

## RESEARCH ARTICLE

### A PK Experiment with Zebra Finches and a Virtual Predator

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**Abstract**—The hypothesis that PK is a biological function which can be used by prey animals to their own benefit was tested using 25 zebra finches. To test whether birds can manipulate the randomness of REG devices in a virtual predatory context, experimental and control trials were run. During the former, one subject was placed in the testing cage and could see a 25-frames-per-second, 150-second-duration video clip of a crawling predatory snake in a TFT-LCD screen. Immediately before each image, a REG device would randomly increase or decrease by one point the opacity of the subsequent image, which, as a consequence, would become more solid or more transparent. During the control test no subject was present in the testing cage. When the REG outcome was analyzed, the total number of events of image fading was found to be significantly higher for the experimental condition than for the control condition, and during the experimental condition the number of image fadings was also significantly higher than that of opacity increases (and non-significant during the control condition). Therefore, the birds might be able to influence the REG production to reduce the presence of the predator (i.e. the proposed hypothesis appears to be supported).

*Keywords:* birds—PK—predation—zebra finches

#### Introduction

The literature is abundant with reports evidencing the ability of directional psychokinesis (PK), in which deviations in random systems are produced while the actors are specifically intending to influence the situation (Chauvin & Genthon 1965, Schmidt 1971, 1973, Jahn, Dunne, & Nelson 1987, Dunne & Jahn 1992, 1995). If directional PK is of the same or similar nature as non-directional PK (subject not intending any effect), the actors' emotional state might be crucial in both cases (Bierman 1996, Lumsden-Cook 2005a, 2005b, Mason, Patterson, & Radin 2007).

There are few animal studies with sufficient number of subjects in which the PK effect may be considered as directional, involving a benefit to the potential animal PK agent. In a preliminary work with REGs using cockroaches as animal subjects, Schmidt (1970) demonstrated an effect, albeit in the opposite direction than the subjects' welfare, which was attributed to experimenter effect. PK by three species of aggressive tropical fish was also suggested by the results of Braud (1976) on the non-random display of a positive reinforcement (a mirror presentation) controlled by an REG.

Also, as a continuation of previous work on mice's psi ability to avoid electric shocks (Duval & Montredon 1968), Chauvin (1986) demonstrated that the animals were able to drive a randomly moving object (the tychoscope) whose source of randomness was electronic noise (Janin 1986) away from them, apparently by the action of PK. Using Janin's tychoscope, Peoc'h (1988), and later on Peoc'h (1995) with an improved version of it, examined the influence of young chickens on the movement of a small self-propelled robot, on which the animals had developed a maternal bond through imprinting. The result of the object moving significantly more often toward the chicks suggests the action of PK on the birds' part. The attempt by Johnson (1989) to replicate these findings obtained negative results, although in this case the imprinting object was different and the REG's effect was for the object to be presented or not to the birds, while the results of Green and Thorpe (1993), in which the chicks were imprinted on a flashing light or another chick, were inconsistent and pointed more to an experimenter effect.

If an animal would increase its life expectancy by way of PK, and if this ability would depend to some extent on genetic inheritance, its overall genetic success would also be improved. As a consequence, we should expect this ability to be widespread in nature. Levin (1996) has called attention to the fact that observation of animals in action does not support such expectancy and has reviewed the various explanations of it. While most of these explanations refer to PK as a biological function acting for the benefit of the agent, Levin (1996) has opted for considering psi (and hence PK) a function of non-material consciousness, and therefore not entirely subject to encoding by genes, and therefore to its selection.

The view that PK has biological functions (Stanford 1974) gives way to the idea that it is a product of Darwinian evolution and can be modelled by natural selection (Broughton 1988, Taylor 2003). Under this most parsimonious hypothesis with regard to strictly naturalistic grounds, since much evidence points to gene frequency affecting normal psychological traits, if PK is considered just another biological adaptation for survival, its effects can be analyzed in contexts of predation.

In a predatory situation a potential prey individual gifted with PK could be able to manipulate the predatory context to its own benefit, but so would the potential predator. According to evolutionary theory, contrasting selection pressures could possibly arise, leading to an evolutionary arms race between the two species (Dawkins & Krebs 1979, Vermeij 1987), the prey trying to evade capture and the predator attempting hunting and killing.

Under the view that PK is a biological function that can be used by living beings in natural circumstances, my hypothesis is that a potential prey individual can influence a predatory context to its own benefit by way of PK. In order to detect this effect with no interference by the potential predator, in the present study I will explore the possibility that, in a laboratory setting, a subject prey species (namely the zebra finch, *Taeniopygia guttata*) is capable of affecting the random presence of a virtual predator in the form of video clip images of a predatory snake. A previous experiment trying to detect non-directional REG randomness departure in the same bird species in an alarm situation produced no significant results (Alvarez 2011), although a psi observer effect was suggested.

### Methods

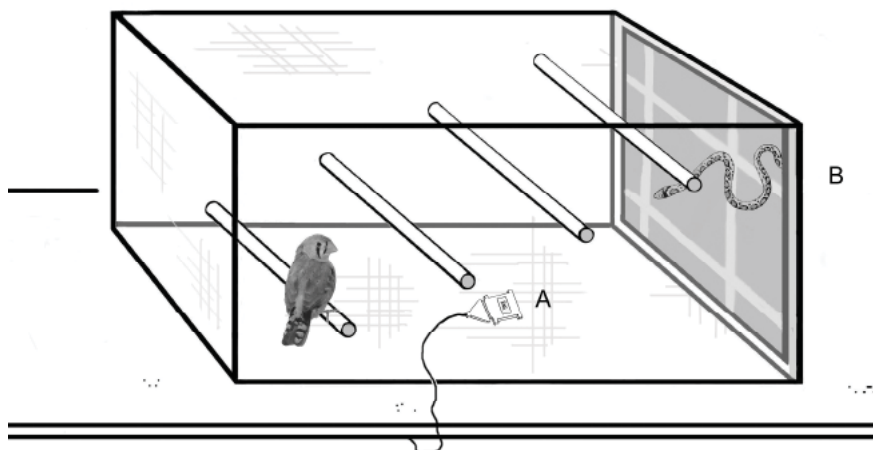
The present experiment was designed to test whether the finches are able to manipulate the randomness of an REG device controlling the presence of a virtual predator (by way of its image in a video clip becoming more solid or rather fading away, thereby also virtually reducing the threat to the birds). If, when the birds are present, the images become consistently more transparent, we can conclude that the hypothesis of a PK effect caused by the birds is supported.

All subjects (25 adult female zebra finches) lived in two unisexual adult groups of conspecifics in a  $3 \times 3 \times 2$  meters aviary near Seville, Spain. The  $70 \times 35 \times 35$  centimeters testing cage was provided with four perches and a thin-film transistor LCD screen (TFT) at one end, where the stimulus in the form of a video clip was to be presented. During the sessions an Orion REG device was permanently in position on the center of the cage floor and, connected to a laptop computer in an adjacent compartment, controlled the presentation of the stimulus in the TFT screen.

The use of TFT screens to present video playback has been successful in eliciting behavioral responses in zebra finches and other estrildines (Ikebuchi & Okanoya 1999, Galloch & Bischof 2006, 2007, Alvarez 2010, 2011).

Tests were carried out under experimental and control conditions. During the trials of the experimental condition, each of the 25 birds received the test individually while the experimenter was 10 to 25 meters away from

the experimental zone (Alvarez 2011). The area with vegetation outside the testing area could be seen by the bird inside the testing cage, since being visually enclosed appears to affect the spontaneous behavior of zebra finches toward predators (Lombardi & Curio 1985). The experiments were performed between February 23 and April 18, 2011. Starting between 9:00 and 11:30 UT, the subject to be tested was taken from its group and put in the testing cage, where from the beginning it would encounter a still image of red tiles on the TFT screen. After an accustoming period of 15 minutes, 10 equal video clip segments of 15 seconds duration each (at 25 frames per second) of a predatory whip horseshoe snake (*Coluber hippocrepis*) slowly crawling from the right to the left side of the screen over the red tiles background were presented uninterruptedly in the TFT screen. Following the end of stimulus presentation, the test ended after another 15-minute period of just the still background of red tiles on the screen (Figure 1).



**Figure 1. Testing situation. (A) REG. (B) TFT screen.**

The opacity of the image of the crawling snake could vary from fully opaque (a score of 50) to completely invisible (a score of 1), and the operation of the REG on the floor of the testing cage was to randomly increase or reduce by one point the opacity of the snake image (not of the background) of each of the 25-per-second images of the video clip. The “decision” by the REG for each image to become more solid or more transparent was taken immediately before each frame was displayed. When entering the screen for the first time, the snake image was almost fully opaque (score

40, apparently fully solid to the human eye). The series of events of opacity increase and decrease was continuous along the 150 seconds of stimulation, i.e. the initiation of each of the 10 segments of the video clip, as the snake image entered from the right side of the screen, inherited the opacity of the last image of the previous segment, when the snake had ended its movement toward the left side of the screen. The background of red tiles was completely opaque throughout the 30 minutes of the experiment.

The 25 control tests were carried out following the same procedure, although in this case the testing cage was empty (no bird).

### **Statistical Analysis**

The individual opacity score of each of the 3,750 images (the 1 to 50 scale of how solid images are) along the 150 seconds of stimulation of the experimental and the control tests, and the events of increase or reduction of the opacity of each of the images (i.e., respectively, of becoming more solid or more transparent) were registered and used for the analysis.

The nonparametric Mann-Whitney U test was used to compare the individual number of events of image fading between the experimental and the control trials, and the Wilcoxon matched pairs test was used to compare the individual number of events of images becoming more solid and of events becoming more transparent in both conditions of the experiment.

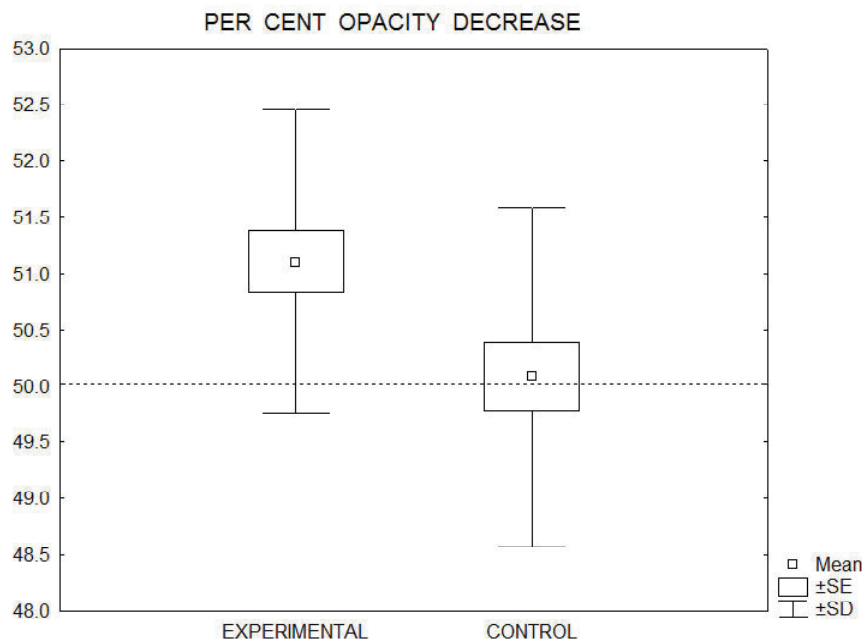
The Spearman's rank correlation test was used to compare, out of the ten segments of stimulus presentation, the mean video clip segment image opacity (i.e. how solid images are) to the mean number of events of opacity decrease (i.e. how often images faded away) per video clip segment, in both conditions, when the data from all subjects were pooled.

Linear and polynomial regressions were used to fit a model to the time series of events of opacity decrease along the ten video clip segments.

### **Results**

The total number of events of opacity decrease obtained in the experimental condition was found to be significantly higher than that for the control condition (experimental: 51.11 percent, control: 50.09 percent;  $U = 191.5$ ,  $N_1 = 25$ ,  $N_2 = 25$ ,  $p = 0.019$ , Mann-Whitney U test) (Figure 2), that is the snake images faded away more often when the birds were near and watching the video clip than when the testing cage was empty.

The comparison of the total number of events of opacity increase (images becoming more solid) and decrease (images fading away) for each of the 25 subjects of the experimental condition showed that the number of decreases significantly surpassed that of increases (ratio decreases–increases



**Figure 2.** Percent of decreases of the opacity of all video clip images of the snake predator (i.e. images fading away) during the experimental condition (when presented to the zebra finches) and control condition (when no subject was present in the testing cage).

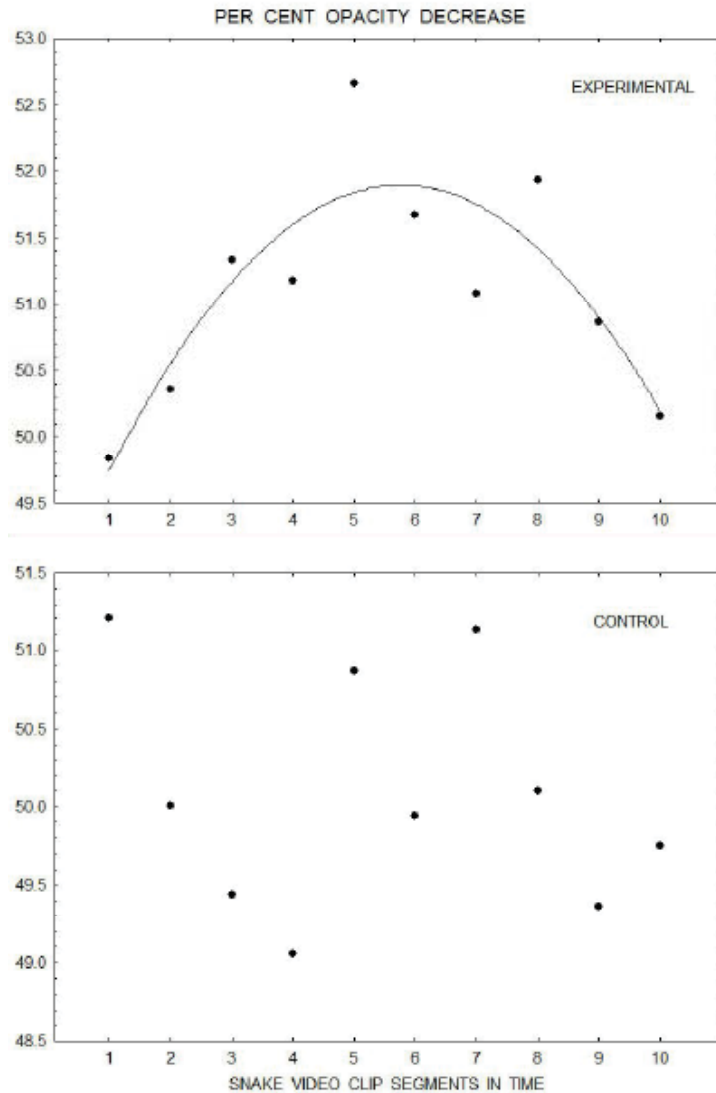
The 50 percent random value is indicated by the dotted line.

of 1.1:1.0) ( $N = 25$ ,  $T = 40$ ,  $z = 3.30$ ,  $p = 0.001$ , Wilcoxon matched pairs test), while no significant difference was obtained for the control condition (ratio of 1.0:1.0;  $N = 25$ ,  $T = 142$ ,  $z = 0.55$ ,  $p = 0.581$ , Wilcoxon matched pairs test).

The analysis of correlation between mean image opacity scores (i.e. how solid the images were) during each of the ten 15-second video clip segments and the mean number of events of opacity decrease (i.e. how often images faded away) during the same segments resulted in a significant negative correlation during the experimental condition ( $N = 10$ ,  $R = -0.721$ ,  $p = 0.019$ ), and non-significant for the control condition ( $N = 10$ ,  $R = 0.091$ ,  $p = 0.803$ , Spearman's rank correlation test).

Considering the time series of opacity decreases, that is the relationship between the order of appearance of the video clip segments in the screen and the percentage of events of images fading away during the presentation of each segment, the linear regression model does not adequately describe the pattern of the scatter plot, neither for the experimental nor for the control

conditions ( $r = 175$ ,  $N = 10$ ,  $p = 0.629$ ;  $r = -0.219$ ,  $N = 10$ ,  $p = 0.544$ ; respectively). On the other hand, the quadratic regression model shows a better and significant fit for the experimental condition, and non-significant for the control condition ( $R^2 = 0.672$ ,  $N = 10$ ,  $p = 0.008$ ;  $R^2 = -0.222$ ,  $N = 10$ ,  $p = 0.837$ ; respectively).



**Figure 3.** Time series of percent of events of the snake images fading away during the experimental and control conditions, and trend curve for the former.

The equation describing the pattern for the experimental condition is:

$$Y = 48.7532 + 1.0909 X - 0.0947 X^2$$

where Y is the percentage of events of image fading and X the order of appearance of the video clip segments. Corresponding to this model, the trend curve that best fits the data for the experimental condition is a frown parabola (Figure 3). As can be seen in Table 1, the ratio of total number of events of the images fading away to that of images becoming more solid rose from the lowest level at segment 1, to a peak at segment 5, and then went down.

**TABLE 1**  
**Experimental Condition: Order of Video Clip Segments, Ratio of Opacity Decreases/Increases (Events of Images Fading / Events of Images Becoming More Solid), and Comparison between Number of Decreases and Increases (Wilcoxon Matched Pairs Test)**

Order of Video Clip Segments	Ratio: Decreases/Increases	Comparison Decreases and Increases			
		N	T	z	p
1	0.99	25	161	0.04	0.993
2	1.05	25	130	0.88	0.382
3	1.06	25	110.5	1.40	0.162
4	1.05	25	123	1.06	0.288
5	1.11	25	57.5	2.83	0.005
6	1.07	25	111	1.39	0.166
7	1.04	25	107.5	1.48	0.139
8	1.08	25	77	2.30	0.021
9	1.04	25	126	0.98	0.326
10	1.01	25	155.5	0.19	0.851

### Discussion

The significantly higher number of events of the predator images fading away in the experimental condition, as compared to the control condition, together also with the significantly higher number of events of image fading, as compared to that of images becoming more solid in the experimental



condition, and its lack of significance in the control condition, support the hypothesis that PK is taking place, and that in nature this effect could act for the benefit of the PK agent.

These results are comparable to those obtained with other bird species, namely young chickens, apparently affecting the random movement of a self-propelled object on which they had been imprinted, in the sense that PK ability would also work to the benefit of the potential agent (Peoc'h 1988, 1995). Then, with respect to the context in which the experiments were carried out, our finches' apparent capacity to make the virtual predator (totally or partially) disappear resembles more that of Chauvin's (1986) mice, which were able to keep a disturbing randomly moving object away from them, apparently by PK.

If our finches were actually able to reduce the risk of being captured, the possibilities of manipulating the predatory situation are immense, and among them the possibility of communication from the prey bird species to its potential predator (Alvarez 1993, Alvarez, Sánchez, & Angulo 2006) should not be discarded. In fact, if our finches were able to influence the REG outcome, their PK ability could as well reach any aspect of the predator's nervous system or behavior, or any component of the environment. However, since not being hunted in the case of the prey is equally important as the need to obtain food for the potential predator, there is no reason to suppose that only prey species would be endowed with PK. If certain predator and prey species would depend much on each other for survival, an evolutionary arms race would possibly arise (Dawkins & Krebs 1979, Vermeij 1987), perhaps making the PK effects less visible to outside observers.

As to the found negative correlation of the opacity of the snake image (or how solid images were) with the frequency of events of images fading away, at first sight it would be expected that the more often images fade, the more transparent they become. However, the fact that no correlation was found between those two variables during the control condition, when no bird subject was present in the testing cage, suggests that at least in part the birds were responsible for that negative correlation during the experimental condition, acting in a feedback system, so that the less solid the presence of the predator, the stronger the PK effort to make it disappear. The high influence of feedback favoring the expression of PK by humans was demonstrated by Heseltine (1977).

The pattern along the ten segments of the experimental condition of the percent of images fading away, in which values progressively go up, to reach a maximum one minute after the first presentation of the stimulus, and then descend, is best described by a frown parabola (see Figure 3), and could be regarded as a case of decline effect. Similar phenomena appear to

be common in human psychic performance (Colborn 2004), and occurred in Braud's (1976) PK experiment with aggressive tropical fish, where the PK scores went down progressively from the high level in the first to the low level in the last experimental series.

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