DEGREES OF AUTOMATIC ACTION: SOME PSYCHIATRIC APPLICATIONS OF HUGHLINGS JACKSON'S CONCEPT OF 'REDUCTION TO A MORE AUTOMATIC CONDITION'

By

MAX LEVIN, HARRISBURG, PENNSYLVANIA

INTRODUCTION

THE doctrine of the reflex constitution of the nervous system—the foundation of Hughlings Jackson's neurological teaching (II, 63, 399)*—has received ample recognition in the study of the more primitive activities of the organism, such as locomotion, but has, by contrast, received practically no recognition in the study of that most complex activity, mentation. Failure to regard the highest cerebral centres as a reflex mechanism is utterly contrary to the views of Jackson, who held that the highest centres, while more complex than the lowest, are, like the lowest, subject to the laws of reflex action. Thus he wrote (II, 63):

'A man, physically regarded, is a sensorimotor mechanism. I particularly wish to insist that the highest centres—physical basis of mind or consciousness—have this kind of constitution, that they represent innumerable different impressions and movements of all parts of the body, although very indirectly, as certainly as that the lumbar enlargement represents comparatively few of a limited region of the body nearly directly. . . . If the doctrine of evolution be true, all nervous centres must be of sensorimotor constitution. *A priori*, it seems reasonable to suppose that, if the highest centres have the same composition as the lower, being, like the lower, made up of cells and fibres, they have also the same constitution. It would be marvellous if, at a certain level, whether we call it one of evolution or not, there were a sudden change into centres of a different *kind* of constitution.'

The purpose of this paper is to demonstrate some concrete applications of Jackson's views on the reflex constitution of the highest centres. Specifically, I shall try to show that certain mental symptoms may be looked upon as illustrations of what Jackson called 'reduction to a more automatic condition.'

While Jackson insisted that the laws of reflex action apply to mental

* Bracketed figures refer to volume and page of the *Selected Writings of John Hughlings Jackson*.

phenomena, yet, disclaiming any knowledge of psychiatry, he attempted only in the most fragmentary way the task of applying these laws to the study of specific mental symptoms. Therefore, while I believe the formulations offered in this paper are in accord with his views, I cannot with certainty say he would have sanctioned them, and it would be a mistake to charge him with any errors and crudities to be found in them.

In accordance with Jackson's teaching (II, 63, 72, 156, 160), a distinction will be made, throughout this paper, between mental states and nervous states. The brain is a material thing; the mind is something immaterial. During every mental state there is a concomitant nervous state. The two should be considered separately in any attempt to analyze the nature of mental processes. The study of the immaterial thing, mind, is psychology; the study of the material thing, the brain, is physiology. As physicians, it is not enough that we consider mental symptoms as mental phenomena (a psychological study); we must also consider the nervous processes concomitant therewith (a physiological study).

The nervous system may be regarded as a complicated series of reflex arcs, superimposed one on the other. The lowest are the least, while the highest are the most, complex. Jackson roughly divided the central nervous system into lowest, middle and highest centres, but he emphasized that each of these levels may be divided and subdivided into lower and higher portions, so that really the central nervous system is made up of an almost infinite number of levels. Following Jackson's terminology, I shall speak of the highest 'centres,' which are, in turn, divided into lower and higher 'layers' (I, 380; II, 50, 56, 487, 480).

Lower levels of the nervous system differ from higher levels in two important respects: they are less complex and more automatic.

1. *Complexity*.—The gradation from lowest to highest centres is a gradation from least to greatest complexity. Consider, as an example, two problems in mathematics—problem A, which can be solved by the average man, and problem B, which can be solved only by the most eminent mathematicians. Obviously B is more complex than A. Moreover, the nervous substrate utilized in comprehending and solving B is more complex than that for A. When an eminent mathematician is in process of solving B, the very highest layers of his highest centres are engaged; when he is solving A, the layers engaged are in some degree lower.

2. *Automaticity*.—The gradation from lowest to highest centres is also a gradation from most to least automatic (II, 46, 53, 68). A reflex arc may be termed automatic to the extent that it functions stably under a variety of conditions, without requiring the attention of the subject. Thus the reflex arcs engaged during walking are more automatic than those engaged during the solving of a difficult mathematical problem: one can walk without attending to it, but one cannot solve a difficult problem without giving it one's closest attention.

The nervous system, then, may be regarded as an elaborate structure of reflex arcs, varying (as we proceed from below upward) from the least complex and most automatic to the most complex and least automatic.

In studying examples of mentation, one must consider not only a particular mental act but also the situation which evokes it. In the following example I shall consider two situations which evoke a response consisting of the utterance 'Good morning.' (a) On the one hand, one may meet a friend, and, returning the friend's greeting, may say 'Good morning.' (b) On the other hand, one may be conversing with a foreign acquaintance who is trying to learn English; the foreigner may ask, 'What do people say as they greet each other in the morning?' and the reply will be 'Good morning.' The utterance in (a) is the same as in (b), and one might be tempted to say that the nervous pathways engaged in both cases are the same. Actually this is only partially true. Both utterances are responses to stimuli, and since the stimuli in (a) and (b) are different, the reflex arcs engaged cannot be identical. The two reflex arcs coincide only in so far as they have a 'final common path.' The difference in the two arcs may be stated thus: the arc engaged in (a) is more automatic than in (b). Saying 'Good morning' in response to a greeting is a highly automatic act: one may say it even when one is deeply absorbed. On the other hand, saying it in reply to the foreigner's query is less automatic, since some degree of attention is required. Here, then, we have two reflex arcs, one slightly, the other highly, automatic, sharing a final common path. (This viewpoint is further discussed in the next section.)

Considering further the last example, it is conceivable that a lesion of the highest layers of the highest centres might extend downward just far enough to interrupt the reflex arc utilized in (b) without interrupting that utilized in (a). In such a case the patient would be unable to reply 'Good morning' to the foreigner's query, but would be able to say it in response to a greeting. There would, in other words, be loss of the more complex utterance of 'Good morning,' together with retention of its more automatic utterance. Such 'selective' loss of function may seem incredible, but really is not. In the next section I shall give actual instances of this type of loss.

The following proposition, then, is the keynote of this paper: paralysis of the highest layers of the highest centres may produce loss of the least automatic (most complex) mental functions, while leaving unimpaired those mental functions which are more automatic (less complex). This retention of more automatic function is what Jackson implied by his phrase 'reduction to a more automatic condition.'

How can one distinguish the more automatic and the less automatic activities of the organism? One criterion I have already alluded to: a function is automatic in the degree in which it may be exercised without the subject's attention. The only other criterion to which I shall here refer relates to priority of appearance in the ontogeny of the organism. Those

functions which appear first become the most automatic—a proposition in keeping with the fact that, speaking generally, the nervous system develops from the bottom up. Children can walk long before they can solve problems in geometry. This means that there is a stage at which the substrate of walking is fully evolved, while the substrate for the solving of problems in geometry is not. Anatomically, the latter substrate occupies a higher level than the former. A lesion of the highest centres might interrupt the latter and not the former, in which case there would be loss of the more complex function, mathematical reasoning, and retention of the more automatic function, walking.

It should be noted that I do not say that in *all* cases of nervous disease there is loss of the most complex functions and retention of the most automatic. I say this is true only of those cases where the dissolution is from the top downward. It is not true of cases where the lesion is confined to parts below the top. Thus, a patient with tabes and with intact highest centres will show impairment of some of his more automatic functions, such as walking, but no impairment of his complex functions, such as the ability to solve problems in geometry. This combination of phenomena would never occur in cases of disease of the highest centres.

Before proceeding, the terminology to be used in this paper will be further defined.

1. For each function and for each mental state there is a nervous substrate. The 'substrate of walking' denotes that combination of reflex arcs which is engaged during walking. When one sees a brick, one has what Jackson called a 'vivid image' (II, 70). At this moment there is activation of many reflex arcs, comprising what may be called the 'substrate of the vivid image "brick."' When one merely thinks of a brick, one has what Jackson called a 'faint image'; the reflex arcs now engaged may be said to comprise the 'substrate of the faint image "brick."'

2. The adjectives 'automatic' and 'complex' will be applied both to functions and their substrates. Thus, comparing the functions walking and thinking, we may say that the former is the more automatic (or the less complex); we may say the same of their respective substrates.

3. Functions and their substrates are automatic only in a relative sense. Thus it means nothing to say that walking is an automatic function. Walking is more automatic than abstract thinking, since it appears earlier in life. On the other hand, walking is less automatic than grasping, since the former appears at the age of one year while the latter is present at birth. The relativity of the concept 'automatic' may be compared with that of the concepts 'tall' and 'short.' For the sake of convenience some men are called tall and others short, but really every man has some degree of tallness. A dwarf measuring 2 feet in height has 2 feet of tallness. When we say a man is tall, what we imply is that he is taller than most other men. Similarly, when one speaks of some functions as automatic, it should be remembered

that all functions are in some degree automatic. Even the functions of the highest cerebral centres are automatic, though relatively slightly. Sometimes in order to avoid cumbersome phraseology I shall say of a function merely that it is automatic, when I mean that it is more automatic than some other function under consideration.

4. In addition to 'automatic' and 'complex' the words 'voluntary' and 'organized' are sometimes used, 'voluntary' being applied to functions and 'organized' to their substrates. For example, thinking is a more voluntary function than walking; this is another way of saying that thinking is more complex than, and less automatic than, walking. Speaking of their substrates, we may say that the substrate of mentation is *less* organized than that of locomotion; again this is another way of saying that the substrate of mentation is more complex than, and less automatic than, that of locomotion.

In the first part of the last sentence the word 'less' is purposely emphasized. Physicians sometimes say that the highest centres are *more* organized than the lowest. The highest centres are said to be 'highly organized,' while the lowest are 'unorganized.' Thus one writer spoke of inhibiting influences which the highest centres exercise 'over automatic and unorganized motor processes.' Another, referring to Jackson's three levels, spoke of the highest level as the 'third and most highly organized level.' This is exactly opposite to the way Jackson used the word 'organized.' Jackson spoke of the lowest centres as the *most* organized, and the highest as the *least* (II, 395, 437). The most organized centre is that in which the connections between the component pathways are most stable, most resistant to interruption. It is that which functions stably under the widest variety of conditions. On this view, the most organized centres are the lowest. Thus the centres of circulation and respiration are so highly organized that they function stably day and night unceasingly until death. By contrast, the highest centres are so slightly organized that their smooth functioning is impaired by very slight influences: a little alcohol or a moderate degree of fatigue will prevent one from exercising his reasoning powers to their fullest extent.

After these preliminary remarks, I shall now consider the significance of Jackson's views for certain specific mental symptoms.

LOSS OF VOLUNTARY, AND RETENTION OF AUTOMATIC, PERFORMANCE OF CERTAIN ACTS

Jackson repeatedly pointed out that in aphasia it is not words which are lost but certain uses of words. Taking as an example the word 'No' (one of Jackson's favourite examples), there are three ways in which the word is used (II, 134). (1) A man may angrily shout 'No!' when his child is about to do something bad, or anxiously when the child is about to make a misstep, or incredulously on hearing some astonishing bit of news. These illustrate the 'emotional' use of the word. (2) He may say 'No' in reply to a question

requiring a negative answer. This is the 'propositional' use of the word. (3) He may say 'No' in response to the request to say it. Jackson described this use of the word, but did not name it. For the sake of convenience I shall refer to it as the 'volitional' use of the word.

Jackson observed that in aphasia the volitional use of 'No' is most impaired, the propositional use less so, and the emotional use least of all. Thus in one case (II, 134, footnote; 177) the patient could not say 'No' when asked to do so, yet said it in response to the question 'Are you ninety years old?' and shouted it angrily when his child misbehaved. Jackson's other examples need not be cited here. The point which is important here is that in aphasia, as Jackson emphasized (II, 49, 160), the uses of words are disturbed inversely as their degree of automaticity, the most automatic uses being least disturbed, the least most.

It would be wrong to suppose that there is only one substrate for the utterance of 'No.' If that were true, a lesion which interrupted this substrate should abolish the power to say 'No' under all circumstances. In reality (if we consider not merely the actual utterance of the word but also the situation which evokes it) there are innumerable substrates for the utterance of 'No'—as many substrates as there are situations which evoke the response 'No.' These substrates may be grouped into those for the emotional, those for the propositional, and those for the volitional, use of the word. All of them have a final common path, consisting of those portions of the lowest centres which must be activated in order to permit the actual vocalization of the word. Before converging into their final common path, these substrates occupy diverse levels in the higher centres. The 'emotional substrates' (substrates for the emotional use of 'No') are the most automatic and occupy levels lower than the others; the 'propositional substrates' are less automatic and occupy higher levels; the 'volitional substrates' are the least automatic and occupy the highest levels of all. A lesion of the highest centres will impair the 'volitional substrates' first and most, the 'emotional substrates' last and least.

It may seem pedantic to insist on considering the substrate of the stimulus which evokes the utterance 'No' as well as the substrate of the utterance itself. To show that it is neither arbitrary nor pedantic but, on the contrary, consonant with good neurological reasoning, I shall refer to the selective loss of the pupillary reflex found in the Argyll Robertson pupil. Normally the pupil reacts to light and on accommodation. It would be absurd to say that since in both instances the result is the same—pupillary contraction—the pathways engaged in both must be the same. In reality, there are two pathways, one activated when the eye is exposed to light, the other when the eyes are accommodated for near vision. The two pathways coincide only in so far as they possess a final common path, which probably originates in the oculomotor nucleus. No one thinks it strange that there are cases in which the light reflex is lost while the accommodation reflex is retained. In

such cases everyone accepts the inevitable conclusion that there is interruption of the substrate of the light reflex but not of the accommodation reflex. The point of interruption of the substrate of the light reflex must be somewhere above the origin of the final common path which the two substrates have in common. When, on the other hand, there is interruption of the final common path, the pupil is irresponsive not only to light but also on accommodation. The contraction of the pupil may be compared with the utterance 'No.' There are innumerable situations which cause one to say 'No.' There are, in other words, innumerable reflexes whose common response consists of the utterance 'No.' Correspondingly, there are innumerable nervous substrates (reflex arcs) possessing a final common path. When there is interruption of this final common path, inability to say 'No' is complete, in the sense that under no circumstances can the patient say it. When, on the other hand, there is interruption of some of the substrates above the point of origin of the final common path, there is selective loss of the ability to say 'No': the patient can say it under some circumstances but not under others, just as in the Argyll Robertson pupil there is pupillary constriction on accommodation but not on exposure to light.

In two cases of delirium I have observed a phenomenon identical in principle with this selective loss of the ability to say 'No.' In these two cases the patient, being disoriented, failed to answer correctly when asked to name my vocation, *in spite of the fact that during the conversation just before the question he had spontaneously addressed me as 'Doctor.'* In one case (delirium in a chronic drinker with pulmonary tuberculosis and moderate fever), the patient, as I walked into his room at the Harrisburg State Hospital, said, 'Good morning, Doctor.' After a bit of casual conversation I questioned him as to his surroundings and found him disoriented; he thought the place was a factory in a small town near Harrisburg. Next he was asked what my vocation is; looking blank, he replied, 'I don't know *what* you do.' In the other case (bromide delirium in a patient with cerebral arteriosclerosis) I had the following conversation with the patient at the Harrisburg State Hospital. (You look pretty well this morning.) 'I can't say I feel worse, Doctor. I'm holding my own pretty well.' (Tell me, what place is this?) 'Isn't this a fair?' (What county is this?) 'Aberdeen County.' [There is no Aberdeen County in Pennsylvania.] (What State is this?) 'I really can't tell you.' (What is my vocation?) 'You must know that yourself, because I ain't employed for you to get that part out.' (What do you think my vocation is?) 'I don't know *what* your vocation is.' It may seem inexplicable that a man who has just addressed me as 'Doctor' should be unable to name my vocation, but it is no more inexplicable than the fact that sometimes an aphasic patient who has just replied 'No' to a question cannot say it on command. The explanation is the same. Spontaneously addressing a man as 'Doctor' in the course of conversation is an automatic act, like the spontaneous use of 'No' in conversation. By contrast, naming a man's

vocation on command is, like saying 'No' on command, a much less automatic (much more voluntary) act.

Thus far in this section only verbal acts (utterances) have been considered. Similar remarks may be made about non-verbal acts, such as movements of the face, tongue and limbs. There have been cases in which the patient lost the ability to perform a particular act voluntarily but was still able to do so automatically. Jackson (II, 153) alluded to an aphasic patient who could not protrude the tongue when asked to do so, yet protruded it after drinking, when, as was her custom, she licked her lips. Case 3 of Wilson and Walshe⁷ was that of a woman with leftsided motor symptoms resulting from disease of the highest centres. One of her symptoms was inability to perform on request certain movements which automatically she performed quite well⁷ (p. 218). Wilson and Walshe called attention (p. 223) to the occurrence of a similar phenomenon in a case reported by Goldstein, and (p. 224) in one reported by Kroll.

Particular reference may be made to hysteria, in which there are many instances of selective loss of more voluntary function. Thus some patients with hysterical aphonia can phonate while coughing, but not on attempting to converse or on being asked to say 'Ah.' Gowers³ wrote (p. 914) that patients with hysterical aphonia 'have been known to speak in a loud voice during sleep.' The phonation of coughing and that of utterances made during sleep are highly automatic types of phonation; the phonation of ordinary conversation is less automatic; that of the response to the request to say 'Ah' is still less automatic. A perfect parallel exists between these patients and some of Jackson's aphasic patients. The hysterical patient, unable to phonate when asked to say 'Ah,' is like the aphasic who could not say 'No' when asked to say it. Unable to phonate in conversation, he is like the aphasic who could not say 'No' in reply to questions calling for a negative answer. *Able* to phonate while coughing, he is like the aphasic who was able to cry 'No!' as an expression of his emotion.

Patients with hysterical astasia-abasia may be unable to walk in ordinary situations, yet may be able to run perfectly in escaping from danger. In a fiction magazine I have read of an Italian soldier in the World War who, after a trifling injury, became completely paralyzed. The physician, suspecting hysteria, drew his gun and, in the patient's hearing, said it was a pity that the government in the interests of economy had decreed that all chronic invalids must be shot. As the physician aimed the gun, the patient leaped off the stretcher and ran away screaming with terror. The story was reported as having really occurred. I cannot vouch for its authenticity, but physiologically it is credible. If a fire broke out in a neurological ward, no one would be surprised to hear that hysterical paralytics ran to safety. Cases of this sort, in which a helpless paralytic is able to run in an urgent situation, have led some physicians to conclude that in hysteria there is 'nothing really wrong with the brain.' This untenable conclusion is based on the erroneous

belief that there is only one substrate of locomotion. In reality (if we consider not merely the physical movements of locomotion but also the situations which evoke it), there are as many substrates as there are situations capable of evoking a locomotor response. These substrates converge in a final common path, but before converging they occupy varying levels in the central nervous system, the level depending on the degree of automaticity of the locomotor response in a particular situation. In situations of peril, locomotion is a highly automatic function ; in the ordinary situations of life, it is a more voluntary function ; during a physical examination, when a person walks in response to the physician's command, it is even more voluntary. A patient's ability to run from a fire when in ordinary situations he is helpless by no means signifies that there is nothing wrong with his brain. It does not even signify that there is nothing wrong with the substrate of locomotion. All it signifies is that there is nothing wrong with the substrates of automatic locomotion, the pathological process affecting only the substrates of voluntary locomotion. The pathological process, in other words, is high rather than low in the central nervous system.

**THE EVOLUTION OF THE HIGHEST CENTRES ;
THEIR ACHIEVEMENT OF INDEPENDENCE OF LOWER CENTRES ;
LOSS OF THIS INDEPENDENCE THROUGH DISEASE**

This section is a continuation of certain parts of the discussion contained in my recent paper⁵ on the psychiatric importance of Jackson's theories. In order briefly to summarize the pertinent parts of that paper, I shall refer to certain aspects of the rôle of the highest centres in mentation.

In discussing the physical processes concomitant with imagery, Jackson used the terms 'vivid image' (e.g. when one actually sees an object) and 'faint image' (when one merely thinks of, or visualizes, that object).

When one actually sees an object, the physical process, according to Jackson (II, 69), is as follows :

'I suppose that I am seeing a brick. . . . What first happens is that there is a peripheral impression (upon the retina), impulses then pass through the lowest, through the middle, and up to the highest sensory centres. . . . So far we have only stated one half of the reflex action, have only reached the physical condition in the highest sensory centres correlative with the colour of the brick. It and all other objects have shape, and this as much requires to be accounted for as the colour. The shape of an object is the relation of its several positions one to another ; our knowledge of this relation is by movements, in this case ocular movements. . . . By currents passing from the highest sensory centres, so to speak, "across" to the highest motor centres, and from these downward, through middle and lowest motor centres to muscular periphery, there is development of movements of the eyeballs. . . . Here we have . . . reflex action.'

When one *thinks* of a brick, the reflex action is confined to the highest

centres (II, 70) : 'The highest sensory and motor centres are alone engaged ; there is still reflex action, but only the central links of the great sensorimotor chain are engaged ; the central part only of the whole process which occurred in perception is done over again, and, the excitations being slight, the image arising is faint, and, the lower centres not being engaged, it is feebly and indefinitely projected, *seems* more part of ourselves.'

Assuming Jackson's views to be correct, we may say that the 'substrate of the *faint* image "brick"' (the substrate activated when one thinks of a brick) lies in the highest centres ; it forms a component (the central or topmost component) of the 'substrate of the *vivid* image "brick,"'

Turning from imagery to movement, we find a similar distinction between a movement actually made and one merely thought of. Quoting Jackson (II, 95, footnote) :

'When I actually move my arm . . . there is a process from highest motor centres, through lower centres, then by nerves to some muscles, which are discharged in a particular way. This is a purely physical process. . . . When we think of the movement, or remember it (popularly "have an idea of it"), the physical process is limited to the highest centres ; *the very same* nervous arrangements of these centres are engaged, but they are slightly engaged, and the psychical state concomitant with the slighter process is faint' (italics in original).

According to Jackson, then, the substrate of an 'idea of a movement' lies in the highest centres ; it forms the central or topmost component of the substrate of the actual movement.

In this paper I shall more particularly be concerned with a special instance of movement—speech. In saying a word, e.g. 'tree,' one makes certain movements of respiratory and articulatory muscles. The nervous substrate activated when one says the word may be termed the 'substrate of the spoken word "tree."' On the other hand, one may think of the word without saying it. The mental state now is a special instance of that which one has when one thinks of any movement ; it is an 'idea of a movement.' There is, concomitantly, activation of what may be called the 'substrate of the unspoken word "trec."' The substrate of an unspoken word bears the same relation to that of the spoken word as the substrate of an 'idea of a movement' bears to that of the actual movement.

Jackson's views on the nervous processes concomitant with faint images and with 'ideas of movements' are of the utmost importance in a consideration of the nature of the substrate of mentation. Thinking involves, one might say, the 'interplay' of faint images and 'ideas of movements.' Suppose today I am thinking of something I saw yesterday, e.g. an automobile accident. I visualize the scene, the paths of the automobiles, the collision, and I recall the sound of the crash and the cries of the injured. All these images that come to my mind are faint images. At the same time I have in my mind a series of unuttered verbal propositions describing the

occurrence : ' The two cars met at the corner, one travelling east, the other north. They were going fast and collided with a loud crash,' etc. Since I am only thinking of the accident and not talking about it, these words remain unspoken. During silent thinking, then, one may infer activation of substrates of faint images and substrates of unspoken words. Since these substrates lie entirely in the highest centres, it may be said that the nervous processes concomitant with thinking are (with trifling exceptions which need not be gone into here) confined to the highest centres. In other words, during silent thinking *the highest centres function independently of lower centres.*

But the capacity of the highest centres to act independently of lower centres is a trait which makes its appearance only after the highest centres have reached a certain degree of maturity. In early childhood the highest centres are relatively incapable of acting independently. When a young child thinks, the activity of his highest centres is accompanied by activity of lower centres. Since thinking is concerned with imagery and with movement, there are two manifestations of this infantile condition of the highest centres. (1) The child thinks in terms of *vivid* images, while the adult thinks in terms of *faint* images. (2) The child thinks in terms of *actual* movements, while the adult thinks in terms of '*ideas* of movements.' These manifestations will be considered separately.

1. *Young Children Think in terms of Vivid, rather than Faint, Images.*—The evidence for this proposition was given in my recent paper ⁵ (pp. 862–864) and need not be repeated here in detail. To sum it up briefly, one may say that children are relatively incapable of representation ; they are, of course, capable of perception. Children therefore are relatively unable to appreciate the difference between ' I saw a dog running across the street ' and ' I fancied a dog running across the street.' (Ignorance of this characteristic of infantile mentation causes people unjustly to accuse children of lying.) The earliest representation is so weakly developed that it does not occur independently of perception. One sign of this is the habit children have of asking that a story be read to them in spite of the fact that they already know it word for word. If the reader should omit a single word of the story the child will correct him. The explanation for the child's wanting to hear the story when he already knows it is that he wants to enjoy the pleasure of thinking it through as a fantasy, but, being incapable of representation, he cannot *think* it save when he *hears* it. Thus the earliest representation is indistinguishable from perception, and only as the child matures do these functions become independent. This statement describes the psychological process. To describe the physiological process, one may say that in the infantile brain there are substrates of vivid images but none of faint images. The topmost portions of the substrates of vivid images form the rudiment of the future substrates of faint images. As the highest centres develop, these rudimentary substrates of faint images evolve, until at last they become fully developed substrates capable of activation even when lower centres are inactive. When

this stage is reached, the person is able to think even in the absence of auditory and other external stimuli.

2. *Young Children Think in terms of Actual Movements, rather than 'Ideas of Movements.'*—Mentation in everyone is intimately associated with movement, especially the movements of speech (words), but while adults think in terms of unspoken speech, children think in terms of spoken speech. A two-year-old child, looking out of the window, sees a lawn and trees, and people and a dog walking by; at the same time he delivers a continual chatter of words, phrases and sentences corresponding to the objects and events that he sees. This chatter is his way of thinking. The child learns many words and learns to form verbal propositions. To him, at first, these words and propositions are things to be *said*, not merely thought of. Only after much evolution does he acquire the ability to think of words and propositions without saying them. Speaking physiologically, in the infantile brain there are substrates of spoken words but none of unspoken words. (This is exactly comparable to the statement that in the infantile brain there are substrates of vivid images but none of faint images.) The topmost portions of the substrates of spoken words form the rudiment of the future substrates of unspoken words. As the highest centres develop, the substrates of unspoken words evolve, finally reaching the stage at which they are capable of activation even when lower centres are inactive. The child is now able to think of words and propositions without saying them.

The last paragraph dealt only with speech—a special instance of movement. The same remarks apply to all movement. Thinking of abstract matters is carried on largely in words (spoken and unspoken). Thinking of concrete matters, especially those involving one's own movements, is carried on partly in words (spoken or unspoken) and partly in body movements (actual or imagined). If near me I see an object which I want to hold in my hand, I have 'ideas' of certain movements—those movements of my upper limb which would enable me to seize the object. I 'reflect' that the imagined movements, if executed, would put me in possession of the object. But early in life I must have passed through a stage at which I could perform the movements but could not yet imagine them well enough to be able to indulge in this reflection.

To summarize: Of the manifestations of the evolution of the mind, we are particularly concerned with two. (1) The child is incapable, while the adult is capable, of representation. The images that enter into the child's thinking are vivid, rather than faint, images. To ignore the objects that lie within the scope of one's perceptions and to think instead of objects not present is an impossible or difficult task for the child. He can think of things only, or more easily, when they are presented to his senses. When he wants to think of a story—even if he knows it word for word—he can do so more easily if he hears it read to him (or reads it himself). From this he evolves into a person who can, when necessary, think of things not presented to his

senses. (2) The child is incapable of thinking without simultaneously *saying* (or otherwise doing) what he is thinking. From this he evolves into a person who, when necessary, can engage in deepest thought in silence and immobility.

This evolution of the infantile mind is made possible by a corresponding evolution in the highest cerebral centres, which, from being dependent on lower centres, incapable of activation save when lower centres are being activated, become at length so independent that now they may be activated when lower centres are idle.

Jackson, years ago, expressed the same conclusion regarding the independence of the highest centres. He wrote (I, 375):

'As evolution progresses the highest centres not only gradually develop (become increasingly complex, etc.), but also become more and more detached from, and more independent of, the lower centres out of which they have been evolved. . . . There are degrees of detachment and of independence. . . . (When independence has been attained) our highest sensory and highest motor centres (together the "organ of mind") can energize, to a large degree, independently of the lower centres out of which they have been evolved, and by aid of which they have been developed; consequently they can act independently of the environment.'

Again, speaking of the hierarchy of nervous centres, he wrote (II, 477):

'The relations of these centres to one another is a very complex one. Besides relation of direction and control, the higher their evolution the more independent do centres become in their activity; there is quasi-detachment, so that in the most "detached" (the highest) centres activities can go on (internal evolution) largely independent of present converse with the environment; on the psychological side there can arise trains of thought independent of present experiences.'

The degree of independence attained by the highest centres depends in part on their healthiness. The healthier they are, the more independence do they attain. It is therefore to be expected that in acquired disease of the highest centres there would (at least in some cases) be some degree of diminution of the independence previously attained. Mentation in these cases would be characterized by either or both of two infantile tendencies: (1) the tendency to think in terms of vivid rather than faint images; (2) the tendency to think vocally rather than silently. Cases illustrating these tendencies will now be cited.

1. *The Abnormal Tendency to Think in terms of Vivid, rather than Faint, Images.*—This tendency, I submit, may be said to exist in all patients who have hallucinations. A hallucination is a vivid image occurring in a situation in which a healthy man would, at most, have only a faint image. Consider the case of a sailor who has on his forearm a tattooed figure of his sweetheart. When he looks at the figure, he may respond by thinking of his sweetheart, picturing to himself how she looked when he last saw her, and recalling what she said. These are faint images; they occur because the highest centres are

sufficiently healthy to be capable of independent activity. Now suppose the sailor happens to be in a delirium when he glances at the tattooed figure. The same train of thought will be evoked, but now it may be expressed in *vivid* images. The sailor may now have hallucinations of his sweetheart—he may ‘see’ and ‘hear’ her.

In the foregoing (hypothetical) instance we know the stimulus which led to the hallucination; it was the sight of the tattooed figure. In most actual instances of hallucination the stimulus cannot be identified. Nevertheless these instances are open to the same explanation as the instance of the sailor. Believers in determinism will agree that each thought, or, more accurately, the cerebral process concomitant with each thought, is a reaction to the cerebral processes which existed a moment before. This principle holds even for those instances in which we cannot ascertain what thoughts (conscious or unconscious) immediately preceded the hallucination. I submit, then, that the following formulation, if valid at all, is of general validity. Supposing a series of cerebral processes leads to activation of the substrate of a particular idea, the form which this idea will take will depend on whether the highest centres are at the moment able to function independently of lower centres. If they are, there will be activation of highest centres only—activation of the substrates of certain *faint* images: the subject will *think* of certain things. If they are not, there will be activation of highest centres and lower centres as well—activation of the substrates of *vivid* images; the subject will *see, hear*, or otherwise perceive these things.

In my earlier paper ⁵ I have discussed more fully the significance of hallucinations as manifestations of ‘reduction to a more automatic condition.’ I therefore pass on to the second manifestation of loss of independence of the highest centres.

2. *The Abnormal Tendency to Think Vocally rather than Silently.*—One of the popularly recognized symptoms of insanity is ‘talking to oneself.’ Everyone has observed some human derelict walking by on the street, muttering to himself. Here is a perfect instance of disease of the highest centres causing them to return to their infantile state. The demented patient, like the two-year-old child, *says* what he is thinking.

Some patients are painfully aware of this inability to think their thoughts without saying them. I ⁵ have mentioned the case of a woman who, in giving a retrospective account of a period of overtalkativeness following her emergence from a catatonic stupor, said, ‘I had no speech control. It seemed as if I couldn’t *think* things but could only *say* them. There was a great fear in my mind that I would never again be able to think without speaking, and I thought how horrible it would be to have to go through life that way.’

In the same paper I referred to Lindemann’s ⁶ observations on the effects of amytal on normal subjects. Under the influence of the drug the following statements were made: ‘It’s funny I am telling you things which I wasn’t

going to tell you. . . . No matter what comes to my mind it wants to be expressed too. . . . I feel like saying all sorts of things. The words kind of just come out of my mouth. . . . The words just go rambling on my tongue.'

The following additional cases have come under my observation.

A young woman, after recovering from a manic excitement, gave a retrospective account, in which she said that her chief trouble had been with her 'head running away.' In explanation of this phrase she said, 'You can't keep quiet. You can't keep your own secrets. Things that happened years ago would come to my mind and I'd say them aloud. I'd give everything away I had ; I couldn't keep quiet.'

It is possible that much, perhaps all, of the overtalkativeness of manic patients is a manifestation of inability to think without speaking. Manic patients *say* what healthy people merely *think*. I once walked through a ward accompanied by a very obese nurse. We met a manic woman who looked the nurse up and down and said contemptuously, 'My, how fat you are !' A healthy person in the same situation would have *thought* this proposition, not said it.

In the examples already given, the patient's thoughts were expressed in overt speech, so as to be audible to bystanders. In the next three examples the vocalization of the patient's thoughts did not reach this extreme degree.

A coal miner, age 31, entered the Harrisburg State Hospital suffering from schizophrenia. The two symptoms that will be mentioned here are hallucinations and a condition which he described with the adjective 'loud-minded.'

The hallucinations were auditory and olfactory. The auditory hallucinations consisted of voices which said vile things about the patient. In loudness they varied from a whisper to the volume which would be employed by a man calling another man ten yards away. They sounded like natural human voices, so much so that he steadfastly believed people were talking about him.

The feature of the case which is important here is the 'loud-minded' condition. The patient first revealed this in giving an account of his illness, when he said, 'It all started when my brain got loud-minded.' (What does 'loud-minded' mean ?) 'I mean, whatever I think, you can hear, without me saying it with my tongue.' (Can *you* hear it ?) 'Yes.' (Give an example.) 'Whatever I think, my voice-box goes like. I should think with my *head*, not with my voice-box.' (Give an example.) 'The other day I was wondering how my blood test was going to turn out, and I heard these words, "I wonder how my blood test is going to be."' (Give another example.) 'I was thinking about getting parole here, and *that* got loud too : "Maybe they're going to parole me." My lips didn't say it, my voice-box said it. I think in my voice-box, and then it goes way up in my mind, and then it sounds just like—(gropes for the proper phrase)—transformed broadcasts.'

On another occasion he gave this description : 'If I was natural (i.e.

healthy), when I think of something I'd think just a little bit. *This* way, I must think with my voice-box. I must *talk* it—but not with my tongue. It's all in my head.' Because his thoughts were audible to himself and (he thought) to others, he spoke of them as 'loud thoughts.' They, however, were not loud in the ordinary sense : they were even quieter than a whisper. 'They don't sound like no voice : just like imagination. It's no voice. It just goes through me like—yet I can hear it.'

The patient drew a distinction between his 'loud thoughts' and his hallucinations ('voices'). The 'voices' impressed him as real : he thought people were actually making vile remarks about him. On the other hand, the 'loud thoughts,' he knew, arose in his own mind. Another difference is that the content of the 'voices' was usually expressed in the third person, while that of the 'loud thoughts' was always in the first person.

This, then, is a case in which the patient's thoughts, while unspoken, were accompanied by laryngeal sensations so intense as to lead him to believe his thoughts were being vocalized. He heard them himself, and thought others heard them too, though at the same time he realized they lacked the quality of ordinary utterances.

A woman of 61, with signs of cerebral arteriosclerosis, entered a moderately severe depression, one of her symptoms being that 'I talk to myself.' In describing this she said, 'Everything I think I'm going to do I say to myself. (For example) I "say" to myself, "Now I'm going to go to bed."' When out walking she 'talked' to herself about the things she observed. 'Almost everything I see I have to repeat.' For example, she 'said' to herself, 'I see this'; 'That's a car.' Many of the thoughts which she 'said' to herself were sensible : e.g. 'I don't know what to do'; 'I'm afraid.' On the other hand, some were strange and incomprehensible to her : e.g. 'I ask for punishment'; 'I refuse.'

This 'talking to herself' always occurred with lips perfectly motionless, so that members of the family were never able to observe anything unusual. She herself *heard* everything she 'said' to herself. It sounded like 'my own voice.' It was even quieter than a whisper. She knew that the phenomenon took place entirely in her mind.

A schizophrenic woman of 47 entered the Hospital, one of her complaints being that people 'seem to put thoughts in my head.' These thoughts she was compelled to 'repeat,' her lips being either shut or open and slightly in motion. Later, after much improvement, she said retrospectively, 'It seemed as though I had to repeat what they (hallucinatory voices) said. I repeated it in my mind, not with my lips—just like thinking it over.' The symptom had gone ; as she said, 'I have more control.'

In the next two cases the patients did not think they were 'saying' or 'repeating' their thoughts, but mentation was accompanied by sensations referred to the organs of articulation.

A paranoid schizophrenic woman of 45 often heard a 'spirit' talking

to her. She identified the spirit as Jesus. She said, 'When I hear the spirit talking, I feel it in my mouth and throat. My lips and tongue move.'

A schizophrenic man of 22 heard voices which he termed 'undertones' and which, he said, came in through his nose. When asked why they came in through the nose and not the ears, he replied, 'Because your mind is connected with your mouth'—a remarkable statement, considering the importance of speech (spoken and unspoken) in mentation.

Some of the foregoing cases show that there are degrees of loss of independence of the highest centres. To take but two instances: (1) the loss is great in those cases in which the patient's thoughts are actually vocalized, so as to be audible to bystanders; (2) the loss is slighter in those cases in which the patient *thinks* he is vocalizing his thoughts when to bystanders they are inaudible.

Echolalia is a special manifestation of loss of independence of the highest centres. One of the results of our saying 'tree' to a person is that he 'thinks of' the word; he has an 'idea of the word.' There is activation of the substrate of the unspoken word 'tree.' When the highest centres are insufficiently independent of lower centres, there will be activation of the substrate of the *spoken* word, with the consequence that on hearing the word 'tree' the patient will actually *say* it.

The same explanation applies to echopraxia. When A claps his hands in the presence of B, there are two consequences in B. (1) B has vivid images (visual and auditory) corresponding to the sight and sound of A's movements. (2) He has an 'idea' of A's movements; he 'thinks of' them. There are faint excitations in certain parts of his highest motor centres. When his highest centres are insufficiently independent of lower centres, B, instead of 'thinking' of these movements, will actually execute them.

MASS REFLEXES IN THE HIGHEST CENTRES

In the stage of recovery of reflex function after complete division of the spinal cord, stimulation of any part of the lower limbs is followed by a widespread response consisting, in part, of flexor movements of the lower trunk and lower limbs. This has been called a 'mass reflex.' It typifies the response of the most primitive levels of the nervous system, released from the control of higher levels. It illustrates the general rule that the more primitive the nervous system, the greater is its tendency to produce widespread or diffuse, rather than narrow or discrete, responses.

Many further illustrations of this rule may be given. Coghill,² studying the earliest movements of *Amblystoma*, and Minkowski and others,² studying the movements of the human foetus, have shown that in the earliest stages of the organism movements usually involve large segments of the body; in later stages there is increasing occurrence of movements of small segments—movements of a single limb, or of part of a limb. When one compares an infant and an adult, the contrast is striking. The infant's movements are

unmistakably more diffuse than the adult's. As the infant matures, he becomes increasingly capable of movements involving smaller and smaller segments. The marvellously fine and precise finger movements of the violinist's left hand characterize the mature, rather than the immature, nervous system.

Examples will now be given to show the application of this general rule to the higher levels of the nervous system.

Becher¹ found that 'a large percentage of children, when told to open the mouth wide and put the tongue out, spread the fingers.' This is a forceful illustration of the occurrence of mass reflexes in the immature organism. In the nervous system of the young child, the substrate for opening the mouth wide and that for opening the fingers wide are inadequately differentiated, so that the command to open the mouth wide activates both substrates. Thus a relatively large cerebral area is activated by a stimulus which, in the adult, would activate a small area.

I have observed the following incident in a bright healthy boy 35 weeks old. The child, not yet able to sit unsupported, was being held by his mother while she sat in a restaurant eating a plate of soup. The mother held the child on her knee, and ate the soup with her other hand. Each spoonful, on its way to the mother's mouth, passed a few inches from the child's face. The child had had his own meal only two hours before, so that now he was not hungry. Nevertheless the odour of the soup aroused an alimentary response. After several spoonfuls had passed before his gaze, each succeeding spoonful was observed to elicit a response in the form of tasting movements. He watched the path of the spoon from the plate to the mother's mouth, and as it passed the point nearest his own mouth he made five or six tasting movements. The significance of this observation becomes evident when one considers what the response of an adult in a similar situation would be. An adult, when his appetite is aroused, responds only with salivation; the infant responded with salivation (inferred, not observed) *and* tasting movements. In the infant's highest centres the area excited is larger than in the adult's. The infant's reflex, as compared with the adult's, is a mass reflex.

I now offer a similar observation in the case of a middle-aged man suffering from a fever delirium. The patient was in bed, wearing a hospital gown. When asked what time of day it was, he replied, 'I don't know—I haven't got my watch.' As he said this, he placed the fingers of his right hand into the right-hand pocket and then into the left-hand pocket of an imaginary waistcoat. A clear-headed man, if asked the same question while wearing a hospital gown, might have made the same verbal response, but no manual response. It may be objected that this example proves nothing, that the patient fumbled in his imaginary pockets merely because he was too confused to realize he was not wearing a waistcoat. This is a psychological explanation. Without going into the question of the merits and demerits of psychological explanations of behaviour, I say only that I am here trying to analyse the

physiological substrates of certain examples of behaviour. A physiological inquiry must deal only with nervous substrates and their excitation and inhibition. Viewing the delirious man's response physiologically, we must say that there was excitation of the substrates of a verbal reflex and a manual reflex, and that, in the case of a clear-headed man under the same circumstances, the substrate of the verbal reflex only would have been activated. The delirious man, therefore, showed, relatively speaking, a mass reflex.

I submit that the two symptoms discussed in the previous section—hallucinations and loss of the ability to think silently—are instances of mass reflexes. The substrate of a vivid image includes, and is therefore larger than, that of a faint image. When a psychotic man reacts with a hallucination (a vivid image) to a stimulus which in a healthy man would produce only an idea or a representation (a faint image), we may infer, in the psychotic man, excitation of a relatively wide cerebral area; in the healthy man, excitation of a relatively narrow area. Similarly, in the case of patients who must speak their thoughts, there is excitation of a relatively wide cerebral area (the substrate of a spoken word being larger than that of an unspoken word).

Summarizing the data contained in this section, it may be said that the primitive nervous system is characterized by the relative predominance of mass reflexes—diffuse responses involving large parts of the nervous system. As the nervous system evolves, its parts become more and more complex, and more and more capable of acting alone, thus permitting responses involving smaller and smaller cerebral areas. When the nervous system is diseased, there may be a return to the more primitive condition, with the reappearance of mass reflexes.

AUTOMATIC REASONING

Automatic reasoning is illustrated by two examples. (1) Suppose one is asked to solve this problem in arithmetic: if *two* men can build *two* boats in *two* days, then *one* man can build *one* boat in how many days? Stupid persons will say that the answer is obviously *one* day. This is an automatic response; it is 'the first thing that comes to one's mind.' Only a person who has passed a certain point in cerebral evolution is capable of discerning its incorrectness. (2) This example consists of a trap which children set for each other. A asks, 'How do you pronounce M-A-C-C-A-R-T-H-Y?' B replies, 'MacCarthy.' A asks, 'How do you pronounce M-A-C-D-O-N-A-L-D?' B replies, 'MacDonald.' A then asks, 'How do you pronounce M-A-C-H-I-N-E?' B, if he falls into the trap, replies 'MacHine.' This too is an automatic response; it is what the child will say 'without thinking.'

I do not mean to imply that all automatic reasoning is inferior reasoning. Reasoning may be highly automatic and yet in no way inferior. Suppose A asks B, 'I ate one apple, and I now have one apple left; how many did I have at first?' B's response, two apples, is highly automatic, yet correct.

An automatic response is inferior only when it can be shown that another, more complex, response is better adapted to the circumstances. In this discussion I shall be concerned only with those automatic responses which are at the same time inferior.

Automatic reasoning is primitive reasoning. It is primitive because it characterizes those with poorly developed minds. It may therefore be assumed that automatic reasoning occurs during activation of lower nervous pathways, while more complex reasoning occurs during activation of higher pathways. Moreover, the lower pathways are activated before—even if only a split-second before—the higher. Thus a person solving the problem in arithmetic given at the head of this section might respond as follows: ‘I suppose the answer is *one* day. . . . H’m, let’s see, that doesn’t seem right. *One* man can build two boats in *four* days; therefore he can build *one* boat in *two* days.’ This response consists of two parts. First there is activation of lower pathways, producing an automatic, and (as it happened) incorrect, response; then there is activation of higher pathways, inhibiting the more primitive response and producing a more complex, and correct, response. When the highest centres are sufficiently underdeveloped or sufficiently paralyzed by disease, the automatic response is allowed to pass unchecked.

In the remainder of this section I shall discuss further the occurrence of automatic responses in ‘normal’ people, after which I shall give one instance of its occurrence in a delirious patient.

Responses which depend on suggestibility are automatic. It should be emphasized that positive responses to suggestion are not necessarily inferior. They are inferior only when they occur in circumstances in which they should have been inhibited. Thus when one gives a match to a friend who asks for it, one’s obedience to the suggestion is eminently proper. But if a child of ten obeyed the suggestion to put his finger in the fire, his highest centres would fall under suspicion. Similar statements may be made regarding those responses which take the form of beliefs. Suppose on returning to town after an absence of several days I am told that yesterday it rained here. If I have no reason to doubt my informant, I respond by believing that it rained. This, an automatic response, is suited to the situation. On the other hand, when a known braggart says he is worth a million, it would be stupid to believe him automatically. Here the automatic response is checked by a more complex response.

Many of the beliefs of the vast majority of mankind are automatic beliefs—beliefs implanted by suggestion and maintained in the face of conspicuous lack of proof. For example, a woman spoke in glowing terms of a book of reminiscences by an astrologer who claimed he had foretold the date of many events, including the death of King Edward VII. She marvelled at this ability and said that until she read this book she had been unaware of the value of astrology. Her obviously sincere, and not ironic, manner showed that she had accepted uncritically the astrologer’s statement of his achieve-

ments. In so doing she had reacted automatically in a situation which, in a more highly evolved person, would have evoked a more complex and more critical response.

An instance of an automatic response to suggestion in delirium will now be given. The patient, age 63, had a delirium associated with myocardial failure. In testing his orientation, I asked him to tell me the time. He pondered several seconds. Then, as it happened, the ward telephone gave two sharp rings. As soon as he heard them, he replied, 'That says two—I think it's later than that—I'd say it's about 3 o'clock—maybe 2.30.' (Actually it was 10.30 a.m.) The two rings had produced in him the mental state 'two,' whereupon uncritically he had accepted it as relevant to the topic of his cogitation. In a person with intact highest centres this mental state would have been promptly suppressed as irrelevant.

The lesson of these examples is plain. There are primitive and complex modes of reasoning. The former are acquired early in life, the latter late. The former occur during activation of lower layers of the highest centres, the latter during activation of higher layers. When the highest centres are incompletely evolved (as in children and in unintelligent and immature adults), or when disease (by interrupting the highest layers) reduces them to a lower level of evolution, there is 'reduction to a more automatic condition,' manifesting itself in relative predominance of primitive modes of reasoning.

MISCELLANEOUS EXAMPLES OF AUTOMATIC ACTION

1. The more one practises an act, the more automatic it becomes. To the greeting 'Good morning' one responds automatically 'Good morning'—automatically because one has done it so often. Sometimes circumstances arise which call for a response different from the habitual. In these circumstances the ability to break away from the habitual response is a measure of the evolution of the highest centres.

Children whom I examine address me sometimes with the polite forms reserved for women: they say 'Yes, ma'am' and 'No, ma'am.' Those who do this are usually below the average in intelligence, and usually come from poor homes. The reason for this behaviour is that children of poor families are accustomed to speak politely only to their school teachers (usually women). They rarely hear 'sir' and 'ma'am' at home and rarely are taught to use them, except at school. At school, when the teacher is a woman, 'ma'am' is used to the exclusion of 'sir.' In this way they acquire the 'ma'am' habit. Sometimes a child, after saying 'ma'am' to me, becomes embarrassed, having recognized his blunder, in spite of which—so hard is it to break the habit—he continues to address me in the same way.

The force of habit is seen in the case of those demented senile patients who give the year as 18 hundred and something. Taking an actual case, a patient of 75, seen in 1935, gave the year as 1835. This error indicates

the predominance of a more automatic over a less automatic response. Until the age of 40 the patient lived in the nineteenth century, and it was habitual with him to think of the year as 18 something. After the turn of the century it became habitual to think of the year as 19 something. The habit of mature years is less automatic, less stable, than that of childhood; it is the more easily lost—just as a language learned in later years is easier to forget than that learned in childhood. Accordingly, when the highest layers of the highest centres are diseased, there is loss of the more complex habit (19 something) and reappearance of the more automatic habit (18 something). There is a tendency to think that the errors of senile patients are haphazard. This is not entirely true. Errors in the last two digits of the year are sometimes seemingly haphazard, but errors in the second digit are always (in my experience) traceable to the strength of the habit laid down in childhood. When the patient errs in the century he always says it is 18 something. I have never heard a patient give the year as 17 something, because I have never had one who passed his childhood in the eighteenth century. For a similar reason I have never heard a patient give the year as 20 something. I think it probable that the senile patients of 100 years ago often made the mistake of thinking it was 1735, but never (or rarely) 1935. I also think it probable that the senile patients of 1890 never erred in the century; if this is true, it is because they never knew a time when it was not 18 hundred and something.

2. The untidiness of demented patients is automatic. In infants distention of bladder and rectum is followed promptly by evacuation. In older persons this response is suppressed save under special circumstances. Perhaps it will be said that the demented patient's untidiness needs no physiological explanation, that a psychological explanation is enough, viz. the patient is apathetic, and lacks the will to go to the toilet. But this is really no explanation; it is only another way of saying he is untidy. On the other hand, it *is*, I think, an explanation to say he is untidy because of impairment of those higher pathways which normally inhibit the primitive evacuation reflexes.

3. Some psychotic patients are easily irritated and respond belligerently with undue haste. An epileptic under my observation was sitting at his meal in the ward dining-room. To keep flies away from his glass of milk, he had laid a slice of bread on top of the glass. A fellow-patient came up from behind to borrow the sugar. In reaching for it he accidentally dislodged the bread from the epileptic's glass. Without pausing to ascertain the circumstances, the epileptic wheeled about savagely and for a moment seemed about to strike the other man. Such behaviour is automatic.

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