

deriving any required oblique view from the original direct ones.

The new base line  $L''L'''$  being drawn, all the points of No. 7 are projected in a direction parallel to it, in the construction of No. 8. Setting up a vertical reference line  $y'y'$ ,—that is, a line perpendicular to the base line,—corresponding to  $y'y'$  of No. 6, and recollecting that this is the extreme left of this view, just the same as though the horizontal plane had not been changed, we project  $q$  to that line, thus fixing one point of the ellipse of the lower base of what once was the vertical cylinder.

It will be observed also that this ellipse is to be tangent to  $y'y'$ , and the problem may be presented in this form: Given, the major axis and a tangent to the curve, to construct the ellipse. The solution will also appear from Fig. 276; for, if  $FP$  be the tangent, it cuts the major axis produced at  $F$ , whence we draw  $FD$  tangent to the circle whose diameter is  $AB$ , find the point of tangency  $D$ , and draw  $DP$  perpendicular to  $AB$ ,  $DP$  cuts  $FP$  in  $P$ , and  $PR$ , parallel to  $AB$ , cuts  $DC$  in  $R$ , giving  $CR$  the length of the semi-minor axis.

This will not always be a practicable mode of operation, because it may happen that the given tangent will be so nearly parallel to the major axis that  $F$  will be inaccessible. Still in many cases it can be employed, and the trouble of finding a point in the new curve saved.

The best mode of proceeding, then, is to find the new positions of  $u$  and  $z$ , and to construct the axes of the ellipses as explained in connection with Fig. 7, by drawing perpendiculars to  $uz$  at its extremities, equal in length to the radius of the cylinder, which will be the major axis; from which the minor axis of the lower base is to be determined as in Fig. 276. By this means we save time, and also make the construction of our new view more reliable, since we make sure at the very beginning that it shall endure the test spoken of previously, that is, that the apparent diameter of the cylinder shall be equal to the real diameter in any projection, however inclined. A similar construction may and should be adopted in drawing the other cylinder, which thus far was parallel to the horizontal plane, but will now be seen obliquely in all the views: we will naturally fix upon  $w$ , the intersection of the two axes, as one very serviceable point in locating the axis, and for another we may take  $v$ , which will be the centre of the ellipse representing the outer base of the cylinder.

It may be stated as a general rule, though we hope it will occur to our readers without the need of our stating it, that in the drawing of any solid which has an axis, or centre line, in any projection, that axis should always be determined and made a reference line in the process of construction, whether it be retained or not. In finished drawings or pictures, for illustrative purposes only, these lines are very frequently omitted in inking, though in working plans they are invariably put in, or at least ought to be; but in the construction they are indispensable, forming a skeleton upon which the other parts are placed.

By the ordinary mode of proceeding, which it is not worth while again to give in detail, we may construct from the two elevations, Nos. 7 and 8, the top view of the object in this position, thus completing the group, Nos. 7, 8, 9, in which the cylinders are shown after having been revolved successively about the three axes mentioned in connection with Fig. 185. We have not given detailed explanations of the steps of finding the curves of intersection, for the simple reason that there is nothing whatever involved in them in any way different from the process of finding the projections of the axes, the bases, or any other lines than these curves, which may be supposed to lie on the surfaces of the cylinders, and if the reader can go through with the operations involved in drawing the cylinders themselves, he will not find any difficulty in drawing the intersection.

But it is worth while to remark, that although we have thus shown that it is not necessary to go through the whole routine of this method of revolving the body as before explained, yet the abbreviation has not been carried to its limit. Supposing that the object is to obtain the last group, consisting of Nos. 7, 8, 9, we may do it with the aid of only three other views. In order to illustrate this, we have in Fig. 277 shown the operation in full, drawing, however, only the axes of the cylinders. In the first place, it is to be noted that only two views, Nos. 1 and 2, are needed to define perfectly the object in its first position, if it be known that it consists of two intersecting cylinders. Next, the top view, No. 6, is needed, but it may be at once constructed from Nos. 2 and 1 without making No. 5 at all, and that view was not used in the subsequent proceedings, as the altitudes in No. 7 were or might have been measured from  $L'L'$  in No. 2 as well as in No. 5. In this series of skeleton diagrams we have introduced the successive base lines  $L'L'$ ,  $L''L''$ ,  $L'''L'''$ ,  $L''''L''''$ , and the reference lines  $y'y'$ ,  $y''y''$ , precisely as in the preceding drawings of the complete cylinders; also the different views which it is necessary to use are numbered to correspond in both cases. The skeletons also are completely lettered, the same letter indicating the same point throughout, with which aid the student should be able to trace the operation.

But he is advised in this as in all other cases—as he often has been and will be—not to rely upon an examination and a study of the diagram alone, but to make the construction for himself, and not to be satisfied until he can go through the whole operation with a clear understanding of the meaning of every line. In this skeleton construction particularly, he will find that he must exercise his imagination to some extent; the marks as they appear on the paper are not intended to seem as though they lay merely on its surface, but should convey the idea that they stand out from it with the various degrees of prominence due to the conditions of the case. And here the aid of a model, which may be never so rudely made of two bits of wood or wire, will be found of no small service to those who find difficulty in realizing, from an inspection of the figures, just how the lines which are represented by the lines which are drawn really stand in space. Less difficulty is usually experienced in reading a drawing of a tangible, solid object with all its dimensions of sensible magnitude, than in comprehending the relations between the projections of a mere abstract line, and the line itself. It was for this reason that such objects were first selected; but in subsequent operations it will be found necessary to train the imagination to such an extent as to enable the operator, if he wishes to proceed intelligently, to form clear conceptions of the relations between abstract lines and surfaces, which may be represented by drawings; and no time is better than the present to begin such training. In problems of this kind, as before remarked, the determination of the axes is or should be the first step in the construction of each view; it is not, of course, necessary to make the skeletons of all the views first, nor indeed would it practically be advisable in all cases, since the space occupied by a complete view is to be taken into account in arranging the series required to good advantage on the paper; but practice in the sort of work illustrated in Fig. 277 is now in order, and will be found most beneficial. And the student ambitious to improve will find it also a

good thing to make additional exercises for himself, by drawing in various positions the other examples of intersecting surfaces which have been given.

## WHAT IS THE MEANING OF HUMAN PERSONALITY?

By HENRY J. SLACK, F.G.S., Sec. R.M.S.

WHAT constitutes human personality? It is a kind of consciousness, complex in character. Memory is concerned in it, or we should not associate the past sufficiently with the present, or with the closely recent, to supply the means of forming the conception of continuity.

Dugald Stewart remarked that "we can not properly be said to be conscious of our existence, our knowledge of this fact being necessarily posterior in the order of time to the consciousness of those sensations by which it is suggested." The time occupied in the transmission of an impression from, say a finger, with its sense of touch, to the sensorium, and its conversion into a sensation of resistance, hardness, softness, smoothness, or roughness, is a minute fraction of a second. Nerve action, like electrical action, appears to consist in pulsations, and the personality of the supposed simpler creature with the lower personality would consist in intermittent productions of consciousness. But, if personality is a matter of consciousness, and is thus distinguished from the mere individual or distinct existence belonging to minerals, such a being would be, and not be, a person, in alternations, like the beats of a clock. The unconscious intervals might be long or short; the sensation would be the same. It is conceivable that beings might exist those pulsations of consciousness and personality varied from millionths of a second to millions of years. If able to think, and satisfied with Descartes' maxim, *cogito ergo sum*—"I think therefore I am"—one such would be certified of its existence through either alternating millionths of a second or millions of years.

Dr. Carpenter's view of personality involves a series of nervous actions, each of which may be regarded as pulsations; and we have no reason to affirm that the rate of our nerve action, or pulsation, is the only one that can answer the purpose of producing a sense of personality bearing analogy to our own. We set our clocks by the beats of seconds; but if we lived on the sun, and had sight of the central sun round which he is supposed to move and carry his attendant worlds in millions of years, we might substitute centuries for seconds as our time units, and perhaps could do well with nerve pulsations proportionably long in their intermittent intervals. At each beat we should be persons, in the intervals no persons; but memory and consciousness would tie together the periods of personality, and those of no personality could be known only as inferences which knowledge might enable us to draw.

If personality, such as Dr. Carpenter defines it, could exist in all the stages of insect life—egg, grub, chrysalis, butterfly—the sense of continuity would be handed on through quite different states of existence. In the case of man, his healthiest normal personality runs through periods in which he develops, or changes, within limits that are much narrower, and which cause him to retain one character, or nature, throughout. In many cases of insanity, however, the change of character is so great that the afflicted person may be said to have become some one else. "A man beside himself" is a well-known phrase, intimating the sort of dual being that passion, or disease, or narcotics may make of what should be an orderly uniform being.

The perceptive, the intellectual, and the moral faculties are all subject to modification from cerebral disturbance, or disease. In some cases the sufferer is conscious of his errors or delusions; and a well-known physician, having the care of the insane informs the writer that hopes and prospects of cure are then much stronger than when the patient can not be persuaded there is any thing wrong with him. In these instances there is a kind of double personality, one surveying the other, and knowing it to be wrong-headed. When the errors, or delusions, are not recognized, the personality is single, but different from that which existed in a sound state. When insane people of normally good characters fancy they have committed crimes, and feel horror and remorse, the character, or personality, remains the same, but is the victim of delusion. From this mode of speaking it must not be supposed that character and personality are regarded as the same thing; but what is called *character* consists in attributes of the personality, and when those attributes suffer a great change, the result is like a transformation of one person into another. Thus, in a case mentioned by Forbes Winslow, on the authority of Dr. Briere de Boismont, a person in high office, who had performed the duties of his station satisfactorily, and in private life exhibited generosity and honesty, became mean, avaricious, licentious, and fraudulent. Similar disorders cause "the brave and heroic to become as timid and bashful as any; maiden in particular states of ill health. Mild, inoffensive, and humane men are driven to acts of desperation and cruelty;" and modest girls indulge in indecent actions and disgusting talk. The late Forbes Winslow thought such outbursts of evil came from the "innate corruption and natural depravity of the human heart;" but scientific men do not allow theological crochets to serve as explanations for physical facts; and although no one can afford the slightest explanation of why and how thought and emotion are connected with chemical and molecular changes in nervous or cerebral matter, abundant cases prove that physical disturbance by diseases or wounds can produce the changes of character which we are now considering. Not only can mechanical violence change character in certain cases for the worse, but we find opposite instances recorded where there has been a beneficial result. Thus, to cite an instance from Forbes Winslow's unphilosophical but amusing and useful story-book, "Obscure Diseases of the Brain and Mind"—"a child, up to the age of thirteen idiotic, giving evidence either of a total deficiency of intelligence or of a stunted intellect of the lowest grade and order, fell from a height upon his head and was stunned. He rallied from this state of unconsciousness, and was, *credat Judeus!* found to be in full possession of his intellectual faculties. Father Mabillon is also said to have been cured of idiocy, at the age of twenty-six, by tumbling against a stone staircase and fracturing his skull, for which he was trepanned, and thereupon exhibited a "lively imagination, an amazing memory, and a zeal for study unequalled." In another instance a soldier's intellect was improved by a musket-ball knocking out some of his brains.

Temporary disappearances of the real personality and its replacement by an assumed one, not only occur in cases of insanity, but can be induced by the action on the nervous system of what has been termed "electro-biology." Thus Dr. Carpenter records having seen a lady "metamorphosed into the worthy clergyman on whose ministry she attended and with whom she was personally intimate."

Cerebral physiology is not yet advanced enough to say how the brain acts, or whether functions are rigidly localized. Professor Golz has recently shown that functions which seem quite destroyed by excision of large portions of one hemisphere, reappear after a time, if the animal subjected to the process can be kept alive. A physiologist who contributes to the *Academy*, referring to these experiments as narrated in *Pflüger's Archives*, says: "A belief in the existence of localized centres in the cortical substance is incompatible with the fact that lesion of any part whatever of a hemisphere is followed by one and the same train of symptoms, and with the observed restoration of the particular functions over which those centres are supposed to preside." May one who has no pretensions to be a physiologist suggest that the gray matter of the brain may have its molecules arranged in patterns somewhat analogous to those of steel-filings under the influences of a magnet, but that in some way the direction of the forces—or vibrations—may be changed in them. The pattern will then be different, and the position of supposed organs altered. If this be true, the search should not be for organs, but for centres of action, which in healthy brains may have fixed positions.

Leaving this and other guesses for what they are worth, we must admit that personality as we know it is a result of organization, and that a molecular change, or a variation in the rate, or character, of those chemical actions and decompositions that are the invariable physical antecedents of thought, sensation, or volition, can instantly convert one personality into another, in which that sense of continuity which links the personality of yesterday with that of to-day may be wholly or partially destroyed. Thus we may see realized something like Circe's magical transformation of men into beasts, or a new man created surpassing the old.

Many will be startled at the notion of their personality being intermittent, not continuous; but if it consists in a series of impressions converted into consciousness, with the memory's links tying them together, the sense of the continuity of our existence, which we all feel, must be like the sensation of a continuous sound produced by successive beats at small intervals, or of continuous light from rapidly recurring impressions. If our modes of consciousness enabled us to take note of infinitesimally minute time intervals, and of infinitesimally minute molecular changes, each second would be crowded with a corresponding infinity of impressions, and a personality lasting a few minutes would be more amply filled with incidents and recollections than a human life of the longest term of years. If, with our present limitations of power to perceive minute time intervals, we were able to notice the molecular changes that took place between one pulsation of personal consciousness and another, we should suppose that nature, contrary to the old adage, did act by jumps. If a being could exist with enormously slower pulsations of conscious existence, these jumps would seem enormous, and, in an extreme case of such a supposition, the world that existed in one period might be extinguished and rearranged before another came on. The whole philosophy of such a being would differ from ours.

But if intermittence and change be the condition of our lives, is there nothing permanent to which we can cling? Physical Science has to do, in its present stage, only with facts belonging to the regions of incessant change; but man must from his constitution form an ideal of the continuous and the enduring towards which he aspires, and in which, in spite of doubts, he in the long run believes.—*Popular Science Review*.

## THE HEALTH OF MILL HANDS.

FROM the paper on "National Health" by Dr. B. W. Richardson, in *Good Words*, we are able to compare the mortality amongst workers in cotton, flax, and silk, with that of other trades. The annual death-rate has been taken of males aged 15 years and upwards, who were engaged in 70 occupations, 100 being taken as the standard.

"The class of life that presents the highest vitality is the barrister's, who die at the rate of 63 as compared with the standard; while the class that presents the lowest vitality is the inn and hotel keepers, whose death-rate is 143. Workers in cotton, flax, and silk die at the rate of 109, while the death-rate among grocers is only 76, and that of drapers 108."

The work of the draper bears some analogy to that of the worker among cotton. The writer says, "Let us glance, for example, at the facts relating to the two trades—the grocer's and the draper's trade. In the work carried out by the laborers in those businesses there can not be any great difference in the amount of work done nor in the hours of work. Neither can there be any marked or sufficient difference in respect to social advantages. The draper lives as well, is sheltered as well, is or may be as well provided with recreative pleasures as the grocer. They both live in the same communities, exposed to common general influences and to similar anxieties in reference to business affairs. It is not probable, and indeed there is not the slightest reason to assume, that the grocer leads, as a rule, a more temperate or more perfect moral life than the draper. Yet there is this extraordinary difference between them, that, by a mean of 100 as a standard for men belonging to 70 occupations, only 76 grocers die to 108 drapers, and this in males varying in age from 15 to 75 years. When we analyze the phenomenon we find that this great difference is produced at different periods of life—that from 15 years up to 55 the mortality at every period is in excess amongst the drapers. From all these facts we are driven to infer that the evil which is at work is of an acute kind, influencing life in its earlier stages, and if we inquire one step further we discover that the evil lies in diseases affecting the organs of respiration, such as consumption and bronchial phthisis. The explanation is at hand without mystery. The grocer lives in an open shop, with doors rarely closed from morning to night. He deals in goods which give off little dust. He is rapid in his movements, and keeps himself warm by exercise, without the aid of hot stoves and thick raiment. The draper, on the other hand, works in a close atmosphere. His shop door is on swing hinges, and is commonly blocked up with rolls of woollen or cotton material. His shop is literally stuffed with goods. He is engaged handling goods which fill the air with fluff and dust. He warms up his place with stoves, and from morning to night he keeps up his temperature by artificial means. Under these conditions he becomes first dyspeptic, thin, pale, and anæmic, then consumptive or bronchial, and so he succumbs. The source of evil here is easily traced, and is as easily removable. It belongs to the occupation as a matter of ignorance, not of necessity. It is a type of many similar errors connected with those occupations which yield the highest mortalities."

We need not point out to our readers the necessity for good sanitary arrangements in connection with every mill or manufactory, where large numbers of individuals are employed. Very often the temperature of spinning rooms is far in excess