paratus, microscopes, minerals and zoological specimens have already notified the Special Committee of their intention to exhibit. The goods here displayed are to be kept over for the Ninth Cincinnati Industrial Exposition, opening September 7, the Managers of which have offered special premiums for this class of exhibits.

The local executive committee comprises the following names: A. T. Goshorn, Chairman; F. W. Clarke, Ormond Stone, Secretaries; Julius Dexter, Treasurer; J. D. Cox, William McAlpin, Herbert Jenney, George W. Jones, Archer Brown, C. W. Wendte, Robert Brown, Jr.

CONTRIBUTIONS TO COMPARATIVE PSYCHOLOGY.

By S. V. Clevenger, M. D.

II. LANGUAGE.

Excepting in Kussmaul's (1) elaborate essay, speech has had but little consideration anatomically and physiologically. The philologists and ethnologists have been trying to interpret phenomena while ignoring the mechanism directly concerned therein. As readily might the operations of a locomotive be explained by a person who had never seen one. Herbert Spencer, on the origin of language, is discursive and inconclusive. Darwin passes hastily over the subject in his "Descent of Man," but later (2) lays the foundation for a proper study. Bastian may be taken as the representative of the majority expressing opinions on language (3). He says: "Language was started by some hidden and unknown process of natural development or as a still more occult God-sent gift to man." If inquiries are to terminate in such assumptions, why not extend our conceptions of occult God-sent gifts, to the explanation of the Universe? Bastian's words mean, "I cannot fathom it, therefore, no one should try to do so."

Mivart (4) adopts the usually accepted divisions of language:

I. Sounds which are neither articulate nor rational, such as cries of pain, or the murmur of a mother to her infant.

II. Sounds which are articulate, but not rational, such as the talk of parrots, or of certain idiots, who will repeat, without comprehending, every phrase they hear.

III. Sounds which are rational, but not articulate, such as the inarticulate ejaculations by which we sometimes express assent or dissent from given propositions.

IV. Sounds which are both rational and articulate, constituting true speech.

V. Gestures which do not answer to rational conceptions, but are merely the manifestations of emotions and feelings.

VI. Gestures which do answer to rational conceptions and are, therefore, external, but not oral manifestations of the *mental* word. Such are many of the gestures of deaf mutes, who, being incapable of articulating words, have invented or acquired a language of gesture.

Analyzing these divisions, we find therein the prevailing idea to be that:

I. Language consists of speech and gesture (This essay will be directed toward proving that speech is also gesture; hence *Language is gesture accompanied, or not accompanied with sounds*).*

II. Language is voluntary or involuntary.

An impassable gulf exists between the voluntary and the involuntary in the minds of those who are disposed to reverence authority more than logic. The history of human thought proves Agnosticism to be a far better friend to man than Vaticanism or its disguises. Huxley (5) concludes that "We are conscious automata endowed with free will in the only intelligible sense of that much-abused term—inasmuch as in many respects we are able to do as we like—but none the less parts of the great series of causes and effects, which in unbroken continuity, composes that which is, and has been, and shall be—the sum of existence. As to the logical consequences of this conviction of mine, I may be permitted to remark that logical consequences are the scarecrows of fools, and the beacons of wise men. The only question which any wise man can ask himself, and which any honest man will ask himself, is whether a doctrine is true or false?" Kussmaul (6) feels justified in claiming that "each act of the will is always also the realization of a movement image previously sketched out in the recollection, or an entire chain of such movement images." * * * "*What we call the will is not only a motor, but always a sensory process.*" That which is involuntary in our actions appears, neurologically speaking, to be most evidently reflex, and those who know most about the mechanism of the will, know also that it is none the less reflex for being complex, or for having evaded the analysis of dualists and those ecclesiastically biased. It is from this automatical basis that I seek an explanation for the hitherto inexplicable. Brown-Sequard insists that speech is a reflex phenomenon (21). We find certain muscles, tendons, bones and cartilages concerned in mastication, and deglutition of food common to many vertebrates. Many of these same parts, separately or conjointly, prove useful to these animals in noise production: A woodpecker (7) finds by drumming rapidly upon a sonorous piece of wood, that he excites the admiration of his kind, and attracts attention to himself. When he repeats the operation for the distinct purpose of exciting admiration and attracting attention, he uses as much and precisely the same kind of reason, as the serenader, who pours out his rhyme to the jingle of a guitar. Wilder (8) speaks of the inharmonious feline nocturnes, and *Lieder ohne Worte*, but cats to whom that sort of music is addressed, find it quite as rational and expressive as the seranaded biped, and the greater part of both sorts of caterwauling, may be interpreted to mean the same thing, inharmonious only to those not interested.

Thus the brays, snorts, shrieks, grunts, etc., of the myriad kinds of animals are only methods for expressing their satisfaction or displeasure. Many such sounds being made use of after their accidental origination. The North American Indian uses the hoggish grunt in affirmation, and a perusal of Darwin's "Expression of the Emotions in Man and Animals" would be profitable to philologists who are not too strongly permeated by a metaphysical bias. At the outset any animal having observed that its noises, of whatever origin, attract attention of other animals would be led to the use of such noises as are serviceable. All that follows is simply an improvement upon these conceptions, and the animal that uses one noise or gesture, or a thousand, to bring itself into relation with other animals, expresses, in so doing, an idea, conveys a thought and hence speaks.

But this matter of reason and language possessed by animals has been ably worked out by observers and thinkers (9).

When water in an engine boiler is low and the alarm whistles through a simple float device; or when portions of machinery jar and scrape, the necessity for more water or oil is conveyed to the engineer's mind, and by a means comparable to the mechanism of crying. Just so the colony of beavers dive out of sight when they hear the warning slap of the sentinel's tail.

* No attempt at a perfect definition is made here. In fact the impossibility of absolute definiteness, in a world where everything is relative, seems, in this instance, not to have occurred to the metaphysicians. Language, owing to its blending of voluntary and involuntary, and consisting of gestures, used thoughtlessly, as well as those for expressing thought, is inseparable from other animal activities. One definition of Life is that it consists of Motion, but everything moves, hence everything lives, and there is no such thing as Death. Even the mathematical definition of a point is absurd and unthinkable. Who can define Health or Disease satisfactorily?

Professor Whitney, of Yale (10), thinks that "there needs to be, perhaps, a radical stirring up of the subject, a ventilation of a somewhat breezy, even gusty order, which shall make words fly high and noisily against one another before agreement shall be reached. If so, the sooner it is brought, in whatever way, the better; and they are no true promoters of the progress of Science who strive to smooth things over on the surface and act as if all were serene and accordant below." The gentleman just quoted might have made short work of his opponents had he approached the controversy physiologically.

M. Renan (11) says: "Languages have sprung forth completely formed from the very mould of the human spirit like Minerva from the head of Jupiter." Schleicher, Steinthal and Müller are guilty of similar puerilities. The latter claims that "animals cannot talk because they have no general ideas; they evidently have no general ideas because they do not talk." This sort of reasoning might be pardonable in scholars of metaphysical tendencies, but when we find Carl Vogt refusing to deal with the question, and Haeckel (12) saying, "Our ape-like progenitor very probably did not possess an articulate language of ideas," the appearance of this essay does not seem to require an apology. To deny, as Mivart (13) does, that "the cat, or any other beast or bird" has the gift of speech, and to base this denial upon man having a peculiar language of sounds and gestures to express his thoughts, is quite as sensible a proceeding as for the woodpecker to taunt man with his inability to drum in its peculiar way. "Psychology," says Mivart, "denotes the study of all the activities, both simultaneous and successive, which any living creature may exhibit." Mivart, therefore, is the grossest kind of materialist, without knowing it, for "Psyche," after this definition, consists of motion alone, and this pre-supposes a material origin. Kruse (14) mentions a deaf and dumb lad who, after having acquired a gesture language, told of years of abuse to which he had been subjected by an inhuman father and narrated other details of his previous life. Kussmaul cites this as an evidence of the speech faculty, upon its creation, finding everything prepared for it in the way of ideas to convey. The phylogenesis of speech should be studied by proper consideration of such facts. The dog only needs human speech to tell in words what he thinks and expresses in every other way beside when his master takes a gun to start on a hunt for game.

We may set aside all consideration of sound in language by remembering that persons entirely deaf may converse in the regular way, "judging of what was said by the movements of the lips and tongue, which they had learned to connect with particular syllables; and regulating their own voices in reply by their voluntary power, guided in its exercise by their muscular sensations" (15).

Speech therefore is the same as any other muscular act under the control of the will. The jaw is a limb, the parts accessory to which and concerned in its movements are as susceptible of cultivation as is the arm, and in the matter of speech acquisition, and the gradually better and better subjection to the mind of all bodily parts concerned in its expression. Herbert Spencer's words are applicable though the passages here given had no reference to the point under consideration:

"Functions, like structures, arise by progressive differentiations just as an organ is first an indefinite rudiment having nothing but some most general characteristic in common with the form it is ultimately to take; so a function begins as a kind of action, that is like the kind of action it will eventually become, only in a very vague way." (16) Thus a "lecture" by the Rev. Joseph Cook was predetermined by the bark of the primordial dog. (Vogt says "let them bark, it is their nature.")

"In animals, however, besides analogously structural changes wrought during the period of growth by subjection to circumstances unlike the ordinary circumstances, there are structural changes similarly wrought after maturity has been reached. Organs that have arrived at their full size possess a certain modifiability." (17) (This I would apply to the structural changes in the brain inevitable upon language learning as well as to those occurring through training or drilling in any art or trade involving manual dexterity or proficiency.)

"The growth of muscles exercised to an unusual degree is a matter of common observation. In the often cited blacksmith's arm, the dancer's legs, and the jockey's crural adductors we have marked examples of modifiability which almost every one has to some extent experienced. It is needless to multiply proofs. The occurrence of changes in the structure of the skin when exposed to a stress of function is also familiar. That thickening of the epidermis on a laborer's palm results from continuous pressure and friction is certain." * * * "An orchestral conductor gains by continual practice an unusually great ability to discriminate differences of sound, and in the finger reading of the blind we have evidence that the sense of touch may be brought by exercise to a far higher capability than is ordinary. The increase of power which habitual exertion gives to mental faculties needs no illustration, every person of education has personal experience of it." (18)

Language, therefore, may be regarded as pure gesticulation and its perfectibility as dependent upon the gradual evolution of the reasoning powers of animals. This being the case, it requires but a glance at the construction of the jargons of to-day (by courtesy called languages) to convince us of the very low plane to which man with his much vaunted intellect has arrived. From the teleological standpoint, certainly German with its nonsensical genders, French with its slaughter of letters for euphony sake, and English with its multitude of barbarisms, must have had more of a malign than divine origin. (But then the tower of Babel story accounts for it all.) Maudsley (19) mentions the inability of the Bosjesmen to talk in the dark, owing to their depending more upon signs than vocables for intercommunication. The North American Indians can thus converse without uttering a single sound. Laura Bridgeman may also be mentioned as expressing her thoughts, and even "muttering" in her dreams by finger motions. The necessity for such considerations as the foregoing appears in the philological bias which has crept into our physiological literature through the one-sided studies of such men as von Schlegel, and through their claims that the perfectly regular and complex construction of languages of many barbarous nations is a proof of the divine origin of language. By placing language upon an equal footing with all other voluntary gestures we see at once that speech is entitled to no more regard than any other set of complex motions performed by any animal to subserve rational purposes. We cannot deny the possession of rational language to animals when we see them conveying their thoughts and desires with and without sounds, by menaces, contortions, glarings, and a multitude of other movements. I have known mules and oxen on the arid plains of the West to acquaint a thirsty herd half a mile away that water has been discovered. All of us know of the hen's ability to talk to its chickens. The most perfect rhetoric and oratory of man can be said, therefore, to differ from these animal expressions only *in degree*, and often the most pretentious discourse conveys fewer ideas than the cluck of a hen or the growl of a dog. A pure linguist, hence, can claim but little more in an intellectual way than a pure gymnast. Different groups of muscles, nerves, bones, etc., are exercised and cultivated by each. Man can claim no more for developing adroitness in the use of his jaws, lips, tongue and larynx than any animal which, finding itself in possession of certain other limbs and groups of muscles turns them to the utmost possible advantage. The great function of the jaw was masticatory, its use

in enunciation of words was subsequently developed. The hands of our progenitors were adapted to climbing trees and by subsequent training are made dexterous in us in the use of tools. The point I desire to bring prominently into view is, that the speech faculty has for its basis nothing more important than prehensile abilities. The mechanic is entitled to the same amount of respect as the linguist; in fact, the mechanic is more apt to have acquired a respectable amount of skill in the use of his tools, as generally his labor is directed to some useful and definite end; not necessarily so with the linguist, his acquisition of a few jargons frequently causes him to be mistakenly regarded as intellectual. It is not the ability to use tools or to speak that elevates man above his fellow animals, for man is not the only animal that speaks or uses tools. The intellectual differences between men consist in the greater power of co-ordination and correlation of faculties.

Dr. M. Dax, in 1836, designated the left anterior lobe of the brain as the seat of language, because loss of speech often coexisted with disease of this part, though the labors of Bouilland previously had paved the way for this definiteness. Aubertin and Broca finally assigned this faculty as centralized in the "operculum," and Dr. Wm. A. Hammond (20), in reviewing the subject, concludes that: "The integrity of the posterior part of the third frontal convolution, and perhaps of the second, is indispensable to the normal operation of the function of speech." Hughlings Jackson, and Ferrier agree with Broca in restricting the location to the operculum, but Dr. Hammond (20) claims:

1. "That the organ of language is situated in both hemispheres, and in that part which is nourished by the middle cerebral artery.

2. "That while the more frequent occurrence of right hemiplegia, in connection with aphasia, is in great part the result of the anatomical arrangements of the arteries which favors embolism on that side, there is strong evidence to show that the left side of the brain is more intimately connected with the faculty of speech than the right."

I would like to suggest to the advocates of opercular and insular localization an idea which has probably not been previously advanced, to wit: The sinistral nature of central cerebral speech innervation has, doubtless, some relation to the azygous tendencies of the parts concerned therein; for example, the tongue, uvula, maxillæ, vocal cords, etc., though not strictly fused or impaired, present peculiarities of structure and synchronism of motion of the bi-laterally placed parts widely different from those of the extremities, which could easily influence innervation to centralize upon one side of the brain, particularly when favored by the better blood supply afforded by the left middle cerebral artery. Were the two hands of man joined so as to restrict motion mainly to a perpendicular plane, as in the case of the lower jaw, then we might expect the summit of the ascending frontal convolution on the left side to develop over the corresponding part on the right side as a centre for arm motions. But this matter of localization has not been firmly established. Dr. E. C. Spitzka, before the Medical Society of the County of New York in 1877, reviewed "The Localization of Cerebral Diseases in the Light of recent Anatomical Discoveries" (22). Spitzka acknowledged that "the fibres which ultimately abut in the hypoglossal and facial nerve nuclei can be traced into the operculum and island, giving us an anatomical basis for the aphasic symptom," but insisted that "our faculty of speech is certainly more complex than is generally supposed, and the terms amnesic and ataxic aphasia, by no means exhaust the possible pathological interferences with its delicate mechanism. The first step in the acquirement of speech is its phonetic element. We hear a word or sound, and as far as it is a mere sound impression it is registered in a sensory area of the cortex. We then experiment, as it were, with our motor apparatus, until we find the combination requisite to repeat said word or sound. This motor innervation has its conscious seat in Meynert's region, while the sensory perception is located in a distant area (probably, though not certainly) the occipital lobe. Now in order that the sensory perception may control the "correctness" of the motor expression the two must be associated. It will then be indifferent, whether the sensory center, the motor center, or the associating band be destroyed, we will have aphasia in either case. And there are still more intimate relations which may be equally interfered with, causing either aphasia, agraphia, alexia, or a combination of any two of these, or all." * * * "Any intricate intellectual processes *must* involve the greater part, or the whole, of one hemisphere." This was *a posteriori* completely, and "localizers" should not fail to read the proceedings of that meeting carefully. These views are consistent with the theory I recently presented to the American Neurological Society concerning the histogenetic function of nerve cells in opposition to their being "force producers." Spitzka has shown that the Island of Reil has nothing whatever to do with the development of the speech faculty. In some aberrant forms he found this lobe largely developed. It would seem that primarily this region has, if it have any connection at all with speech innervation, only a certain convenience of situation, an accidental contiguity to certain fasciculi which was taken advantage of as the speech faculty developed.

(1). Ziemssen's Cyclopædia.
(2). "Expression of the Emotions in Man and Animals."
(3). "The Brain as an organ of the Mind."
(4). "The Cat.'
(5). "On the Hypothesis that Animals are Automata and its history."
(6). Op. Cit.
(7). The Duke of Argyll, in *Nature*. See "SCIENCE," Vol. I, p. 24.
(8). "Anatomical uses of the Cat."
(9). Houzeau. "*Etude sur les facultés mentales des animaux comparées à celles de l'homme*, Mons. 1872. Bechstein "*Naturgeschichte der Hof und Stubenvogel.*, C. G. Leroy, Intelligence and Perfectibility of Animals."
(10). "Are languages Institutions? *Contemporary Review*.
(11). "*Origine du Langage*," Chap. III.
(12). *Naturliche Schöpfungsgeschichte*."
13. Op. Cit.
(14). "*Ueber die Taubstummen*" *u. s. w. Schleswig*, 1853, *S.* 54.
(15). Carpenter's Physiology, p. 727.
(16). Principles of Biology, Vol. I., p. 157.
(17). Ibid, Chap. V., p. 184.
(18). Loc. Cit., p. 187.
(19). "Physiology of the Mind.
(20). "Diseases of the Nervous System," Seventh Edition, 1881, p. 182, *et seq.*
(21). E. C. Seguin, *Quarterly Journal of Psychological Medicine*, Jan. 1868.
(22). Journal Nervous and Mental Disease, Vol. IV, pp. 724-734.

ÆTHER.

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The laws of æthereal action and re-action are laws of action and re-action in an elastic atmosphere.

The following well known laws have an important bearing upon photodynamics and other æthereal researches:

1. Cyclical activities may often be accurately represented by formulas which introduce mean or average ve-