The effects of tactile stimulation on imprinting in ducklings after the sensitive period

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Four-day-old ducklings received visual-plus-tactile exposure to one novel object and visual-only exposure to a different novel object. In a subsequent test, strong suppression of ongoing distress vocalization was exerted only by the object to which visual-plus-tactile exposure had been given. With these results, the experimental conditions under which physical contact is known to facilitate the initiation of imprinting are extended to include subjects that are past the sensitive period.

Although the effects of tactile stimulation on the social behavior of young precocial birds have not received a great deal of experimental attention, several bits of evidence suggest that physical contact can in fact be an important variable. In the context of intraspecific aggression, for example, tactile stimulation from a conspecific—even without concurrent visual stimulation—is sufficient to largely reduce the subsequent occurrence of aggressive behavior in both quail and ducklings (Eiserer, Emerling, Scardina, & Hoffman, 1976). In the context of imprinting, Collias (1952) found that **contact with a human hand can reduce distress calling in newly hatched chicks**; Thompson and Dubanoski (1964) reported that physical handling enhanced subsequent imprinting in 5-h-old (but not in 9-h-old) chicks; Maier and Maier (1970, p. 202) suggested that contact is important in maintaining the following response of older chicks; and Clements and Lien (1975) found that contact facilitated initiation and maintenance of following behavior in newly hatched quail. Young precocial birds may even be capable of forming specific attachments to particular tactile stimuli (Taylor, Sluckin, Hewitt, & Guiton, 1967).

The present experiment investigated the effects of tactile stimulation on the initiation of a filial response (namely, the suppression of ongoing distress vocalization) in ducklings that were several days old and hence well past the sensitive period for imprinting. Thus the work assessed the effects of tactile stimulation under conditions in which visual stimulation by itself would be relatively ineffectual in eliciting filial behavior (Hoffman, Ratner, & Eiserer, 1972). In doing so, the present study employed ducklings as subjects, in contrast to the imprinting research cited above. In view of the possibility that some species of precocial bird might be significantly more "contact oriented" than others (Clements & Lien, 1975), use of a new species is important in determining the extent to which the facilitation of

imprinting by tactile stimulation is general across precocial birds.

METHOD

Subjects

Six Peking ducklings (*Anas platyrhynchos*) were incubator-hatched in visual isolation. Except for periods spent in the experimental apparatus, each duckling was maintained in an individual housing unit consisting of a 15-gal white translucent container that was lined with a clear polyethylene bag and partially filled with bedding material. Under these conditions, the ducklings could hear each other but their visual environment was restricted to that provided by the inside of their individual housing units. While in these units, the ducklings had continuous access to food and water.

Apparatus

The experimental apparatus consisted of a plywood box (122 cm long, 38 cm wide, 76 cm high) that was divided across its width by a stainless steel screen. This barrier was positioned such that the section of the apparatus lying to its left (i.e., the stimulus compartment) was 32 cm long, while the section to its right (the subject compartment) was 90 cm long. Lighting for both compartments was provided by two continuously illuminated 75-W incandescent lamps mounted along the length of the apparatus.

Two different stimulus objects were used. One was a white cube made of soft foam rubber (10 × 10 × 10 cm), and the other was a black styrofoam ball (approximately 12 cm in diameter). In order to permit manual manipulation of the stimuli at a distance, the objects were attached to the ends of fiber glass rods, of the sort used for fishing. Each rod (one for the cube and one for the ball) had previously been broken into two unequal pieces and then cemented back together into an L shape. One of the stimulus objects was then securely fastened to the tip of the smaller portion of the rod, while the end of the larger portion was used by the experimenter as a handle.

The distress vocalization of the ducklings was monitored with a specially constructed voice key which, through selective filtering, was sensitive only to those sounds that fall in the frequency range characteristic of distress calls (approximately 3,000 to 4,000 Hz).

Procedure

The ducklings were maintained in their housing units during the first 3 days posthatch. On Day 4, each subject received three 15-min exposure sessions with an intersession interval of approximately 120 min. Two of these sessions (the first and third)

involved *visual-only* exposure to one of the stimulus objects (the ball for half of the subjects, the cube for the other half), while the remaining session (the second session) involved *visual-tactile* exposure to whichever of the stimulus objects was not used in the visual-only sessions.

During each of the two visual-only sessions, the stimulus object was moved within the subject compartment in such a way that it always remained approximately 6 in. from the duckling. During those periods when the duckling remained stationary, the object was slowly moved in a circle around the bird; thus the object was kept in nearly continuous motion throughout the session. During the visual-tactile session, the stimulus object was moved within the subject compartment in such a way that it remained in nearly continuous physical contact with the duckling. The nature of this contact could best be described as being gentle but firm, and involving various portions of the subject's body (i.e., for part of the time, contact was made with the duckling's back, and at other times the duckling's wings and flanks).

Approximately 2 h after the last exposure session was completed, each duckling received two distress vocalization tests. One of these tests assessed suppression by the object to which the ducklings had received visual-only exposure, while the other test involved the object with which visual-tactile exposure had been given. Each test consisted of five 15-sec presentations of the object in the stimulus compartment in alternation with five 15-sec intervals of complete stimulus absence (i.e., the object was withdrawn from the stimulus compartment and hidden from the subject's view). Throughout periods of stimulus presentation, the object was kept in slow but steady motion back and forth within the stimulus compartment. The order of the tests was counter-balanced across subjects, and the intertest interval for each duckling was approximately 30 min.

RESULTS

Throughout both of the visual-only exposure sessions, the ducklings typically emitted large amounts of distress vocalization while running about the subject compartment in apparent attempts to escape proximity with the stimulus object. The ducklings gave similar amounts of distress calls and flight responses during the initial portion of the visual-tactile session as well; however, after several minutes of such exposure, both of these behaviors became much less frequent until—towards the end of the session—all of the ducklings had almost completely ceased distress calling and were making little or no effort to move away from the object as it touched them.

Figure 1 shows the results of the distress vocalization tests. As can be seen from the figure, little suppression of baseline distress vocalization (i.e., vocalization during stimulus absence) was exerted by the object with which the ducklings had received visual-only exposure. On the other hand, strong suppression occurred during presentation of the object with which the birds had received visual-tactile exposure.

Statistical analysis of the data confirmed the reliability of these effects. More specifically, an analysis of variance revealed a significant effect of type of exposure [$F(1,5) = 15.7$, $p < .05$], a significant effect of stimulus presentation [$F(1,5) = 86.1$,

$p < .05$], and most importantly, a significant interaction between the effects of stimulus presentation and type of exposure [$F(1,5) = 28.8$, $p < .05$].

DISCUSSION

In the present experiment, 15 min of visual-tactile exposure to an imprinting object was sufficient to achieve strong suppressive control over the distress calling of 4-day-old ducklings, while 30 min of visual-only exposure failed to produce such control. It is important to realize that visual-only exposure to an initially novel object is itself adequate to achieve strong behavioral control in older ducklings, provided that the duration of the exposure is sufficiently long (Bateson, 1964; Hoffman et al., 1972). Thus, in the present study, the slight suppression induced by the object that was presented only visually probably represented the earliest beginnings in the development of strong suppressive properties by that object. Still, the crux of the present results is that visual-tactile exposure was so much more effective in mediating this development than was visual exposure by itself.

In obtaining this finding, the present study has extended the experimental conditions under which facilitatory tactile effects are known to occur in the initiation of imprinting. These conditions now include older as well as newly hatched subjects, and include ducklings as well as chicks and quail.

At least two different explanations can be offered for the effects of tactile stimulation found in the present work. According to a commonly accepted conception of imprinting (Hess, 1959a; Hoffman & Ratner, 1973), the end of the sensitive period is largely caused by the maturational development of fear towards novel stimulus objects, since expression of this fear suppresses the filial responses that would otherwise be directed towards such objects. Even in

Figure 1. Seconds of distress vocalization per 15-sec interval of stimulus presence vs. absence, for both the object to which visual-tactile exposure had been given and the object to which visual-only exposure had been given.

older subjects, however, this fear decreases (i.e., habituates) during prolonged exposure to the object, whereupon the imprinting process seems to proceed more or less normally (Hoffman et al., 1972). In the present experiment, the facilitatory effects of tactile exposure may have derived from a hastening of the fear habituation process, perhaps by making the exposure more intense or salient from the ducklings' point of view. Alternatively, tactile stimulation may have added to the overall "attractiveness" of the imprinting object (i.e., a visual-tactile object may be more attractive to ducklings than is a visual-only object). This increased attractiveness, then, might have more easily overcome the otherwise suppressive effects of novelty-induced fear. Consistent with the suggestion that tactile stimulation may increase the attractiveness of an imprinting object is the observation by Hess (1959b) that young chicks sometimes attempt to crawl under an imprinting object.

Little or no aggressive behavior—in the form of pecking directed towards the imprinting object—was observed in the present study, even though such aggression might have been expected to occur (Hoffman, Ratner, Eiserer, & Grossman, 1974). However, in the visual-only condition, the stimulus was kept 6 in. away from (and hence out of the pecking reach of) the ducklings, who probably remained too fearful of the object to be aggressive in any event. Had the visual-only object been kept closer to the birds, and if its exposure had been prolonged to the point where the ducklings' fear could have waned to the intermediate level that seems optimum for aggression (Hoffman et al., 1974), then presumably pecking would indeed have occurred. As for the visual-tactile object, perhaps the ducklings' fear of that stimulus declined so quickly that the transient optimum level was passed before much

aggression could appear (in the Hoffman et al., study, the stimulus was kept very near the duckling, but no physical contact was effected).

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(Received for publication December 2, 1976;
revision accepted August 8, 1977.)