Notes and Comment

Reply to Sjöden and Archer

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In Holder (1988), I pointed out that the majority of work from the laboratory of P.-O. Sjöden and T. Archer was difficult to interpret because of a confound common to most of their experiments. Using taste-aversion procedures, their experiments showed that rats could discriminate bottle stimuli, and they have suggested that the important dimension of the bottle stimuli was likely to be tongue-tactile stimulation. On the basis of this research, they have concluded in many publications that "exteroceptive contextual stimuli" are an important factor in taste-aversion learning. In addition to the problem of interpretation stemming from a procedural confound, their use of the term "contextual stimuli" seems inappropriate to me.

The procedural confound involved always using one type of drinking spout in conjunction with glass bottles and another type of spout with plastic bottles. This allowed for the possibility that the important dimension of the bottle stimuli may have been that water from plastic bottles tasted different from water that came from glass bottles. Three experiments from two different laboratories have demonstrated that the tastes arising from glass and plastic bottles are discriminable by rats even when the water is stored in the bottles for less than 1 h and when flavors are added to the contents of each bottle (Finch, 1985; Garcia, McGowan, & Green, 1972).

Although Sjöden and Archer (1988) acknowledge that the plastic/glass confound existed in the majority of their work, they claim that the issue I raised "rests on a very shaky empirical foundation." This is not true. They point out that Garcia and Koelling (1966; see Garcia et al., 1972) always used drinking spouts with plastic bottles and drinking tubes with glass bottles. In fact, Garcia and Koelling used only one type of drinking spout. The words "spouts" and "tubes" refer to the same drinking spout and stopper. To emphasize this, I referred to the spouts used with the glass and plastic bottles as "identical" (Holder, 1988). Sjöden and Archer (1988) incorrectly claim that the work by Finch (1985) "is confusing in relation to the issue." Finch showed that the taste of water stored in glass bottles is different from that stored in plastic bottles, and that this difference arises quickly and can sup-

port conditioned taste aversions. This finding empirically demonstrates that the plastic/glass confounding variable throughout Sjöden and Archer's work can be salient. Furthermore, the plastic taste is not masked by other flavors. Using an A+/AB- design, rats were given saccharin-LiCl and saccharin + banana-no injection pairings. The water was always presented to the rats in glass bottles, but the water for the saccharin + banana solution had previously been stored in a plastic bottle and the water for the saccharin-alone solution had not. When tested with two glass bottles (no saccharin or banana flavors), one of which contained water that had previously been stored in plastic, rats showed a strong aversion to the plastic taste (Finch, 1985). The inability of flavors to mask the distinct taste of water from plastic bottles is important. Sjöden and Archer (1988) suggest that their "rats must discriminate ... between saccharin solutions in different bottles" and, therefore, that "the saccharin taste may mask any 'plastic' taste." If banana and saccharin do not mask the plastic taste (Finch, 1985), then saccharin by itself probably does not.

In their reply to my comments (Holder, 1988), Sjöden and Archer (1988) showed that when the plastic-glass confound is eliminated, the bottle stimuli are still discriminable. This work successfully showed that whatever the contribution of the confound (they did not measure its contribution), it is not sufficient to account for their entire effect. However, I do not agree with their interpretation that their work indicates that "the exteroceptive background context in which the CS-US pairing takes place ... exerts a major control over the amount of saccharin consumed" following saccharin-illness pairings (Archer, Sjöden, Nilsson, & Carter, 1979). Contextual stimuli are stimuli that occur independently of the presentation of potential conditioned stimuli. For example, the home cage might be described as a contextual stimulus because the animal experiences it whether or not noncontextual stimuli, such as a taste, are presented. The presentation of the context is not perfectly correlated with the presentation of conditioned stimuli. Since tongue-tactile stimulation (i.e., the dimension of the bottle that Sjöden and Archer identify as the important stimulus) arises from licking different drinking spouts and is perfectly correlated with taste, this stimulation is not a contextual stimulus.

The difficulty I have with Sjöden and Archer's use of the term *context* is illustrated in their phrase "the effect of stimuli other than taste (thus, contextual stimuli)" (Sjöden & Archer, 1988). In conditioned taste-aversion studies, stimuli other than taste are not necessarily contextual stimuli. Sjöden and Archer suggest a careful reading of three studies (Nachman, 1970; Nachman, Rauschenberger, & Ashe, 1977; Revusky & Parker, 1976), which show that nongustatory stimuli can be as-

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sociated with illness. But these three studies do not demonstrate the role of context. In fact, the work is presented in terms of showing that "a nongustatory stimulus can be used as a CS in learned aversions" (Nachman et al., 1977). The issue is whether external cues, such as tongue-tactile stimulation, are properly considered as contextual stimuli. I do not think they are.

In summary, there are three main points made by this exchange between Sjöden and Archer and myself. First, a confound existed in the majority of the work by Sjöden and Archer. This confound has been empirically shown to be important and could explain their results. Second, Sjöden and Archer (1988) showed that they can replicate their results without this confound. Although they do not measure the effect of the confound separately, one can assume that their earlier work cannot be completely explained by the presence of this confound. Third, assuming that their earlier work is not explained by the confound, we are left with essentially a replication and extension of earlier work showing that animals can learn associations between drinking spouts and illness (Nachman et al., 1977). Sjöden and Archer have emphasized that their work is important and interesting because their results show that the context exerts strong control over the development of associations involving illness. However, tongue-tactile stimulation is uniquely correlated with taste, and therefore, like taste, should not be considered as a contextual stimulus.

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