental color preference, with eight participants showing a preference. This group also had the highest average of responding on the preferred colored slot machine with 28 responses compared to Group 1 with 20 responses and Group 3 with 21 responses. Group 3 had fewest participants with a preference with only three, but then again one of these participants (1) showed a 92% preference to one color that was the highest among the participants.

Following the pretest, the first conditional discrimination phase was conducted. Table 1 illustrates the amount of blocks the participants used during conditional discrimination training and testing 1 and conditional discrimination training and testing 2. The results varied from one block of training to 18 blocks of training during the first phase of conditional discrimination training. The average amount of training blocks during the first conditional discrimination training for the participants were five blocks, and one block of conditional discrimination test. One participant did not complete the training, and therefore, the results for this participant are not displayed in the Table 1 or Figure 5 and 6.

In Group 1, the amount of training during conditional discrimination training phase1 varied from one to 18 blocks with an average of five blocks. All of the participants in this group managed the conditional discrimination test 1 with one block. In Group 2 the amount of training in the conditional discrimination training 1 phase varied from two to seven blocks, with an average of four blocks. The group average on the conditional discrimination test phase 1 was one block, but one participant (5) needed two test blocks during the conditional

discrimination test. As Table 1 illustrates, the amount of training during conditional discrimination training phase1 in Group 3 varied from two to 12 blocks with an average of five blocks. During the test phase 1 all of the participants managed with one block. The participants in Group 2 used in average one block less during first training phase than participants in Group 1 and Group 3.

After the conditional discrimination training and test phase 1, the participants went through posttest 1. Figure 6 illustrates the amount of responding on the "more than" color during pretest, posttest 1and posttest 2 for all of the 30 participants. In Group1, where the participants experienced a 50% probability for a win on both slot machines, six of the 10 participants increased their responding on the "more than" slot machine during posttest 1 and proceeded to the second conditional discrimination training and test phase and posttest 2 (6, 16, 19, 20, 26 and 27). Participants 2, 4, 28 and 31 did not increase their responding on the "more than" slot machine during posttest1, and the experiment was ended. In this group, the average of responding on the "more than" colored slot machine during posttest 1 was 44%. In Group 2, where the participants experienced 80% probability for a win on the "more than" colored slot machine and 20% probability for a win on the "less than" colored slot machine, all of the 10 participants increased their responding on the "more than" colored slot machine during posttest 1. The average responding on the "more than" colored slot machine during posttest 1 was 71%. The participants in Group 3 experienced 80% probability of winning on both slot machines during posttest 1. As illustrated in Figure 6, only three of the participants in this group increased their responding on the "more than" slot machine during posttest 1 (21, 24 and 30). The rest of the participants (1, 3, 9, 10, 18, 23 and 25) decreased their responding on the "more than" colored slot machine during posttest 1, and the experiment ended. During posttest 1, the average responding on the "more than" colored slot machine for

Group 3 was 49%. Of the three groups, Group 2 was the only group where all of the participants increased their responding on the “more than” colored slot machine. Group 2 was also the group with the highest increase on the “more than “colored slot machine during posttest 1 with an average responding on this slot machine of 71%. Group 1 had the lowest responding on the “more than” colored slot machine with an average of 44%, while Group 3 had the fewest participants increasing their responding on the “more than” colored slot machine with only three participants.

Following posttest 1, a second round of conditional discrimination training and test was conducted. Of the 30 participants, 11 participants (1, 2, 3, 4, 9, 10, 18, 23, 25, 28 and 31) did not increase their responding on the “more than” slot machine during posttest 1 and did not proceed to this phase. For the participants who proceeded to conditional discrimination training and test phase 2, the average amount of blocks during training and test was one block, see Table 1 for illustrations. In Group 1, six of the participants (6, 16,19,20,26 and 27) proceeded to conditional discrimination training and test phase 2, and managed the training and test with one block. All of the participants in Group 2 increased their responding on the “more than” colored slot machine and proceeded to conditional discrimination training and test phase 2. The average amount of training and tests blocks during this phase was also one block. Only three participants (21, 24 and 30) in Group 3 increased their responding on the “more than” slot machine during posttest 1 and proceeded to conditional discrimination training and test phase 2. The average of training and tests phases during this phase was one block.

After conditional discrimination training and test phase 2, the participants proceeded to posttest 2. The reinforcement schedules in this posttest were the same as in posttest 1. In Group 1, six participants proceeded to posttest 2, and the average of responding on the “more

than" slot machine for these participants was 51%, an increase of 7% from posttest 1 to posttest 2. As illustrated in Figure 6, of the participants in Group 1that conducted posttest 2, three of them (6, 19 and 26) actually allocated fewer responses on the "more than" colored slot machine during posttest 2 than during posttest 1. In Group 2 all of the participants also increased their responding on the "more than" colored slot machine from posttest 1 to posttest 2. The average responding on the "more than" slot machine during posttest 2 was 93 %, an increase of 12% from posttest 1. An analysis of the participants responding showed that five of 10 participants (7, 11, 12,15,17,22 and 29) allocated almost all of their responses (98% to 100%) on the "more than" colored slot machine during posttest 2. In Group 3, three participants proceeded to posttest 2. The average responding on the "more than" slot machine during posttest 2 for these participants was 40%, a decrease of responding on 9 % from posttest 1. The results showed that the participants that allocated most of their responses on the "more than" slot machine during both posttests were participants in Group 2 with an average of 71% in posttest 1 and 93% in posttest 2.The majority of participants in Group 2 also had a more stable responding and less switching between slot machines during posttests than participants in the other groups. The result indicates that the participants altered their preference and responded in accordance to both conditional discrimination training phases and chose the "more than" colored slot machine. In Group 1, there was less response allocation on the "more than" colored slot machine during posttest 1 compared to Group 2 with an average of 44%. Group 1 had a minor increase in posttest 2 with an average of 51%. The participants in Group 3 had similar results as Group 1 during posttest 1 with an average of 49%. They decreased their responding on the "more than" colored slot machine during posttest 2 to an average of 40%.

Statistical analysis.

A One -way ANOVA revealed that there was a statistical significant effect of groups responding on posttest1, F (2, 27) = 9, 15, p=0,001, ω =0, 59. A One-way ANOVA was also done on responding during posttest 2. Group 3 was excluded from this analysis since only three participants implemented this posttest. The result showed that there was also a statistical significant difference between Group 1 and Group 2 in responding during posttest 2, F (1, 18) = 40,79, p = 0,000, ω = 0, 81.

Discussion

The purpose with the presented experiment was to replicate the findings of Hoon et al. (2008) and Revheim (2011) Experiment 2, and also to alternate the effect of contextual cues on gambling behavior through a conditional discrimination procedure. The participants in Group 2, which arranged the same procedure as Revheim Experiment 2, increased their responding on the "more than" colored slot machine. The result replicated the findings of Hoon et al. (2008), Revheim, Experiment 2, and other research done in the area of contextual cues affect on gambling behavior (e.g. Hoon et al., 2007; Nastally et al., 2010; Zlomke & Dixon, 2006). The increased responding on the "more than" colored slot machine during posttest in Group 2 indicated that the participants had altered their preferred color in accordance to the conditional discrimination procedure. The participants responding in Group 2 was also in accordance to other research done on contextual cues, and transformation of stimuli function on other types of behavior (e.g. Barnes & Keenan, 1993; Dymond & Barnes, 1995).

Hoon et al. (2008), which was a replication of Zlomke and Dixon (2006), had a 50% probability for a win on both slot machines during posttest, and reported an increased

responding on the “more than” colored slot machine. Both Zlomke and Dixon and Hoon et al. suggested that the conditional discrimination procedure had lead to a transfer of stimuli function, manipulating the function of the contextual and increasing the responding on the “more than” colored slot machine during posttests. Both studies also implied that contextual cues were important environmental variables that might affect gambling behavior. However, it has been difficult to replicate the result under the same conditions as in Zlomke and Dixion and Hoon et al. Both Group 1 and Group 3 in this experiment also had the same reinforcement schedule on both slot machines during posttests. The participants in Group 1, which was a systematic replication of Hoon et al. where the participants experienced a 50% probability for a win on both slot machines during both posttests, did not replicate the findings of Hoon et al.or Revheim (2011) Experiment 2. Neither did the participants in Group 3, which experienced 80% probability of a win on both slot machines during posttests. Other experiment using the same reinforcement conditions on both slot machines, Fredheim et al. (2008) and Revheim Experiment 1, have also failed to replicate the results of Zlomke and Dixon and Hoon et al..The fact that it is difficult to replicate the result of Zlomke and Dixon and Hoon et al. using the same reinforcement conditions on both slot machines questions the effect of contextual cues on gambling behavior. In the presented experiment Group 2 managed to replicate earlier findings of Hoon et al. and Revheim Experiment 2. However, as Revheim mentioned in her master’s thesis, it is possible that experiencing 80% probability for a win on one schedule and 20% probability for a win on another schedule during posttests, may have affected the results. The result therefore indicates that the participants might have detected the reinforcement schedules and that the responding was contingency shaped (Fester & Skinner, 1957; Skinner, 1969) instead of as a result of the conditioned discrimination procedure.

The variables responsible for the higher increase in Zlomke and Dixon (2006) and Hoon et al. (2008) compared to the results in Group 1 and Group 3 in the present experiment remains unidentified. One procedural difference that might have influenced the inconsistency is that in the present experiment the “more than” and “less than” color is based on the participant’s response allocation during pretest. If the participants had 60% or more responses on one colored slot machine during pretest, this color would be the “less than” color during the first conditional discrimination procedure. The purpose was to prevent the participants form continuing to choose their favorite color during posttests. Neither Zlomke and Dixon nor Hoon et al. arranged procedural elements to prevent pre-experimental preference so that the participants wouldn’t choose their favorite color during posttest. Thus, it is possible that the results in Zlomke and Dixon and Hoon et al. were more affected by the participant’s preference for color than the participants in the present experiment. To gain information about how the color preference affects results, future experiments might consider a systematic alternation of the “preference percentage” during pretest. Adjustment of the percentage of preference might give insight to whether pre-experimental color preference affects the results or not.

In this research line, Zlomke and Dixon (2006) have reported the highest increase of responding on the “more than” colored slot machine. One feature of the procedure used in Zlomke and Dixon was that the “less than” relation was trained first, and then the “more than” relation and the last training sequence was a mix of both “less than” and “more than.” In the present experiment, the relational training was mixed from the beginning. It is unclear how much these differences in training have affected the results, so a systematic manipulation of different training structures may be interesting to investigate in a future experiment.

In the present experiment, 50 trials were arranged in both pretest and posttests. The fact that there were only 50 trials may not have been efficient enough to get a stable responding. The analysis of the participants' response allocation during posttests showed that there was a lot of switching among the slot machines, a bit more in Group 1 and Group 3 compared to Group 2. One solution to gain more stable responding is to prolong the pretest and posttest. However, as mentioned in Revheim (2011), because the tasks are monotonous, if the pretest and posttest are prolonged there is a risk that the participants get bored and conduct rules and patterns of responding to entertain themselves. The results also showed that 57 % of the participants had a preference for one colored slot machine during pretest. The fact that some participants had very high preferences for one color during pretest may have affected their responding during other phases in the experiment, even though the procedure tried to prevent this from happening. It was in Group 2 the participants showed the most preference and it is unclear if this may have affected the result of the increase on "more than" slot machines during posttests. The participants in Group 2 also used in average one block less during the first conditional discrimination training phase, indicating that participants in Group 2 learned the color and value correlation a little quicker than the participants in the other groups. The participants in Group 3 also had a higher SOGS with an average of 0, 13 compared to 0, 05 in the other groups. This implies that participants in Group 3 might have a different pre-experimental gambling history than the participants in the other groups, and this could have affected the responding during posttests.

Since the experiment was conducted in a laboratory, there are also some implications of generalization(Shadish, Cook, & Campbell, 2002). The results found with participants in a laboratory situation don't have to be representative for the population in general. Also results found is strictly controlled environment may fail to represent the environment in "real life."

According to Weatherly and Phelps (2006), uncontrolled variables like different discriminative stimuli (light, sounds, colors), establishing operations, the quantity of money that the gambler can win or lose and the gamblers reinforcement history, can make it problematic to study gambling behavior in a laboratory setting. The reinforcement history is a factor that is almost impossible to control, but Weatherly and Phelps recommend trying to limit participation to people with a similar history. In the present experiment the SOGS screen was conducted before the experiment started to get some information about the participants' reinforcement history and could therefore exclude participants with certain gambling history, for instance, pathological gamblers. The participants volunteer in a laboratory experiment and have different reasons and motivation to participate in gambling than when a gambler enters a casino or logs on to the internet gambling site. Weatherly and Phelps also point out that out of ethical reasons one cannot let the participant's gamble with their own money and leave the experiment with less money than when they entered. The fact that the participants have no real risk of losing their money, as in the presented experiments were the participants gambles with points and not money, may have affected their behavior during the experiment. On the positive side, laboratory experiment gives the opportunity to study gambling behavior with experimental design and get insight in why people choose the way that they do, which can be more difficult in a "real life" setting (Weatherly & Phelps, 2006). Hopefully, the knowledge gained from laboratory research might be beneficial in treating people struggling with pathological gambling.

The conclusion in this present experiment was that Group 2 was the only group where the participants alternated their responding in accordance to the conditional discrimination procedure, and replicated the results of Hoon et al. (2008) and Revheim (2011) Experiment2. However, since the participants in this group experienced 80% probability for a win on the

"more than" colored slot machine and 20% probability for a win on the "less than" colored slot machine, there is a reason to believe that the responding was affected by the reinforcement contingencies arranged in the group and not by the conditional discrimination training. This interpretation implies that the manipulations of contextual cues didn't affect the response allocation during posttests. Despite this interpretation, contextual cues may still be an important variable that affects gambling behavior and future research in this area is needed. Both Zlomke and Dixon (2006) and Hoon et al. implied that the manipulation of contextual cues through conditional discrimination training generated verbal rules that lead to the alteration of responses during posttests. There are reasons to assume that humans that have verbal behavior conducts self-talk and utterances about how to play the game. Verbal behavior, and especially rule -governed behavior, might therefore be of importance in understanding gambling behavior (Arntzen, 2008). However, the procedure in these experiments is not sufficient enough to give valid information about verbal behavior. To gain more knowledge about how rules and contextual cues affects gambling behavior, future researchers should instruct the participants to talk aloud while they are conducting the experiment (Arntzen, 2008). "Talking aloud" procedures are considered a sufficient way to get an indication of what rules the participants may follow during the experiment (Arntzen, 2008). Also, because of the differences in results between this experiment and earlier experiments, future research should consider a systematic alteration of both the conditional discrimination training structure, and the preference percent during pretest to reveal if any of these procedural differences might have affected the results.

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Figures and tables

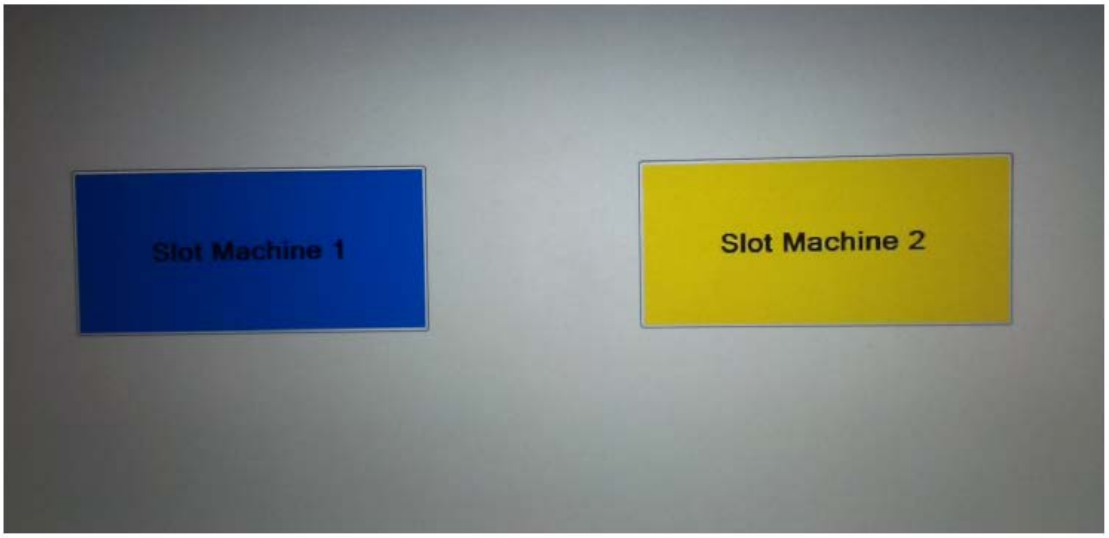


Figure 1. Photography of the screen during a pretest. The participants were presented with two choices yellow or blue slot machines, during both pretest, posttest 1 and posttest 2. The participants chose which colored slot machine they wish to play on by clicking on the buttons on the screen.

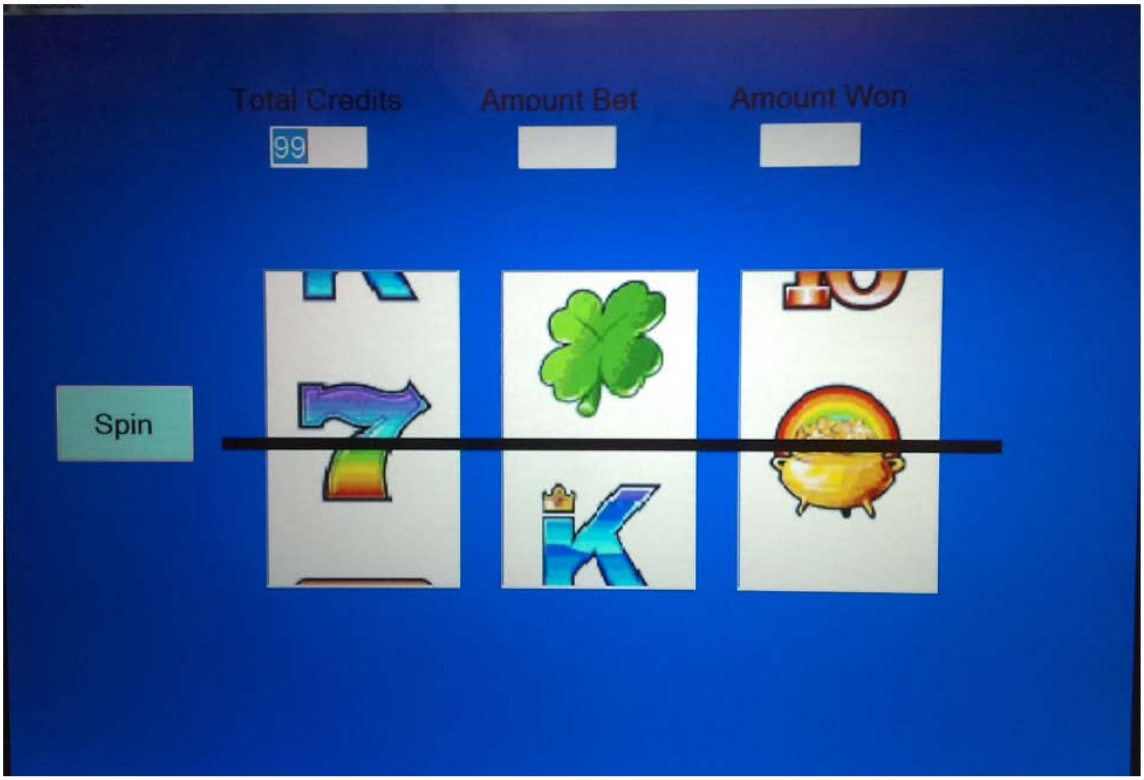
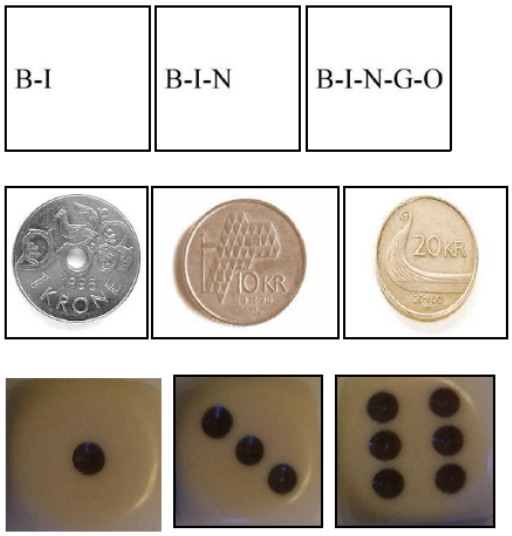


Figure 2. Photography of the screen during a slot machine sequence. The image displays Total Credits, Amount Bet and Amount Won. The background color was based on the participant choice to play on the blue slot machine.

Figure 3. Photography of the screen during sequence of a conditional discrimination training. The background color functions as a contextual cue for choosing the"more than" or the "less than" stimuli.

Stimuli used during training:



Stimuli used during test:

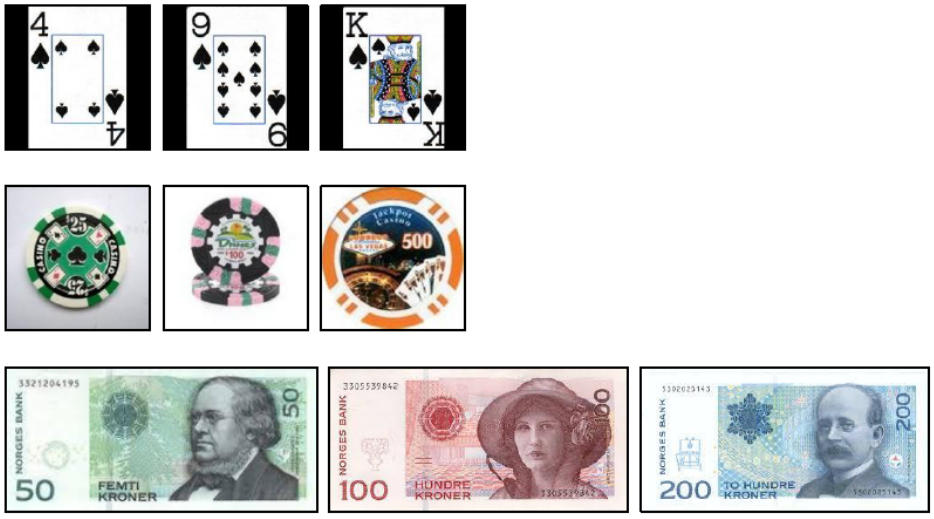


Figure 4. Stimuli used in conditional discrimination training and tests. The participants were presented with three sets of stimuli with three stimuli in each during both training and testing phase. For more detailed descriptions see "Conditional training and testing".

Table 1

An overview of participants screening scores and amount of training.

			Conditional discrimination training and tests 1		Conditional discrimination training and tests 2	
Conditions	Participants	SOGS score	Blocks of training	Blocks of tests	Blocks of training	Blocks of tests
Group1	2	0	1	1		
	4	0	2	1		
	6	0	2	1	1	1
	16	0,1	1	1	1	1
	19	0	1	1	1	1
	20	0	18	1	1	1
	26	0,1	13	1	1	1
	27	0	4	1	1	1
	28	0,3	1	1		
	31	0	2	1		
Average		0,05	5	1	1	1
Group 2	5	0	4	2	1	1
	7	0	2	1	1	1
	8	0	5	1	1	1
	11	0,1	2	1	1	1
	12	0	3	1	1	1
	13	0	4	1	1	1
	15	0	2	1	1	1
	17	0,1	2	1	1	1
	22	0	6	1	1	1
	29	0,3	7	1	1	1
Average		0,05	4	1	1	1
Group 3	1	0,1	4	1		
	3	0,3	6	1		
	9	0,1	5	1		
	10	0,1	7	1		
	18	0,3	8	1		
	21	0,1	2	1	1	1
	23	0,3	12	1		
	24	0	4	1	1	1
	25	0	2	1		
	30	0	3	1	1	1
Average		0,13	5	1	1	1
Total avrage		0,07	5	1	1	1

Note. Table 1 shows the results of the South Oaks Gambling Screen (SOGS) for all the participants. A score of 5 or higher indicates that the participants have a gambling problem (Lesieur & Blume, 1987). The table also shows the amount of training blocks each participant went through during both conditional discrimination training and testing phases. For more detail information of the results see the "Result" paragraph.

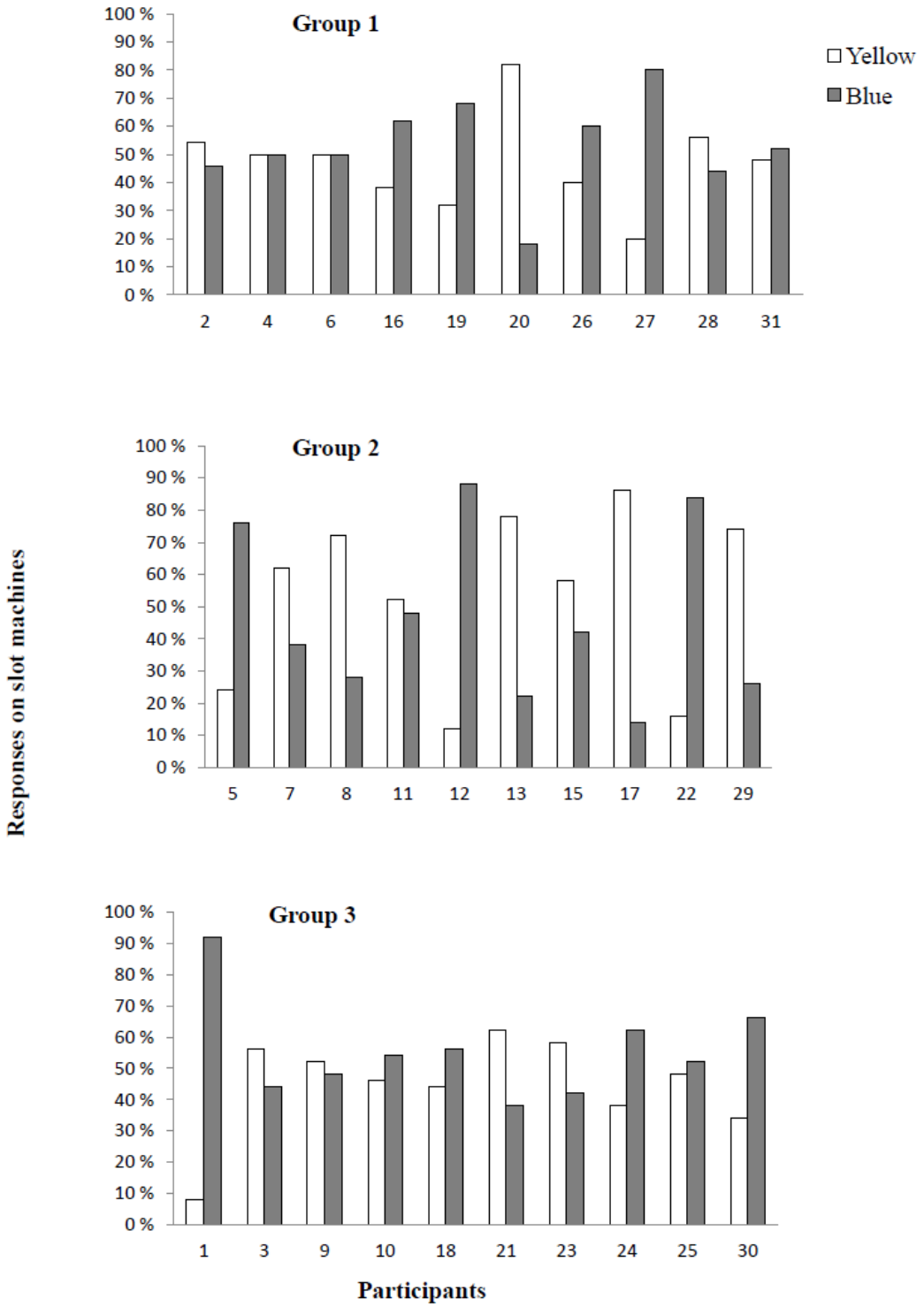


Figure 5. Responses on slot machine yellow and blue during pretest for all of the participants. The graphs show if the participants have any preferences for any of the color before the conditional discrimination training starts. A preference is defined as 60% or more responses on one color.

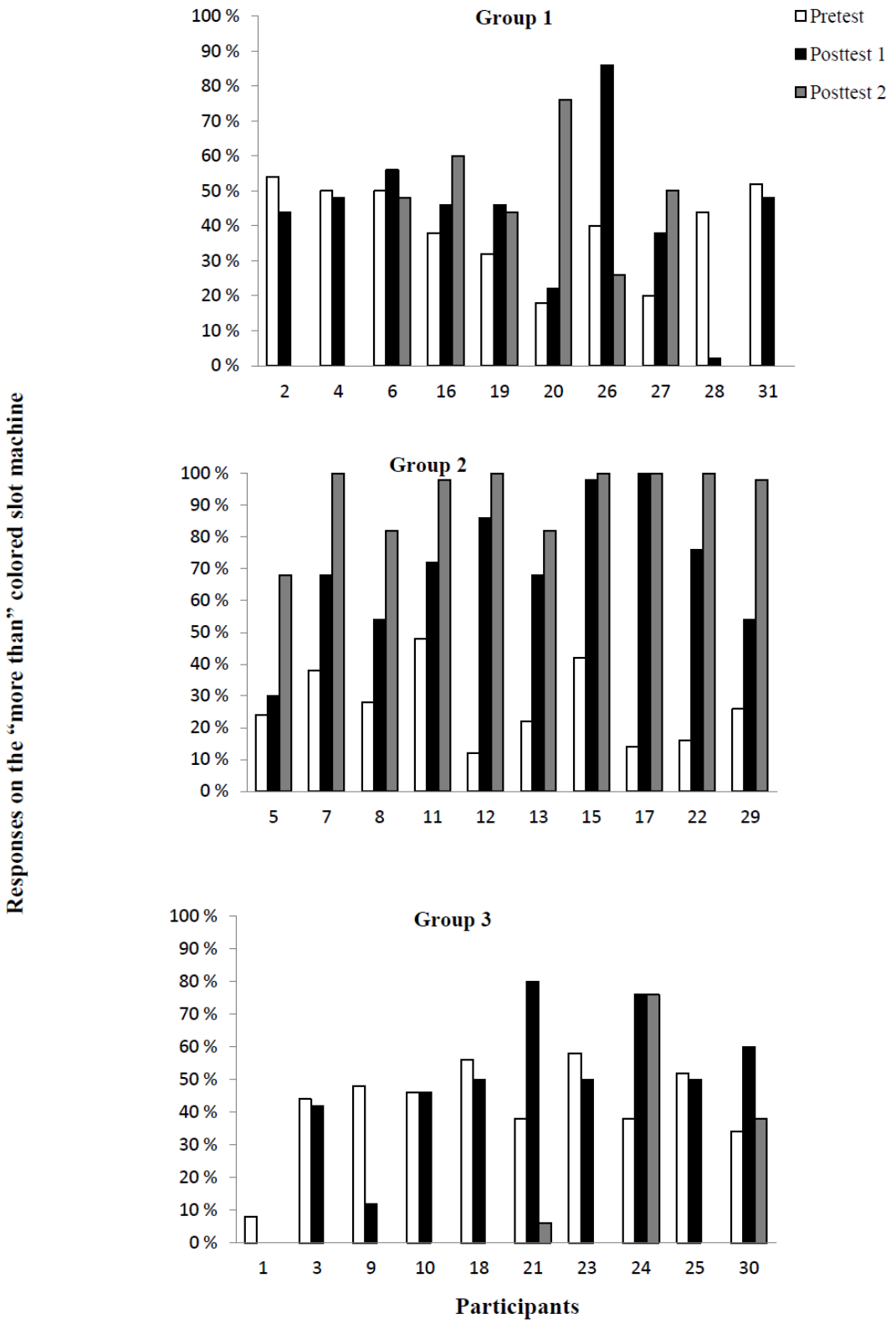


Figure 6. Responses on the"more than" colored slot machine during pretest, posttest 1 and posttest 2. Reponses on the "more than" color indicates if the participants have altered the preference for color in accordance to the conditional discrimination procedure.