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Current Directions in Psychological Science 2010 19: 296
DOI: 10.1177/0963721410383381

ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Current Directions in Psychological Science
19(5) 296-300

DOI: 10.1177/0963721410383381
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Justification of Effort by Humans and Pigeons: Cognitive Dissonance or Contrast?

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Abstract

Justification of effort by humans is a form of reducing cognitive dissonance by enhancing the value of rewards when they are more difficult to obtain. Presumably, assigning greater value to rewards provides justification for the greater effort needed to obtain them. We have found such effects in adult humans and children with a highly controlled laboratory task. More importantly, under various conditions we have found similar effects in pigeons, animals not typically thought to need to justify their behavior to themselves or others. To account for these results, I propose a simpler mechanism than justification of effort—a mechanism based on contrast between the end of the effort and the reinforcement (or signal for reinforcement) that follows. This model predicts that any relatively aversive event can serve to enhance the value of the reward that follows it simply through the contrast between those two events. In support of this general model, my colleagues and I have found this effect in pigeons when the prior event consists of (a) more rather than less effort (pecking), (b) a long rather than a short delay, and (c) the absence of food rather than food. We have also found that a pigeon's preference for food at one location can shift toward a different location if acquiring food at the new location requires that the pigeon work harder to obtain the food. Contrast may also play a role in other social psychological phenomena that have been interpreted in terms of cognitive dissonance.

Keywords
cognitive dissonance, contrast, delay reduction, justification of effort

Cognitive dissonance occurs when there is a discrepancy between one's beliefs and one's behavior. According to cognitive dissonance theory (Festinger, 1957), such a perceived discrepancy may result in an emotionally uncomfortable state, or dissonance, that one will work to reduce. One way to reduce such dissonance is to modify one's beliefs to account for or justify one's behavior.

Justification of effort is one method of reducing cognitive dissonance, in which the value of a reinforcer is judged relative to the effort required to obtain it (Aronson & Mills, 1959). Students judged their interest in a discussion group after reading a passage out loud to the experimenter. If the passage contained embarrassing material, they expressed greater interest in the group than if the passage did not contain such material. Presumably, the students needed to justify their embarrassment by adding extra value to the group discussion. Another example would be the following: A student who receives an A grade in organic chemistry will generally value that grade more than a similar A grade in physical education (e.g., an introduction to golf). Presumably, the greater effort that goes into obtaining the A in organic chemistry enhances the value of the grade to justify the greater effort. However, although the two grades may count equally toward the student's grade point average, there is likely to be additional objective value given to the A grade in organic chemistry (e.g., when attached to an application to medical school or in gaining the admiration of friends). Thus, most examples of this kind that are presumed to involve equal objective value are flawed, because the actual or implied value of the two outcomes is generally not equal.

A Simpler Procedure for Studying Justification of Effort

We have been exploring a similar effect using a simpler within-subject design (Klein, Bhatt, & Zentall, 2005) than that used by Aronson and Mills (1959). At the start of each trial, human

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subjects were presented with a blue square. On half of the trials, a single mouse click to the square produced two abstract shapes (S1 and S2) and a single click to S1 was rewarded. On the remaining trials, 20 to 30 clicks were required to produce a different pair of abstract shapes (S3 and S4), and a single click to S3 was rewarded. On probe test trials with no feedback, when subjects were given a choice between the two rewarded shape stimuli (S1 and S3), they showed a significant (65.2%) preference for S3, the shape that in training required 20 to 30 clicks to produce.

The results of our (Klein et al., 2005) experiment could be viewed as an example of cognitive-dissonance reduction because subjects may have valued the correct stimulus (or conditioned reinforcer) that required greater effort over the correct stimulus that required less effort. They did this presumably to justify the added effort required to obtain the reward. However, it is more parsimonious to explain the result as a form of contrast, which Klein et al. call within-trial contrast.

The Contrast Model: An Alternative to Justification of Effort

According to the contrast model, each trial starts at a relative value of zero (see Fig. 1). The clicking requirement reduces the value below zero, and 20–30 clicks reduces the value more than does 1 click. Reinforcement is assumed to have a positive effect on value relative to the value at the start of the trial. Thus, the increase in value is assumed to be greater following an initial 20–30 clicks than it is following 1 click, and it is the increase in value at the time of reinforcement (or in this case at the time of presentation of the correct shape, a conditioned reinforcer) that is assumed to give added value to the reinforcer. Put more simply, subjects judge the 20–30-click requirement to be relatively aversive compared to the 1-click requirement, and the appearance of the shapes signals relief

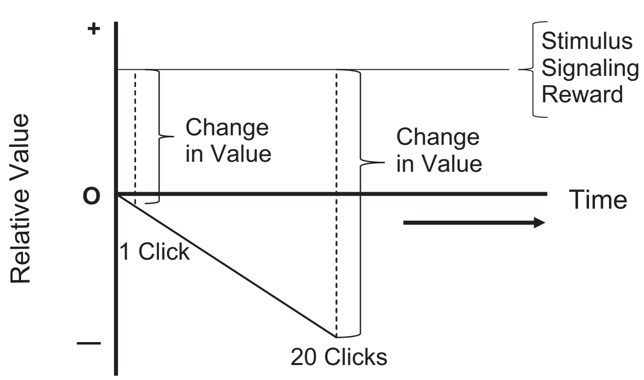

Fig. 1. Contrast model based on change in relative value, proposed to account for effects that would typically be explained in term of the justification of effort. One click should not be very effortful (it should have relatively little negative value), so the change in value when upcoming reinforcement is signaled) should be modest. Twenty–30 clicks should be more effortful (it should have greater negative value), so the change in value when the discrimination appears should be somewhat greater.

from the aversive event. It is that greater change from aversive to appetitive that gives the correct shape greater value in the 20–30-click condition than in the 1-click condition.

The interesting aspect of this model is that it does not specify the event that results in negative value. Thus, according to this model, any relatively more aversive event should result in a preference for the correct stimulus that follows it. In support of this prediction, we have found that human adults showed a 64.2% preference for a conditioned reinforcer that required more effort (greater downward pressure on a transducer) to obtain than one that required less effort to obtain (Alessandri, Darcheville, Delevoye-Turrell, & Zentall, 2008). Furthermore, we extended this prediction to a different relatively aversive event (delay), using children as subjects (Alessandri, Darcheville, & Zentall, 2008). On half of the trials, after responding to an initial stimulus, the children immediately were presented with a simple shape-discrimination task. On the remaining trials, after responding to an initial stimulus, the children experienced a 6-second delay prior to being presented with a different shape-discrimination task. When they chose the correct shape, they were rewarded with a short cartoon clip. On randomly rewarded test trials, when the children were given a choice between the two correct stimuli, they showed a significant (62.3%) preference for the positive stimulus that, in training, had followed the 6-second delay.

Justification of Effort by Pigeons

If the results of the experiments with humans can be attributed to within-trial contrast, a simpler explanation than cognitive dissonance, it would suggest that under similar conditions one should be able to obtain similar results with other animals. Although Festinger (1961) suggested that phenomena such as the greater resistance to extinction found by animals trained with intermittent rewards was due to cognitive dissonance (an extra value that animals gave to running to a food reward to maintain running in the face of unrewarded trials) there is considerable support for more parsimonious accounts (Amsel, 1958; Capaldi, 1967). If animals can show effects similar to the justification-of-effort effects found with humans, it would argue strongly for a more parsimonious account, because it is unlikely that animals have the need to justify their behavior.

Differential response requirement

We tested this hypothesis with pigeons using key pecks rather than mouse clicks (Clement, Feltus, Kaiser, & Zentall, 2000). During training, each of the two response requirements (high effort, 20 pecks, and low effort, 1 peck) were followed by a simple simultaneous discrimination (e.g., red correct, yellow incorrect or green correct, blue incorrect, respectively) that appeared on the left and right response keys. Choice of the correct color was rewarded with food. On randomly rewarded test trials involving a choice between the two correct stimuli, the pigeons showed a 69.3% preference for the stimulus that in training had been preceded by 20 pecks over the stimulus that in training had been preceded by only 1 peck (see also Kacelnik & Marsh, 2002).

We have also found a similar shift in preference for a more direct measure of food preference: the location of food that follows greater effort over a different location of the same food that follows less effort (Friedrich & Zentall, 2004). This experiment involved two feeders: one that provided food on trials in which 30 pecks were required, the other that provided the same food on trials in which a single peck was required. On probe trials, we occasionally gave the pigeons a choice between the two feeders. Over the course of training, we found that there was a significant, 20.5% increase in preference for the feeder associated with the 30-peck response (relative to the control condition, in which the location of the feeder was not correlated with the required number of pecks). It was not that the pigeons preferred to work harder for their food; it was that they showed an increased preference for the food location that followed the harder work.

Delay to reinforcement as an aversive event

To test the hypothesis that delay could serve as the relatively aversive event for pigeons, as it did for children, we conducted a new experiment. On some trials pecking an initial stimulus was followed immediately by one pair of discriminative stimuli, whereas on the remaining trials pecking an initial stimulus was followed by a different pair of discriminative stimuli, but only after a delay of 6 seconds. On test trials, when the pigeons were given a choice between the two correct stimuli from training, they showed a significant preference (66.3%) for the stimulus that in training had followed the delay (DiGian, Friedrich, & Zentall, 2004).

The absence of reinforcement as an aversive event

A related form of relatively aversive event is the absence of reward in the context of reward on other trials. Pigeons pecked an initial stimulus, and on some trials, pecking was followed immediately by food and then immediately by the presentation of one pair of discriminative stimuli, whereas on the remaining trials pecking was followed by the absence of food (for a similar duration) and then by the presentation of a different pair of discriminative stimuli (Friedrich, Clement, & Zentall, 2005). On test trials, the pigeons were given a choice between the two correct stimuli, and once again, they preferred the correct stimulus (66.7%) that followed the relatively aversive event (the absence of food).

Hunger as an aversive event

Marsh, Schuck-Paim, and Kacelnik (2004) used a different type of relatively aversive event. They trained European starlings to peck a lit response key that was one color (e.g., red) on trials when they had been fed prior to the experimental session and that was another color (e.g., green) on trials when they had not been fed prior to the session. On test trials, whether they were prefed or not, they were given a choice between red and green, and they showed a significant preference for the color that in training had been associated with the absence of prefeeding (viz., hunger; see also Vasconcelos & Urcuioli, 2008).

Contrast or relative delay reduction?

In all of the research with pigeons that I have described, the trial duration or time between reinforcements has been longer on trials with a relatively aversive event (i.e., pecking 20 times takes longer than pecking once, a delay takes longer than no delay, and the absence of reinforcement means that the time between reinforcements is longer). According to Fantino and Abarca (1985), if trial duration differs, conditioned reinforcement (delay reduction) rather than contrast can account for all of the preceding results. That is, relative to the total time between rewards, the closer a signal for reinforcement comes to the reward, the stronger is the conditioned reinforcement associated with the reward. But recently we have found that with trial duration carefully controlled, pigeons still prefer the correct stimulus that follows the *least preferred* initial event (Singer, Berry, & Zentall, 2007; see also Alessandri et al., 2008, for similar results with humans when trial duration is controlled).

Two critical variables

Over the course of our experiments with pigeons, we have used varied amount of training (from 20 to 80 sessions). Although we have found significant effects with only 20 sessions of training (Clement et al., 2000), others have not (Vasconcelos, Urcuioli, & Lionello-DeNolf, 2007; Arantes & Grace, 2008), and more recently we have found that it often requires more training to observe the effect (Friedrich & Zentall, 2004; Singer et al., 2007). Although Arantes and Grace included several pigeons that were given extended training, their pigeons had had extensive prior training with schedules involving infrequent reinforcement, thus for these pigeons 20 pecks may not have been sufficiently aversive.

Possible Implications for Other Social Psychological Phenomena

The within-trial-contrast hypothesis was proposed specifically as an alternative to the justification-of-effort hypothesis, a variant form of the cognitive dissonance account. But the contrast account also may be applicable to other presumably complex social psychological phenomena.

The classic cognitive dissonance effect

With a minor adjustment, the within-trial-contrast model proposed in Figure 1 may also be able to account for the cognitive dissonance experiment originally reported by Festinger and Carlsmith (1959). In this case, the dependent measure is the

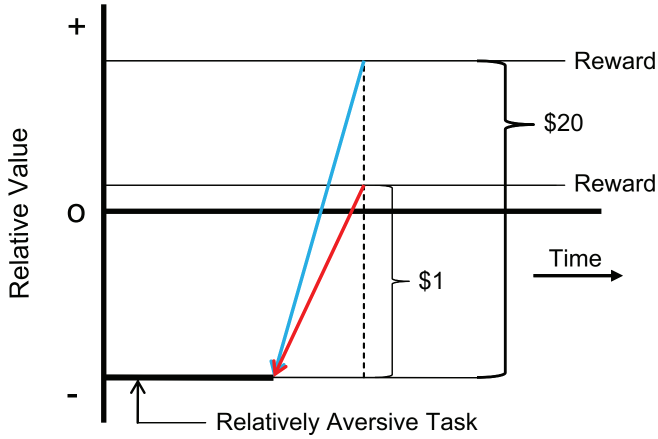

Fig. 2. Contrast model applied to cognitive dissonance experiment (Festinger & Carlsmith, 1957). Subjects were given $1 or $20 to agree to tell another subject that a tedious (relatively aversive) task was interesting. After performing the task and then being asked how interesting the task actually was, subjects given only $1 judged the task to be more interesting (i.e., having a higher relative value; red arrow) than those given $20 (blue arrow).

subjects' retrospective evaluation of a just-peformed tedious task after having been paid either $1 or $20 to tell a waiting subject that the task was interesting. The researchers found that subjects who were paid $1 found the task to be more interesting than those who were paid $20. The authors concluded that the cognitive dissonance produced by having performed a tedious task and having agreed to tell another subject that it was interesting was reduced for the more highly paid subjects because the payment justified the misrepresentation. However, for subjects who were paid only $1, it was assumed that such a payment was inadequate to justify the misrepresentation. For them, cognitive dissonance could be reduced only by convincing themselves that the task was not so tedious. According to the much simpler contrast account, when viewed retrospectively from the relatively high value of $20, the task should have appeared to be of lower value than when viewed from the lower value of $1 (see Fig. 2). Thus, the contrast account may provide a more parsimonious, or at least complementary, account of this and other cognitive dissonance results.

Intrinsic versus extrinsic reinforcement

Contrast effects of the kind reported here may also be involved in the finding that if there are activities that are intrinsically rewarding (e.g., puzzle solving), then providing extrinsic rewards (e.g., money) for such activities may lead to a subsequent reduction in that behavior, especially when the extrinsic rewards are no longer provided (Deci, 1975). This effect has been interpreted as a shift in self-determination or locus of control (Deci & Ryan, 1985). Presumably subjects reason that "If I am being paid to do something, it can't be much fun." But, such effects can also be attributed to satiation or, more germane to the present interpretation, to contrast. In this case, it is the contrast between extrinsic reinforcement and its sudden removal that may be responsible for the decline in performance (Flora, 1990). Intrinsic rewards may be sufficient to maintain behavior, but the contrast experienced when extrinsic rewards are removed may diminish the value of the intrinsic rewards. Compare this result with Tinklepaugh's (1928) classic finding that monkeys that are switched from reinforcers of fruit (preferred) to lettuce (less preferred) often refuse to eat the lettuce, in spite of the fact that the monkeys were quite willing to work for the lettuce during earlier sessions.

Learned industriousness

Contrast effects may also be involved in a somewhat different phenomenon that Eisenberger (1992) has called learned industriousness. If reinforcement is provided for performing a difficult (high-effort) task, it may increase one's general readiness to expend effort on other goal-directed tasks. The contrast account is as follows: If the second or target task is easy, having had a previous difficult task should result in positive contrast, and the positive contrast should result in increased task persistence (relative to having had an easy initial task). On the other hand, if the second task is difficult, having had a previous easy task should result in negative contrast, and the negative contrast should result in decreased persistence (relative to having had a previous difficult task). Thus, in either case, a contrast interpretation of the learned-industriousness effect suggests that pretraining on a difficult task should result in better transfer than pretraining on an easy task.

Conclusions About the Generality of Contrast Effects

It should now be clear that contrast effects of the kind reported here in humans and pigeons may contribute to a number of experimental findings that have been reported with humans but that traditionally have been explained using more complex cognitive and social accounts. Further examination of these phenomena from the perspective of simpler contrast effects may lead to more parsimonious explanations for what have previously been interpreted to be uniquely human phenomena. This is not to say that more cognitive social accounts do not play a role but only that they may be based on simpler more universal behavioral processes.

Recommended Reading

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In E.A. Wasserman & T.R. Zentall (Eds.), *Comparative cognition: Experimental explorations of animal intelligence* (pp. 651–667). New York, NY: Oxford University Press. A more thorough review of justification-of-effort effects in humans and pigeons.

Acknowledgments

I thank Rebecca Singer, Tricia Clement, Andrea Friedrich, Kelly DiGian, and Jerome Alessandri for their assistance with this research.

Declaration of Conflicting Interests

The author declared that he had no conflicts of interest with respect to his authorship or the publication of this article.

Funding

The research reported in this article was supported by Grants MH59194 and MH63726 from the National Institute of Mental Health.

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