

Busy as a Bee

Andy Lattal



In 1984, not too long after his return from a Fulbright Fellowship in Brazil, Murray Sidman told me about the work of a Brazilian scientist, Isaias Pessotti, who had been doing research on stimulus equivalence in honey bees. Pessotti's work was published only in Portuguese (e.g., *Rev. Brasil. Biol.*, 41(4), 681-693), so I have only Sidman's report of that work. A decade later during a trip to Brazil I met at the University of Belo Horizonte, through my colleague Sergio Cirino, Ana Maria Lé Sénéchal-Machado. As part of her continuing research on honey bees in the tradition of Professor Pessotti, she showed me the apparatus she was using, which I understood to be modeled after Pessotti's apparatus.

The honey bees lived, free-roaming, outside the laboratory building and had been trained to pass through a special entry attached to a window that allowed them into a space located inside the building housing the apparatus shown in Figures 1, 2, and 3. Figure 1 shows a side view of the apparatus (it is about 2.25 inches high). Figure 2 shows, looking down on the apparatus from above it, respectively, the mechanical devices described below. Figure 3 shows from the same vantage the device at would appear to the bee, that is, with an opaque cover over the mechanical devices shown in Figure 2. A ruler has been placed at the lower edge of Figures 2 and 3 to place the size of the apparatus (about 6.25 inches long by 3.25 inches wide) in perspective (it is very small).



Only one bee was allowed into the space containing the chamber at a time. Once inside, they could press the small lever (about .5 in long, with a spoon like shape at its top) shown in Figure 4 (it has broken off of the apparatus; it was attached at the point marked by Arrow "A" in Figure 2. It protruded above the opaque floor in Figure 3 through a slot that appears as a straight line perpendicular to the lower edge of the apparatus at the point marked by arrow "A" in that figure. The lever operation activated the small electric motor (red in actual color), shown in Figure 2 at the arrow marked "B." This motor in turn raised from a tray containing a sugar-water mix (Figure 2, arrow marked "C") a (very) small dipper (Figure 2, arrow marked "D"). By inserting its proboscis into a small aperture (arrow marked "B" in Figure 3) above the raised dipper, the bee then could retract a small amount of sugar water before the motor deactivated and the dipper fell back into the tray, below the level it could be reached with the proboscis (identical to the way that liquid dispensers operate when such liquids serve as reinforcers for

rats' lever presses in more conventional operant chambers). The sugar in the dipper then replenished, requiring another response for its re-appearance at the proboscis hole.

The first report of reinforcement-schedule-controlled responding with bees to appear in *JEAB* was one by Klaus Grossmann (*JEAB*, 1980, 20, pp. 105-109). He reported sustained responding on fixed-interval schedules with inter-reinforcement intervals as long as 90 s. Unlike the lever in Figure 2, Grossmann's apparatus defined the operant response as the interruption of an infrared photocell beam. He observed that "after entering the chamber [containing the sugar water dispenser], a subject had to withdraw from the chamber and then re-enter it for another response to be counted" (p. 105).

An alternative version of the popular saying that comprises the title of this comment is "busy as a beaver." To my knowledge, however, no one in behavior analysis has ever studied beavers in the operant lab; however, when Nate Azrin was studying pain-elicited aggression in the 1960s, he demonstrated such an effect when two nutria (a relative of the beaver) were so studied. ~ *Andy Lattal*

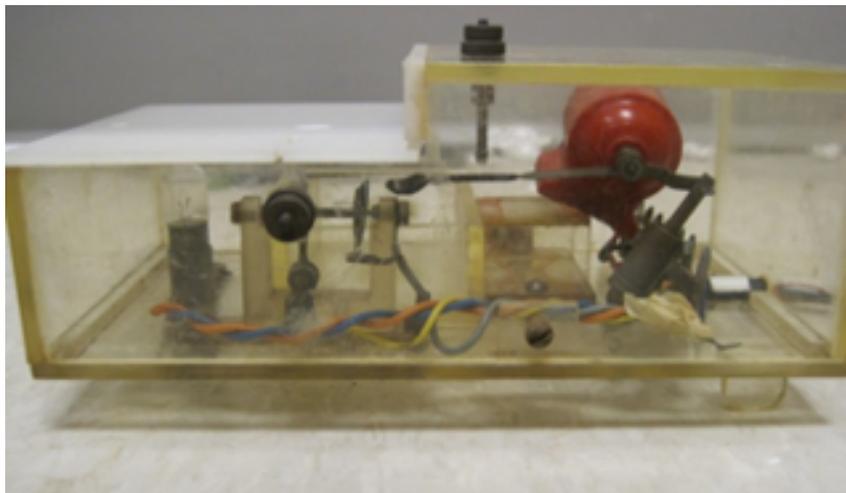


Figure 1. Side view of the operant apparatus for bees with the opaque cover in place.

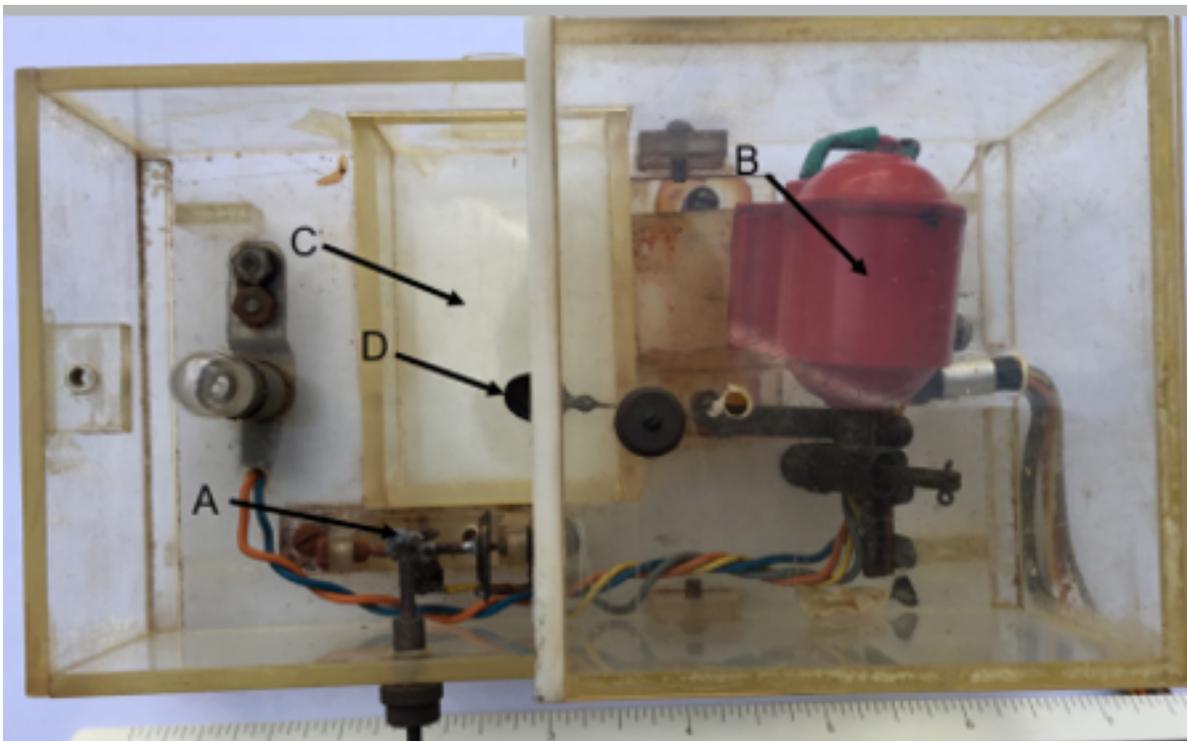


Figure 2. Top view of the operant apparatus for bees with the opaque cover removed. See text for explanation of the letters.

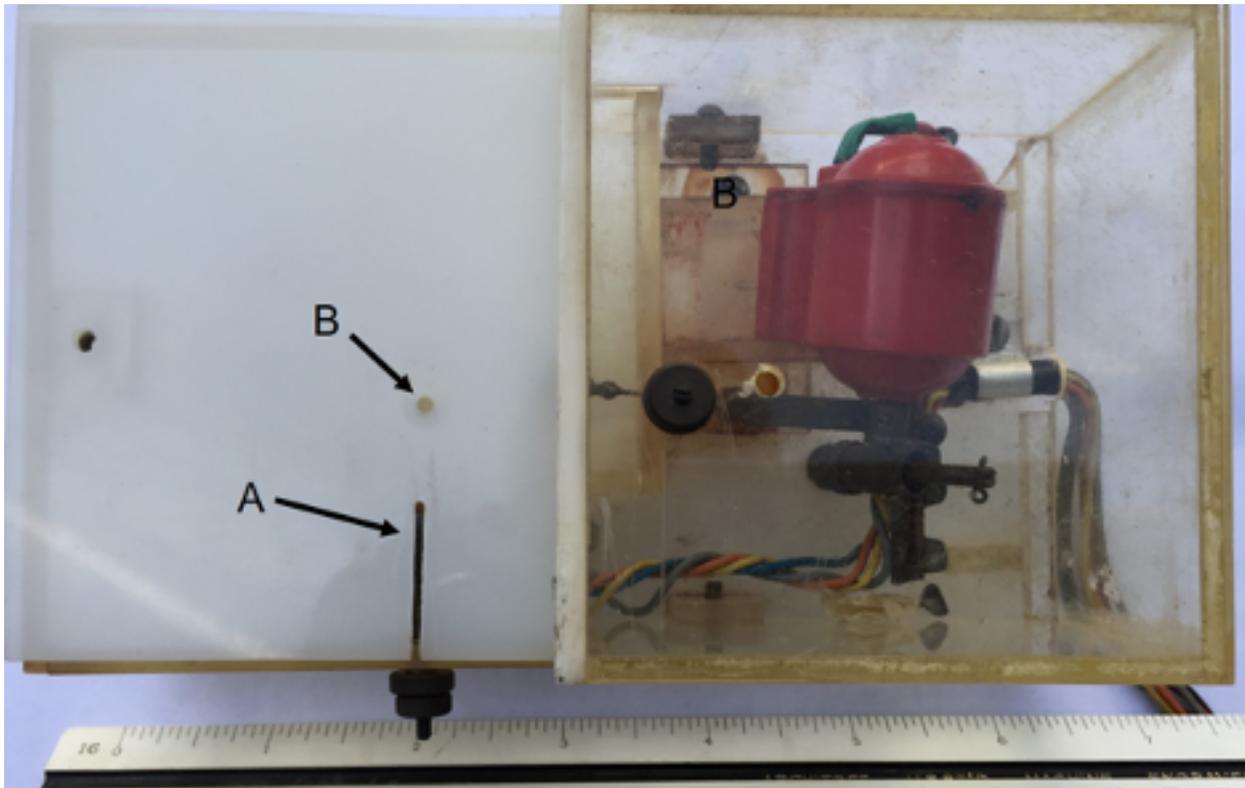


Figure 3. Top view of the operant apparatus for bees with the opaque cover in place. See text for explanation of the letters.



Figure 4. The bee lever.