

# Pigeons and the Sunk Cost Effect

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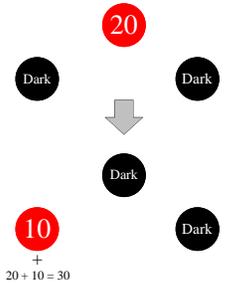
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## Experiment One

Initially, the birds were given experience with two colors presented individually; one requiring 30 pecks and one requiring 15 pecks.



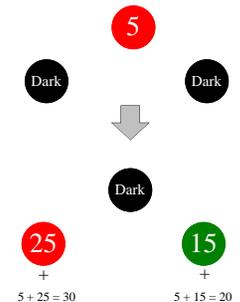
The birds were then given experience with the variable FR color moving to the right or left for the balance of the FR requirement.



The birds were given experience with all combinations of outcomes in forced choice trials.



During testing, the birds were given a choice. The choices were offered at 5, 10, 15, 20, and 25 pecks to the high FR color.



## Abstract

The sunk cost effect involves staying with an alternative because of prior resources invested even when there is a better alternative available. At various points during pecking a colored light 30 times (a Fixed Ratio, FR, 30) schedule (after 5, 10, 15, 20, 25 pecks) pigeons were given a choice between completing the FR30 schedule or switching to an FR15 schedule. When the number of responses remaining to reinforcement was the same for either alternative, the birds showed a strong bias to complete the FR30 requirement. When the number of responses remaining to complete the FR30 requirement was somewhat greater, 20 pecks, the pigeons were indifferent between completing the remaining FR30 pecks or switching to the FR15. This deviation from optimal choice suggests that pigeons too are susceptible to the sunk cost effect and suggests that the mechanism responsible for the effect is neither cultural nor associated with a high level of cognitive ability.

## Results of Experiment One

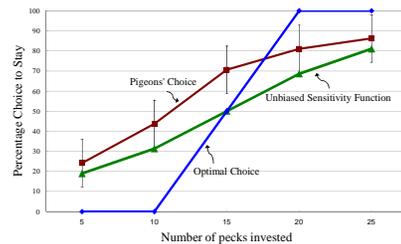


Figure 1: Choice of the High FR stimulus as a function of the number of responses already made (investment). Optimal Choice (diamonds), Unbiased Sensitivity Function (triangles), and Pigeons' Choice (squares).

On average, the pigeons tended to complete the initial requirement (stay with the initially chosen color) even when that choice was not optimal and to do so required making more pecks than would have been required had they chosen to switch to the alternative color.

The percentage of choice to stay with the initial color at each level (5, 10, 15, 20 and 25 initial pecks) was averaged over the last 10 test sessions. The mean choice to stay after 5 pecks was 24.17% (SD = 12.75). The mean choice to stay after 10 pecks was 43.75% (SD = 17.65). The mean choice to stay after 15 pecks was 70.63% (SD = 17.7). The mean choice to stay after 20 pecks was 81.04% (SD=18.2). The mean choice to stay after 25 pecks was 86.25% (SD=16.93). The critical point, where the same number of responses were required for either alternative (15 pecks to stay with the FR30 color versus 15 pecks to switch to the FR15 color) was compared to chance responding (50%) using a t-test. The t-test revealed that the difference from chance was reliable,  $t(7)=2.67, p<.05$ .

To obtain an estimate of this response bias, a measure of sensitivity to the difference in response requirements (or discriminability) was calculated that was independent of the response bias. When FR(30-I) was equal to 15, the unbiased preference score was plotted as 50%. Then, to obtain a measure of the sunk cost bias, choice at each level was tested against this sensitivity function. Those comparisons revealed a reliable difference from an unbiased response after 10 pecks,  $t(7) = 1.96, p < .05$ , as well as after 15 pecks  $t(7) = 3.2, p < .05$ , but not after 20 pecks,  $t(7) = 1.87, p > .05$ . Differences after 5 pecks or 25 pecks were not expected because of floor and ceiling effects, respectively.

## Discussion (Exp 1)

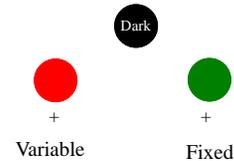
The degree to which the pigeons should choose to complete the FR30 response requirement or shift to the FR15 response requirement given the number of center key-pecks already made if they consistently choose the lower number of responses to complete the trial and they are indifferent when the number of responses to complete the trial is the same for both alternatives appears in Figure 1. When the number of responses was the same, a deviation from chance would indicate a sunk cost effect (if it was greater than chance). No difference from chance would indicate appropriate indifference.

In fact, the birds showed a significant difference from chance in their preference for the high FR stimulus after 15 pecks initial investment. The most compelling evidence that the birds showed a sunk cost effect occurred after 10 pecks of initial investment. Both for the entire group and for the sub-group of pigeons, there was a reliable bias to continue with the initial color, even when to do so required investing more than would have been the cost to switch. Although one might argue that the indifference the pigeons showed when they had invested 10 initial pecks occurred because they may have been unable to discriminate between 15 and 20 required pecks to complete the trial, the fact that they showed a strong preference to complete the FR30 requirement when only 15 pecks were required to complete the trial suggests that the indifference the pigeons showed after having made 10 initial pecks resulted from a bias to complete the FR30 schedule.

Perhaps the birds simply prefer the variability of the high investment stimulus?

## Experiment Two

Using the same subjects from Experiment 1, birds were asked their preference if no initial investment was made.



Randomly either 5, 10, 15, 20 or 25 pecks were required to complete the requirement on the variable key. 15 pecks were always required on the fixed key.

## Results of Experiment Two

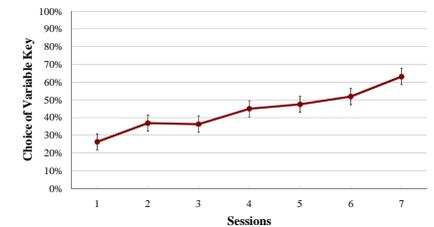


Figure 2: Average choice of the variable response requirement (the High FR color) in the absence of any initial investment for the seven testing sessions.

Percent responses to the high FR key were averaged across birds for each of the seven sessions. Choice of the high FR key on each of the test sessions is presented in Figure 2. When the critical first session means were compared to chance responding (50%) with a t-test, the difference was statistically significant,  $t(7) = 3.36, p < .001$ , revealing that the pigeons' choice of the high FR alternative was significantly below chance. A repeated measures ANOVA performed on the data, with sessions as the factor, indicated that there was a significant effect of session,  $F(6,42) = 9.02, p < .05$ . A planned comparison indicated that the linear trend was also significant,  $F(1,7) = 27.08, p < .05$ .



Special thanks to all the undergraduates who helped with the birds!