THE EFFECT OF LEUCOTOMY ON CREATIVE PERSONALITY.*

By E. L. HUTTON, M.B., B.S., D.P.M., and M. BASSETT, Dipl.Soc.Sc.,
Burden Neurological Institute.

IN some of our earliest investigations into the effect of leucotomy we used the Rorschach test, hoping thereby to obtain a fairly full and clear-cut picture of the personality changes produced by the operation, but it was found that this test had the disadvantage that, when repeated, memory of the previous test or tests to some extent minimizes the validity of the later interpretations.

The results obtained, however, did seem to indicate that leucotomized persons show somewhat less originality and creativity than normal people of the same age, social status and educational background. It was found, and I think our findings agree with others who have used this test, that although leucotomized patients are co-operative and quite unhampered by any nervousness, timidity or self-consciousness, they show no enthusiasm and make no great effort; their answers are usually given fairly quickly and briefly, and tend to be conventional responses evoked by large obvious details; they are content to give one or more of these, and then pass on to the next card. If they do not readily find anything they have no hesitation in putting the card down unanswered after quite a cursory examination of it. In cases where we were able to get a pre-operative record many of the post-operative responses are mere repetitions, rather more accurately described and with the more bizarre details omitted. Although human and human movement responses are introduced post-operatively they are relatively infrequent, and the majority of new answers are evoked by colour, or in some cases by texture, and are mainly conventional animals or objects. The introduction of new shading responses is relatively uncommon.

Later the individual test was supplemented by the Multiple Choice Method devised by Harrower-Erickson. In this, 30 answers divided into three groups of 10, are suggested for each card, and the subject is asked to underline one answer in each group. The answers have been selected from those commonly given by normal and abnormal subjects, and are according to the table given below:

SCORING VALUES OF MULTIPLE CHOICE RORSCHACH.

Explanation of Numerical Values Assigned to Answers in Terms of Rorschach Scoring.

1. Human movement responses (Rorschach's M).

2. Animal responses either with or without movement, including many "populars."

3. Good form answers given relatively frequently by unselected normals. In the coloured cards 3 stands for Form-Colour responses (FC).

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4. Answer located in the small detail area of the card.

5. White space answers.

6. Anatomical answers with bad form (F-).

7. X-ray responses, clouds, and a few vague formless whole answers (leaf on card VI, animal skin on Card II, etc.).

8. Answer indicating an explosive response to Colour (CF or C answers).

9. Completely formless answers in uncoloured cards, including those indicative of unpleasant feeling tone in looking at the card (nightmare, etc.). In the coloured cards 9 stands for an evasion of the responses, or a mere statement of the colours on the blot.

10. Failure, the " nothing at all " answer.

Answers with scores between 1 and 5 are supposed to be those which occur most commonly in normal records and between 6 and 10 in abnormal records. Subjects with high scores in this test are, therefore, rated as being pathological.

Our results are here plotted in the form of a graph, comparing a group of leucotomized patients with a group of adult normals and a group of adolescents. In the leucotomized group the small number of human responses is noticeable, but the outstanding feature is the high proportion of the 9 and 10 responses ; 9 seeming to indicate a literal but rather casual description of the blot, and 10 an inability or refusal to formulate anything. These findings, coupled with the clinical observation of a lack of initiative in some of the patients, and a tendency to live in the immediate present and to depend upon the immediate environment for stimulation, suggested that there might be a definite diminution of creative activity after the operation, and prompted us to investigate the matter more thoroughly.

Many trial experiments of different kinds were made, but at the present time we are more or less restricting ourselves to the use of two other tests in addition to the Rorschach. The first of these was introduced after we had experimented with the Thematic Apperception Test where the test is given in two sessions, in each of which the subject is given ten pictures and asked to invent a story about them, introducing what he thought was happening in the situation depicted by the picture, what events had led up to it, and what results would follow from it. We found that it took too long, and also in spite of all instructions people tended to describe the pictures rather than tell stories about them. The following eight sentences, therefore, were devised to use instead of the pictures. The subjects are asked to write eight stories introducing one sentence into each story.

1. I was sunk in the depths of misery ; never had I felt so unhappy as I did at that moment.

2. The joy I felt at that moment is indescribable.

3. All right, I'll tell you about the most terrifying experience I have ever had.

4. There ended one of the most exciting adventures that any human being can ever have experienced.

5. It was the funniest story I have ever heard.

6. You have committed one of the worst crimes that any human being could commit.

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7. It was the loveliest thing that had ever come my way.

8. Night after night I lay awake, eating my heart out with remorse, remembering what I had done.

We stress that it is a test of imagination and make it quite clear that we prefer an imaginary story, but if they cannot do this we will accept something they have seen or read, or a real experience of their own ; and we ask them to record at the end whether it is imaginary, remembered or autobiographical.

This test reveals considerable variation among normal subjects, some of whom experience great difficulty in doing it, and we have not yet sufficient comparable material to make any definite and dogmatic statement, but such evidence as we have suggests that on the whole leucotomized patients find it more difficult than normal, and in some cases we have almost been unable to get them to write at all. This inability does not appear to be due to lack of intelligence or education, and may be present in cases showing good social recovery. For example, one patient, who was operated on at Barnwood House for a severely incapacitating hypochrondriasis, is now successfully holding his own as a French master in a Prep. School and working for a Degree, but he found the greatest difficulty in doing this test, and at the end of an hour had produced practically nothing. On the whole such stories as they do write tend to be brief and are either autobiographical or an account of something seen, read or heard.

The following two stories are interesting in that they exhibit this constriction of thought in an extreme degree :

1. " I am no Author or story-writer really, and on being asked to write something ' I was sunk in the depths of misery, never had I felt so unhappy as I did at that moment '."

2. " I have just finished No. 1 and must admit ' The joy I felt at that moment is indescribable '."

The second test is non-verbal but graphic. The complete test takes longer than was originally anticipated and so cannot always be given in its entirety. The following instructions given to the subject explain the nature of the test.

Drawing Test.

1. Write your name and underline it clearly.

2. Write 609 as neatly as you can.

3. Copy the drawing as exactly as possible.

4. Do you think this drawing could be improved in any way ? If so, draw it as you would prefer it.

5. Copy the painting as exactly as possible.

6. Do you think the painting could be improved in any way ? If so, paint it as you would prefer it.

7. Draw anything you like using six curved lines and twelve straight ones.

8. Choose one of the following : Joy, Anger, Sorrow, Fear—and then draw anything you like which will portray that emotion to you.

When given an entirely free hand and told to draw anything they like, leucotomized patients seem to have difficulty in thinking of anything to draw

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and tend either to a literal reproduction of twelve straight and six curved lines, or else to copying some object in front of them.

When given a painting to copy the leucotomized patient often does better than the normal adult—his perceptive sense seems sharpened—it is, however, when he is asked to paint the picture as he would like it that his originality seems to be limited. He is asked to do a copy in the first place because it is important to have some idea of his technical and motor skill ; manifestly these factors must be considered apart from his creative ability—his copy then acts as a control for his original painting.

As a preliminary canter, and to avoid our own bias, our first collection of 10 paired paintings was submitted to an independent arbiter for his assessment. He ranked them in decreasing order of creative ability shown, and it is interesting that the leucotomy paintings in this batch were ranked at the bottom of the group, with the exception of the very last which was the painting of an adolescent hemiplegic girl with an I.Q. of 49.

It seems that the leucotomized patient tends to stick to the same choice of colours, especially the purple ; he seldom adds anything to the original picture, and often ignores the background. A sufficient number of these paintings has not yet been collected, so that these deductions are very tentative, but our collection is steadily growing from which more definite conclusions will emerge.

Since there does seem some indication that prefrontal leucotomy does diminish, even if it does not altogether abolish creative activity, we have been led to consider the nature of creative activity and its relation to the total personality.

By creative activity is here meant, that form of activity which results in the actualization or realization of some object or event which only comes into being because the creator, having first conceived it in his imagination, deliberately transforms his idea or vision into fact. The motives of such activity must be, as of course the motives of all activity are, emotional, and as such, associated with judgments of value on the part of the creator. In his imagination he conceives desirable objects or events which, had they a real existence, would satisfy his real needs, but which, while they have only an immaterial existence in his phantasy, tend merely to tantalize and stimulate impelling him to translate his ideas into facts. This, however, he can only do provided he has sufficient technical knowledge and practical ability, and the necessary persistence and sustained effort.

There are, therefore, at least four factors involved in creative activity :

(1) Imagination.
(2) Emotional motives and associated judgments of value.
(3) Technical knowledge and practical ability.
(4) Sustained effort and persistent application.

Is there any reason to suppose that leucotomy produces an alteration in one or more of these factors, which might account for any observed diminution of creative activity. Our own observations and those of others, indicate that there is no gross change in the last two factors. There are now many cases on record of patients who have successfully resumed jobs requiring considerable

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technical knowledge, practical ability and sustained hard work. This leaves, therefore, the possibility of changes in imaginative ability, or in emotional motivation and associated judgments of value. For the present I propose to consider only whether the experimental results we have obtained might be due to a relative lack of imagination in persons who have been subjected to leucotomy.

Here it would seem necessary to define what one means by imagination, but in order to do so it is equally necessary to define what one means by its basic root, viz. image. In order to simplify matters the illustration is here confined to visual imagery and visual perception, but it must be remembered that all forms of sensory perception have corresponding sensory images.

In visual perception the stimulus, provided by free energy in the form of light rays reflected or emitted from some physical entity, detonates as it were the potential energy stored in the receptors of the retina, and initiates a wave of biophysical and biochemical activity in certain nerve-fibres and their neurons in the cerebral cortex ; and this is accompanied by the subjective perception of an object, which appears to be placed at the site whence the light rays, which cause this train of events are reflected or emitted.

In the case of a visual image the subjective experience is again of an object situated in space at the same site as in the perception, and this experience is also accompanied by biophysical and biochemical activity in the corresponding nervous pathways. The subjective experience and the concomitant neurological activity though similar are not normally identical, and the image is distinguishable from the percept. This is important because in the case of the image the free energy or stimulus which is necessary to bring about the requisite biological activity is not provided by light rays emanating from the site at which the imaged object appears to be situated, but is derived from some other source. This is made possible by the tendency of the cerebral cortex, under certain conditions to fuse into one composite whole two originally discrete patterns of neuronal activity initiated by free energy from two different sources, with the result that finally the presentation of only one stimulus evokes activity in the whole configuration. The subjective counterpart of this fusion is the emergence of the image ; the presentation of one stimulus not only evokes the perception corresponding to it, but also the image of that other perceptual experience which formerly accompanied it. (The study of the conditioned reflex has thrown much light upon the conditions which govern the fusion of the two separate stimuli into one organized whole.)

The image is thus a fainter copy of an original percept, and is aroused by events which were associated with it. It is, therefore, the physiological basis of memory and the more accurate the memory the more exactly the image reproduces the original percept. To paraphrase Leibnitz, " There is nothing in the image that was not first in the percept " ; and so long as imagery is used only for the purpose of remembering the objects and events of the imaged world, they correspond to those the Lady of Shalott saw in her mirror, and are but copies of the perceptual world, and their order and their relations are exactly the same as those of that world." (Any reference to illusions and errors is here deliberately omitted.)

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This relationship between the imaged and the perceptual world no longer holds good when we turn from memory to imagination, for here we find objects and events that have no counterpart in the world we perceive, but are purely imaginary and fantastic. Now this originality of the imaginary world is more apparent than real, for on careful investigation it will be seen that the entirely new objects and events which exist in the world of imagination are constructed out of parts which are derived from the world we perceive. Even in imagination there is nothing in the image which was not first in the percept, the only difference is that images of perceived parts are re-organized and re-integrated into new imaginary wholes, but it is only the re-organization which is novel.

Nevertheless I believe it is true to say that this re-organization of images derived from percepts is the essential basis of man's creative activity, and further that it is dependent upon language ; only man has representative language, and there seems good reason to suppose that the proximity of the speech area to that controlling the motor activity of the dominant hand is not purely accidental.

With the introduction of representative language a speaker can by *his own activity* produce the stimulus necessary for the evocation of an image. For example, since normally the physical phenomena responsible for the visual perception of a dog and the auditory perception of its bark fulfil the conditions necessary for fusion the presentation of one stimulus is capable of evoking the image of the percept normally caused by the other. If a man deliberately copies a dog's bark, this sound will serve instead of the animal's bark and will be capable of arousing the image of a dog in the hearer. No longer is man dependent upon immediately given stimuli in his environment to provoke imagery and re-awaken memory, he is able to do this by means of his own activity ; he can do it at will. By means of the representative function of language he can translate his own percepts and images into sounds or gestures whereby he can arouse corresponding images and percepts in others ; his word whether gestural, spoken or written serving as the physical stimulus which arouses the image in the hearer.

This is important from the point of view of memory, but language serves yet another function in imagination, for words may be combined by the speaker in ways in which the natural phenomena which they represent cannot, with the result that the images which they evoke will be of objects and events that have no counterpart in the world which we perceive ; by means of language a world can be imagined in which cats play fiddles, cows jump over the moon, and dishes run away with spoons. Cats, fiddles, cows, the moon, dishes, spoons, playing, running and jumping, all are derived from the world of perception whence they are translated by language into a world of phantasy.

Now although language can construct purely imaginary objects and events, man by no means necessarily uses it this way. None the less the child's development and evident enjoyment of pure phantasy suggests that it does satisfy some emotional need, and is probably essential for the full development of man's genuine creative activity.

The objects and events which man perceives in the world around him have gradually been observed by him to behave in certain ways which he has formu-

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lated as natural laws. The imaginary objects and events which he has constructed by means of his language do not necessarily so behave, but may do so. These latter objects and events are still imaginary in that they exist only in man's imagination, but man may by his re-organization of those parts in the real world whence his images are derived, in conformity with his re-organization of them in his imagination, create new objects and new events in that *real* world which we perceive, objects and events which would never have happened had not man first imagined them and then brought them into being. This is true creative activity and it is dependent upon keen observation and accurate knowledge concerning the nature and behaviour of objects and events in the perceptual world, upon the ability to re-organize these imaginatively into a new and desirable whole, and then by effort and practical ability to translate the imagined concept into reality.

In the case of the leucotomized patient his command of language seems as good as ever, his imagery and memory appear unimpaired, his perception of his environment if anything rather keener than it was before, his knowledge and intelligence and practical ability unaltered and in many cases his diligence and industry show little or no diminution. Is there, however, any reduction of that activity by means of which man constructs out of the world he knows, another and a better world, an ideal world which only exists in imagination, but which, if it did exist in reality, would be a more satisfactory world than the real one in which he lives.

If leucotomized patients do, in fact, cease to exercise this creative activity is it because a section of the prefrontal fibres has destroyed the power to do so, or has it merely in some way dissociated the emotional factors which in normal persons motivate such activity ?

This is the problem on which we are hoping to throw light by our experimental investigations.

The absence of such creative activity might account for some of the behavioural changes that have been noted in these patients, particularly their tendency to live in the present and their freedom from anxiety and the sense of moral obligation. For while the present exists in perception and the past exists in memory, the future exists in man's imagination, being imaginatively constructed by him out of his experience of present and past. And whatever may be one's views about absolute values, it is surely true to say that man's ideals also exist in his imagination, and that moral obligation consists in the necessity to translate the ideal into the real. If, as the result of the operation, these patients are either unable or have no emotional urge to imagine a possible future or an ideal standard of what ought to be, they will naturally be freed from anxiety concerning what might happen and from the sense of guilt and remorse which the ordinary person has when he thinks on " those things he has done which he ought not to have done, and those things he has not done which he ought to have done."

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