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SUPERSTITION IN GAMBLING

Rosa Bersabé* and Rosario Martínez Arias*
*Universidad de Málaga, **Universidad Complutense de Madrid

The aim of this study was to test Skinner's (1948) hypothesis on the acquisition of superstition behaviours. The main tenet of Skinner's theory was that for conditioning to take place the most important factor is contingency, even if it is accidental. Three experiments were carried out with a dice game, with real money bets. In the first experiment subjects could sometimes throw the dice themselves and other times they had to let someone else throw for them. In the second experiment, gamblers were only sometimes allowed to choose the figure they wanted to bet on. Finally, in the third experiment, subjects played with and without a biomagnetic bracelet. We observed that gamblers were more confident of winning in the situations in which they had previously happened to win most. These results are discussed in the context of a reformulation of Langer's (1975) hypothesis on illusion of control.

El objetivo de/ trabajo era poner a prueba las hipótesis de Skinner (1948) sobre la adquisición de la conducta supersticiosa. Para este autor, lo fundamental para que se produzca un condicionamiento es la contingencia, aunque se haya producido accidentalmente. Con esta idea, se realizaron tres experimentos con un juego de dados en el que se apostaba dinero real. En el primero, cada sujeto jugaba en ocasiones tirando él mismo los dados, y en otras, dejaba que otra persona los arrojase en su lugar En el segundo, cada jugador a veces podía elegir la figura a la que apostar, y a veces no. En el tercero, cada uno jugaba con una pulsera biomagnétíca en el brazo y sin ella. Se observó que los jugadores mostraban mayor confianza en ganar, en la situación en la que habían ganado más veces de manera accidental. Estos resultados se discuten replanteando las hipótesis de Langer (1975) sobre la ilusión de control.

INTRODUCTION

One of the most important contributions to the study of cognitive bias in gambling is that of Langer (1975), with her experiments on the illusion of control. Langer's hypothesis attempted to explain previous observations in which some people treated random events as controllable. For example, Henslin (1967) observed that dice players behaved as though they could control the result of the throw: when they needed low numbers they rolled the dice gently; when they needed high numbers they cast them in an energetic fashion. Previously, Strickland, Lewicki and Katz (1966) had shown experimentally that gamblers bet more money and were more confident of winning when they threw the dice themselves than when someone else threw for them, even though the probability of winning was the same in the two cases. Langer (1975) tried to demonstrate that this illusion of control was produced when situations of luck or chance included elements characteristic of situations that actually involved control or skill. These elements that may induce an illusion of control are, according to this author: the possibility of choice; familiarity of stimulus and response; competition; and active or passive competition. These hypotheses have subsequently been tested in diverse studies which, in general, have corroborated the original results. For a review of the topic, the reader should consult the article by Presson and Benassi (1996), who carried out a meta-analysis of 53 experiments on illusion of control.

Introducing into gambling elements typical of situations involving skill appears to be one way of inducing an erroneous feeling of control. However, it is not the only one. Before the experiments referred to above, Skinner (1948) had already succeeded in provoking superstition behaviours in pigeons using another strategy. In his classic experiment, he subjected eight hungry pigeons to a fixed-time schedule, whereby they received food every 15 seconds, independently of their response. Six of these pigeons developed strange behaviours that were so well defined that two observers coincided perfectly in their description of them. The superstition behaviours were different for each pigeon: one of

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Correspondence concerning this article should be addressed to Rosa Bersabé Morán. Universidad de Málaga. Facultad de Psicología. Departamento de Psicología Básica, Psicobiología y Metodología de las CC del Comportamiento. Campus de los Teatinos. 29071 Málaga. E-mail:bersabe@uma.es

them spun round two or three times; another two rocked to and fro in some way; another banged its head against a corner of the cage. None of these responses had appeared systematically in the period of adaptation to the cage, prior to the reinforcement programme. It would appear, then, that the pigeons, like dice players, developed rituals with which to control reinforcement.

Skinner suggested that this occurred because, on administration of the first reinforcer, the pigeon happened to be carrying out a certain behaviour. Food increased the probability of repetition of this behaviour. If a second reinforcer was applied within a short space of time, the same contingency accidentally occurred again (the behaviour was followed by food), so that, once more, the probability of the superstition behaviour appearing would increase. Skinner (1948) begins his article by stating that "to say that a reinforcement is contingent with a response only means that it follows the response" (p. 64). That is, the essential factor in conditioning is contiguity. Thus, conditioning can occur even when the behaviour has not actually caused the reinforcement. Attempts have been made to extrapolate these results with pigeons to humans in various contexts (Ono, 1987; Matute, 1993; Bleak and Frederick, 1998; Pisacreta, 1987), including that of games of chance or gambling (Keren and Wagenaar, 1988; Brown, 1993).

The present work aims to investigate whether chance contingencies that occur to a gambler may provoke some kind of superstition. With this objective, we designed three experiments with the game of dice. In the first two we included an element characteristic of situations of skill. The initial hypothesis was that if the gambler happened to win more in the first few throws when s/he threw the dice him/herself (Experiment 1) or chose the figure (Experiment 2), then in the following throws s/he would be more confident of winning in these same conditions. If, on the other hand, s/he won more when s/he did not throw the dice or choose the figure him/herself, we would expect the gambler to invert his/her preferences –even though this contradicts Langer's hypothesis on illusion of control. The third experiment included an external element (a biomagnetic bracelet). We felt the gambler might consider the bracelet as a lucky charm, or as a predictor of negative results, depending on his/her experience in the game(s) in which s/he wore it.

EXPERIMENT 1

METHOD

Subjects

23 third-year students from the Universidad Complutense in Madrid (UCM). They collaborated voluntarily, but were told that participation would win them an extra mark in one of their course assessments.

Total number of valid cases was 18 (4 males and 14 females, aged between 20 and 24). The remaining cases were discarded because in the first 20 throws the gamblers won the same number of times regardless of whether they threw the dice themselves or someone else threw for them.

Design

Factorial 2x2 design with repeated measures in the second factor.

Independent variables

Between-subjects variable was *type of contingency* that occurred in the first 20 throws. This was defined operationally (Alloy and Abramson, 1979) as the difference between the probability of winning when the gambler threw the dice (p(W/T)) and when they were thrown for him/her by someone else (p(W/NT))

Contingency = (p(W/T))- (p(W/NT))

Subjects were assigned to one of the following two conditions:

Positive contingency. If in the first 20 throws the gambler won more times when s/he threw the dice than when s/he did not throw them.

Negative contingency. If in the first 20 throws the gambler won more times when s/he threw the dice than when s/he did not throw them.

A second, within-subjects independent variable was also established. This was *active participation*, with two conditions:

1) When the subject him/herself threw the dice.

2) When another person threw the dice for him/her.

The two gamblers (subject and experimenter-gambler) took turns at throwing, in order to counterbalance the levels of this variable.

Dependent variable

This was *confidence in winning*. In order to measure this variable, subjects were asked to estimate the probability of winning for each throw. The mean of subjective probabilities ($\overline{f}$) was found, and this was compared with the proportion of times the subject actually won ($\overline{d}$):

$Bias = \overline{f} - \overline{d}$

Bias can have scores between -1 and 1 (Yates, 1990). A positive Bias indicates subject's overconfidence in winning: the subjective probabilities of winning are greater than the proportion of times s/he actually wins. Negative Bias reflects underconfidence in winning. Null Bias indicates a perfect calibration.

This measure was calculated from the 10 probability judgements emitted for the last 20 throws: 10 when the

subject him/herself was throwing the dice, and 10 when they were thrown for him/her.

Procedure

The experiment was carried out in an experimentation cubicle in the Psychology Faculty at the UCM, and was applied individually to each subject. The two experimenters involved were unaware of the initial hypothesis. One of them played the role of the banker in the dice game, as well as reading the instructions and noting the subject's responses. This experimenter-banker sat at one side of the table, which was covered with a green baize cloth, whilst the experimental subject and the other experimenter sat at the other side. The experiment began with the bank giving twenty 25-peseta[1] coins to the experimental subject with which s/he would place his/her bets in the game. Subjects were told that they could win up to 4,500 pesetas or lose the 500 they had just been given, and which now belonged to them.

Two people participated, as far as betting was concerned, in the game: the banker and the subject-gambler. The rules were very simple: the dice (5 poker dice) were thrown from the cup once. The winner was the player with the highest number of similar dice with or without jokers (the ace). If the two gamblers threw the same, the winner was the player with the hand of highest value, according to the following order: K, Q, J, Reds and Blacks. In the event of a tie, the banker always won. The banker always threw first, after which the subject-gambler bet a minimum of 2 coins and a maximum of 4, and then threw the dice. If the subject-gambler won the throw, s/he won the same number of coins as s/he had bet; if s/he lost, the bank took the money that had been bet.

The variable "active participation" was manipulated by making the subject-gambler and the experimenter-gambler take turns to throw the dice, although the bets were always placed by the subject.

Before beginning the game proper there were two trials, so that subjects could become familiar with the rules and procedure. After clearing up any doubts the subject may have about the game, the banker explained to him/her about estimating the probability of winning. The subject was to estimate his/her confidence in winning after the banker had thrown and before making a bet. The estimation was to be made in terms of percentages. Thus, an estimation of 25% would mean that of 100 games in which the banker threw that combination of dice, the subject-gambler would win 25 times and lose 75 times. The gambler could estimate any percentage between 0 and 100, bearing in mind that a percentage over 50 meant that s/he expected to win the throw, while an estimate below 50% meant s/he expected to lose. It was emphasised that the task consisted not in calculating probabilities, but rather in estimating one's own confidence in winning. Three further trials were carried out, now incorporating the probability judgements. The game itself then took place, which consisted of 40 throws. The first 20 served to assign the subject to a contingency group: positive if s/he won more when throwing the dice him/herself, and negative if s/he won more when the experimenter-gambler threw. The following 20 throws were used to analyse the gambler's confidence in winning in two conditions: when s/he threw the dice and when they were thrown on his/her behalf.

1 translator´s note: 1 euro=166.386 Ptas

RESULTS

For each of the four combinations of experimental levels the means and standard deviations of Bias (mean subjective probability minus actual proportion of wins) were calculated. These are shown in Table 1.

Data were analysed by means of an ANOVA for two factors, using the statistical program SPSS. The main effect of type of contingency (positive if in the first 20 throws the gambler won more when s/he threw the dice; negative if s/he won more when they were thrown for him/her) was not found to be statistically significant ($F(1, 16)=0.09$; $p=0.767$). This indicates that, in the second block of 20 throws (regardless of who threw the dice), confidence in winning of gamblers exposed to a positive and a negative contingency was similar. In principle it was not expected to find differences between these two levels of the variable.

Likewise, in this second block of 20 throws (regardless of type of contingency received) subjects did not show more confidence when they could participate actively by throwing the dice. This was demonstrated by the fact that the main effect of the variable "active participation" was not found to be significant ($F(1, 16)=0.01$; $p=0.925$).

Table 1
Means and standard deviations (SD) of confidence in winning (measured by means of Bias) for each of the experimental conditions; n is the number of cases.

		Positive contingency			Negative contingency		
		Mean	(SD)	n	Mean	(SD)	n
EXPT 1	Throw dice	0.075	(0.213)	8	-0.045	(0.160)	10
	Not throw dice	-0.026	(0.248)	8	0.045	(0.152)	10
EXPT 2	Choose	0.224	(0.157)	9	0.154	(0.171)	11
	Not choose	0.172	(0.127)	9	0.216	(0.142)	11
EXPT 3	With bracelet	0.032	(0.170)	9	-0.069	(0.134)	9
	Without bracelet	-0.037	(0.094)	9	0.016	(0.210)	9

This result fails to corroborate the hypothesis of illusion of control, under which we should have found a difference in favour of the condition in which the gambler participates actively by throwing the dice him/herself.

The only effect that did approach statistical significance was that of interaction (F(1, 16)=4.04; p=0.062), represented graphically by the crossing lines in Figure 1.

Those subjects that won more on throwing the dice in the first group of throws (positive contingency) subsequently showed more confidence in winning when they threw again. Inversely, those exposed to negative contingency (in the first group of throws they won more times when the experimenter-gambler threw for them) subsequently felt more confident when the dice were thrown on their behalf. That is, the confidence in winning shown by gamblers when they throw the dice or when they are thrown for them depends on their previous experience in the two situations. This can be described perfectly well as superstition behaviour.

EXPERIMENT 2

METHOD

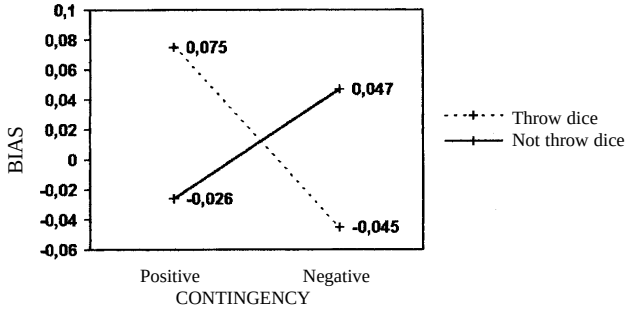
Subjects

23 Psychology students with similar characteristics to those of the first experiment. Finally, 20 valid cases remained: 3 males and 17 females.

Design

The design was once again 2x2 factorial with repeated measures in the second factor. The between-subjects factor was again *type of contingency* (*positive* if in the first 20 throws the gambler won more when s/he chose the figure; *negative* if s/he won more when it was chosen for him/her). The only variation with respect to the first experiment was that the second factor ("active participation") was substituted by *choice of figure* (K, Q, J, Reds or Blacks). This second, within-subjects factor also had two conditions: when the subject could choose the figure and when s/he could not choose.

Figure 1
Interaction between contingency and active participation



Once again, the dependent variable was confidence shown by the subjects (Bias) in the second block of 20 throws.

Procedure

A final-year Psychology student, unaware of the initial hypothesis, offered to act as experimenter. In this experiment, the new independent variable (*choice of figure*) made it necessary to change the rules slightly: in five consecutive throws, the aim was to obtain, on each throw, the highest number of K, Q, J, Reds and Blacks, in that order; in the next five consecutive throws, it was the gambler that chose, before each throw, the figure s/he preferred. In order to counterbalance the two conditions, half of the subjects began with the condition of choosing the figure themselves, whilst the other half began by playing according to the pre-established order.

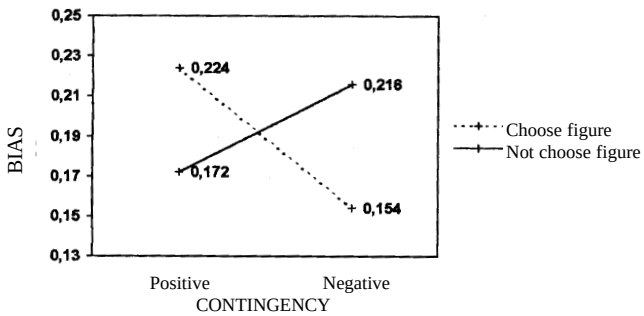
RESULTS

In the first four experimental groups a positive mean Bias was found –i.e., overconfidence: the subjective probabilities of winning were higher than the proportion of times the subjects won (see Table 1). This may be due to the fact that, in this second game, it was more probable that the throw resulted in a tie. In this situation the bank wins, so that the real proportion of wins for the gambler decreases, and his/her Bias increases.

The results provided by the two-factor ANOVA are along similar lines to those of the first experiment. The main effects of type of contingency (F(1, 18)=0.05; p=0.828) and choice of figure (F(1, 18)=0.02; p=0.888) were not found to be significant. Once more, we find a failure of the attempt to create an illusion of control by the addition of an element characteristic of skill situations: the possibility of choice.

As regards the interaction between the two factors (Figure 2), the tendency found in the first experiment was repeated (F(1, 18)=3.45; p=0.080). Gamblers that initially won more when they chose the figure themselves (positive contingency) showed more overconfidence

Figure 2
Interaction between contingency and choosing figure



in the subsequent throws where they could choose. Precisely the opposite occurred in the negative contingency group.

EXPERIMENT 3
METHOD
Subjects
23 students with similar characteristics to those of the first two experiments. Of these, 18 cases turned out to be valid for our research (5 males and 13 females).

Design
Factorial 2x2 design with repeated measures in the second factor. The first factor, between-subjects, was type of contingency: positive if in the first 20 throws the subject won more while wearing a biomagnetic bracelet than without it; negative if in these first 20 throws the subject won more without the bracelet than with it. The second factor, within-subjects, was *wearing bracelet* (a RAYMA biomagnetic bracelet, silver-plated with gold tips). Each subject played in the "wearing" and "not wearing" conditions.

In the second block of 20 throws we once again calculated Bias as an index of subjects' confidence in winning.

Procedure
The procedure was identical to that described in Experiment 1. The only difference was that, in this third experiment, it was always the gambler him/herself that threw the dice: five consecutive throws wearing the biomagnetic bracelet, and five consecutive throws without it. These two conditions were counterbalanced so that half the subjects began the game wearing it and the other half threw first without it.

In the instructions subjects were told that the study had been commissioned by a pharmaceutical company researching the properties of the biomagnetic bracelet. In this way we both justified the fact that they had to wear the bracelet and concealed the true objective of the study.

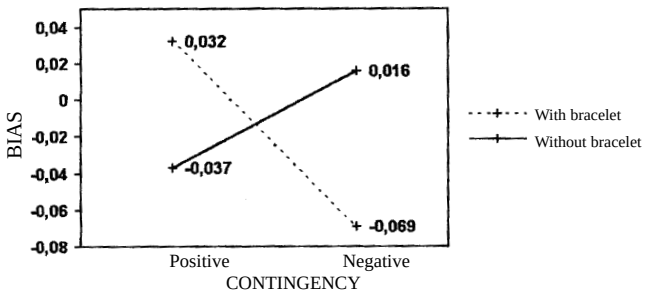
RESULTS
In the first 20 throws subjects were no more confident of winning after being exposed to positive contingency than they were after exposure to negative contingency ($F(1, 16)=0.13$; $p=0.721$); nor were they more confident when throwing with the bracelet than without it ($F(1, 16)=0.06$; $p=0.808$).

What we did observe was an interaction effect even more statistically significant than in the previous experiments ($F(1, 16)=0.23$; $p=0.027$). This effect can be seen clearly in Figure 3. Gamblers that in the first throws won more while wearing the bracelet (positive contingency) considered it as a lucky charm. On the other hand, those that in the first throws lost more while wearing the bracelet subsequently felt less confident of winning when they wore it.

DISCUSSION
In the dice games prepared for the first two experiments we included elements characteristic of skill situations. In spite of this, and contrary to Langer's (1975) hypothesis, no illusion of control was induced. This divergence in results may be attributed to the fact that in Langer's research confidence in winning was assessed on only one occasion, while in our study each subject played 40 times, and estimated 40 subjective probabilities. Other works have also shown how the illusion of control fades away when the gambler is faced with a series of games (Koehler, Gibbs and Hogarth, 1994; Budescu and Bruderman, 1995). The first authors maintain that people assess probabilities better when they can see how results vary over a series of games (or in this case throws), thus demonstrating their random nature. This explanation was quite encouraging, since it pointed to a simple strategy for countering the illusion of control: repeat the game.

The other side of the coin is that, when the game is repeated, the subject is exposed to an experiential situation in which, as in the natural conditions of a game, relations between variables can be inferred. The situation is propitious for the appearance of superstition behaviours. In fact, in the first experiment it was found that, if at first the gambler had won more times when s/he threw the dice him/herself (positive contingency), s/he subsequently felt more confident when s/he could throw them. And the inverse: if s/he had won more times when the dice were thrown for him/her (negative contingency), s/he subsequently felt more confident when s/he did not throw them. This interaction effect was also found in the other two experiments.

Figure 3
Interaction between contingency and wearing bracelet



By means of a meta-analysis (Rosenthal, 1978), we studied jointly the statistical significance of the simple effects averaged among the 3 experiments. In the positive contingency group we found superstitions in favour of throwing the dice, choosing the figure or wearing the biomagnetic bracelet (Z=2.27; p=0.023, bilateral). On the other hand, in the negative contingency group just the opposite was preferred: not throwing the dice, not choosing or not wearing the bracelet (Z=2.64; p=0.008, bilateral).

Thus, it was the contingency to which subjects were exposed that influenced whether they expected to win more in one situation than another, even if this contradicted what would be expected in terms of an illusion of control. These results are coherent with the hypothesis of Skinner (1948) on the acquisition of superstition behaviour: the most important factor in the production of an operant conditioning is contingency, even if this has been produced in a fortuitous way.

This interpretation of the facts is not totally incompatible with Langer's (1975) hypothesis, but it is more general. What Langer suggests is that when an organism has been exposed to a controllable situation, in which reinforcement was contingent upon particular responses, these responses will continue to be emitted in situations that are similar though uncontrollable. Thus, there was also at some point a contingency that became generalised.

In sum, it is proposed –in accordance with Alloy and Tabachnik (1984)– that to evaluate the relationship between two events information is taken form two sources: previous ideas and situational information. In gambling, previous ideas would be more conditioned by the illusion of control, that is, by the generalisation of contingencies learned in skill situations. Over the course of a series of games, judgements would be gradually adjusted using the situational information acquired. Therefore, the initial illusion of control would give way to superstition behaviour as the game is repeated.

In one way or another, gamblers continue to be the prisoners of their irrational beliefs. Nevertheless, there have been few attempts to incorporate cognitive restructuring into therapy for compulsive gamblers. González (1992) reviewed studies on treatments applied to this pathology. He observed that the majority of treatment programmes were oriented towards professional advice, group psychotherapy and, above all, attendance at self-groups such as Gamblers Anonymous.

From another therapeutic perspective, behaviour modification proposed, initially, aversive techniques (Barker and Miller, 1968), which have currently fallen into disuse. Later on, this approach gave way to imaginal desensitisation and relaxation (McConaghy, Armstrong, Blaszczynski and Allcock, 1983). Stimulus control techniques have also been used, as have those of live exposure with prevention of response, independently and in combination, the latter approach obtaining quite acceptable results (Grenberg and Rankin, 1982; Echeburúa, Báez and Fernández-Montalvo, 1996). The objective of stimulus control is that the subject avoids situations associated with gambling. To this end, the subject should be prohibited from handling money (with help, usually from a member of the family), avoid going to places where s/he can gamble (banning him/herself from entering casinos, bingo halls, etc.), and so on. Live exposure with prevention of response systematically exposes gamblers to gambling situations, but without their being allowed to play. In this way, the idea is that the activation response provoked by the unease produced on wanting to gamble and not being able to gradually becomes extinguished.

With the aim of attacking the problem on all fronts, it is also necessary for the gambler to learn to control the inappropriate cognitions that incite him/her to gamble. It would therefore be advisable, as Vázquez (1987) recommends in relation to antidepressive therapy, to incorporate the methods most appropriate for correcting biased probabilistic judgements (Fischhoff, 1982). Some therapeutic programmes already use a package of cognitive techniques applied individually and in groups to compulsive gamblers. However, few studies have evaluated their therapeutic effect. Ladouceur's group has focused especially on the study of this aspect, and with encouraging results. The correction of mistaken perceptions of chance would appear to be a measure capable of significantly reducing pathological gambling (Ladouceur, Sylvain, Duval, Gaboury and Dumont, 1989; Sylvain, Ladouceur and Boisvert, 1997; Ladouceur, Sylvain, Letarte, Giroux and Jacques, 1998).

Finally, we suggest that there is a need for more research into the differential effectiveness and efficiency of the various therapeutic components involved in the treatment and prevention of compulsive gambling. This last-mentioned aspect, prophylaxis, has received scant attention, and yet it is precisely in this area that the most encouraging results can be found. Self-control of irrational ideas about games of chance will have a greater effect if this ability is acquired before the gambling becomes a problem.

A final word to gamblers, then, is that "in gambling, and only in gambling, nothing depends on anything". Even so, these are the words of the very man –Dostoyevsky– who nevertheless continued to gamble quite irrationally, despite his efforts to give it up. "Tomorrow, tomorrow, and then never again!".

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