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SMILING IN BLIND INFANTS AND THE ISSUE OF INNATE VS. ACQUIRED

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INTRODUCTION

DARWIN (1872) wrote that many of the expressions of the congenitally blind, since they could not be learned by visual imitation, must be innate. He quoted the case of congenitally deaf-blind Laura Bridgeman, reported in 1851 by Lieber, to illustrate his point, and among the expressions he listed as innate were smiling and laughing. Darwin also noted that his own children first smiled at about forty-five days of age, and he reasoned that since this was too early for imitation to have played a role it was also evidence that smiling in man is innate. As further evidence, he noted its universal presence in man.

As for the survival value of the baby's smile, Darwin presented what would today be an obvious hypothesis concerning the joy it creates within the adult caretaker. (See Goldstein, 1957 for citations and discussion of function; see also Ambrose, 1960.) This paper, then, is primarily concerned with the "innateness" of the baby's smile, and with the clarification of this problem provided by studies of blind infants.

NORMATIVE DATA, IMITATION AND FEAR OF STRANGERS

In the sections which follow, observations and studies will be reported in which the age of the infant appears to play an important role in the development of smiling. Aside from hereditary causes for individual differences (Freedman, 1965), a major difficulty of focusing on age is the fact that different environments can slow or speed development of smiling, usually depending on the amount of social stimulation (Kaila, 1932; Spitz and Wolf, 1946; Ahrens, 1954; Brackbill, 1958; Ambrose, 1961; Gewirtz, 1963; Wolff, 1963). Also, the reported first age of smiling may often be an artifact dependent on the amount of time the observer spends with the infant; the more time he spends, the greater are his chances for observing a smile. The stress throughout the paper will therefore be on sequence, rather than age, in developmental events.

With regard to imitation, observers agree that deferred imitation, i.e. imitation removed in time from the act imitated, does not normally occur until after the first year (Valentine, 1930; Piaget, 1950; Freedman and Keller, 1964). Thus smiling to a non-smiling stimulus in the first months of life cannot reasonably be called imitative, even in seeing children.

Another general point is that smiles are increasingly reserved for familiar persons, beginning at about five months of age in family-reared infants (Freedman, 1961; Freedman, 1963), and at about eight months of age in institution-reared infants

(Spitz, 1950; Malliardi *et al.*, 1961; Ambrose, 1961). Soon afterwards infants begin to react with overt fear when confronted with a stranger (Schaffer, 1963; Tennes, 1963), and this rising fear of strangers is a major factor in the waning of smiling in many of the investigations to be reported.

EARLY NONELICITED SMILING

In the first weeks of life in full-term infants, and over a longer period in prematures, one often sees smiling after a feed as the infant is falling off to sleep. All modern observers agree that these smiles are not due to escaping gas, as the old-wives' tale would have it, and no eliciting stimulus has been discovered (Kaila, 1932; Spitz and Wolf, 1946; Koehler, 1954; Wolff, 1963; Freedman, 1963). Nonelicited smiling thus falls into the general category which Lorenz (1937) calls "vacuum activities", i.e. behaviour which appears in the absence of normal eliciting stimuli, usually in an early stage of development. Wolff (1963) has a similar interpretation:

"Particularly in prematures, but also in full-term infants, the smile may often be preceded by a twitching myclonus at the corners of the mouth which has at least a superficial resemblance to an electrophysiological event and gives some further support to the notion that smiling in the early days after birth may be a spontaneous discharge. A final piece of indirect evidence for this supposition was the observation that, like erections and spontaneous startles, smiling tends to occur with a high frequency during drowsiness when the eyes close."

SMILING TO TOUCH AND TO SOUND

Nonelicited smiles tend no longer to appear by the end of the first month, but instead, touching various parts of the face, especially the lips (Smets, 1962), and a variety of auditory stimuli, may bring about smiling. Hetzer and Tudor-Hart (reported in Buhler, 1933) tested 126 infants, ranging from one day to five months of age, with various acoustical stimuli including the human voice. While general reactions to the voice were only moderate, the reaction of smiling was almost exclusively to voice. Various modifications of the human voice at two months all resulted in smiling. There was no difference in smiling to mother's or other people's voices, or to nuances of vocal expression, within the first five months.

Wolff (1963) found that smiling to acoustical stimuli occurred in the third week of life in a detailed study of eight precocious and highly stimulated infants. Such smiling occurred after nonelicited smiling had dropped out, and before smiling to visual stimuli (see below) had developed. While smiling might be elicited by a bell, whistle or rattle at this stage, a high-pitched human voice was easily the most effective stimulus used. Wolf, in the course of her work with Spitz (1946), also made the observation that a high-pitched voice more readily elicited smiling than a low-pitched voice (personal communication).

Recently L'Allier (1961) studied 120 institutionalized infants ranging in age from one to thirty-three weeks; fifteen infants were tested in each of eight consecutive four-week periods. A series of sixteen stimuli was presented to each infant and the frequency of smiling noted. Maximal smiling to all stimuli occurred between three

and four months, and when all ages were considered together, various musical instruments were the poorest elicitors of smiles. The best elicitors were as follows:

	Frequency		Frequency
Voice (*E* unseen)	19	Voice and face (moving)	80
Voice and caress (*E* unseen)	31	Face	75
Voice and picked-up (*E*'s face in profile)	35	Voice and face and caress	65
Voice and caress and picked-up	39	Voice and face and caress and picked-up	46
Picked-up and caressed	25		

In a study of 88 family-reared infants, Laroche and Tcheng (1963) also found "voice and face" to be the best elicitor of smiling, over the first half year. In this study "voice" alone was superior to a "static face" but a "moving face" or "smiling face" elicited about as many smiles as did "voice" alone. In this population, maximum smiling to all stimuli occurred between four and six months.

Clearly, voice is a highly efficient stimulus to smiling. In L'Allier's study, however, the visualized moving face was the most efficient stimulus, and this is in accord with the bulk of current data.

SMILING TO VISUAL STIMULI

By far the greatest interest and greatest amount of work has been in this area. Starting with the highly original work of Kaila (1932), there have been several studies of infant smiling to various forms of visual stimulation (Spitz and Wolf, 1946; Ahrens, 1954; Wilson, 1960). Beginning at the end of the first month and into the second and third months, infants begin to stare into the observer's eyes, and for the first time eye-to-eye contact is obtained. Soon afterwards smiling occurs as the infant stares in this way, and such smiling is usually subjectively felt by the observer as the first true social smile probably because of the eye-to-eye contact (Wolff, 1963).

Kaila (1932), working in Charlotte Buhler's nursery in Vienna, became interested in the infant's "fascinated" staring into the adult face just preceding the smile, and set out to find what elements of the face the infant actually fixed upon. He made his observations on 70 infants over varying periods of time, in an essentially "naturalistic" study. Kaila used several two-dimensional cardboard models which were held above the infant's crib. These included one resembling a human face; one with the bottom half, below the bridge of the nose, blanked out; one containing just two large light eyes; and a mask containing two distinct dark eyes. He also presented his own face at various angles, ranging from full face to profile.

Kaila came to the conclusion that the infant was intitially attracted to a Gestalt configuration consisting of the eyes in *en face* position ("der menschlichen Augen-

partie"), and he held that "der menschlichen Augenpartie" is the first differentiated object in the life-space of the infant. In accord with Gestalt thinking, he theorized that the central nervous system was so constructed that "resonance" occurred to this particular configuration, which gave the figure psychological "pregnanz".

Spitz and Wolf (1946) tested 251 infants of various races and environments and corroborated Kaila's observations. They also added a third element to Kaila's Gestalt of the *en face* eyes: movement. They found the nodding head or nodding model elicited smiles more readily than one held still (corroborated by Laroche and Tcheng 1963, see above). Also, a grimacing mouth was found to be as effective as a smiling one, so that movement of the mouth rather than specific shape was deemed most important. This finding, of course, threw doubt on such observations as Washburn's (1929) that the smiling face of an adult is the best elicitor of infant smiles. In both Kaila's and Spitz's studies, as in the study of Laroche and Tcheng (1963), maximal smiling to the presented stimulus occurred between three and six months of age, and thereafter the experimenter's face, and models of a face, ceased to be effective. It should be added that the work of Spitz and Wolf also served the important function of bringing these findings to the attention of English-reading workers.

Ahrens (1954), continuing the same approach and using a greater variety of two-dimensional models, came to some rather attractive conclusions. It should be noted, however, that as in Kaila's studies there is much informality in reporting, and because of the complicated nature of the undertaking every procedure could not be done with every child. It is not clear how many different infants were observed in all, but there are a number of charts with specified procedures, subjects and results. All of Ahrens' observations were made in an institution for infants.

In the second month the most adequate stimulus Ahrens found was a face-sized card with eye-like dots, and a six-dotted model proved more effective than similar cards with one or two dots. At older ages greater and greater detail of a face was demanded before the infant would smile, beginning with the top half of the face, and including the mouth by the fifth month. By seven months these infants required a model with a broad mouth, and by eight months only an actual human face would do.

There was an attempt to refine Spitz's finding regarding movement by varying the speed with which the model was moved, but the results were complex and unsatisfactory. Movement of the models, however, had its clearest positive effect between two and four months.

By the time of this study, ethology had appeared as an exceedingly virile movement in animal behaviour, and Ahrens made the irresistible comparison, since made by many, between the smile of the baby and the gaping or begging responses of thrush and herring-gull chicks (Tinbergen, 1951). Adult herring gulls have a red spot on the underside of their yellow beaks, and naive chicks will gape (i.e. gaping is "released") when a model of the adult beak is presented at a proper angle (sign-stimulus). In varying the visual pattern by means of a variety of models, one was found which elicited a greater rate of gaping than did the natural stimulus: a small white stick with several dark red rings on it. Such a stimulus is called a "super-normal sign-stimulus" (Lorenz, 1952).

Similarly, in Ahrens' study, smiles in the first month were most readily elicited by what can be considered an exaggeration of the eye-part of the face. The six-dotted model elicited more smiling than a face and, in ethological terms, this model could also be considered a "supernormal sign-stimulus". Ethological conceptions of smiling have since appeared in a number of reports (e.g. Koehler, 1954; Gray, 1958; Ambrose, 1960).

SMILING IN CONGENITALLY BLIND INFANTS

Kaila and Ahrens were strictly visual in their theoretical thinking. Neither dealt with the problem posed by smiling in the blind, nor the related problems concerning smiling to sound and other stimuli. What then is known about smiling in the congenitally blind, and what does this information tell us about the mechanisms which bring about smiling?

Before reviewing the literature, a few remarks about blindness are in order. By current standards a child is considered blind if the corrected vision on his best eye is measured at less than 20/200. Considerably less vision is necessary, however, to move about and explore new objects and places (Parmelee, 1959). A regard for bright light is often present when the source of blindness is a defective lens, as in cataracts or in retrolental fibroplasia, but the infant is still considered blind. So-called searching nystagmus, a ceaseless jerky motion of the eye, is usually present after the first month. Its exact nature is not known, but it has been described somewhat romantically as physiological searching for a foveal image.

Until recently, there have been only scattered case reports on behaviour in congenitally blind infants, and in none of these reports was the degree of blindness detailed, nor are we usually told the etiology of the blindness.

Thompson (1941) quantified various aspects of facial movement, via motion-picture film, in laughing, smiling and crying, of twenty-six blind children, eleven of whom were blind at birth. There was a control group of twenty-nine seeing children of the same age range (seven weeks to thirteen years six months). The only marked difference was a decrease in the amount of facial movements, after six years of age, in the smiles of those who were blind at birth. Thompson felt that this drop occurred because imitation was necessary to sustain the full smiling response. She also found heightened individual differences in smiling among the younger blind children, and she attributed this finding, as well, to the lack of opportunity for imitation. Imitation, she hypothesized, tended also to stylize expression and limit random muscular movement.

Thompson filmed only one child in its first year, at seven weeks and again at eleven and twelve months. It was noted that at seven weeks there was a barely perceptable retraction of the corners of the mouth in smiling; by eleven months there was a round-mouthed smile, and at twelve months the mouth had the more mature elliptical shape. Thompson compared this finding with that of Washburn (1929), who observed the same sequence of development at about the same ages in fifteen seeing infants, and she concluded that smiling appears on a "maturational" basis in the blind.

Gesell *et al.* (1949) reported on a congenitally blind child who smiled on hearing her sister's voice at an examination when sixteen weeks old. Koehler (1954) briefly

reported on two cases in which smiling occurred at "the normal time" in one, and in the third month, "just after eating", in the other.

In recent years, soon after the discovery that supra-oxygenation of the incubator causes retrolental fibroplasia (RLF), a degeneration of the lens, a major longitudinal study of sixty-six RLF's was launched at the University of Chicago.

The report on this study by Norris *et al.* (1957) gave no specific data on smiling, but the statement is made that at four months these infants responded to human beings, and demanded personal attention, as do seeing children at the same age. Elonen, the psychologist on this project, has told me privately that all the infants she saw "smiled normally".

Parmelee (1955) reported on questionnaires sent to parents of RLF children in California. He used only those responses reported from written records in baby books ($N = 28$) and found that the first smiling, with one exception, occurred between two and five months. Since these infants were on the average ten weeks premature, the first smiles could be said to have appeared on schedule. Dunn (1962) gathered data in lengthy interviews with parents of twelve congenitally blind children. These included eight with RLF, and one each with retinoblastoma, glaucoma, cataracts and a cortical syndrome (a retardate). He found that with the exception of the retarded infant, all smiled in response to social stimulation between ten weeks and six months, and when corrections for prematurity were made, all smiled at about the same time as their sighted siblings, that is, between one and a half and four months. All, including the mentally retarded infant, smiled spontaneously and "without any instruction by the parents".

As for negative evidence, there are no reports available of blind infants who do not smile. It is safe to conclude, then, that vision is not a prerequisite for social smiling.

CURRENT INVESTIGATION

In an ongoing study, limited because fortunately blinded infants are now rare, we have been able to directly observe the first elicited smiles, within two weeks of onset, in four congenitally blind infants.

Each observational and testing period averaged about one and one half hours, and a good deal of cinema film has been taken and studied. Our four cases included one of congenital glaucoma and auridia, observed and tested at 4 months; one with primary vitreous hyperplasia as well as cranial synostosis, observed and tested at 3½ months; one with Rubella induced cataracts observed and tested four times, between 2½ and 6 months; one with Rubella induced cataracts observed and tested on a weekly basis, between 2 and 4 months, and again at 6 months. In each case the ophthalmological report was bilateral blindness (i.e. vision less than 20/200 in each eye). In addition we noted that while all four infants tended to stare in the direction of bright light there was no visual pursuit of any objects, including a moving pen-light and a dangling red ring (each moved horizontally, vertically, and in a circle and repeated several times).

The Nancy Bayley Infant Mental and Motor Scales (Bayley, 1960) were administered each session and mental and motor performance, aside from visual items, was within normal limits in each case. Developmental tests, however, are a

crude estimate of overall development in blind infants since in the first four months all scales are composed primarily of visual items.

The procedures for eliciting smiling were as follows (Bayley, 1960): "When child is first placed in the crib, stand at his side, lean over with your face about twelve inches above the child's, (a) unsmiling for about 5 sec to 10 sec; (b) unsmiling but speaking softly ("hello baby", or speak child's name); (c) then smile, nod; (d) make a clicking sound while smiling and nodding; (e) then speak to him softly while smiling and touch his body lightly. Note whether the child responds with a smile to situations (a), (b), (c), (d) or (e), or whether he laughs, and whether he vocalizes. If the smile does not occur on the first presentation, repeat the test at a later time, when the infant is in a contented mood."

In each instance the ostensible eliciting stimuli for smiling were touch, voice, or the two combined, and we were struck that in each of the four subjects these first elicited smiles were extremely fleeting, i.e. they quickly formed and disappeared as in normal eyes-closed smiling in the first weeks of life (see above). Normal non-elicited smiling was also reported in two of the blind infants, and occurred at the usual time, in the first month. Following these observations, we asked parents of older blind children whether the first elicited smiles were of a similar fleeting nature, and we have since accumulated six cases of congenital blindness where such smiling is definitely recalled by the parents.

In the two cases we observed through six months of age, these fleeting smiles gradually changed to normal prolonged smiling, and the six retrospective cases, too, were reported as smiling normally by six months. This has led to two interim hypotheses. (1) The initial elicited smiles were reflexive in nature, since there was the typical sharp onset and almost immediate waning. (2) In these early months prolonged social smiling seems to require visual regard as a maintaining stimulus.

We will now report in detail our most closely observed case, a girl with Rubella induced cataracts in whom there were no other significant sequelae. According to the ophthalmologist's report (Akademiska Hospital, Uppsala), Yvonne had less than 20/200 vision in both eyes, and on our tests there was no following of the test objects, including a bright pen-light. She did, however, attend to very bright light, and although no pupillary response was noted, she furrowed her brow to light shone directly on her eyes.

As in seeing babies, Yvonne smiled frequently as she was going off to sleep but never to social contact in the first month (information from mother). Then came a period of reduced nonelicited smiling (also a normal development), followed by social smiling to voice and touch early in the second month (the time of onset for visual social smiling in precocious normals). When observed at 2 months 13 days her smiles, while beautiful, were not normal. They seemed to be a series of reflexes firing in rapid succession, so that they appeared and then faded rapidly. Of great interest was the fact that at this visit Yvonne's otherwise constant nystagmus became arrested during a smile. At this time she smiled most often to voices, but also briefly to our test bell and a familiar squeaking toy.

By 3 months 8 days her smiles were rather prolonged, especially to the human

voice. However, if one observed closely, the prolonged smile still consisted of a discrete series, i.e. regular twitching at the corners of her mouth. Again, nystagmus halted during the social smile. At this age it was noted that nystagmus was also arrested when she turned toward a sound or, in one series of observations, the source of a breeze caused by fanning. It was also noted that her eyes characteristically turned toward the source before her head turned, and that the eyes were always bilaterally coordinated.

We have tentatively concluded that the arrest of nystagmus and the directing of eyes towards voice and sound were manifestations of highly motivated states which enabled processes, isolated by disease, to become temporarily integrated. Goldstein (1963) offers an admirable theoretical basis for such an interpretation.

In the third month, Yvonne was observed "peering" at her hands, a maturational event that occurs regularly in seeing children, i.e. the hands are brought before the eyes and wiggled there for long periods of time. When she did this, Yvonne's eyes converged to the centre and down, as if she were trying hard to see her hands. It seemed unlikely that shadows had been cast on the retina since these observations were made under dim lighting conditions. Also, she did not touch her face, so that tactile sensations were not a factor. It appears, therefore, that the motor pattern of wiggling the hands before the eyes may operate independently of peripheral stimulation. Even if one argues that forms must have been cast on the retina, it is still of singular interest that this phenomenon developed; for it is now clear that very little visual stimulation is necessary for its performance. Evolutionally this may have come about as a "guarantee" that eye-hand coordination would occur.

The hands-before-the-eyes behaviour dropped out a few weeks after it appeared, and at the sixth month visit Yvonne was still not reaching for objects introduced by sound or touch.

Clearly, these observations must be checked in a substantial series of blind infants, and we plan to do so.

SMILING IN INFANTS WITH OTHER ANOMALIES

No careful studies of smiling in deaf infants have been reported but we have obtained retrospective data on two deaf infants whose course of smiling was described as completely normal.

The deaf-blind reported in the literature smile. Darwin's (1872) reference to Laura Bridgeman has already been mentioned, and Goodenough (1932) reported on a one year old girl, blind and deaf from birth, in whom smiling and laughing were appropriately expressed. Thompson (1941) reported that four deaf-blind cases were not markedly different from her blind subjects (see above) in laughing, smiling and crying.

Infants with Down's syndrome (trisomy of the 21st chromosome) may smile normally and with full eye-to-eye contact, albeit several months later than normal (personal observations; see also Benda, 1960), and Dameron's (1963) remarks to the contrary seem to be in error. Although no studies are in print, I have questioned workers in the field and the general opinion was that smiling is present in all but the most severely impaired defectives. If there is any generalization to draw from this, it is that smiling tends to remain intact despite substantial biological impairment.

INNATE VERSUS LEARNED

The notion of "innateness" has never sat well in American Psychology and the early work of Dennis (1932) was the first attempt to contest such an interpretation of smiling. Dennis and his wife observed a pair of infants over their first year under conditions of minimal stimulation. He found, as did many of the above authors, that the human face was the best eliciting stimulus for smiling, but it should be noted that since by design he avoided vocalizing to the babies, he gathered little data on responsiveness to voice.

Dennis concluded that the smile appeared as a response to reduction in tension, although he admitted his data did not necessarily suggest such a position. He wondered why, for example, the baby did not smile at its milk bottle and to other objects associated with reduction in tension, but achieved no clear answer to these questions.

In dealing with the position that smiling is an innate response to a human face, Dennis referred to his own review of the literature on congenitally blinded children who had had cataracts removed. He wrote, "In accounts of their early visual reactions (after the operation), there is nothing to suggest that they instinctively smiled at the human face, or even that they instinctively chose the human face for fixation". There was apparently nothing to suggest the opposite either, and Dennis himself agreed that facile counter arguments are available, such as the waning of instinct.

In the section concerned with normative data in smiling, we have seen that time of onset and amount of smiling is affected by environmental events. For example, Brackbill (1958) has shown that smiling can be increased and decreased by schedules of social reinforcement, while Gewirtz (1963) and Ambrose (1961) have shown that time of onset and amount of smiling can vary with the amount of social stimulation. However, these studies were not concerned with the origin of smiling or the neurophysiological mechanisms involved. Recently, however, Schneirla (1959) addressed himself to this problem on a theoretical level.

Schneirla, in taking an anti-instinctivist pro-learning position, postulated that the smile is derived from a rudimentary "grimace" (early nonelicited smiling in our terminology). The "grimace", he hypothesized, is induced by low-level stimulation of the facial nerve and it thereafter becomes associated with social stimuli. Schneirla termed even the developed smile of three months a "grimace", apparently because it served the argument that smiling is gradually differentiated from early diffuse responses.

Since no data were offered to support the case that stimulation of the facial nerve elicits early eyes-closed smiling, we can assume Schneirla considered some form of external stimulation logically necessary, and his discussions on other topics in the same article and elsewhere (1961) bear this out. However, the work of Weiss and others (Weiss, 1954) shows that external stimulation is not necessary for all CNS activity, so that data and not logic is needed in this case.

In our own work (Freedman, 1965) we have found that many infants never showed nonelicited "grimace" smiling, yet they developed normal social smiling at the usual time. Also, when nonelicited smiling was present, the gradual and continuous development from diffuse to well-formed smiling, postulated by Schneirla, was not

observed. Instead, there was a distinct noncontinuity between early nonelicited smiles and later social smiles which entail eye-to-eye contact. Other observers agree that before smiling to the face develops, there is a non-smiling period in which eye-to-eye contact first takes place (Spitz and Wolf, 1946) Ahrens, 1954; Wolff, 1963), and by this time nonelicited smiling appears only rarely (Wolff, 1963).

In addition there is great variation in onset of social smiling and some infants are extremely precocious under routine hospital care (see Gewirtz, 1963; Laroche and Tcheng, 1963, for literature on age of onset). We have closely observed one infant whose first social smiles, i.e. smiling with his eyes on the caretaker's face, occurred at 3 days of age. This infant smiled consistently thereafter, exhibiting both "nonelicited" and elicited smiling throughout the first month. The infant was under routine care so that it is less pertinent to speak of learning and more pertinent to speak of a precocious capacity for smiling.

Finally, a learning view, such as Schneirla's or Dennis', should account for the fact that certain stimuli are better elicitors of smiling than others. As discussed above, the best eliciting stimuli are normally the human voice and the human face, whereas various non-living objects, more directly associated with the reduction of tension, are not smiled at. Schneirla has dealt with this point by suggesting that if the feeding bottle could be visualized during feeding instead of "just felt", the bottle would henceforth elicit smiling. However, Wilson (1960) has performed such an experiment and shown this is not the case: various stimuli visually associated with feeding were quite ineffective in eliciting smiles.

We may conclude that learning or Pavlovian explanations can tell us something about the relative strength and frequency of smiling responses under different environmental conditions, but they tell us little regarding the origin of smiling or the mechanisms involved.

What then, do the "nativists" tell us? In our own work, we have found that identical twins exhibit greater concordance than fraternal pairs in time of onset and in amount of social smiling (Freedman, 1965). Such studies, of course, say only that heredity is playing some role but nothing about the nature of this role. Ethological thinking, on the other hand, has led to the postulation of a specific neurophysiological mechanism (see section on visual elicitation of smiling), but unfortunately the evidence indicates that this hypothesis is also inadequate.

It is based on the assumption that a specific visual stimulus, a moving face-like pattern, acts as a "releaser" by disinhibiting the "innate releasing pattern", which results in smiling; but as we have seen smiling occurs regularly in the absence of vision. The moving face-like pattern must therefore be considered a facilitator of smiling rather than a primary elicitor.

Lehrman's (1954) sweeping critique of ethology contains several parallel cases, from animal behavior, in which identification of a specific "releaser" turned out to be misleading. One famous example, "short neckedness" in birds (as in hawks), had been identified as a "releaser" of escape responses in gallinacious chicks (Tinbergen, 1948); subsequent work has shown the relationship to be a good deal more complex (Curio, 1963), and in one study, gallinacious chicks which showed this escape response had apparently learned which birds not to fear (Schleidt, 1961).

In general, the fight between nativistic and learning positions has helped very

little in clarifying the mechanisms behind smiling in human babies. The representatives of both positions have so far drawn too narrow a picture, and we are reminded of other similar arguments. For example, anti-instinctivists often cite Kuo's (1932) work which makes the point that pecking in chicks is not an innate response but is dependent on the physical juxtaposition of head and heart in the egg (Lehrman, 1954; Schneirla, 1960). An instinctivist, however, can answer this argument easily by pointing out that the positions of the fetal head and heart, etc., have been channelled by evolutionary changes which must ultimately be reflected in changes at the genetic level.

On the other hand, as Lehrman has pointed out, when ethologists have spoken of organized patterns of behavior as "innate", the door to further investigation of this behavior has often been shut. For to hypothesize that a behavior is innate can only mean that the behavior appears to be evolutionally meaningful and/or that it appears to be a reflection of the organism's genotype. Beyond this, only careful investigation of the behavioral pattern will help us understand it. Beach (1955) makes the same point.

CONCLUSIONS

It is probable that cybernetic models will eventually provide an adequate theoretical basis for dealing with tangled problems like the present one. For the present, however, the evidence that the infant's smile is "innate", given the above use of the term, can be found in much of the data cited. The lack of ability for deferred imitation, i.e. imitation removed in time from the act imitated, eliminates imitation as an explanation of the young infant's smiling to non-smiling stimuli; social smiling in blind infants precludes some sort of (hypothetical) primitive imitation; the reflexive nature of early social-smiling observed in blind infants suggests an electrophysiological discharge; the twitching-myoclonic pattern of early non-elicited smiling, present in the seeing and in the blind, is similarly suggestive; the greater concordance in smiling patterns within identical-twin pairs compared to fraternal-twin pairs implies hereditary control; the inability, despite repeated attempts, to demonstrate either tension reduction or conditioning as the cause of early smiling implies a non-learned aspect; in the nonblind, over the first months, the facilitation of smiling with specific "supernormal" visual stimuli suggests an ethological-type "releasing" (read facilitating) mechanism; facilitation of the earlier smiles by a high-pitched voice can be similarly interpreted.

Some less direct evidence for innateness is: the universal presence of smiling in the great variety of cultures; the continued appearance of smiling in the congenitally blind although facial movement, in general, is greatly reduced after six years of age; the fact that smiling is intact, even if slow in developing, in defective children. Finally, there are the strong but tautological arguments regarding evolutional function. For example, the joy the baby's smile creates in the caretaker, and its continued importance as a signal of mutual positive feeling throughout life.

In conclusion, we who investigate behavior can benefit from the embryologist N. K. Brooks (quoted by Openheimer, 1954): "When we say the development of the egg is inherent must we not also say what are the relations with reference to which it is inherent? When we say it is induced, must we not also say what are the relations

with reference to which it is induced? Is there any way to find this out except scientific discovery?"

SUMMARY

The literature on smiling in infancy was briefly summarized and data were cited which appear to support the thesis that smiling in infancy is an "innate" expression. Particular emphasis was placed on observations of blind infants since ethologically oriented theories hold that smiling comes about as an "innate" response to certain visual "sign stimuli". It was found that blind, deaf and blind-deaf infants smile, which indicates that no single sensory channel is the exclusive releaser of smiling. On the other hand, it was found that vision definitely facilitated smiling since blind infants did not exhibit normal prolonged smiling until 5 or 6 months of age; instead, they exhibited fleeting, reflex-like smiling. Finally, examination of theoretical positions in current innate vs. acquired controversies pointed-up weaknesses in each position.

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