Supplementary analyses

Non-target latencies during devaluation tests

The latencies to initiate and complete non-target sequences were recorded during devaluation tests. In the main text we presented initiation latency data for all sequences beginning with a correct left lever press, what others have referred to as “first step” (Rothwell, et al., 2015). To assess non-target initiation latencies we similarly examined those sequences beginning with an incorrect right lever press. This was comprised of initiation data from RL and RR sequences, but most data came from RR sequences. Due to a low sampling rate, we chose to combine initiation latencies across both of these sequence types. The data are presented below in figure S1A. Separate one-way ANOVAs were conducted on each group using a pooled error term (MS error = 0.57), and revealed a significant difference between valued and devalued tests for both groups (Moderate: $F(1,53) = 9.45, p < .05$; Extensive: $F(1,53) = 6.15, p < .05$). There was no main effect of group ($F(1,53) = 0.35, p > .05$). The presence of a devaluation effect in the extensive group was unexpected based on the initiation data we present in the main text for correct first responses. This result may be an artifact of a failure to adequately press the left lever following trial initiation. Specifically, we informally observed that when the levers inserted at the beginning of a trial, the rats sometimes mounted the left lever but failed to sufficiently press it for the computer to register it as a response, before then switching over to press the right lever. These trials were counted as RR or RL trials, but the “initiation time” arguably could have reflected an LR completion time. Thus, it is unclear whether the increased time to initiate RL and RR sequences in the extensive group during devalued test sessions reflects true goal-directed initiation or goal-directed completion.
Completion latencies were also recorded for non-target sequences, analyzed separately for LL, RL, and RR sequences (figure S1B). For each sequence type we performed within-group repeated measures ANOVAs based on pooled error terms (MSE = 0.81, 0.61, and 1.11 for LL, RL, and RR sequences, respectively). In addition, a between-group main effect test was also performed separately for each sequence type. The only significant within-groups difference between valued and devalued test sessions was observed with RL completion times in the extensively trained group \( (F(1,42) = 5.73, p < .05) \). There were no between-group differences. Thus, an additional feature differentiating extensively from moderately trained rats during reward devaluation was the slowing of completion times only during sequences during which rats transitioned between levers (LR and RL).

[Insert Figure S1 here]

**Magazine latencies during devaluation tests**

As the magazine entry could be conceived as the terminal response in the sequence, we measured the latency to enter the food magazine following an LR sequence during the devaluation tests (figure S2). Within-group ANOVAs did not reveal any significant differences between valued and devalued test sessions for either group (pooled MS error = 0.02; \( Fs(1,52) < 3.49, p > .05 \)). However, there was a main effect of group, with the extensive group showing a faster overall latency to enter the magazine following an LR sequence \( (F(1,52) = 5.01, p < .05) \).

[Insert Figure S2 here]
**Figure S1.** Initiation and completion latencies for non-target sequences during devaluation tests.

(A) Initiation latencies for RL and RR sequences combined. (B) Completion latencies for non-target sequences.
Figure S2. Magazine latencies during devaluation tests.