Prinzip der abstraktiven Relevanz, ein Etwas mit hochklingendem Namen in der Wissenschaft, das aber in der Lebenspraxis als Faktum jedem Schulkinde verdeutlicht werden kann. Darauf will ich hier nicht noch einmal eingehen, sondern in geradliniger Fortsetzung jener ersten logischen Analyse zwei weitere Thesen über Phoneme und Phonologie hier vorlegen.

Die erste hebt hervor, dass die Phoneme im Sprechverkehr als *Zeichen an Zeichen* fungieren. Die Wörter *Tische, Tasche, Tusche* werden von jedem deutschkundigen Hörer als drei verschiedene Lautsymbole erfasst und zwar an der Differenz ihres Stammvokales. Von dieser Art sind alle grundlegenden Feststellungen der Phonologie. Fordert nun einen Zeichentheoretiker auf, an solchen Tatbestanden sein Können zu bewähren und in exakt definierten Begriffen wiederzugeben, was hier vorliegt! Nicht wahr, so wird er anheben, Ihr betrachtet in der üblichen Weise das ganze Klanggebilde *Tasche* als ein Lautsymbol, weil es im Sprechverkehr als Zeichen steht für ein bestimmtes Ding oder eine ganze Klasse solcher Dinge. Der Vokal a darin ist ein Teil (ein Stück) dieses ganzen Klanggebildes; wenn er als Diakritikon gegen *Tusche, Tische* fungiert, dann nenne ich auch dies eine Zeichenfunktion. Es ist freilich eine andere als die Symbolfunktion; aber auch sie ist uns aus dem täglichen Leben bekannt und kommt nicht nur in der Lautsprache vor. Wenn wir sehr ähnliche Dinge leicht und sicher unterscheiden müssen, so lernen wir entweder auf subtile Eigenheiten, die sie schon an sich haben, zu achten oder wir bringen Unterscheidungszeichen eigens an ihnen an. Man nennt im Deutschen derart verwertete Eigenheiten Male oder Marken. Angeborene Hautfleckchen z. B. heissen *Muttermale*, auch Wunden und Narben sind Male; dagegen nimmt man die auf Waren angebrachten besonderen Erkennungszeichen *Marken*. Es gibt mehrere Untergruppen von Marken, neben den Warenmarken auch *Briefmarken, Stempelmarken* u. dgl. m., die ungestempelt einen gewissen Geldwert repräsentieren. In der Umgangssprache ist eine ganz scharfe Begriffsgrenze zwischen Malen und Marken nicht eingehalten; doch klänge unserem Ohre *Muttermarken* oder *Briefmale* hart und ungebräuchlich.

Was die Phoneme angeht, so wird man auch für ihre Funktion den Namen "Male" vorziehen. Denn so ist es keineswegs, dass sie einem Klanggebilde nachträglich und von aussen her angeheftet werden wie Briefmarken auf ein versandfertiges Schreiben. Nein, sie gehören mit zur Lautsubstanz des Wortklanges. Und es ist nur die Frage, ob im psychophysischen System des Sprechers einer Sprache besondere Einrichtungen nötig und getroffen sind, denen es zu verdanken ist, dass die Wortklänge bei ihrer Erzeugung schon richtig mit *Lautmalen* ausgestattet werden. Nehmen wir dies zur Kenntnis, dann ist alles beisammen, was zum einfachen Verständnis der These gehört, dass die Phoneme als Zeichen an Zeichen auftreten. Nämlich als Diakritika (Unterscheidungszeichen) an den Lautsymbolen.

Übrig bleibt aber noch eines. Nämlich zu fragen, ob die Einzellaute, von denen wir sprechen, ausser ihrem Beruf als Diakritika

der ganzen Klangbilder auch an der Symbolfunktion, die diesen zukommt, teilnehmen oder nicht. Die Antwort auf diese Frage lautet *ja* überall dort, wo Phoneme lautmalend im weitesten Sinn des Wortes auftreten; und die Antwort lautet *nein* überall dort, wo dies nicht der Fall ist. Die Auffassung der Sachverständigen geht bekanntlich dahin, dass das zweite für die weitaus überwiegende Mehrzahl der Laute in unseren Wörtern, wie sie heute sind und gebraucht werden, zutrifft. Ich habe die Angelegenheit der Lautmalerei in der "Sprachtheorie" ausführlich durchgesprochen und will nicht darauf zurückkommen. Es ist hier überflüssig, weil eine rein zeichentheoretische These zur Diskussion steht.

4. Der letzte meiner allgemeinen Sätze über die Phoneme lautet so: *Sie sind systemgetragen.* Wenn der Psychologe die Lautkataloge der sachverständigen Linguisten studiert, so findet er durchgehend vom Altertum bis heute Systemanordnungen. Geblieben ist z. B. die einleuchtende Anordnung der Konsonanten nach den massgebenden Verschlusstellen: Labiale, Dentale, Gutturale; geblieben ist einiges, was Gleichungen wie p : b = t : d = k : g symbolisierten, und noch sehr viel feinere Unterscheidungen sind neu hinzugekommen. Die Forscher um TRUBETZKOY arbeiten ausgiebig mit der Voraussetzung, dass zweigliedrige oder mehrgliedrige *Oppositionen* das System der Phoneme durchwalten. Der Psychologe und Sprachtheoretiker ist nicht berufen, im Einzelnen dazu das Wort zu ergreifen. Aber er stellt sich nach Einsichtnahme in solche Systemversuche bestimmte Fragen, die ihn angehen. Allgemeine Tatsachen fordern allgemeine Begründungen. Ist es sematologisch oder psychophysisch begründbar, dass die Lautmale an den Klangbildern der Wörter jeder Sprache der Zahl nach beschränkt (im Deutschen wohl einige Vierzig, wenn man die Diphthonge nicht mitzählt) und wohlgeordnet in Scharen oder zum mindesten in Teilsystemen auftreten? Beides gehört zusammen.

Ich werde an anderem Ort die ausführliche Antwort auf diese Frage bieten. Es ist in der Tat so, dass das psychophysische System des Menschen in diesen Dingen eine beschränkte Leistungsfähigkeit aufweist. Und damit hängt es zusammen, dass die Zahl der Phoneme auf einige Dutzend beschränkt ist und dass sie sich, wenn eine leichte und sichere Unterscheidung im Sprechverkehr garantiert sein soll, gegenseitig auseinander treiben.

WEDNESDAY, 24 JULY. AFTERNOON

INDIAN SESSION

Chairman: Prof. S. K. CHATTERJI.

39. Mr K. BHATTACHARJEE (Delhi): *Articulation of some particular species of birds in India.* [Read by Prof. DANIEL JONES.]

While introducing the subject, I beg leave to say that, since I took the line of teaching the deafmute, a strange phenomenon that leads some particular birds to articulate almost intelligibly, attracted my

admiration. Thenceforward I began to investigate the scientific basis of the faculty in those birds already taught, and I began to study the books on ornithology written by western and Indian writers for help in this direction. Theoretical study helped me very little, since very few books are available on the practical line of the subject I intend to pursue. Then I commenced my work with the species of the teachable birds both taught and untaught, and also with the birds which were unteachable, for the sake of comparison. The result was of great interest to me, and gave me a real impetus and encouragement to make a research on the subject more cautiously on purely scientific lines.

I consider that there are three different species of bird which fall into the category of the teachables, having more than one species of the respective genera. Besides their geographical distribution in other parts of the world, the parrot and the "bird of character", or as it is locally called, mayana, are distributed almost all over India, while the cockatoo is mainly found in the province of Burma and in the Andaman Islands. With the exception of a few species of each genus most of them are commonly kept tame and are frequently taught to talk.

Parrots are a large family. They are gentle, vivacious, and apt at talking. Their plumage is mostly green with a scarlet band round the neck, and they have long tapering tails. West African parrots with a red tail also make good talkers.

The "bird of character" or mayana, although by no means a songster, is able to emit a great variety of notes. A bird which can produce a large variety of sounds is almost always a good mimic, and the common native mayana is no exception to the rule. Mayanas are deep bright black with a yellow skinny projection just behind the head. The general appearance of the mayana is sometimes confused with that of the raven. Mayanas also make excellent pets because they are so alert and vivacious, above all they have so much character. They are self-assertive birds and will stand no nonsense. They are very quarrelsome too.

Cockatoos are amongst the most striking and attractive of the parrot race, most of them capable of a considerable culture in the matter of tricks and talk, and generally gentle and graceful under domestication. They are mainly white, with a pearl bloom tinge on the front, a broad backward inclining crest and puffy and loose feathering. The bare-eyed cockatoo of Western Australia, spare of crest, red throated, is also known as about the best of talkers of a numerous loquacious family.

The nature of these birds under domestication changes to a great extent. In most cases after a few months habitation in the human family they seldom want to run away when released. Food at home becomes attractive to them, and they hanker less after their natural food. They like those who are very familiar to them and specially those who feed them. Generally they become pets to women and children.

Both the parrot and the cockatoo have their bills stout and

strongly hooked, but the parrot's bill is rather short. The palate of both the birds is fully arched; there is a distinct fleshy cere at the base of the bill and the tongue is thick and fleshy. The mayana has its bill straight and pointed, though less strong than the other two. The mayana's palate is a little arched; and there is almost no cere at the base of the tongue. The tongue is thin and hard and its consistence is almost like that of soft cartilage.

The outer openings of the ear are concealed by feathers, which are often rather stiff or modified into bristle. There is no other projection, but slightly movable folds of the skin rise from the outer rim; the function of these folds is probably more that of catching sound than that of projection. The middle ear communicates with the mouth by the Eustachian tube. The auditory chain of ossicles extends between the fenestra ovalis and the tympanic membrane. Birds possess both Reissner's membrane and the organ of Corti. It was observed that most birds not only hear extremely well, but also distinguish between and understand pitch, notes and melodies.

The trachea generally is such that it tends to bulge into a large neck-pouch which is used as a resounding bag. For emitting a peculiarly harsh voice the trachea is lengthened forming a loop which lies subcutaneously. The syrinx or the lower part of the larynx is the most interesting and is absolutely a useless modification. The syrinx is a modification of the lower part of the trachea and of the adjoining bronchi. The essential organs of voice are the vibrating membrane between the cartilaginous framework and the special muscles for regulating the tension. These birds possess a special pair of internal tympani-form membranes, one on each side forming the inner or medium walls of the bronchi which are there furnished with semi-rings only. External tympani-form membrane exists, with great variation, between the specialized one or the two last tracheal rings and most of the first bronchial rings.

The most characteristic feature of the brain shows clearly a further development of the reptilian types, not always showing the terminal feature in a direct line, but rather side departures, sometimes even a secondary sinking to a lower level, and in almost every case in a direction away from those fundamentally reptilian lines which have led to the character typical of mammals. The fore-brain forms the bulk of the whole brain while the other part is thin. Owing to the small size of the olfactory lobes the anterior arms of the lateral commissure are wanting. There is very little grey matter in the cortex of the hemisphere, the surface of which is devoid of convolutions, mostly quite smooth with the exception of a very slight furrow which might be compared with the Sylvian fissure. The mid-brain is represented by optic lobes, the cortex of which alone corresponds to the corpora quadrigemina of the mammals. The right and left lobes are themselves rent asunder, and are visible from above. In comparison with the reptiles, the cerebellum shows a high development. In the posterior part it covers the optic lobes and in the anterior part it hides the much shortened medulla oblongata.

The faculty of speech is peculiarly an attribute of man, yet there

are exceptions though they are very rare. It is really a problem to answer correctly why and how an exception is possible. Several attempts have been made by some eminent scientists to discover the reasons why some animals can produce articulate sounds almost like those of man, and finally after comparative study they concluded that the larger the convolutions present in the brain process the greater is the feasibility of distinct sound production. Dr GERNER of America once made an extensive study with monkeys specially in this connexion, and found that the higher apes have a greater faculty of articulation than the lower ones. He observed that the sounds which the chimpanzee can produce after some training are almost like human vowels and consonants both in articulative form and sound quality. Besides this, their articulation is meaningful and they have the understanding of human expressions too. Dr OSCAR FUNGST, a German scientist, on learning from a newspaper of a dog's ability to speak some words, made an attempt to analyse phonetically the character of the sounds, but he came to the conclusion that the phenomenon was a sort of illusion and that the sounds had no articulative value. If we regard convolutions in the brain process as a pre-requisite of the existence of speech faculty, it is interesting to notice that there is very little of it in these birds. Although their organs of speech and hearing are almost normal and intact, yet in the absence of necessary convolutions in the brain having different motor and sensory areas, it is very difficult to see how their power of speech production is possible. It seems then, that besides the characteristic brain development which exists in them, there are some faint traces of motor and sensory development in the particular area, having slight relation to the link of nerve and association fibres, which helps to stimulate the auditory centre, to excite automatically the motor nerve of the speech centre and thereby articulation follows. I cannot see how this can be explained in any other manner.

The structure of the organs of speech of these birds is also in no way a handicap to their speech production, excepting that their bills are not flexible for vowel configuration. This, however, is adjusted particularly by the modifications of the tongue for all vowels. It is, perhaps, needless to mention that most of the vowels, even the back-rounded vowels, can be formed without the modification of the lips, although they may differ in sound quality; while for the front and mid-vowels the hard bills of the birds serve quite well for the purpose. The bi-labial consonants are formed mainly with the contact of the gummy projections on both the inner sides of the bills, the hard part of the bills being brought together and separated either with an audible expulsion of breath or vocalization. For denti-linguals, the upper bill and the fore-part of the palate serve the purpose of the teeth, and for denti-alveolars, palatals, velars, rolled, lateral non-fricatives, sibilants, open glottals, and nasals, the normal intactness of the necessary organs is sufficient to make their correct articulative formation possible. The denti-labial fricative elements do not exist in most Indian vernaculars, with the important exception of Urdu, which contains elements derived from both Arabic and Persian. The birds which up till now have come into my survey have been tamed and taught in the provinces where this element is absent from the sound-systems. This fricative element can also be expected to be formed with both the bills almost shut leaving a thin aperture in between the two and a stream of breath forced through. The sound of **w** is formed in all cases as **o** (in *go*), since the bills fail to give the sound a "dark" quality which is produced by close rounding of the lips. From this short phonetical explanation it will be seen that, within the capacity of these birds, articulation, though with various sound deviations and to a limited extent, is not an impossibility, provided their brain process co-operates to help the object.

These birds of teachable quality are generally taken in at an age when they are unable to feed themselves, and at this period the teaching commences along with taming. Though all wish that their birds should learn to talk, very few people proceed either scientifically or with a definite motive. It is merely the casual habit of asking the birds to talk and utter some names of gods and goddesses, which the women are accustomed to do especially in the mornings and also occasionally at other times of the day, that results in their articulation. All of them follow the same principles of learning to articulate through imitation on hearing human speech, just as our babies do. The understanding of language is first noticed when they express obedience to particular commands by slightly nodding their heads, and when they emit shrills at the appearance of somebody well known. Whenever anything is said they try to follow keenly through hearing. Constant repetition of the same word or sound is necessary until articulative response begins. From this time the bird tries to move the tongue to and fro as if it is placing it in some particular position for articulation. Simultaneously with this movement of the tongue in combination with voice a sound is produced which sounds to our ear as something other than their natural voice or sound of communication. This first articulative effort may be called babbling of the bird, which generally begins after a teaching of three months. This power of babbling ensures in most cases their capability of gradually forming definite vocabularies. Within a period of three to six months from the time of babbling the birds commence to use what we might call real speaking, and gradually extend their capacity. They do not always understand the meaning of the expressions which they use in the beginning; these are simply the outcome of imitation. After a year or so from the time of their acquiring some words or expressions, natural articulative or speech expressions according to their needs begin to develop, with a gradual progress to their limited capacity. It is at this stage that the natural faculty to imitate odd words from conversation is mainly observed.

It is also distinctly seen that the environment plays a prominent part in their achievement. Hoarseness or softness, vulgar or polished expressions, etc., are due to the home conditions in which they live.

Naturally in low homes they are apt to pick up more slang expressions than in more refined ones. In this connexion I am reminded of the opinion of Mr DOUGLAS DEWAR, who from his experience of some talking birds, perhaps particularly of low homes in India, says: "If you want to make a bird talk quickly, use plenty of bad language in front of it." But from my practical experience I differ. Anyway it does not make any difference to the main conclusion. Of course, vocabularies of a profane nature have also been heard in some cases from birds, particularly those residing in low homes; but even they were started with good words. Mr DEWAR's suggestion of teaching through gramophone records under the name of *Polly's Lesson* attracted my attention, but I have not as yet been able to experiment with it.

In cases where no response was perceived at all or where the talking stopped at the babbling stage, the birds were examined from anatomical and physiological points of view under all possible tests, both in regard to the organs and the sense of hearing, and since no defect of either nature was detected we may fairly conclude that the non-response was not the result of deafness or any other ear disease, but that it was possibly due to lack of development of the speech centre in the brain. In these cases it was noticed that at the very appearance of the teacher the bird became annoyed and irritated, while other members of the family never disturbed their normal mood. In such cases they even preferred to go without food than to take it from the teacher's hand. Thinking that the aversion might be against the particular individual teacher and not to the act of learning at all, further attempts were made, with someone else, but even so no appreciable response was experienced. Along with the teachable birds the birds of unteachable quality, such as doves, pigeons, etc., were also tried, but though they have the power of hearing, no articulative effort was shown at all.

A few specimens of the talk of these birds are given below, with their phonetical analysis. They are represented in International Phonetic characters. The meanings of the expressions are also given in English.

1. Parrot: captured at the age of three months; began to babble after two months' attempt; formed a vocabulary at the age of ten months, present age three years. Language as follows: **ʈai ʈo bɒ te go, se sɒb kɒpale kɒre** (*All is due to fate*). The lady of the house used to use this expression and the bird learned it by himself on hearing it. **chatu khabe. o ma kothi, ma** (*Will you eat? Oh mother, where are you?*) This sentence was uttered as the time for feeding approached. In the meantime a hawker passed by shouting: **ɖoi ɖoi ɖoi** (*Curd, curd, curd*), and the bird also repeated the same word three times.

Analysing these expressions phonetically it was found that **s** and **r** were not formed completely, and instead the bird gave the vowel **ɔ**. The elements **m, p, b** and **ʈ, c** and a few vowels were tried. The vowels and the consonants **k** and **ʈ** were distinct to a great extent.

2. Mayana: present age five years; teaching began at the age of six months. **babu pɹoʈo. ku ku ku** (whistle). **ma, raɖhe kriʃnɒ ram. ma, kɒta bajlo. ha ha** [*Gentleman read on* (whistle). *Mother, names of God and Goddess. Mother, what is the time? Ha Ha* (laughing)].

The elements excepting **r** and **ʈ** are more or less distinct. Vowel sounds are not very intelligible in all words.

3. Cockatoo: present age fifty years; teaching commenced at a very early age. The master stated that the bird was purchased before his birth, and was left to him by his grandfather. **khoka, babu eseche. o ke kakaʈua** (*You boy! Some gentleman has come. Who is he? Cockatoo*). This expression was uttered just as I entered the house where the bird was. The vowels and consonants in the words were very distinct.

4. Mayana: present age six months; taught particularly with elements only and special care was taken to keep the bird away from hearing human speech. Four elements were tried, which were **p, b, t, k,** and **c, ʈ**. After six months' effort, a little attempt at babbling and **ʈ** and **k** were heard. Whistling was often heard during the time of teaching.

The articulation of the parrots and cockatoos sounds more akin to the human sound quality than that of the mayana, which in my opinion is particularly due to the more fleshy structure of the tongue of the former birds.

Though the articulation of these birds is not always very distinct to strangers, yet at times it creates an astounding effect on them. In this way they babble, form vocabularies, express their ideas in meaningful sentences, and when necessary they command, ask for food and inform the master of visitors' calls. Their understanding of human speech also is good, though limited in extent, since they have only a restricted sphere of ideas. Both their power of imitation and of articulate expression are natural, and it is even more surprising that they can imitate any sounds from the crack of a whip and the exhortation of a bullock-cart driver to the throat-clearing operation of men.

In conclusion I should like to say that the statement made in this paper is not claimed to be in any way exhaustive; it is simply an account of my limited experiments. I shall be very glad and encouraged if this short account of my original work can create some interest in scientific circles.

40. Prof. S. K. CHATTERJI (Calcutta): *Phonetics in the study of classical and sacred languages in the East.*

This paper was illustrated by some twenty-nine lantern slides, and in it the following topics were described and discussed: (i) the indication of tones in Veda chanting by means of the gestures of the hand and the fingers, (ii) the methods followed in Ancient and Mediaeval China and Japan to ensure the proper articulation of Sanskrit, (iii) Arabic phonetics and the diagrams used in books of Arabic phonetics, and (iv) the transliteration of Hindi (Braj-bhakha) words in a seventeenth-century treatise in Persian on Braj-bhakha language and literature.