



When animals misbehave: Analogs of human biases and suboptimal choice



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ABSTRACT

Humans tend to value rewards more if they have had to work hard to obtain them (*justification of effort*). Similarly they tend to persist in a task even when they would be better off beginning a new one (*sunk cost*). Humans also often give greater value to objects of good quality than the same objects together with objects of lesser quality (*the less is more effect*). Commercial gambling (lotteries and slot machines) is another example of suboptimal choice by humans because on average the rewards are less than the investment. In another example of a systematic bias, when humans try to estimate the probability of the occurrence of a low probability event, they often give too much weight to the results of a test, in spite of the fact that the known probability of a false alarm reduces the predictive value of the test (*base rate neglect*). In each of these examples, we have found that pigeons show a similar tendency to choose suboptimally. When one can show comparable findings of suboptimal choice in animals it suggests that whereas culture may reinforce certain suboptimal behavior, the behavior is likely to result from the overgeneralization of basic behavioral processes or predisposed heuristics that may have been appropriate in natural environments.

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1. Introduction

Much of the research in comparative cognition has been directed at the extent to which abilities typically thought of as primarily human can be found in other animals (see Zentall and Wasserman, 2012). For example, although humans are known for their ability to imitate, a wide variety of species have been found to copy the behavior of conspecifics and in some cases, the nature of the copying rivals human opaque imitation (imitation in which the correspondence between the behavior observed and the behavior performed must be inferred, e.g., clasping one's hands behind one's back; Zentall, 2012).

Recently, we have become interested in the degree to which animals engage in a class of human behaviors that are distinguished by the fact that in humans they result in behavior that is biased when the alternatives are associated with equal probabilities of reinforcement and are even suboptimal when they are associated with unequal probabilities; among these are: justification of effort (based on cognitive dissonance), sunk cost, commercial gambling, the less is more effect, and base rate neglect. I will discuss each of

these in the sections that follow. The importance of this research is, to the degree that other animals show similar biases and suboptimal behavior, it suggests that the basis of those behaviors in humans may not depend on what might be considered cultural influence such as the value of hard work, the value of completing what you started, and persistence in the face of failure but these phenomena may have basic behavioral origins.

2. Justification of effort

Justification of effort is a phenomenon in which humans tend to value outcomes in proportion to the effort required to obtain them. It is a subcategory of an attempt to reduce cognitive dissonance, the unpleasant feeling that comes from a discrepancy between one's beliefs and one's behavior. For example, groups that have difficult initiations are often valued more than those that do not (Aronson and Mills, 1959). This occurs presumably because one needs to justify subjecting oneself to the difficult initiation. However, in practice, it is often the case that the value of an outcome is proportional to the difficulty of the task, so if no other information is available, task difficulty may serve as a useful heuristic for the value of the outcome. Thus, past experience may encourage us to use this rule of thumb. Alternatively, the effort that goes into a task may actually change the subjective value of the outcome and

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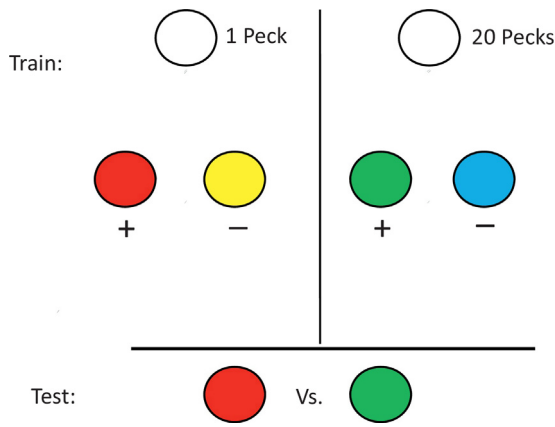


Fig. 1. Design of the justification of effort experiment (after Clement et al., 2000). On some trials pigeons were required to peck once to receive a simple simultaneous discrimination (red+/yellow–). On other trials they were required to peck 20 times to receive a different simple simultaneous discrimination (green+/blue–). On probe trials, the pigeons were given a choice between the two S+ stimuli (red and green). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

it may do so by way of a mechanism that is simpler than cognitive dissonance. To explore this alternative, one can ask if other animals would also show a justification of effort effect.

To study justification of effort in animals we presented pigeons with a task (see Fig. 1) in which, on some trials, a single peck to a white light presented them, for example, with a red and a yellow light and pecking the red light provided them with a reward (2-s access to mixed grain). On other trials 20 pecks were required to the white light which presented them with a green and a blue light and pecking the green light provided them with the same reward (Clement et al., 2000). After many sessions of training, when the pigeons were given a choice between the two stimuli associated with reinforcement (red and green) they showed a significant preference for green (the stimulus that required 20 pecks to obtain).

Kacelnik and Marsh (2002) found similar results when they required starlings to fly back and forth between perches at the front and back of their cage. On trials when they had to make 16 trips they received a light of one color and on trials when they had to make only 4 trips they received a light of a different color. When they were tested for their preference between the two colored lights, they preferred the color that had been preceded by 16 trips during training.

Our explanation of this justification of effort effect does not require the reduction in dissonance caused by the discrepancy between behavior (making 20 pecks) and beliefs (one should not have to work so much harder for the same reward; Festinger and Carlsmith, 1959). Instead, we proposed that the effect could be explained by the contrast between the state of the organism immediately prior to the appearance of reward and the reward itself, or in the case of the experiment described, the appearance of the signal (color) for reinforcement (see Fig. 2). As this contrast effect is somewhat different from other well-known contrast effects (incentive contrast, behavioral contrast, anticipatory contrast) we have referred to it as *within-trial contrast*.

According to this model, the 20-peck requirement results in a decrease in the hedonic state of the organism (analogous to fatigue or frustration) and reinforcement (or the signal for reinforcement) results in a greater improvement in hedonic state than the appearance of the signal for reinforcement following a single peck.

The interesting characteristic of this model is the prediction that any relatively aversive event that occurs prior to the appearance of the discriminative stimuli should result in a somewhat negative hedonic state and the appearance of the discriminative stimuli

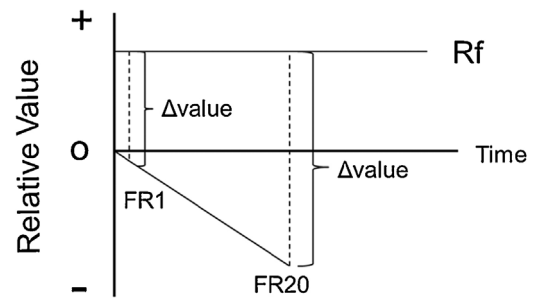


Fig. 2. Within-trial contrast based model of the justification of effort effect.

should result in greater contrast than would occur on trials on which the prior event was less aversive. For example, animals generally prefer not to wait for food. Thus, on some trials after an initial response the pigeons incurred no delay before being presented with the signal for reinforcement, whereas on other trials there was a 6-s delay after an initial response before being presented with the signal for reinforcement, then according to this model, on choice trials involving the two signals for reinforcement, the pigeons should prefer the signal preceded by the 6-s delay. Support for this hypothesis was found by DiGian et al. (2004).

Further support for the model came from an experiment in which reinforcement preceded the presentation of one signal for reinforcement whereas the absence of reinforcement preceded the other (Friedrich et al., 2005). Once again, the signal for reinforcement that was preceded by the relatively aversive, absence of reinforcement was preferred.

Different signals for reinforcement (red and green lights) were used in the experiments described to ensure that the actual outcome following red and green lights was identical (the same kind of food, from the same feeder, for the same duration). It may be possible, however, to substitute a more natural consequence of the effort than an arbitrary color. For example, in another study we asked if pigeons would prefer food at one location more, if they had to work harder to obtain it at that location. This might be analogous to animals foraging for food at two locations, one that was located further from home than the other. Of course, the animals should prefer to find food closer to home but if they were given a choice between the two locations (without having to travel different distances to get there) would they prefer the location that during training they had to travel farther to get there? To provide pigeons with an analog of different distances to obtain food we asked pigeons to respond with a different number of pecks (1 or 30) to obtain food from each of two identical feeders (left or right; Friedrich and Zentall, 2004). On test trials, we asked the pigeons which feeder they preferred (without the differential response requirement). In this experiment we monitored the feeder preference on each training session and found a gradual shift in preference in the direction of the feeder that on training trials they had to work harder to obtain. In this experiment, monitoring the shift in preference was informative because we found that although the shift in preference was reasonably progressive, a reliable shift in preference required considerable training (Fig. 3). The gradual effect of the prior relatively aversive event on the feeder preference may account for the report of failures to replicate the within-trial contrast effect (Arantes and Grace, 2008; Vasconcelos et al., 2007). Furthermore, the effect may depend on the fact that the relatively aversive event is actually perceived as being relatively aversive. Thus, pigeons that have recently experienced lean schedules of reinforcement in which reinforcement occurs infrequently may not treat the 20-peck requirement as relatively aversive (Arantes and Grace, 2008).

Hunger can also be thought of as a relatively aversive event. To determine if preference for a colored light could be affected by

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