THE MECHANISM OF PERSONALITY.*

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Our conceptions of how the organs of the body work are primarily derived from experiments done on muscle, the organ from which experimenters have been accustomed over many decades to ascertain the fundamental properties of living tissues; the principles there learnt have then been directly applied to the problems presented by other organs. Such having been, and still being, scientific practice, it follows that, if we find out about the working of muscle something fundamentally different from that hitherto suspected, we not only obtain therefrom new ideas of the working of muscle, but also new principles to apply to our ideas of the working of other organs. It could happen, however, that new knowledge concerning the fundamental working of the organs of the body should actually come from some other organ than muscle. In that case the newly discovered phenomena would not be directly explicable in terms of the fundamental principles derived from muscle. Two courses would then be possible. The discoverer could re-consider his fundamental principles, and thereby be led to re-examine the workings of muscle in the light of the information supplied by the other organ, or he could frame an *ad hoc* hypothesis concerning the supposed peculiar behaviour of the other organ. The latter has been the usual course followed, though it would not appear that the framing of such hypotheses has been made with full awareness that they really resolve conflict between principles derived from muscle and principles derived from the other organ.

The existence of the practice being appreciated, it is further to be appreciated that the number of special hypotheses framed in connection with any organ gives a rough index of the extent to which knowledge of its workings is in advance of our knowledge of the workings of muscle. On that basis, present knowledge of the workings of the organ of mind must be placed well ahead of current

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muscle physiology. But the point remains that an advance in muscle science can mean the re-stating or discarding of a greater or less number of the present special hypotheses of mental science. We therefore turn to our advances in muscle.

As is well known, an induced shock applied to the excised muscle of the frog causes contraction, and hitherto it has been tacitly assumed that the electric current directly acted on and exploded, as it were, some explosive, or excitable substance in the muscle, the energy thereby set free being in some way manifested as the contraction. But we find a duality of muscular structure, in that one part is concerned in reception of, or excitation by the electric current, and then this excitable part, in its turn, evokes the activity of the contractile material (1) (8).

Muscle, in fact, works something like an ordinary gun cartridge, where the stimulus or trigger detonates one explosive, which, in its turn, evokes the activity of the propellant. In addition, in muscle all drugs, etc., influencing its activity act primarily on the excitable part.

If my muscle results be generalized, we expect to find two anatomically and physiologically distinct parts in every organ. There will be first the responding part concerned in the proper responses of the organ; there will next be an excitable part, in immediate contact with the organ's environment, determining what the responding part shall do.

This generalization is next applied to the organ of mind, and gives us two parts in it. There should be a responding part in which the proper responses of the organ occur, and these for mind should be thoughts: there should next be an excitable part in immediate contact with the perfusing fluids or other environment of the whole organ and determining the activity of the responding part. Thus, so far as my own results on muscle indicate, we could render the whole organ quiescent by an anæsthetic without that anæsthetic exerting any direct action whatever on the responding part (3) (5). The energy of the responding part of the organ of mind I would term psychic, that of the excitable part, neural.

The theory just given is very similar to that of psycho-physical parallelism, but with this marked difference in its genesis, that the present one comes directly from muscle, whereas the other is a special *ad hoc* hypothesis framed to explain what was believed to be the peculiar nature of the organ of mind. But while priority in the realization of this duality is to be conceded to the psychologist, we yet get something much more definite than he ever believed.

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We find, for instance, "action at a distance" as the nexus between the two parts; in addition we find it necessary to place definite limits to the capacity of the responding organ (8).

We give also some words of caution in regard to terminology. "Neurasthenia" and "psychasthenia" can quite possibly imply quite different conditions when used in connection with the machinery we find and the conditions the clinicians find. It may therefore be pointed out that while in my judgment there is some agreement in regard to neurasthenia, it seems to me that some of the conditions at present labelled "psychasthenia" would be more accurately indicated by the term "dysneurometria."

The Two Types of Augmentation of Activity.

I find that cardiac activity can be augmented in two ways. The one way is peculiar to the action of calcium and its relatives. In this the augmentation rapidly reaches its full effect when its producer acts, and next, when the producer is taken away, the augmentation as rapidly subsides. That is all we have to say about this type of augmentation, and it is readily seen that its characters are amply described by the word "rapid." The rapid type of augmentation rapidly appears and disappears with its generator (4) (6).

There is, however, much more to be said about the second type of augmentative change, as may readily be grasped when we enumerate some of its chief properties, which are:

(1) The augmentation definitely takes time to produce, and so, as a direct result of this time factor, if a stimulant be not allowed to act long enough it cannot produce its full effects.

(2) When the effect of a stimulant is an augmentation of moderate intensity, the amount of change produced may be regarded as roughly proportional to the time of action of the stimulant. The rate of production, however, tends to fall away when augmentations have become large.

(3) A given amount of augmentation is produced more rapidly by a strong than by a weak stimulant.

(4) When this type of augmentation has been produced, removal of its producer is not followed by removal of the augmentation. Instead, the change persists in being a short time and then slowly subsides.

(5) The greater the amount of augmentation, the greater the

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time required for its subsidence after removal of its producer, though times and amounts are not directly proportional to one another.

(6) An augmentation may subside regularly, or else in a series of waxings and wanings (overswing phenomena).

This type of augmentation has, thus, many properties, and one naturally seeks to give it a name. A comprehensive name, however, would be longer than any word at present in our language, and so it was instead nicknamed by its most prominent character, which, to me, was the property it possessed of subsiding in its own time after removal of its producer. Accordingly I termed this type of change the "hysteresial," or the lagging-behind change (4). This word was originally used by the physicists, and has also been used by investigators of colloidal systems to express what seems to be a fundamental property of them. It was my intention to imply, when I used this word "hysteresial," not only that there was this lagging behind, but also that the change was mediated by aggregation changes in a colloidal system (4) (6).

Now this hysteresial change was found by me in muscle, and so it is to be anticipated that the same type of augmentative change is to be found in any other organ, provided the experiments are done in a manner permitting the organ to demonstrate this change to us; and the proviso is important, because the traditional methods of experimenting on muscle have actually prevented observers from seeing this change there before (8). It can happen, however, and it has happened, that experiments can be performed on other organs under conditions permitting observation of change possessing the characters of this change which I have observed in hearts. When that happens, then, because the experimenter does not know of the occurrence of a similar type of change in muscle, an *ad hoc* hypothesis will be framed in explanation of the supposed peculiar behaviour of the other organ. In addition, there will be differences of nomenclature—a point we may immediately consider.

Other observers have noted what was termed above, on a biochemical basis, hysteresis, but have called it by different names. Thus the psychologist speaks of perseveration, the ophthalmologist of after-images, the neurologist of after-discharge and so on, each observer giving it a name according to the bias of his experiments.

Nomenclature may also be affected by the end the experimenter has in view. If, for example, the end were to produce a definite amount of this change, then the time taken in developing that amount could quite reasonably be measured as a delay instead of developmental time. The statement above, that a given amount of

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this change is produced more rapidly by a strong than by a weak stimulant, would then become transmuted into the statement that the delay is shorter with strong than with weak stimuli.

If we next add to the qualities of this change the fact that it is adversely influenced by inadequate oxidation, and then make allowances for differences of nomenclature arising from the causes just mentioned, it will be appreciated that there can be found in hearts an augmentative change having most of the qualities hitherto believed to be specific to the activities of reflex arcs. But when these qualities were found for reflex arcs, it was not known that a change of similar qualities could be produced in either muscle or nerve. The cause for this lack of knowledge, so far as the heart was concerned, was that tradition developed experimental rules, preventing the change being observed. The same probably holds good for nerve-trunks; at any rate the phenomena of electrotonus, re-interpreted in the light of the two changes observed in hearts, show that nerve-trunks can undergo hysteresial change. It is probably also of significance that these changes can only be conveniently observed in a rhythmically active organ. But whatever may have been the actual cause, the fact remains that investigators of reflex activity were able to evoke somewhere in the reflex arc activities of a type which we have found it possible to make hearts undergo. To these investigators, however, these activities were entirely novel, and outside their experience of the behaviour of either muscle or nerve-trunks. They therefore sought in the reflex arc some structure which was neither muscle nor nerve, and assigned to it these supposed peculiarities of activity. As is well known, the structure considered to possess these properties was the synapse.

It can no longer be considered, however, that a particular element in the reflex arc alone possesses these believed peculiar properties: instead, having found muscle also to possess them, and concluded that they are based on aggregation changes in a colloidal system, we should expect them to be general properties of such other colloidal systems as are the nerve-trunk and nerve-cell. Moreover, having regard to other evidence pointing to the synapse acting as a semi-permeable membrane, it really is the last element in the reflex arc, to which one should assign these properties (2). The synapse should therefore be relieved of its supposed peculiar properties—a relief which leaves it with the duty of passive conduction. Having done that, we are in a position to appreciate that the properties of reflex arcs are dependent on the production of hysteresial

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augmentation in a fundamentally rhythmic structure, probably the intercalated neuron. But having thus relieved the synapse, it should be clearly understood that the theories at present current, which are based on the assumption that the synapse alone possesses these peculiar properties, automatically perish. In turn, that means an entire re-casting of current neurological ideas concerning the mode of working of the nervous system.

The Value "*T*."

Every heart so far examined by me has a definite limit to its normal capacity for response, and so I assume the same holds good for the mind. This limit for the mind I call "*T*" (8).

It would be accepted by most, I think, almost as axiomatic that there must be a limit to the power of the mind, but, so far as I know, no one has used this axiom in the propositions or theories framed concerning the mind. Yet, as we shall see later, use of this axiom can make all the difference to the deductions that can be drawn from the facts of the case.

A Second Duality.

All visible cardiac activity may be regarded as being essentially an augmentation above the zero level of beating. The augmentations, however, are never of pure type; they always consist of mixtures of our two types. But while the living machine requires both to act, it can work as strongly with a predominance of the one as of the other. And what this comes down to is that if you want a beat of a particular height, though both calcium and colloidal aggregation are necessary, the more you use of the one the less you require of the other, a relationship we express by the simple indeterminate equation—

$$X + Y = C.$$

In this equation X denotes calcium, Y colloidal change, and C the height of beat required, and in it we reach our second duality, that of the excitation processes. The first, it will be remembered, was a structural duality in that we divided organs into two parts, the one concerned in response, and the other concerned in reception and control. We are now finding that the excitable structure's energy is derived from two independent sources. These facts make

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it possible that drugs, etc., which act on this excitable structure, should be able to exert two independent actions.

In a previous communication it was shown that alcohol exerted two independent actions on the excitable structure of the heart, and so, presumably, it will do the same to nerve-cells (7). It happened, however, that the experimental technique devised for muscle as effectively prevented observation of this double effect of alcohol as we have already noted it to prevent observation of the hysteresial augmentation. But, just as hysteresial change was readily observable in reflex arcs, so also a double effect of alcohol was readily deducible from its effects on the organ of mind. Hence, because the effects observed on mind did not lead to a re-examination of the effects of the drug on muscle, two things, higher and lower centres, had to be imagined to exist in the organ of mind in order to have two things for alcohol to act on there. But having found the two things in every cell, the hypothesis of higher and lower centres can now be dropped.

If we next attempt to state the actions of alcohol and cocaine in words appropriate to the Freudian terminology, we can only conclude that, in the rapid change, we have the physical basis of his reality principle, and that in the hysteresial change we have the physical basis of his pleasure-pain principle.

The relation between these "principles" can be illustrated by the analogy of a petrol motor. In a petrol motor two "principles," petrol vapour and air, can be considered to fight one another for possession of the limited space of the induction pipe and cylinders. Wherefore, because of the limited space, the more you have of the one the less you can have of the other. Therefore the two principles might be thought to be antagonists, than which there could be no more misleading conception of the working of a petrol motor.

Reverting to mind, we have to note that in the latter also there is a limited capacity which determines that the more you have of the one principle the less you can have of the other. That relationship was appreciated by Binz, and gave rise to his theory of the existence of inhibition between higher and lower centres; it was appreciated by Freud as well, and gave rise to his theory that his two psychological principles were antagonists. We considered petrol motors above to indicate that, while we consider inhibition and antagonism to be reasonable deductions, yet nothing could be further from the true workings of the organ of mind. Our finding is that this organ works always on two things which, because of the

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limited capacity of the organ, have to one another the relationship the more there is of the one the less there can be of the other.

The position we have reached therefore is that we accept Freud's two psychological principles as facts of the case, but consider that to call them antagonists provides a highly misleading half-truth.

The Divisions of Mind.

The conception reached above that thoughts are of the nature of binary alloys has been previously used by me to make subdivisions of the mind, the dividing being made entirely by deduction. For, if thoughts be based on alloys, there must be some optimum mixture of the two constituents of the alloy. Next, on either side of that optimum, the quality of the alloy must grade away until impure elements rather than alloys are reached. Such results follow from the inherent properties of any regular series of mixtures of two things. In this way the territory of mind was divided into a central cognoscible region, where thoughts are what we think thoughts ought to be, and placed on either side of this was an infra-cognoscible and an ultra-cognoscible region respectively, in which thoughts have not the qualities we customarily assign to them. Thus, if we strain to see a black hat in a dark room our cerebral visual perceptive mechanism works hard, but, in the absence of data, there is nothing in the result we should call by the name of "vision" (11).

The cognoscible region was further subdivided into the para-critical or emotional region, and the eu-critical or region of sound solid fact (11). It now seems worth while, however, to interpose a dimly-lighted or hypophasic region between the eu-critical and the infra-cognoscible region. Possibly also it may be found worth while later to place a paranoiac or ultra-critical region between the para-critical proper and the ultra-cognoscible. But, however many further subdivisions may be made, a point always to note is that mind is like the spectrum, where, while you may accurately distinguish yellow from green, you cannot say where green ends and yellow begins. These divisions we show in the diagram (see Fig. 1).

So far as I am aware, while everyone has previously appreciated that memories could die and be buried in the infra-cognoscible mind, no one has before realized that memories could be "lost" by translation to the ultra-cognoscible mind, the region of the super-abundant vigour of mental poltergeists. It was therefore not

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appreciated that a memory could be as automatically "lost" through its strength, as it is automatically "lost" by increasing weakness. Nevertheless the fact remained that memories could get lost otherwise than by merely fading away with the passage of time, and so to explain this other way of losing a memory the mechanism termed "repression" was postulated.

On the whole, discussion of this repression mechanism would now be profitless. Rather should we admire the patience and toil of those who found there were two kinds of "lost" memories, and acknowledge they did the best that could be done with the material at their disposal.

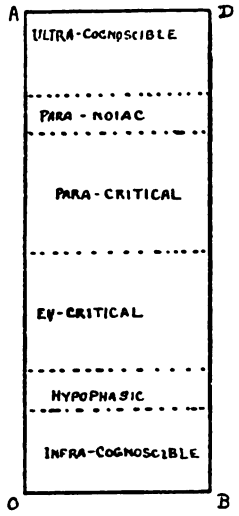


FIG. 1.

THE MECHANISM OF PERSONALITY AS DEDUCED FROM THE FOREGOING.

It has possibly been appreciated from some of the foregoing that many of the difficulties of the psychologist or psychiatrist are created by the method of approach to the facts rather than by the facts themselves. To speak, for instance, of a sensation "entering" consciousness, or of something being "made" conscious, precludes one from realizing that consciousness, by addition to something else, gives an alloy whose properties are typical of neither of its constituents. In the same way the question is begged when the mind is regarded as a storehouse of memories. Our

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finding is that the mind is a storehouse of memory-traces, or L (8) (9), and also a manufactory of a judging or conscious-making factor, H. That gives us an entirely different view of what the mind of a normal person may be. We endeavour to present this view in our next diagram (see Fig. 2).

We have a rectangle, AOBD, divided into four regions (*cf.* Fig. 1), and we represent the strength of memory traces, or their content in L, by lines inside the rectangle and vertical to the line OB. The amount of H normally applicable is represented by the distance between the lines representing L and the line AD.

In interpreting this diagram some words of caution are necessary; no distinction is made between the L of an idea derived by integration from already internal sources—theory-framing, meditation—and

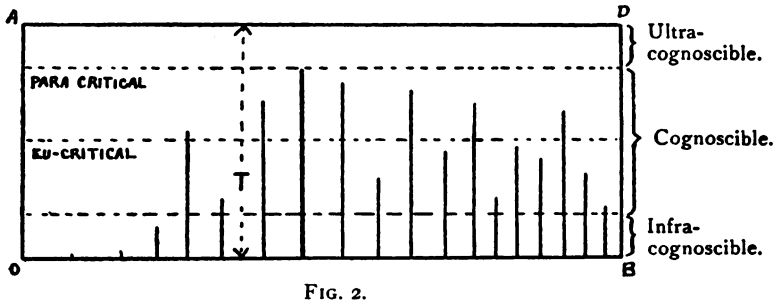


FIG. 2.

the L directly derived from some event in the environment. We merely concern ourselves with L content, and treat each packet of L as a neurogram or memory trace.

Now the ordinary John Citizen is expected to be honest, truthful, patriotic, moral, to believe himself possessed of the best woman in the world for a wife or *fiancée*, and, if he be a father, to have children somehow or other superior to other people's children. So, in the diagram, the L of the man's wife extends well into the para-critical region, whereas the L mediating any other woman should be, if not actually eu-critical, at any rate much less para-critical. The same holds in respect of children.

None of us knows, of course, what we ourselves, or anyone else, is really worth. We only know what we think we or they are worth; wherefore I am inclined to think that the "ego" is normally really an idea with much L. When we imagine we actually know what we are worth, the L mediating our ego has become eu-critical.

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But the original of an idea which possesses so much *L* in it that enough *H* cannot be added for accurate judgment necessarily appears to have an overwhelming value. Hence, if some change take place in us reducing the incalculable value to the calculable, the latter must appear worthless in comparison with the former. We should also note here the possibilities associated with the all-pervading *T*. The ego may appear overwhelmingly valuable because of its very strength in *L*, or a normal strength in *L* may appear of overwhelming value because its possessor has a small *T*.

Now when the individual is truly honest, patriotic and moral, he never requires to do any hard thinking before he exercises these virtues. He just acts without pausing to consider the matter. His practice of virtue is, in fact, of that effortless type which denotes little *H* (10). Hence we place the virtues in the para-critical region. On the same basis we would assign to the good woman's conception of her virtue an amount of *L* which places it beyond her appraisement, but the prostitute's corresponding *L* would be eu-critical. But, if the average man has a greater *T* than the average woman —which seems likely—and a man and a woman develop equal amounts of *L* to mediate a virtue, the man should be more "reasonable" about it than the woman and so appraise its value more accurately. Wherefore the average man should be more "reasonable" about these affairs than the average woman. But a virtue that can be "reasoned" about ceases to be what we regard as a virtue. On the other hand, when we consider inborn capacity to tell the truth, the possessor of the smaller *T* is at a disadvantage.

The para-critical region, then, is the region where are the memory traces of all the ideas on which we place a high or incalculable value, that is to say where a man keeps the memories of his parents, wife, children, and his virtues. The eu-critical region is the region of technical skill. Thus, when the architect "dreams" a new building he works in the para-critical sphere; when he draws up the plans and estimates, he works eu-critically.

In the diagram above (Fig. 2) a specially thick line has been drawn extending far into the para-critical region. It may be considered in fact, if we make a subdivision between the paracritical and ultra-cognoscible, to extend into the paranoic or ultra-critical region. That long line is intended to represent its possessor's "bee in the bonnet" —that superlative idea which to him is the most important thing in the world. Because of its strength in *L*, that idea must be ever prepotent to attract his *H* (10), and only by continuous effort can he add *H* to any other idea. To be possessed of such an idea is quite

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a normal phenomenon, and when he "marries the girl" everyone is satisfied. We may, or may not, be satisfied if the possession of such an idea leads its owner to devote his life to the conversion of the heathen. We are usually dissatisfied when the idea is one of conspiracy. But we should no more expect to argue the young man out of his conspiracy idea, than we should expect to argue the young man out of his love for the lady because these ideas are to their possessors beyond reason. They can only feel "in their inmost soul" that these ideas are true. But they get that feeling because there is so little *H* and so much *L*. Our minds are built for self-deception!

We consider next what would happen to the person after taking alcohol, the drug which adds *L* and removes *H*. Ordinarily this drug is taken because the resulting accretion of *L* to all ideas gives feeling-tone to what in its absence is plain, cold fact. Thus also it comes about, since *H* mediates effort (10), that many things now can seem effortless which, without alcohol, would be effort-full; the eu-critical tends to be para-critical.

But the same change that makes para-critical of things eu-critical makes ultra-cognocible the "bee in the bonnet," and its possessor thereby temporarily "loses" what without alcohol was his most treasured possession. Admittedly also it could be his most thoroughly disagreeable possession. If it be the latter he will take alcohol to lose it, at least temporarily; if it be the former he dare not take alcohol for fear of losing, even though temporarily, his most treasured possession.

Emotion can do the same as alcohol, and temporarily "lose" for the individual all that, without the emotion, he stood for.

Our next step is to assume that there are toxins which can selectively increase the content in *L* of neural excitation processes even more effectively than alcohol. If such happen within us and we possess a "bee in the bonnet" that bee will be the first to go. The result will be an altered personality, for the result of sending an idea into the ultra-cognoscible region will not be a mere "cooling off," but a complete loss of that idea from cognoscibility. We shall get, in act, complete frigidity—*une belle indifférence*. The new person will know nothing of the old, but be dominated instead by the next "highest" idea. Moreover this "new" person, while perfectly oblivious to its predecessor, should yet be known to, but be despised by that predecessor—though despised is, perhaps, a harsh word. The point is that the largest *L* should value less highly and so look down on, as it were, ideas with lesser *L*.

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It seems to me possible that these altered personalities are more common than are generally supposed. One that came under the direct cognizance of the psychologist was a young lady, keen on some form of good work, who suddenly left it and went in for a "good time" instead. Then there is the engaged girl who suddenly realizes that her *fiancé* really means nothing to her and breaks off the engagement, and renews the engagement some months later when the "normal person" once more returns. It seems to me that these events are just as much cases of altered personality as those which the psychologists describe, for there could be no more radical change of outlook than that implied by a broken engagement.

Returning to our honest John Citizen, who has settled down with his wife and family, we expect his behaviour to be dominated by them and his responsibilities to them. If, then, some change take place in him, giving a general accretion of L to all his ideas, we should expect those he holds dearest to pass first to the ultra-cognoscible. His wife, children, and his responsibilities pass to the ultra-cognoscible, and mean nothing to him. The same change gives added feeling-tone to his former eu-critical ideas. Therefore he may believe he has money to spend; he can no longer exactly appraise his possessions; he can only believe he possesses much. As regards his personal capacity, that will be believed infinite, for with so much L he cannot have the H which gives the "sense of effort."

L also is energy, some of which is lost in fatigue. Hence, with such an abundance of L, there will be abundance of energy, and little, if any, fatigue. Accordingly I consider such conditions should be considered to be exhausting neuroses, not exhaustion neuroses, because the patient does not get neurosis through exhaustion, but gets exhaustion through the neurosis.

We will examine next the possible happenings if L decreases and H increases. In this case, instead of being entirely oblivious of his responsibilities, he knows that they are much less important than normal people imagine. He has also gained some knowledge of the real value of his wife and family through the L of his responsibilities, wife and family having passed from the para-critical to somewhere near or in the eu-critical level. On the other hand, his "possessions" will have passed from the eu-critical to the hypophasic or even infra-cognoscible region. If they get only to the hypophasic he will believe himself on the verge of ruin, whereas if they get to the infra-cognoscible he will have lost all.

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And it will be useless to argue with him, because he has seen with his own "eyes" these things fade away. For all we ever "see" of our possessions is their L within us, and that we "see" through H.

Our melancholiac will find everything hard work, of course, because all his thoughts contain much H. He can also be expected to be careless about his personal appearance, through his ideas of those matters losing enough L to teach him that they do not matter.

Melancholia and mania were selected above to show how a personality could be dissolved solely by dysneurometria without change of total intensity. Neurasthenia and its opposite "neurosthenia" should be equally potent. There may also be conditions in which the brunt of change falls only on H, and others in which the brunt falls only on L.

The mind is a collection of discrete packets of the factor L sorted out according to size, and we are constrained to estimate the value or importance of any idea or thing in terms of the size of the packet of L mediating it for us. But after a certain optimum has been passed, our capacity to estimate L automatically decreases as L increases, with the result that the L eventually becomes for us incalculable, though actually quite finite.

Practice, training or meditation increase the value of L, and so, if we live amid an environment where the ten commandments are regularly practised, the L mediating them must eventually assume an incalculably high value. If, then, the individual is properly responsive to his environment, he must eventually hold in the highest esteem his own environment; there will be, in fact, "nothing like leather." Moreover, by appropriate training the machinery can develop any sort of "mad" idea, which to its possessor will be held of the highest importance, and, quite rightly, beyond reason; at least it will be beyond its possessor's reason. To another man, of course, this high ideal can well be a "fact" to which the full power of discrimination can be applied.

The man who is normally responsive to his environment thus holds certain ideas in high esteem, and among them, through constant practice, will be his name, occupation, family and so on. We expect him, again in accord with his environment, to hold other things of lesser account. So long as those things happen, we consider him a normal person. Accretion of L "dissolves" the personality, the things normally held of most value going first, those normally held of least value going last, so that at that last

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the victim can only find the greatest delight in things and doings once utterly despised. Depletion of *L*, on the other hand, should give the altered person a low idea of the real value of the things he once prized too highly.

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