ISSN 1982-3541
Belo Horizonte-MG, Brazil
2007, Vol. IX, nº 2, 105-114

Brazilian Journal of Behavioral and Cognitive Therapy

Evaluating the role of verbal behavior on "superstitious" behavior acquisition

Paulo André Barbosa Panetta[1]
Cássia Leal da Hora[2]
Marcelo Frota Lobato Benvenuti[3]
Pontifícia Universidade Católica de São Paulo

Abstract

This experiment evaluated interactions between instructions and behavior acquired by accidental relations with reinforcement ("superstitious" behavior). Four adults participated in a computer task. In each session there was a period of 30 seconds in which the participants could respond by clicking with a mouse upon a colored rectangle displayed on the screen. At the end of each 30-second period, there was one interval of 10 seconds, after which the participant could quit. Four individual sessions were used and in each of them there was only one contingency for scoring points: VR 6, extinction, extinction and 8-second VT . At the beginning of the last two sessions, the participants were told that they would score points by responding to the rectangle. Three participants responded more in the last session than in the third, which showed that instructions implying relationship between response and environmental change can facilitate the acquisition of "superstitious" behavior.

Key-words: "Superstitious" behavior, computers, verbal behavior.

Skinner's *Verbal Behavior*, originally published in 1957, was an important benchmark for the analysis of interactions in which 'man acts upon the environment only indirectly' (1957: 1). The features of verbal interactions are responsible for a considerable share of the complexity which characterizes human behavior and can be present in episodes which could be traditionally considered as belonging to the sphere of *illusions* regarding people in relation to themselves and to the world in which they live (Taylor & Brown, 1988). This work experimentally evaluates the role of verbal variables in a behavioral episode which can be deemed as an 'illusion' or a 'illusion of control' (Rotter 1966). This possibility was assessed in a study on the link between verbal behavior and behavior acquisition through accidental relation with reinforcement.

In the process of reinforcement, responses are emitted and followed by certain environmental changes which make responses from the same class more probable in the future (Skinner, 1953). When there is a relation of dependency between the response and the environmental change, one can state that the latter is a consequence of responding. In the behavior analysis, the process of reinforcement is crucial for the understanding of how we are affected by the consequences produced by our own behavior and how complex repertoires are created and maintained as a result. The reinforcement depends on a special sensibility of organisms to what comes next to the emission of the response. This sensibility appears to be so important that responses of different organisms can be reinforced even

1 MA in Experimental Psychology at PUC-SP.
2 BA in Psychology at PUC-SP; MA student for the Experimental Psychology Program at USP.
3 PhD in Experimental Psychology at USP and professor at the Techniques and Methods Department at the Faculty of Psychology at PUC SP. E-mail: mbenvenuti@yahoo.com

Translation by Leonardo Pereira Nunes. E-mail: leopereiranunes@gmail.com

when the relation between response and environmental change is merely of contiguity. In a study with pigeons, Skinner (1948/1972) showed that when food was displayed regardless of any response from the animals, the mere temporal relation as to something the pigeon would do while facing the food was enough to reinforce the response. The acquired behavior or the behavior kept only through contiguity with reinforcement became known as 'superstitious' behavior.

Skinner suggested that the result of the 1948 experiment could be seen as a 'kind of superstition' (1948/1972: 527) and that the pigeon 'was not exceptionally gullible' (1953: 86), since many analogies between the experiment's results and human behavior could be drawn. 'Superstitious' behavior, however, is not equivalent to the social practices which one would name as superstitions. Concerning this, Skinner (1953) states that:

> '... only a small part of the behavior strengthened by accidental contingencies develops into the ritualistic practices which we call 'superstitions', but the same principle is at work. (1953: 86)
>
> Superstitious rituals in human society usually involve verbal formulae and are transmitted as part of the culture. To this extent they differ from the simple effect of accidental operant reinforcement. But they must have their origin in the same process, and they are probably sustained by occasional contingencies which follow the same pattern' (1953: 87)'

In a similar line of argument, Ono (1994) aimed to place the analysis of superstitions inside the notion of a rule-governed behavior. To Ono, superstitions involve responses controlled by verbal antecedents which do not accurately describe the contingencies provided by the environment. In this case, superstitions could or could not involve responses maintained by the accidental relation with reinforcement ('superstitious' behavior).

In both Skinner's(1953) and Ono's (1994) analysis, the relation between superstitions and 'superstitious' behavior is not equal: superstitions cannot be completely understood as behaviors maintained by an accidental relation with reinforcement. However, the notion of 'superstitious' behavior can be auxiliary in the analysis of superstitions, especially if their interaction with verbal behavior is considered.

An important attempt to investigate the interaction between verbal behavior and the acquisition and maintenance of responding through accidental relation with reinforcement was the study of Higgins, Morris e Johnson (1989). In one of the experiments, the authors would teach children that marbles could be produced if they pressed the nose of a clown-shaped doll. The children would undergo sessions in which the marbles were shown according to the mult VT EXT: signalled periods of presentation the marbles were interspersed with periods signalled by the cease of showings. Most of the children in the study started the sessions by responding in the two periods of the multiple schedule, but soon started to respond only in the period of independent reinforcement and kept doing so for more than fifteen sessions. The results of this study cannot be accounted only by the effect of the instructions, which could suggest 'insensibility' towards the contingencies. The 'superstitious' responding in the experiment ought to be understood as a product of the instructions in combination with the acquisition and maintenance of the relation of contiguity with reinforcement.

In the study of Higgins et al. (1989), the instruction has a fundamental role in facilitating the response which, after being emitted through verbal control, is kept through reinforcement that does not depend on the responding. Other relations between the description of contingencies and 'superstitious' behavior were experimentally investigated. Pisacreta (1998) showed that 'superstitious' behavior may hinder the development of precise self-rules in which the contingencies provided by the environment are described. Description of contingencies which do not correspond to the ones provided by the en-

vironment may appear in certain experimental tasks which do not involve 'superstitious' behavior. Self-descriptions which suggest that certain responses lead to environmental changes when in fact they do not have been named 'superstitious rules' (Heltzer & Vyse, 1989; Rudski, Lischner & Albert, 1999). Heltzer and Vyse (1989) have conveyed the possibility of experimental control over the formulation of what was called 'beliefs or superstitious rules'. In an experiment with humans, a sequence of eight responses should be distributed in two keys (four responses to each key). Any sequence presented by the participants was reinforced depending on each group to which each participant was placed, according to FR 1 or 2 or to RR 2. 'Superstitious rules' were more frequent when the sequences were reinforced in a RR 2 schedule. The results suggested that the more 'confusing' the contingencies of presenting the reinforcement are, the more likely the 'superstitious rules' become. Rudski, Lischner and Albert (1999) have shown that it is more probable that participants present 'superstitious' self-descriptions under reinforcement conditions than under punishment.

Self-descriptions can contribute to the maintenance of the superstitious behavior (Ninnes & Ninnes, 1998; 1999). Ninnes & Ninnes (1998) evaluated the interaction between rules and the behavior kept by accidental relation with reinforcement in an experiment with children. The participants would also be told that they would win a nickel for solving math problems on a computer screen. Among the experimental conditions, the children would undergo a situation in which the consequences were presented according to the VR 6 schedule followed by extinction, by extinction follow-up and by a condition in which nickel were presented independent of the participants behavior. On the occasion of the extinction or the condition in which nickel were presented independent of the participants behavior, the instructions could or could not be read, depending on the experimental group in which the children were previously placed. In Experiment 1, the instruction presented at the beginning was: 'The faster you work, the more money you can win. Press *Enter* if you have understood'. This instruction was correct when presented before the initiated session of the VR schedule and incorrect when presented before the session of extinction or the presentation of the nickel regardless of the response. In each condition, the participant would be given the opportunity to give up at the end of each math problem: when the task was finished, a question on whether to continue or not would appear on the computer screen. To such question, the participant could answer 'yes' or 'no'. By clicking 'yes', a new task would appear. By clicking 'no', the session would terminate. The results of Ninnes & Ninnes (1998) conveyed that responding to mathematic problems ceased in the extinction sessions without instruction. In the sessions with incorrect instruction and extinction, the participants also ceased to respond, although later than those who were not instructed. For those who were incorrectly instructed and received nickel independent of the behavior , the solving of the math problems kept the same or went to a higher frequency than that observed in the VR schedule. Without the incorrect instruction, the notices on winning regardless of the responding did not maintain the latter: for the participants of a control group who were not instructed at the beginning and were not exposed to the 60-second FT schedule, responding ceased to be observed in the initial sessions. The results were replicated with an avoidance contingency and the following instruction: 'If you work fast, you will not lose money. Press *Enter* if you have understood' (Ninnes & Ninnes, 1998, Experiment 2).

Based on the results of such studies, one may conclude that the role of verbal behavior in the interaction of 'superstitious' behavior appears: a) in instructions which favour the behavior maintained through accidental relation with reinforcement; b) in self-reports and 'superstitious' reports which can contribute to the acquisition or maintenance of 'superstitious' behavior. The relationship

between 'superstitious' self-rules and accidental reinforcement is still not completely clear. Recently, some studies have attempted to compare the non-verbal responses under the presentation of environmental events regardless of such responses with the accounts participants give on the situation to which they are exposed. These accounts are gathered from questions aimed to measure the participant's evaluation of the control s/he has over the presentation of environmental events regardless of responding (Aeschleman, Rosen & Williams, 2003; Bloom, Venard, Harden & Seetharaman, 2007). Eventually, the relation between self-reports and 'superstitious' behavior can be similar to the experiments shown by Higgins et al. (1989) and Ninnes & Ninnes (1989) concerning the instructions provided by the experimenter: the control of an imprecise rule over behavior may depend on the occasional reinforcement through the presentation of an event which does not depend on the behavior.

The present study intends to investigate the relationship between instructions and the behavior maintained through accidental relation with reinforcement under a situation based on Ninnes & Ninnes (1998). It shall mainly analyze the acquisition of 'superstitious' behavior in which different experimental conditions are repeated for the same experimentee . Due to emphasis in acquisition, there will be few sessions with brief periods in which the participant may respond. With the study by Ninnes & Ninnes (1988), the participant him/herself will have control over the end of the sessions, therefore avoiding the need of pre-defined criteria for the closing of the session. Together with such investigation, this study also intends to collect data from the participants which allowed a comparison of the verbal performance after each session with the non-verbal performance.

Methodology

Participants

The experimentees were four undergraduate students from the first year of Psychology at Pontifícia Universidade Católica de São Paulo (PUC SP), aged between 18 and 32 years old. All of them have signed the Informed Consent Free Term approved by the Research Ethics Committee from PUC-SP.

Equipment

The experimental sessions were carried out in a room of 3,5 m x 2,5m located in the Laboratory for Experimental Psychology at PUC SP. There was in this room a Pentium II PC on a desk measuring 1,8 m X 1 m (and 1m high), and also a chair. The participants would sit on this chair and click on a mouse which controlled the cursor in the computer monitor. The experimental conditions were set in the software PROG REF V3 (Costa & Banaco, 2002).

Procedures

The participants were led to a room for data collection, which was an activity in the computer in which they could accumulate points. Responses could be emitted in a colored rectangle on the computer screen. For such, the participants would click on the mouse which controlled the cursor on the screen. Once inside the room, the experimentee would listen to the following general instructions given by the experimenter:

"This activity you are partaking in does not intend to measure the level of your intelligence or outline your personality traits. It merely aims to investigate the possible relations between a computer-based task and hypotheses you are bound to formulate while the experiment is being carried out. During this task, you are to use the mouse to click on a rectangle which will appear on the screen. This task is divided into four stages. On the first stage, you may (as you wish) close the session whenever the sign 'WAIT' appears on the screen. I will therefore ask you a question (about the session), which is to be promptly replied. The remaining three stages will last approximately 6 minutes and a half each, but

you may give up anytime."

As the session began, there was a message informing the participant that he ought to click on the OK rectangle in order to start the experimental session.

The procedure was divided into four sessions. In each session, a different contingency would predominate. Also, each session was composed of periods of 30 seconds in which there could or could not have been the presentations of points. During the 30-second period, the yellow rectangle would appear on the screen over a grey background. There was a time out interval between one component and the next, during which the computer screen was black for 10 seconds. During the time out, the message 'WAIT' in red would appear on the screen. Possible emitted responses would not lead to any programmed consequences. Also, the researcher would ask whether the participant wanted to continue the session. If the answer was positive, the experimentee would proceed to the next 30-second period. If it was negative, the session would be finished. The session terminated whenever the experimentee requested so, after 10 minutes of its beginning (VR) or after the end of the tenth component (extinction session, extinction with instruction and FT).

The following contingencies would predominate in each of the four sessions of the experiment:

Session 1: VR 6: For the acquisition and strengthened of the response in the yellow rectangle on the computer screen, points were presented usually after six responses given by the participant. The session was initiated with general instructions (already presented at the beginning of the description of the procedures). As soon as the participant would click on 'OK', an experimental stage would begin.

Session 2: Extinction: responses in the rectangle would not lead to programmed consequences.

Session 3: Extinction with incorrect instruction: responses in the yellow rectangular would not produce points, as planned for session 2. At the beginning of the session, however, the experimentee would be orally given the following instructions:

' You know that the task is to click on the rectangle which appears on the center of the screen, right? I now want you to try to score as many marks as you can. In the end I will bring questions for you to answer'.

Session 4: The same instruction of the previous session was presented at the beginning. Instead of extinction, points were presented regardless of the participant's behavior and according to the 8-second VT schedule. On average, one point was given to the participant every 8 seconds.

At the end of each session, the experimentee would respond in writing to the following questions:

1 – Did you know what you had to do to gain the points during the session?

( ) Yes ( ) No

2 – What did you think you should do to gain the points?

Results

Figure 1 shows the response rates (per second) from the four participants in each 30-second period of the four sessions. The number of 30-second periods in each session varied in between three and seven. Generally, there were fewer periods in both conditions of extinction. The black rhombi indicate the rates in both sessions without incorrect instructions, and the white squares indicate the rates in sessions with incorrect instructions.

The results can be compared in different manners. One possible comparison is between the performance of the participants under specific conditions. In VR, the performance of the third participant (P3) is different from the others. P3 responded less than the other participants, even though the responding rate increased throughout the components of the first session. For the first, second and fourth participants (P1, P2 and P4), the condition in VR kept responding rates stable, which was superior to two responses per sec-

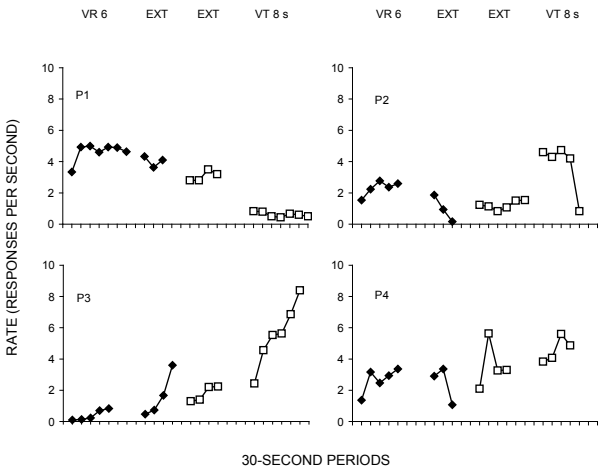


Figure 1 – Rate of responses (responses/sec) in the yellow rectangle per component in the 30-second periods of the four experimental sessions carried out for each participant. The black rhombi indicate the 30-second periods of the sessions in which no instruction was given. The white squares represent 30-second periods with instructions showing that participants should respond to gain points.

ond. In both conditions of extinction (either with or without incorrect instruction), the response rates throughout the components varied more: they were either kept stable or they would increase or decrease abruptly. When the points were presented in the 8-second VT schedule, there were different rate standards throughout the components for the four participants.

Stable responses in VR (at least for P1, P2 and P3) could be used as a baseline measure so that the present variables of the following conditions could take effect. With such measure, it is possible to evaluate the performance of the same participant throughout the different conditions. P1 presented progressively decreasing rates than the ones presented in VR on the three following conditions. P2 presented inferior rates in both conditions of extinction, but in the first four components of VT, the response rate was superior to the one obtained in VR. In the last component, before the participant finished the session, the rate once again decreased, therefore being close to the lowest rates under the condition of extinction. For P3, there was a progressive increase of the rate between the components and the conditions. Finally, for P4 and in the VR schedule, higher rates were observed from those in the majority of periods of the previous conditions (there was only one exception in the second condition of extinction).

To sum up, three out of four participants presented consistent responses under the VT schedule, with rates superior to the ones obtained under conditions of extinction (with or without instructions) and close or higher of those under the VR schedule.

Table 1 shows the response 'yes' or 'no' from participants concerning question 1 (Did you know what you had to do to gain the points during the session?). In the VR session, three out of four experimentees responded 'yes' to the question. In the remaining conditions, the number of *no* responses was higher: only three *yes* responses in the three conditions.

Table 1 - "Yes" and "No" responses to the question: 'Did you know what you had to do to gain the marks during the session?'

	P1	**P2**	**P3**	**P4**
VR	yes	yes	yes	no
EXT	no	yes	no	no
EXT	no	no	no	no
FT	yes	no	no	no

Table 2 shows the response to question 2 in both stages with correct instruction. In the condition of extinction, all the participants stated they did not know what to do or that it was no use responding to gain the points. P4 accounted for his attempts to score the points and concluded that it was unfruitful in the end. Under the VT schedule, the accounts of P1 and P4 suggested the existence of a relationship between responses in the rectangle and the points obtained. P2 and P3 suggested that the gaining of marks did not depend on the responses.

By comparing the results presented in Figure 1 with the ones from Table 2, it is thus possible to link non-verbal behavior with the verbal one in both final conditions of the experiment. In the condition of extinction, there is variability in the patterns of response, but the accounts are quite similar. Under VT schedule, the participants' accounts suggest

Table 2 – Responses to the question "What did you think you should do to gain the marks?' in both sessions with incorrect instructions (sessions 3 and 4)

P1		P2	
EXT	VT 8 s	EXT	VT
I didn't score. I also don't know what I should have done to gain the marks.	I should click a certain amount of times and wait for a while. Example: I clicked once and waited a bit, then I gained marks.	I don't know, but I think it didn't depend on the clicks.	I don't know, but I think it didn't depend on the clicks.
P3		**P4**	
EXT	VT 8 s	EXT	VT
I couldn't gain the marks. I tried clicking one or many times, but nothing seemed to make these marks appear.	I was in doubt whether clicking on the mouse would increase the marks , but from the second or third session I realized that it wasn't necessary to click on the mouse to gain them.	I tried clicking in many ways: fast, slowly, with 2,3 or 4 fast clicks and with a one-second pause between the clicks. Nothing worked.	I noticed that even without a logical sequence in the number of clicks, sooner or later the number of marks increased. That's why I clicked fast so many times.

that there is no relation between responses and points, even when they have responded in the rectangle in various components of the VT session. Moreover, there are accounts which suggest the existence of a link between responses and environmental change, even when there are no or very few responses in the components of the session.

Discussion

This study intented to assess the interaction between incorrect instructions on the acquisition of behavior through accidental relation with reinforcement. Concomitantly, data about self-reports was raised and there was an attempt to evaluate the possible relations between self-reports, instructions and non-verbal performance.

The results can be initially regarded as an additional proof of the accidental strengthened of responding through an environmental change which does not depend on such responding (Skinner, 1948; Pear, 1985; Lee, 1996; Ono, 1987). In this research, the accidentally reinforced response had been previously strengthened through a condition in which there was contingency between response and reinforcement. In this regard, this study also shows that a previous history of reinforcement may facilitate the emission of a certain response in a context of environmental change regardless of responding in itself. Therefore, this response may be accidentally strengthened through the presentation of the event, which no longer depends on the emission of the response (Neuringer, 1970; Wagner & Morris, 1987).

The interaction between instructions and 'superstitious' behavior was analyzed under the condition of presenting the points regardless of responding (VT). As a control condition, a framework with the same incorrect instruction (in which responses did not lead to any consequence neither presented points regardless of the responding) was used. The condition of suspending the points as a strategy of control for the assessment of the in-

teraction instruction / 'superstitious' had already been used by Ninnes & Ninnes (1989), who adopted the procedure as a scheme of control in a session different from the session in which points were presented regardless of the behavior. Higgins, Morris and Johnson (1989) used a similar strategy of control by making use of a multiple schedule, in which incorrect instruction was given and the participants would undergo a situation in which components of the presenting of points regardless of responding would alternate with another without points (extinction). Such strategies of control for instructing appear to be crucial to evaluate whether responding is maintained through an accidental relation with reinforcement and whether it does not reflect only the control through the instruction *per se*. This control through instruction (when the experimentee is then put under a situation in which there is no relation between the response and reinforcement) suggests an 'insensibility to contingencies' (as it has been called in behavior analysis) (see Madden, Chase & Joyce, 1988). Systematic replications of the interaction between instructions and maintained behavior through accidental relation with reinforcement may more clearly indicate the role of reinforcement when the instruction seem to control the performance in a manner apparently not expected by the available contingencies after the instruction (Matos, 2001).

In some moments, self-reports under the condition of incorrect instructions can be deemed as 'superstitious' accounts. Notwithstanding such accounts, the use of the expression 'superstitious' for reports can be called into question if one considers some relations between the verbal and non-verbal performance. The comparison drawn between self-report and non-verbal performance did not allow thorough conclusions about the link between verbal and 'superstitious' behavior. However, some points of discussion can be raised and better explored in future investigations. Not always did verbal performance coincided with the non-verbal. In the VT session, the participants reported that they needed to respond to gain marks when they did not do this and they said they did not need to respond after a session in which they had emitted high rates of responses. The present analysis, in which the non-verbal data was presented by a 30-second component in each session, suggests the possibility of an interesting interpretation: the post-session verbal report can be under the control of different aspects of the participant's performance throughout the session. For instance, P2 responded with a stable rate along the first four components in the VT session. In the last component (the fifth), there was a drastic reduction in the response rate, and P2's account was the following: 'I don't know, but I think it didn't depend on the clicks'. The performance which controlled P2's account seem to have been his final performance and in the last component, in which the participant had already ceased to respond and observed the appearance of points regardless of responding. P3's result, on the other hand, appears to convey a different control. For this participant, there was a growing number of responses in VT. In his account, however, he affirmed that 'from the third session on (a possible reference to the number of components in the session), I realized that it wasn't necessary to click on the mouse to score the points'. The control of P3's report in the VT session seems to be regarding his overall performance, specially at the beginning of the session when this participant possibly gained points without the relation of contiguity with the responses given to the rectangle.

Results such as the ones presented in this research are an evidence of the need to enhance empirical strategies for the assessment of control used to examine how the verbal affects the non-verbal and vice-versa. A significant result in this regard was obtained with P3. At the beginning of the VR session, this participant responded quite little (considerably less than the others). A question can thus be raised: is this participant's under control of the instruction given at the beginning of the

session? Probably not. In other investigations (still unpublished) we have tried to evaluate the verbal control created by instructions based on the requirement of some advice at the start of the experimental sessions. The advice is asked at the beginning with a question on what the participant will do during the session. This advice can be useful to evaluate different controls exerted by the instruction over the participant's verbal performance (in other words, to check whether the experimentee understood the requirements).

The closing of the session based on the participant's wish turns the definition of criteria for stability of performance into something dispensable. These criteria may lead to the participant being submitted to a long condition of extinction, which can compromise the results in the following sessions. This care aids in delimiting less arbitrarily the difference between acquisition and maintenance of behavior through accidental relation with reinforcement. The procedure involved a small number of short duration sessions. Thus, the reached conclusions are limited to the acquisition of 'superstitious' behavior. The short duration of sessions can be one of the aspects responsible for the variability between and within participants, which is a feature of the process for response acquisition. In posterior experiments, a more detailed investigation on the effects of instructions and self-descriptions about the upkeep of 'superstitious' behavior shall be necessary.

Lastly, the results of the present research support Skinner's (1953) notion that 'superstitions' and 'superstitious' behavior should be treated differently. Occasionally, the interaction between the verbal and the 'superstitious' behavior may convey mechanisms through which 'ritualistic practices which we name as 'superstitions'' (1953: 86) are passed over from generation to generation. Since the upkeep of responses through accidental relations with reinforcement contributes to such, it is still an issue open to investigation. Clarifying such issue may show how verbal behavior takes part in what we may call *illusions*, which people create concerning the world in general.

Bibliographical References

Aeschleman, S. R., Rosen, C. C., & Williams, R. R. (2003). The effect of non-contingent negative and positive reinforcement operations on the acquisition of superstitious behavior. *Behavioural Processes, 61,* 37-45.

Bloom, C. M., Venard, J., Harden, M., & Seetharaman, S. (2007). Non-contingent positive and negative reinforcement schedules of superstitious behavior. *Behavioural Processes, 75*, 8-13.

Costa, C. E., & Banaco, R.A. (2002). ProgRef v3: sistema computadorizado para a coleta de dados sobre programas de reforço com humanos – recursos básicos. *Revista Brasileira de Terapia Comportamental e Cognitiva, 4*, 171-172

Heltzer, R. A., & Vyse, S A. (1994). Intermittent consequences and problem solving: The experimental control of "superstitious" beliefs. *The Psychological Record, 44*, 155-169.

Higgins, S. T., Morris, E. K., & Johnson, L. M. (1989). Social transmission of superstitious behavior in preschool children. *The Psychological Record, 39*, 307-323.

Lee, V. L. (1996). Superstitious location changes by humans beings. *The Psychological Record, 46*, 71-86.

Madden, G. J., Chase, P. N., & Joyce, J. H. (1988). Making sense of sensitivity in the human operant literature. *The Behavior Analyst, 21,* 1-13.

Matos, M. A. (2001). Comportamento governado por regras. *Revista Brasileira de Terapia Comportamental e Cognitiva, 3*, 51-66.

Neuringer, A. J. (1970). Superstitious key pecking after three peck-produced reinforcements. *Journal of the Experimental Analysis of Behavior, 13*, 127-134.

Ninness, H. A., & Ninness, S. K. (1998). Superstitious math performance: Interactions between rules and scheduled contingencies. *The Psychological Record, 48*, 45-62.

Ninness, H. A., & Ninness, S. K. (1999). Contingencies of superstition: Self generated rules and responding during second-order response-independent schedules. *The Psychological Record, 49*, 221-243.

Ono, K. (1987). Superstitious behavior in humans. *Journal of the Experimental Analysis of Behavior, 47*, 261-271.

Ono, K. (1994). Verbal control of superstitious behavior: Superstitions as false rules. In S. C. Hayes, L. J. Hayes, M. Sato, & K. Ono (Eds.), *Behavior Analysis of Language and Cognition* (pp. 181-196). Reno, NV: Context Press.

Pear, J. J. (1985). Spatiotemporal patterns of behavior produced by variable-interval schedules of reinforcement. *Journal of the Experimental Analysis of Behavior, 44*, 217-231.

Pisacreta, R. (1998). Superstitious behavior and response stereotypy prevent the emergence of efficient rule-governed behavior in humans. *The Psychological Record, 48*, 251-274.

Rotter, J. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs, 80*, 609.

Rudski, J. M., Lischner, M. I., & Albert, L. M. (1999). Superstitious rule generation is affected by probability and type of outcome. *The Psychological Record, 49*, 245-260.

Skinner, B. F. (1972). "Superstition" in the pigeon. In B. F. Skinner *Cumulative Record* (3rd ed.) (pp. 524-528). New York: AppletonCentury-Crofts. (Trabalho original publicado em 1948).

Skinner, B. F. (1953). *Science and Human Behavior.* New York: Free Press.

Skinner, B. F. (1957). *Verbal Behavior*. New York: Appleton-Century-Crofts.

Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin, 103*, 193-210.

Wagner, G. A., & Morris, E. K. (1987). "Superstitious" behavior in children. *The Psychological Records, 37*, 471-488.

Received in: 10/29/2007
First editorial decision in: 11/06/2007
Final version in: 02/26/2008
Accepted for publication in: 01/28/2008