

BRIEF COMMUNICATION

On Drinkometers: Problems and an Inexpensive Photocell Solution¹

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MARTONYI, B. AND E. S. VALENSTEIN. *On drinkometers: problems and an inexpensive photocell solution*. *PHYSIOL. BEHAV.* 7 (6) 913-914, 1971.—Electronic contact switches may interfere with measurements of taste discrimination and also the ability to utilize physiological recording or stimulation techniques simultaneously. An inexpensive and simply constructed photocell-drinkometer solution to both these problems is presented.

Apparatus Drinkometer Photocell Contact switch

THE USE OF electronic contact switches (drinkometers) for measuring the temporal pattern of fluid intake has proven to be very useful, but we have recently had occasion to note problems with their application to some experimental situations. In the course of measuring the relative consumption of two fluids, it became apparent that some properties of electronic contact switches may influence the data. This is very likely to be related to the fact that most of these devices involve the passage of current through the body of the animal when its tongue makes contact with the drinking tube.

Specifically, when faced with a choice between water and a very mildly bitter quinine solution, animals drank significantly more of the quinine solution when the drinkometers were used than when they were turned off. Obviously, this apparent decrease in discriminability may be a problem in some experiments. Furthermore, electronic contact switches can interfere with concurrent recording or stimulation techniques. We have developed a photocell drinkometer which uses fiber optic principles, that has proven to be a simple and inexpensive solution to both the taste discrimination and electronic interaction problem. This solution and some data indicating the influence of electronic drinkometers on measurement of taste discrimination are briefly presented here.

Two groups of six male rats (300-350 g. Long Evans Strain) were deprived of water for 48 hr and then given a choice between a 0.0018 per cent quinine sulphate solution and tap water during a 30 min session. The animals were given ten daily 30 min tests with no additional fluid provided except for a supplement at the beginning of the weekend. Total daily consumption during the test period averaged

18 ml. The solutions were made fresh every day, the temperature of the two fluids were the same and the positions of the quinine and water bottles were altered every day. One of the groups had Lehigh Valley (LV 221-05) drinkometers with leads attached to the floor and drinking tubes of the bottles for the first 6 testing days, and for the remaining 4 days the drinkometers were turned off. The other group of animals had this procedure in reverse.

It is clear from Fig. 1 that the animals consumed more of the quinine solution when the drinkometers were attached. On test day 7 when the two groups were reversed the consumption pattern also reversed. There are several possible explanations for these results. The current at the surface of the tongue may have partially masked taste sensation or some reinforcing properties (either slight positive or negative) produced by the opening and closing of the drinkometer circuit may have contributed to the animals' performance. We are not in a position to decide between these hypotheses nor do we maintain that the same results would have been obtained with all drinkometer circuits (some utilize less current than others), but we can offer a simple and inexpensive solution to this potential problem. In addition, our solution also eliminates a source of electrical interference with physiological recording and stimulation apparatus that may be used at the same time.

Figure 2 illustrates our photocell drinkometer, which utilizes fiber optic properties in conjunction with a photocell to measure contacts with the drinking tube. In our application, light from a pilot light is transmitted along a glass rod (less expensive and for this purpose as adequate as fiber optics) across a 3mm gap to a second glass rod to which a miniature photocell is secured with shrink tubing. As illustrated in

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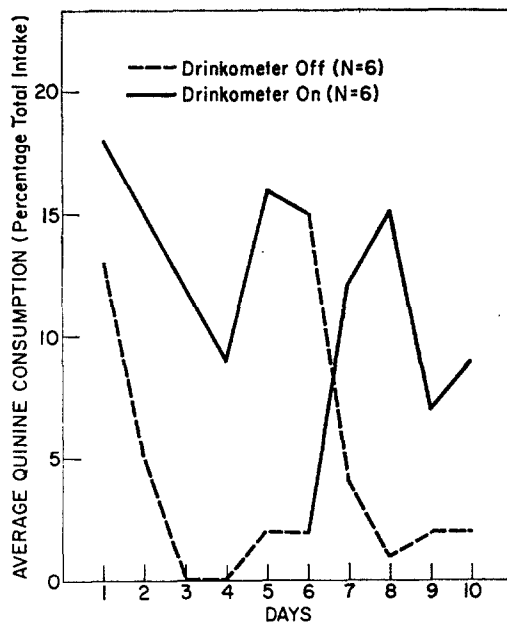


FIG. 1. Average percentage consumption of a 0.0018 per cent quinine solution with electronic drinkometers on and off. Animals were provided with a choice of water or quinine.

Fig. 2, the two glass rods are positioned directly in front of the aperture of the drinking tube so that each tongue contact with the tube interrupts the photo beam. The photocell leads are led back to an amplifier such as Lehigh Valley Electronic's 28 V relay operated photosensor (LVE 221-10) or the BRS-Foringer Company's 12 V solid state photocell amplifier (PA 203), depending on compatibility with the other programming equipment to be used. The amplified discrete responses representing tongue laps can then be used to drive cumulative recorders, digital counters or any other appropriate counting device. It should be clear from the diagram that no current passes through the animal's body. The total cost of the pilot light, glass tubing and photocells for two drinking bottles is less than \$5.00. Photocell amplifiers may be purchased for approximately \$16.00, but can be easily constructed for less.

Also illustrated in Fig. 2 is a Plexiglas restraining box, which would not ordinarily be necessary. We have found

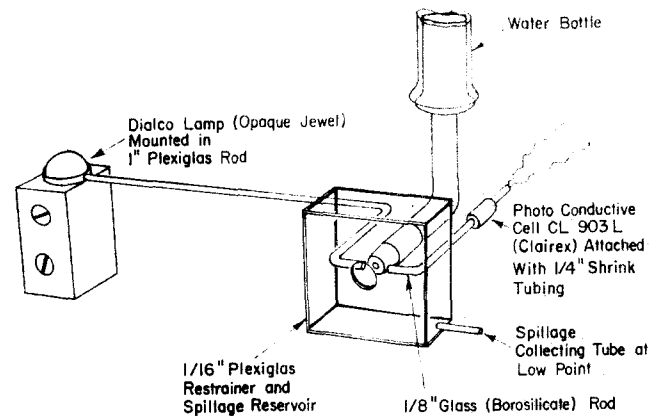


FIG. 2. Illustration of a new design for a photocell-drinkometer. The Plexiglas restraining box would not be used during most applications (cf. text).

such an arrangement useful in experiments in which reinforcing brain stimulation has been administered following laps at the tube in order to encourage animals to consume solutions they would ordinarily avoid. The Plexiglas Restrainer has a 7 mm hole which is positioned immediately in front of the drinking tube. This arrangement prevents the animal from making contact with the drinking tube with anything but its tongue. In most instances all the fluid is ingested, but we have built in a collection tube (Fig. 2) that permits recovery of spillage should there be any. We have tested durability of the glass rods (without the Plexiglas Restrainer) over several weeks during which time the animal had continual access to the tube. The glass rod appears to be impervious to abuse by the rats. The apparatus does not require any apparent adjustment period when animals are first presented with this minor obstruction to the tube.

We have tested the photocell drinkometers with 6 naive rats which were presented with the choice between the weak quinine solution and water under the conditions described above. The preference pattern displayed by the animals were essentially the same as those obtained without any drinkometer (Fig. 1). The photocell drinkometer is capable of responding sufficiently fast to record all tongue laps. Thus this device appears to be a simple solution to the problems sometimes faced with electronic drinkometers.