

# STUDIES IN RESPIRATION AND PERSONALITY

3. A preliminary version of a respiratory modulation  
test - its theoretical perspective and empirical foundation

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## Preface

The present monograph is the third one in a series called Studies in Respiration and Personality. Even though it might be looked upon (and read) as a separate paper, it is closely linked to the two previous monographs. Its first theoretical part elaborates on some of the issues raised in the post-experimental speculations in the second report, and its subsequent empirical part, follows very much the same lines as the data analysis in the first report. It has been written with the aim (as was the case with the two former reports) of stimulating interest in an area of personality research I have come to consider increasingly important and fruitful; and also with the hope of inviting discussions and exchange of opinions with researchers and clinicians working within the same problem area. The monographs are to be considered as working papers or progress reports.

I would like also in this preface to express my deep appreciation for the generous support and encouragement I have received from Dr. Gardner Murphy, and the many good ideas and the excellent technical assistance given me by Mr. Charles Snyder. The empirical work, the collection of respiratory records as well as the scoring of these records, was done in Topeka, Kansas, U.S.A., in the summer of 1963, through a research grant from the Menninger Foundation. The writing up of the report has been done at the Institute for Social Research, in Oslo - made possible by a grant from the Norwegian Research Council for Science and the Humanities.

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## I N T R O D U C T I O N

In an earlier monograph entitled "Tentative suggestions concerning the interpretation of Respiratory Patterns", a theoretical model was launched linking thoracic and abdominal breathing to the tonic condition of peripherally and centrally located skeletal muscles. It was suggested that the tonic conditions of these muscles could be accounted for in terms of different patterns and directions of excitation-flow within the organism. Furthermore, the assumption was made that different patterns and directions of excitation-flow would correspond to, or have repercussions on, psychological functions and experiential qualities.

We assumed a centrifugal flow of excitation to give rise to bodily sensations of pleasure, i.e., of expansion, of being alive, of strength and growth, and a centripetal flow of excitation to give rise to unpleasure, i.e., to anxiety, despair, hopelessness and helplessness. However, we went one step further in our theorizing and introduced the idea that excitation under certain circumstances can become bound and immobilized. As the mechanism behind this process we postulated a generalized increase in the pattern of peripheral muscular tonicity. We suggested that the erection of such a peripheral armor would prevent anxiety and unpleasure, but also pleasurable sensations. In short, that it would insensitize the person as regards his non-cognitive internal sensations generally.

Finally, we suggested that a person may maintain an awareness of his armor, be in command of his armor, be in a position to put in or out of operation at will. But that an armor may also be split off from awareness and assume an autonomous position quite of its own.

There is a great deal of evidence indicating that muscular tensions arising from a protracted state of anxious expectation may

become lasting ones if the stressful situation is not in due time followed by motor activity or postural relaxation. However, in discussing the phenomenon of a perpetuating muscular armor we focused our attention on more dynamic factors. We suggested that a common mechanism behind excitation binding is a simple repression being succeeded by a secondary compensation, i.e., a peripheral muscular dystonicity being replaced by a pattern of more generalized hypertonicity. As regards its dynamic aspect we suggested the appearance of forces actively resisting any attempts toward its resolution.

So far, we have been specifically concerned with linking various states of muscular tonicity to bodily feelings and awareness. We have distinguished between bodily awareness and lack of awareness - between feelings of pleasure and unpleasure, and in the case of non-awareness - between a temporary, situationally-conditioned lack of awareness and a permanent, character-conditioned non-awareness. It is our assumption that this gross typology corresponds to different genetic conditions on the one hand, and to different modes of psychic functioning on the other. This latter assumption follows from our belief that variations in internal awareness are interrelated with other types of awareness, and, in fact, represent an integral part of an individual ego organization.

In the earlier monograph, previously referred to, we took as our point of departure an empirical analysis of the breathing pattern of a small group of subjects in a resting, non-demanding experimental situation, and explored the question as to what extent various breathing patterns do correspond to variations in mental health and to various subtypes of mental pathology. We did not bother about obtaining independent information of internal awareness.

Granted the fact that a respiratory pattern reflects the tonic condition of different skeletal muscle systems, we may assume a person's ability to change his respiratory pattern voluntarily to be dependent upon his ability to control these conditions. We may assume this latter type of control to be intimately associated with and dependent upon the degree of bodily awareness being present. Unless a person has some awareness about how he is breathing he would not be able to change his breathing pattern in accordance with instructions. In order to obey instructions successfully, he would have to have some awareness or "feed

back" from what he was and what he is doing. Respiratory modifications implies muscular control, and muscular control presupposes kinesthetic awareness.

On the basis of records of 'spontaneous' respiratory movements, inferences may be drawn regarding the subject's probable 'bodily awareness' since we may suspect high awareness to give rise to modifications making the respiratory pattern optimally adopted to situational requirements. However, two factors intervene and complicate the problem. The subject's perception of the actual situation may differ substantially from our own perception. And - what looks like an optimally adopted respiratory pattern from our point of view, may represent a non-adapted fixated pattern as far as the subject is concerned.

Our reasoning leads us to believe that a relatively simple respiratory modulation test may provide information about 'bodily awareness' not easily obtained through the recording of spontaneous breathing. In any case, it may shorten the time of observation, since - as previously mentioned - in order to make use of spontaneous breathing for psycho-diagnostic purposes several recording sessions are desirable, in fact, may be considered an absolute necessity.

To sum up, we are assuming an ability to control, to relax and tense, respiratory relevant skeletal muscles voluntarily, to go parallel with a flexible psychological functioning; an inability to decrease the tone of peripheral striate muscles, to correspond to a rigid, immobile armor (permanently blocking internal sensations or increasing their perceptual threshold); and finally, an inability to increase the tone of these muscles, to correspond to a state dominated by feelings of anxiety, weakness, or helplessness.

We would like to add that we are here oversimplifying the issue since we don't take into account the possibilities for various types of fragmentation in awareness and of inconsistency in tonicity. It should also be emphasized that we don't believe the degree of bodily awareness to be solely dependent upon muscular and proprioceptive factors. Quite a number of other types of bodily structures (e.g., cardio-vascular structures) and internal receptors (e.g., baro-receptors) most probably enter into the picture. However, at this stage of our theorizing we find it most expedient to make some simplified assumptions.

The purpose of the present monograph is to elaborate on the theoretical model sketched above. We are going to discuss the concept

of internal awareness, and relate it to other concepts like the self, the body image, and the ego. A large part of our discussion will be devoted to a clarification of the relationship between our own model and psychoanalytic conceptions of affects, drive energies, and mental organizations and structures. We will try to show that Freud's classical theory of the mind, to some extent, can be reformulated in terms of psychosomatic concepts and relationships, and also, that it can be looked upon as a special case of a more general theoretical model. In our discussion of these matters we will be somewhat polemical toward modern psychoanalytic ego psychology. This does not mean that we want to under-emphasize its many positive contributions in bridging the gap in subject matter between psychoanalytic and general psychological thinking.

One of the aims of our discussion is to provide a rather comprehensive theoretical basis for the introduction of a respiratory modulation test for personality evaluation. We are going to describe a preliminary version of such a test. Besides describing the test, its instructions and scoring procedures, we want to offer some empirical data pertaining to its discriminatory power and to its possible validity. We will base our inferences on a group comparison between psychiatric patients and normal subjects.

THEORETICAL ELABORATIONS

The Concepts of the Self and the Body Image

Taking as his point of departure the definition of 'the self' as the individual as known to the individual, Newcomb (1950) has constructed a rather comprehensive social psychological theory of human behavior. What is interesting in this context is his consistent emphasis upon the social origins of self-perception. His main thesis is that the child learns to perceive himself through the use of language, and that the beginning of self-perception is the child's experience of being treated in special ways by other human beings - thereby learning to respond to himself as an object to be perceived. But the child not only becomes an object to himself, he becomes an object to himself within shared frames of references, that is, by adopting the responses of others toward himself. As a speaker to himself, he uses the same words and makes the same distinctions as other people do; as a listener to himself he hears the same words and the same distinctions as other people hear; and finally, as a viewer of himself he focuses the same parts and the same features as other people see. Briefly, the self is a social product exclusively developed through interaction and communication with significant others, Newcomb maintains.

Newcomb's conception of the self follows a social psychological tradition springing from the works of Meads and Cooley (cf. Rommetveit, 1958). His conception of the self is closely related to James concept of 'the social self'. What is important to note is that 'the social self' for James was only a part of a more inclusive self concept - a man's self being the sum total of all that he can call his own.



A similar more inclusive self concept is suggested by Sabin (1952). According to him the self is a cognitive structure - a structure organized on the basis of various sub-structures pertaining to different empirical selves, to how the person has experienced himself in relation to his own body, other human beings, things, symbols, etc. The self is nothing fixed, but a changing entity - emerging from symbolic elaborations of single self-perceptions and abstract integrations of these cognitions. Although Sabin suggests that the social self is the most dominating and integrative component of the self in adults, he doesn't rule out that other components may also be present and temporarily occupy a focal position in self-perception. One such component is what he calls the somatic self, a cognitive sub-structure referring to the initial bodily sensations of early infancy.

In his reference to the somatic self as the nucleus of the self from a developmental point of view, Sabin adopts the position of many psycho-analytic scholars. For instance, Fenichel (1945) writes: "The sum of the mental representations of the body and its organs, the so-called body image, constitutes the idea of I and is of basic importance for the further formation of the ego ... The body 'image' is the nucleus of the ego." (p. 36 ff.) Szasz (1957) states: "I suggest that we consider that the ego relates not only to other people (the mother, etc.) as objects; but also to the body (of the self) as an object ... I favor the idea that the body as an object is more important for the early ego than are people as objects." (p. 54 ff.)

Both Fenichel and Szasz are talking about the body as a cognitive structure, as a psychological object or image. The term 'body image' has been defined by Gerstmann (1958) as follows:

"By body image, or body schema, is understood the inner picture or model which one forms in one's mind, of one's body or one's physical self, in the course of life; and which one carries with one unwittingly, that is, outside of central consciousness. It is a kind of inner mental diagram representing one's body as a whole, as well as its single parts and territories according to their location, shape, size, structural and functional differentiation and spatial interrelation. It also represents the cardinal directions of the body; right or left, anterior and posterior, up and down. The body schema can thus be conceived of as a complex of intimately correlated and integrated individual schemas; some of them seem to predominate over the rest." (p. 500).

This definition of body image is in principle quite similar to Sabin's definition of the self. In both instances we hear about "com-

plex and intimately correlated and integrated individual schemas", and that "some schemas seem to predominate over the rest".

The importance placed on the body schema in psychoanalytic circles is probably in part stemming from clinical observations that body image distortions are very frequently found in psycho-pathological states, and that such distortions frequently are the earliest heralds of schizophrenic regressions and other types of severe mental 'break-downs'. Among psychoanalysts, Paul Schilder (1931, 1935) is the one who has contributed the most to the discussions of the role of the body image. But in recent years it is probably the work of Szasz (1957) that stands out as the most significant contribution.

Szasz, too, writes from the point of view of psycho-analytic theory. He makes the somewhat contradictory point that so-called bodily feelings do not necessarily refer to the physical body. What they are referring to is the subject's body image. And the body image - as a cognitive structure or as an object for the ego, may represent a perceptual framework quite unrelated to the body as a physical entity.

Szasz argues strongly against the common practice of locating pain either to the mind or to the body. In his opinion pain is always a psychological phenomenon. Pain may or may not emerge in the case of a disruption of the body, and it may emerge where no disruption is present. To illustrate the former point he refers to 'hysterical anesthesia', hypnotic ablation of pain, the painless loss of an extremity by a soldier in the heat of battle, and to apparent painless self-mutilations of schizophrenic patients. And to illustrate the latter point, he refers to hypochondriasis and to phantom body parts and phantom pain. In the same way as pain may or may not be related to bodily processes, so may other bodily feelings too be considered as psychological phenomena principally, Szasz maintains.

Increased bodily feelings may express a primitive, somatically enacted defense against a fantasied loss, a reaffirmation of the presence of the body-part in question; it may express a signal which calls the attention to the body signifying a return of repressed wishes or impulses; and it may express that the body-as-an-object is being used as a defense against anxiety (object loss) or as a place to re-enact or to work out a conflict concerning other objects. Conversely, decreased bodily feelings may represent a counter-hypochondrical mechanism, an attempt at mastery

of a very intense, unconscious dread of the body being damaged or mutilated; it may represent a situation in which the ego is absorbed in other tasks or in other objects so that the body-as-an-object remains uncathected; and it may represent a psychotic regression and signify the ego's experience of an essential dissolution, a splitting off of certain peripheral parts of the body as an assertion and reaffirmation of an experienced object loss.

In the opinion of Szasz, pain should be conceived of as analogous to anxiety. Both pain and anxiety are affects produced by the ego as warning signals. Anxiety is a warning of the danger of losing an external object, while pain is a warning of the danger of losing a part or the whole of the body. He writes:

"The meaning of pain can be divided into two large groups. First, pain indicates the danger of the disruption of the continuity of the body and the danger of losing a part of the body. The term 'body part' here denotes a picture of the surface of the body or an appendage - in other words, body parts which are cathected as objects and which accordingly can be lost (detached) ... Secondly, pain is a reaction to and a warning against the danger of excessive stimulation. This meaning of pain applies to those parts of the body which are within the outer covering, at some depth from the surface." (p. 62).

At the earliest stage of ego development there is no differentiation between objects, and the affect pertaining to this stage is best described as undifferentiated pain-anxiety. Slowly the infant learns to differentiate between body and non-body - and subsequently between different non-body objects. With the beginning of this process primitive pain-anxiety becomes differentiated into pain (in relation to the body) and anxiety (in relation to other objects).

It should be emphasized that Szasz doesn't conceive of pain as principally unrelated to bodily processes. Pain is ascribed a primary biological function as a signal by which the organism registers the fact that something is wrong (damaging, dangerous) with its structural or functional integrity. In this sense, pain is not learned, but acquired spontaneously in the process of early development. But this is not a characteristic feature of pain among adults. As the infant grows up and starts to interact through language and symbols with other human beings, pain becomes embedded in his communication network. It ceases to be a message solely between the body and the ego. It becomes a message transferred by the ego, and later on - when it has acquired different kinds

of symbolic meanings - it becomes a message stemming from the ego (and not necessarily from the physical body at all) directed toward other objects. It becomes a means and a method of asking for help. And the need for help may arise from other sources than from bodily sensations. The body itself as a cognitive structure, may assume the position of a transference object - substituting for the mother or the father or another object. Pain may communicate on a symbolic level a need for love and help, but also complaints and retributions against a frustrating but needed authority figure. In other words, the meaning of pain loses its private domain and enters into a social and interpersonal matrix. Originally being a non-cognitive internal sensation, it successively becomes a signal related to a certain cognitive structure called 'the body image' or the body-as-an-object-vis-a-vis-the-ego. In Szasz's opinion, all bodily feelings go through the same development process.

In order to sum up this chapter we would like to call attention to the similarity being present between the social psychological conception of the self and the psycho-analytic conception of the body image. Disregarding that the self may be seen as a somewhat broader concept, we are confronted in both instances with cognitive structures emerging on the basis of integrative, perceptual and communicative processes, and representing important intervening variables assumed to account for individual differences in behavior.

### Different Types and Directions of Awareness

We mentioned in the preceding chapter that percepts and feelings ascribed to the body may emerge from other sources than from the body itself, and that the self and the body image can be seen as cognitive structures, derived from social interactions rather than from direct and private bodily experiences.

This latter point has been strongly emphasized by scholars working in the field of 'sensory awareness'. It has been repeatedly stressed that very few people, in our culture at least, are able to perceive their own body in an immediate and direct manner. For instance, commenting upon his experiments on self-awareness among university students, Hefferline (1958) writes:

"A person neither dead nor in flaccid paralysis presumably should be able to discriminate the tonic condition of all or any part of his skeletal musculature. The first report of a subject is likely to be that he can do this. He can feel, he says, every part of his body. When further inquiry is made, it often turns out that what he took to be proprioceptive discrimination of a particular body part was, however, actually a visualization of the part or a verbal statement of its location. Or else, to discriminate the part, he may have had to amplify proprioception by making actual movements. With further work, if he can be persuaded to continue, the subject may report certain parts of his body to be proprioceptively missing." (p. 748).

Shatan (1963), a psychiatrist, tells that he is in the habit of asking his patients to sense their posture, and to verbalize what it feels like. "The first response is generally gross lack of awareness, even 'numbness'," he reports.

An instruction like the following one: "What can you feel of your own organism, what of happenings within - not what you know of your body, or what you think about it, or believe somebody else expects you to feel of it, but what you actually sense, no matter what comes to the

fore?" according to Selver (1957), in many people gradually brings out a physical self-experience that is entirely new, and often a stirring one. After having outlined some aspects of her technique for sensory reorientation, she states: "Our own organism, whose resources we had not known, who often was a stranger to us, gradually becomes our friend. We actually discover that our organism is 'we' --- our own living self."

What we want to stress at this point is only that it seems possible to distinguish between a cognitive body image and a non-cognitive bodily awareness. By this latter term we are referring to an immediate experience of bodily being based upon internal or kinesthetic perceptions. This latter type of perception makes a person's own body into an object quite different from all other objects. To quote Schachtel (1950):

"... in kinesthetic experience of his own body and its way of moving the person has the only direct, immediate, physical experience of himself from within. The senses other than the kinesthetic provide, compared with this kind of experience, a less direct one, from outside, which is much in the same manner as other objects of the environment are perceived by the person." (p. 72).

In talking about non-cognitive internal perceptions we are in a sense adopting a position similar to the old 'peripheral theories of emotions' put forward by William James and others. As is generally known, James maintained that an individual reacts physiologically to a situation and that the conscious, or feeling, aspect of the reaction is the awareness of the physiological changes taking place. We are extending the theory - postulating that sensations stemming from muscular and visceral tissues within the organism may be present to a varying degree in different individuals and in different situations - and not necessarily in 'emotionally provoking' situations mainly or exclusively.

This is not the place to discuss or survey the many objections being raised against peripheral theories of emotions in the past. It is enough to say that in recent years these theories have evoked great interest and have been offered support from psycho-physiological investigations (e.g. Gellhorn, 1964; Lacey, 1959).

In the following paragraphs we are going to elaborate a little further on the distinction between internal and external, and between cognitive and non-cognitive forms of perception.

By cognitive perception we are referring to an inferential categorization process, - or to quote Bruner (1957) - to a process of categorization in which an individual moves inferentially from cues to

categorical identities representational in nature. There is undoubtedly a great deal of cognitive internal perception going on - perception directed toward the identification of internal states, embodied in cognitive associations and body concepts and images. In fact, our cultural heritage makes it probable that far more internal perception is cognitive than non-cognitive in nature. (Cf. our previous discussion of Szasz's theoretical position.)

It has been suggested by several observers that in the socialization of children in our culture a relative over-emphasis takes place on external as compared to internal awareness, and on cognitive as compared to non-cognitive perceptions. For instance, Mason (1961) writes:

"... internal states are less subject to consensual validation and, also being variable, are more subject to distortion, neglect or oversight, and to blocking or inhibitions that may be fostered by parental or other environmental factors. In our culture, emphasis on the awareness, differentiation and communication of internal states is slight compared to emphasis on differentiation of external sensory experiences." (p. 42).

Talking about different types of perception, Maslow (1957) states:

"Anything or anybody can be seen in itself as unique, ideosyncratic, raw and concrete, i.e., as different from anything else in the world, or it can be responded to, not as unique or per se, but as typical, i.e., as an example or sample of one or another class or category or rubric. That is, what is perceived is not it, but the ways in which it is similar to other things, which in turn means that not all of it is perceived but only those abstracting aspects of it which are needed for classifying it." (p. 17).

Maslow maintains that rubrications, categorizations and identifications in the field of external perception is associated with similar tendencies in the field of internal perception, and that the two types of perceptions are related to different modes of mental operation generally. In this connection he refers to Freud's distinction between primary and secondary process functioning. The former type referring to mental processes being governed by concrete, idiosyncratic perceptions, and extreme mobility of drive cathexis and a tendency to immediate discharge of drive energy (lack of internal regulating structures), and the latter type to processes being governed by delay mechanisms and reality testing operations in the form of judgement, discriminations and associative thinking.

In contrast to most psychoanalytic writers, Maslow maintains that secondary process functioning intrinsically is neither more healthy,

mature, conscious or expedient than primary process functioning. He suggests that a more fruitful distinction than that between the primary and the secondary process, is the distinction between a dichotomized and a non-dichotomized mode of functioning.

In a dichotomized mode of functioning primary process is synonymous with the unconscious, and secondary process with the conscious; the unconscious, furthermore, being synonymous with childish, immature, crazy and dangerous (the cave man), and the conscious synonymous with rational, scientific, logical, practical, responsible (the civilized man).

Dichotomized primary process perception looks at the world through the eyes of wishes, fears and gratifications. It is alogical - having no negatives, no opposites, no mutual exclusions. It is independent of controls, inhibitions, delay, planning and calculations. It is emancipated from time, space, order, causality. Furthermore, the dichotomized secondary process is largely an organization generated by fears and frustrations, a system of defenses, repressions and controls, of appeasements and cunning underhand negotiations with a frustrating and dangerous physical and social environment.

In the opinion of Maslow, a dichotomized primary-secondary process can be conceived of as a culturally-conditioned sick type of mental functioning, a type of functioning giving rise to perceptions being cognitively blind to much in the world of nature, and particularly to that aspect of nature having to do with the perceiving person himself and other human beings.

It is important to note that Maslow doesn't reject the psycho-analytic notion of primary and secondary process cognition. He maintains that for most civilized human beings these two types of cognitive function are split up and dichotomized, but he considers this dichotomization a cultural product and not an intrinsic property of human nature as Freud and most psycho-analysts seem to imply. "Only by resolving and transcending the dichotomy between primary and secondary processes, conscious and unconscious, rational and intuitive, scientific and aesthetic, work and play, abstract and concrete, rubricizing and direct experiencing, can we perceive all of the world and of ourselves," Maslow states. And he suggests that the next step in human integration is to fuse the primary and secondary process, so as to make them both more conscious (more mature)



and both more unconscious (more automatic and spontaneous and less self-conscious).

Of course, Maslow acknowledges the fact that scientific theory construction has to be based on rubricizing and abstractions. What he warns against is the detrimental effect of rubricization in relation to discovery and empiricism (and not in relation to invention and theorizing).

According to Maslow, different kinds of people do not choose but are more or less forced to a particular mode of cognition. To take an extreme case, the compulsive-obsessive neurotic has to rubricise. He has to do so because he is afraid of his bodily feelings and his instinctual urges. He strongly represses these feelings and urges, and this internal drama of fear and defense is generalized and projected outward on to the world at large.

Mason (1961) goes further in the same direction, suggesting that "the ability to focus awareness on the non-cognitive internal environment, and to do so without associated cognitive conflicts, is essential to healthy 'mental' and 'emotional' functioning." He even maintains that psychiatric patients generally, have a very deficient internal awareness and that various psychiatric nosological groups may be roughly characterized in terms of their predominant direction of awareness.

Neither the schizophrenic nor the character-disorder personality type is much aware of his feelings, impulses or internal sensations beyond the cognitive dimension of experience. The character-disorder type tends to focus awareness mostly on the external environment. He is often described as an 'acting out type' implying that he 'acts out' the changes that are taking place in his internal environment without actually focussing awareness on their origin or nature. The schizophrenic patient focuses his awareness predominantly on ideational processes. His preoccupation is fantasy activity, symbolic, confused and relatively arbitrary thought processes. "It should be emphasized", Mason writes, "that the frequent somatic delusions described by schizophrenics are probably more truly cognitive than sensory."

As compared to schizophrenics and character disorders, the neurotic experiences his internal environment to a greater extent. His internal awareness is, however, embedded in conflictual associations and it is restricted to certain aspects. The neurotic may be described as a

person unable to recognize and accept certain feelings, as well as certain associated cognitive contents. Instead of focussing awareness on these affects, and associated cognitions, the obsessive (and phobic) neurotic focuses awareness predominantly on other ('displaced') cognitions. In some cases this preoccupation with cognitions may appear similar to that of the schizophrenic, but the underlying mental integration is better, preventing socially recognizable 'reality breaks'. As regards the hysterical neurotic, we find a different pattern - a relative inability to focus awareness on ideational or fantasy cognitions. In these cases, the way of escaping awareness of unacceptable affects and associated cognitions takes the form of an increased occupation with the external environment (including even the individual's own body parts). The resulting emphasis on external perception parallels that seen in character disorders, but a difference is present in another area, the inner experiences of the hysterical neurotic being much more accessible and pressing and his external orientation much more emotionally colored. Conversion symptoms may be seen as a mechanism providing targets for external perception thereby warding off internal awareness. As is well known, conversion symptoms in terms of paralysis and anaesthesia tend to follow the patient's bodily-cognitive maps rather than his physiological projection systems. The hysteric's typical emotional and anxious behavior may be looked at as overactive responses to constantly threatening stimuli from within. Consequently, the anxiety in question has to be distinguished from the concept of anxiety as an immediate experience (within the framework of a non-cognitive internal awareness). The same distinction seems to be relevant also in relation to other feeling states (e.g. depression).

The viewpoints presented by Maslow and Mason fit quite well into our own conceptional framework. Maslow's distinction between a dichotomized and a non-dichotomized mode of functioning parallels our own conception of a permanent rigid and immobile ego armor. In the case of a permanent armor we would expect a splitting up, a dichotomization of primary and secondary process functioning, i.e., the secondary process being capitalized on by the ego in its endeavor to incapsulate itself from non-cognitive experiences. On the other hand, in the case of a mobile armor - we would expect a high degree of flexibility, the ego being able to function both on a primary and secondary level - not

in an either-or fashion, but in such a way that it keeps in touch with its primary resources even when it is engulfed in secondary ones, and vice versa.

We began this chapter by referring to the common conception of the self and the body image as cognitive structures stemming from social sources. We mentioned that several researchers fully agree that this is a true statement concerning the nature of self and body perception of most people in our own culture, but that they also conceive of another type of self-experience and body awareness being possible. What they suggest is that the immediate experience of bodily feelings of early infancy - a relationship accepted also by those adhering to the social origin of the self - might be maintained throughout childhood and throughout adulthood as well. They even suggest that the maintenance of this ability is a prerequisite for positive mental health. We are confronted here with a point of view disagreeing strongly with classical as well as with modern psycho-analytic theory. In the chapter to follow we are going to elaborate a little further on this issue.

The Concepts of Pleasure and Unpleasure

In the introductory chapter we referred to pleasure and unpleasure as two different types of internal sensations. The same concepts have been dealt with extensively in psycho-analytic literature. At one place, after having drawn a distinction between excitation reaching the system Cs. (consciousness) from within and without, Freud states: "The feelings of pleasure and unpleasure are an index of what is happening in the interior of the mental apparatus."

In the present chapter we are going to relate our own concepts of pleasure and unpleasure to the way these terms are used in psycho-analytic theory.

Let us start out by recalling that according to psycho-analytic theory the mind can operate in terms of two different principles, in terms of the pleasure principle and the reality principle respectively. By the pleasure principle (or the pleasure-unpleasure a pleasure-pain principle) is meant a mode of psychic functioning characterized by immediate excitation discharge and an immediate bodily awareness. It is a mode of functioning modelled after the simple reflex arc: Afferent stimulation either from within or from without causing 'excitation', which is unpleasurable, being followed by efferent stimulation leading to excitation discharge which is pleasureable. The pleasure principle has been interpreted as merely a teleologic principle according to which mental operations endeavour to keep the quantity of excitation in the mental apparatus as low as possible (or as a mode of functioning aiming at a state of quiescence or Nirvana). However, an experiential element is also involved.

In Beyond the Pleasure Principle Freud writes:

"We have decided to relate pleasure and unpleasure to the quantity of excitation that is present in the mind but is not in any way 'bound'; and to relate them in such a manner that unpleasure corresponds to an increase in the quantity of excitation and pleasure to a diminution." (p. 3).

He goes on to say that he does not suggest any directly proportional ratio to exist between the quantity of excitation and the strength of the feelings of pleasure and unpleasure, but that "the factor that determines the feeling is probably the amount of increase or diminution in the quantity of excitation in a given period of time."

What is important to note is that Freud is restricting himself to excitation that is not in any way bound. This restriction points to his conception of another kind of psychic functioning than that implied by the pleasure principle. He is referring to a kind of functioning that is based upon a certain constancy of excitation manifested through excitation regulating structures and the presence of quiescent excitation being at the disposal of the mental apparatus itself. This latter type of functioning is governed by what Freud calls the reality principle.

According to psycho-analytic theory, the abandonment of the pleasure principle for the reality principle is a cornerstone in the development of the ego. The pleasure principle is seen as the primary method of working of the mental apparatus, but from the very outset as a very inefficient and even highly dangerous method from the point of view of the organism's self-preservation. Through difficulties, frustrations, and obstacles with the external world, the pleasure principle is replaced by the reality principle. This doesn't imply that pleasure ceases to be an important motivational component. The reality principle does not abandon the intention of ultimately obtaining pleasure, but it nevertheless demands and carries into effect the postponement of satisfaction, the abandonment of a number of possibilities of gaining satisfaction, and the temporary toleration of unpleasure as a step on the long indirect road to pleasure, Freud states. The reality principle implies that immediate gratification is renounced for the sake of delayed, real or symbolic, reality-adapted satisfaction. Its development implies changes both with respect to bodily awareness, affect dynamics and the expression of instinctual impulses.

To illustrate this point we may refer to Freud's notion that the direct or indirect discharge of sexual instincts which have been repressed, are not experienced as pleasurable but as unpleasurable.

What is happening is that pleasure and unpleasure become attached to the ego and that their attachment to excitational changes proper become substantially weakened. There seems to be no doubt whatever that the unbound or primary processes give rise to far more intense feelings in both directions than the bound or secondary ones, Freud states. And he adds that what is taking place with the development of the ego and the reality principle - is that the pleasure principle undergoes a process of taming.

The process of taming is seen as crucial both with respect to instinctual impulses and affects generally. Among the affects Freud deals with anxiety in particular. As has been pointed out by many observers, his conception of affects and anxiety underwent several changes.

In his earliest writings, affects are conceived of as equivalent to the quantity of psychic energy being present. Within this framework, anxiety is considered the manifestation of libido which have been repressed or blocked from normal discharge.

This is a conception of affects which is generally discarded by present day psycho-analysts (Cf. Rapaport, 1953). However, the two next stages in Freud's thinking about affects are generally accepted. The fact that they represent widely different conceptions has not prevented this acceptance - since they have been referred to as related to the pleasure principle and the reality principle respectively.

According to Freud's second conception of affects, affects are internally directed discharge syndromes that supplant action under conditions of varying excitations. Furthermore, affects serve as safety valves for drive cathexis which are prevented from normal discharge. Within this framework, anxiety is an affect which arises automatically whenever the ego is overwhelmed by an influx of excitation that is too great to be mastered or discharged through external action. It is a response which is inevitable but inexpedient. Although Freud did never agree with Rank that all attacks of anxiety are merely repetitions of the act of birth and endeavors to abreach it, he did accept the view that the trauma of birth may be looked upon as a prototype for later anxiety.

According to his third conception of affects, affects don't reflect internal discharges or safety valves, but are signals by and for the ego. Within this framework, anxiety is an expedient response, a

signal warning about dangers from within or from without so that the ego might take the necessary precautions to avoid or to prevent the danger from emerging. Furthermore, a distinction can be drawn between real and morbid anxiety. In the former case the real nature of the danger is known, while in the latter case it is unknown.

There is some ambiguity in psycho-analytic literature whether anxiety as an ego signal presupposes an earlier experience of traumatic anxiety (whether it is an ego controlled reproduction of an earlier affective state), or whether it can be conceived of as stemming from unconscious fears related to loss of love object, loss of love, genital injury, etc., without any of these fears having ever necessarily reached the point of a traumatic experience.

The most prevalent view seems to be that traumatic anxiety is a forerunner for signal anxiety; that concomitant with the development of the ego affects become 'bound' by processes of thought, and 'tamed' to the point of changing them into anticipatory signals in the service of the ego. Through the development of defense structures affects change their nature from discharge to tensional phenomena, from something passively endured by the ego to something produced actively by the ego. Instead of looking upon anxiety as being caused by repression, repression and other defenses are seen as initiated by anxiety. Through developmental (socialization) experiences affects become increasingly embedded in multiple layered structures of affect-defense configurations. Consequently, the experience of unmodified affects is considered a phenomenon partly belonging to early infancy and partly to psychopathological states characterized by profound regressions. Some present day psychoanalysts even suggest that the term anxiety should be restricted to signal anxiety, and that the term traumatic anxiety should be dropped and replaced by the term 'unpleasure' - referring to an undifferentiated feeling state characteristically found prior to the formation of a separate ego structure.

For instance Brenner (1953) writes:

"Anxiety is an emotion (affect) which the anticipation of danger evokes in the ego. Anxiety as such is not present from birth or early infancy. In such very early periods the infant is aware only of pleasure and unpleasure as far as emotions are concerned. As experience increases, and other ego functions develop ... the child becomes able to predict or anticipate that a state of unpleasure (traumatic situation) will develop. This dawning ability of the child to react to danger in advance is the beginning of

the specific emotion of anxiety, which in the course of further development we may suppose to become increasingly sharply differentiated from other unpleasant emotions." (p. 24).

So far we have been mostly concerned with anxiety. Turning to the other end of the pleasure-unpleasure continuum we find a similar type of reasoning. Discussing the concept of pleasure, Szasz (1957) writes:

"... the concept of pleasure is not explicitly elaborated in psycho-analysis ... Pleasure is regarded as an affect derived from, and mirroring more or less directly, physiological processes. There is a tendency to carry all pleasure back to something 'erotic', meaning narrowly that it is 'sexual' and broadly that it is related to a bodily process (e.g., oral, anal or genital needs) ... A quite different concept of pleasure is associated with considerations of ego psychology. This concept, simply stated, conceives of pleasure as a signal or affect experienced by the ego whenever it successfully masters a previously traumatic anxious situation ... According to this scheme, loss or lack of mastery is equated with anxiety (or unpleasure) and its achievement with pleasure." (p. 188 ff.).

Szasz ends up suggesting that pleasure may be looked upon as an ego signal, i.e. as a signal of safety. He differentiates between a primary and secondary model of pleasure. In the primary model pleasure is dependent upon a current bodily state (pleasure being seen as a signal signifying a satisfactory relationship between ego and body), whereas in the secondary model this is not the case. He states:

"The development of memory leads to the birth of pleasure associated with the undoing of a trauma that is remembered. The memory of the traumata furnishes the fundamental motive behind the strivings for mastery of traumatic memories ... in this way needs - and corresponding satisfactions - arise in human living which recede in the past experiences of the person and which are, accordingly, entirely independent upon physiological needs." (p. 219).

He also notes the possibility of pleasure arising not from past experience, but from anticipations of future needs:

"The anticipation of future needs is of special interest in connection with the problem of pleasure, because it provides a potentially inexhaustible source of needs, protection from which will be experienced as pleasurable. The accumulation of money ... is felt as a protection from future want. Similarly, learning, the acquisition of skills and research work of all sorts are oriented to an increasing mastery over one's environment; implicit in this view is the safety (and pleasure) that accrues to one from being able to predict certain future events. One of the important functions of the accumulation of knowledge (and of culture, in general) thus seems to lie in the protection it affords against anticipated future wants; it is mastery projected into the future." (p. 219).

Our brief survey of the concepts of anxiety and pleasure as seen from the point of view of psycho-analytic ego psychology unveils a



definite trend toward the development of a purified cognitive psychology - where non-cognitive experiences are either overlooked, underemphasized or ascribed a certain role in profound psychopathology or in the earliest stages of development exclusively. The personality model described is to a large extent a dichotomized model, and this holds true even if the bridge-throwing attempts of conceptions like 'regression in the service of the ego' are taken into account.

As alluded to earlier, the psycho-analytic model postulates a sort of basic contra-distinction between a pleasure- and reality principle functioning. Instead of looking upon both types of functioning as sub-types or pathological deviations from a unitary kind of mental organization, it postulates that the one is derived from the other, and that the one is more primary or more basic than the other. By so doing it ends up with a conception of mature psychic functioning equivalent to what might be described as a permanent and rigid ego armoring.

The difference between our own and the psycho-analytic model is related to a few basic assumptions. For instance, it is related to the question of what constitutes underlying drives of human behavior.

According to psycho-analytic theory all psychic structures and functions are ultimately derived from a few basic instincts or drives. We mentioned earlier Szasz's difficulties to account for various pleasure arousing activities in terms of sexual instincts and his attempt to overcome the problem by conceptualizing pleasure as an ego signal arising from an underlying anxiety reduction. The assumption that human beings exercise their capacities and explore their surroundings either to satisfy sexual instincts or to reduce their fear of the environment, does not sound very convincing. It also goes counter to many recent research findings in the area of exploratory behavior.

After having reviewed several of these findings, White (1959) proposes a theory of what he calls an independent effectance motivation, i.e., innate neurogenically conditioned needs being directed towards the exploration and experimentation of the environment. He suggested that the satisfaction of such needs are pleasurable in their own right (that they give rise to feelings of efficacy and competence), and that the needs in question are likely to come to the fore, particularly in situations where neither anxiety, pain or any basic drives (like sex, hunger, etc.) are upsetting the organism's homeostatic balance. "Putting it

picturesquely, we might say that the effectance urge represents what the neuro-muscular system wants to do when it is otherwise unoccupied or is gently stimulated by the environment," White states.

It is true that Freud's reality principle may account for a temporary search for excitation input from the environment. However, White's effectance motivation implies pleasure not primarily in the maintenance of a homeostatic balance, but in gaining and adding competence and abilities enlarging and extending this very balance.

As pointed out by White himself, effectance motivation may possibly be taken care of by Freud's later concepts of Eros - (being defined as the principle underlying growth and the tying together of living matters into even larger unities) and erotic instincts (as a group of instincts including but at the same time being more than - instincts having a specific sexual aim), but he also notes that these are concepts which are not being ascribed much significance in modern psycho-analytic theory.

White's concept of effectance motivation is not fundamentally different from Hendrick's instinct-to-master theory launched in the early forties. In both instances we are indirectly confronted with the idea that a centrifugal flow of excitation is pleasurable, not only as part of the satisfaction of sexual urges, but in its own right.

We have designated a centrifugal flow of excitation as a libidinal discharge. In a sense we are adopting the theoretical position of Bousfield (1925) to the effect that libido is in itself asexual and only becomes sexual when it flows through sexual channels. What is implied is that libidinal discharges can be initiated by sexual as well as by other drive systems, and that they can be manifested in sexual as well as in other motoric patterns.

But our theoretical model opens up the possibility for an additional assumption, namely that libido under certain circumstances may become dichotomized (split up) into sexualized (or aggressivized) and neutralized energies. Consequently, we don't oppose the psycho-analytic view that neutralized 'building bricks' may be employed for the erection of certain ego structures. What we do oppose is that such bricks are the only material by which an ego formation can be established. In fact, we are inclined to say that the bricks mentioned will prevent or impede a fully mature ego formation. In other words, we may agree with Freud

that various ego functions like attending, judging, recognizing, distinguishing, remembering and thinking may be procured (and even to some extent developed) through neutralized energies. But we would have to add that it is likely that the same faculties (although their functional properties may be slightly different) may also develop on the basis of libidinal energies. In this instance, rational and reality adjusted functioning might be compatible both with spontaneity in action, with untamed affect experiences, and with a non-cognitive internal awareness.

We mentioned earlier, Brenner's suggestions to restrict anxiety "to an affect which the anticipation of danger evokes in the ego", and to look upon pleasure and unpleasure as undifferentiated feeling states existing primarily prior to the formation of the ego. What is implied in these suggestions is that the formation of cognitive ego structures replaces, and not only supplements, preceding non-cognitive experiences, and that that these latter experiences are undifferentiated not only in early infancy, but by their nature so to speak. Our own theoretical position makes us oppose both of these inferences.

It is apparent from our earlier discussion that our concept of anxiety is much more closely related to the Freudian term 'traumatic anxiety' than to 'signal anxiety'. This does not mean that our anxiety concept is identical to 'traumatic anxiety'. According to psycho-analytic theory, traumatic anxiety emerges automatically whenever the ego's protective barriers are overrun by excitation, that is, whenever the ego is overwhelmed by an influx of excitation too great to be mastered (bound) or discharged in external action. We too are proposing to look at anxiety as an automatic response, but instead of seeing this response as the expression of an hyperexcitation of the ego, we are thinking about it more in terms of an insufficient or deficient excitation of the ego system. In this respect we are in line with Freud when he states that the hypercathexis of the receptive systems constitute a shield against anxiety provoking stimuli, and also when he states that the higher a system's quiescent cathexis, the greater is its capacity for taking up an additional stream of fresh inflowing energy and binding it psychially, i.e. of converting it into quiescent cathexis. We are disagreeing with Freud, however, when he states that "the hypercathexis of the receptive systems constitute the last line of defense of the shield against stimuli",

and that traumatic anxiety is "a consequence of an extensive breach being made in the protective shield against stimuli." Freud's concern with shields brings back our earlier notion of his reality principle being equivalent to of the functioning of a permanently armored system. Instead of emphasizing the cathexis of a protective shield (implying that what is behind is rather unprotected and defenseless), we are inclined to focus upon the reciliency of the ego system as a whole and particularly its deeper layers. The difference in question is reflected in the fact that Freud is considering a state of panicky helplessness (i.e., the birth trauma) as the prototype of anxiety, while our own model is the state of being completely paralyzed by fear. The case of an hyperexcitation of the ego system, in our opinion, is typical of and related to a state of mania or hypomania (energy plethora).

In some respects, we have great sympathy with Freud's earliest conception of anxiety as dammed up libido being converted into anxiety, although we find it difficult to accept his parallel notion of anxiety as a mechanism releasing and discharging the warded off libidinal energies. In contrast to Freud (at this stage of his theorizing) we don't believe a libidinal repression to be a necessary or sufficient condition for anxiety, i.e., that repressions cause anxiety. We would rather say that repression implies anxiety but anxiety does not necessarily imply repression. A repression may facilitate anxiety, but it may also represent a barrier preventing anxiety from developing.

In one sense we are accepting Freud's view on traumatic anxiety - that anxiety is an inevitable but inexpedient response. However, we would have to add: Even though anxiety may be an inexpedient response from the point of view of ego development and functioning, it may be a highly expedient and adaptive response from the point of view of a particular situational context.

Looking at pleasure and anxiety as opposite poles on a continuum, and relating pleasure to growth, expansions, integrations, - in short, to what seems to be behind Freud's concept of Eros, it should be noted that our concept of anxiety is very much different from his idea of Thanatos. Our anxiety concept does not refer to an independent kind of motivational energy or to an intrinsic principle of organismic functioning. As just stated, we feel close to Freud's initial conception of anxiety as transformed libido - although we would rather prefer

not to talk about transformed, but an inward-turning or backward turning of libido. In this respect we are equating anxiety with a mental process discussed by Freud in his earlier writings, namely 'the turning round upon the subject' - a process he considered equal in position to 'repression' and 'sublimation' but emerging at an earlier stage of development. It should be added, however, that Freud was more concerned with this process from the point of view of interpersonal than intrapersonal libido dynamics. And it should also be added that we use the term 'turning round' in a rather metaphorical sense.

In contrast to psycho-analytic theory, we don't conceive of libido as originating from centrally located bodily tissues exclusively. In that sense we feel it is more appropriate to talk about anxiety as a centripetal flow than as a flow being turned round or turned back on its place of origin. It should be emphasized that we don't believe libido or excitation to stem from peripherally or centrally located bodily layers as such, and to move in various directions, but rather that it is manifested to a varying degree in bodily external and internal layers - and that its directional properties are shaped or mediated through regulatory centers within the central nervous system (both at cortical and sub-cortical levels).

We would like to present some further comments on the economic or energetic aspect of our theoretical position.

As regards the concept of desexualization we are favoring the view - alluded to above - that what is primarily taking place is a libidinal dichotomization, a splitting up of libidinal energy into sexualized and desexualized (neutralized) energies respectively. Furthermore, by the term repression we are referring to the process through which this splitting up takes place.

We want to stress that we don't consider aggression as a separate source of energy, but as a specific aspect or component of libidinal energy. This does not imply that we reject the idea that aggression may become a separate energetic source - that aggression so to speak, may acquire the characteristics of a primary drive system. By stressing the possible self-perpetuating dynamics if aggression under certain circumstances, we are in fact ready to accept a number of psycho-analytic propositions - as conditional ones. We have discussed this problem at some length in an earlier work (1959). What we want to emphasize here is that

we believe libido may be split up into aggressivized and deaggressivized as well as into sexualized and desexualized energies, and that the resulting dichotomy will be a function of the specific 'channel of discharge' being involved in the splitting up process. We are here following the thought expressed earlier, that 'libido is in itself asexual and only becomes sexual when it flows through sexual channels'. We may add that we also consider libido as an a-aggressive energy (that is, different from both aggressivized and deaggressivized energies) which becomes aggressive only when it gets connected with aggressive channels. Somewhat metaphorically, we suggest that both aggression-without-libido and libido-without-aggression are products of a dichotomization process. In psycho-analytic metapsychological theory, the fusion between libido and aggression is often considered the dynamic basis of sadism, while in our terminology, this basis may preferably be seen as the simultaneous operation of sexualized and aggressivized energies.

Keeping on to our conceptual elaboration, we would like to distinguish between an ambivalence on the one hand and a dichotomization on the other. A dichotomization might be defined as the lasting effect of an ambivalence resolution. It should be noted that by the term ambivalence we are not primarily referring to a cognitive ambivalence (but to an affective-motoric one), although we suppose a cognitive ambivalence regularly to be simultaneously present. On the same line, by the term repression we don't primarily refer to a cognitive repression, although we do expect cognitive blank spots frequently to be accompanying phenomena.

To summarize, we have tried to indicate the relationship between some of our own concepts and similar concepts within psycho-analytic theory. We have pointed out that our libido concept has some similarities to Freud's latest conception of erotic energies (in fact, it is also similar in some respects to Jung's libido concept), that our anxiety concept on the content side has similarities with Freud's conception of signal anxiety (pointing in the direction of losing) and on the dynamic side - with his conception of automatic or traumatic anxiety, and that our pleasure concept is related not to diminution of excitation generally, but to its diminution outside the ego apparatus (that is, to its relative increase within this latter sub-system of the personality - giving raise to the sensation of gain).

In a couple of places we have touched on what we consider to be a serious weakness in modern psycho-analytic ego psychology, namely its exclusive focus on cognitive processes. This doesn't mean that we want to object to the conception of signal anxiety, signal safety and so on, per se. What we are concerned with is that in the modern trend toward the emphasis on various ego functions the biological roots of the functions' structural basis seem to be in the process of getting lost. We are going to pursue this problem further in the next chapter.

In order to round off the present discussion we would like to re-emphasize that we look upon pleasure and unpleasure as broad categories of internal feeling states or non-cognitive sensations stemming from different directions of excitation flow. We believe that both pleasure and unpleasure may be sub-divided into more specific experiential qualities. Under pleasure we may possibly subsume - love, trust, autonomy and feelings of competence and efficacy. The latter term being borrowed from White (1959) and trust and autonomy from Erikson's (1950) conception of lasting qualities emerging from a successful resolution of early psycho-sexual developmental stages. Furthermore, under unpleasure we may subsume anxiety, feelings of hopelessness, depression and despair. It is conceivable that these different feeling states may be related to various properties of 'excitation flow' like the bodily segments involved, consistency, intensity and to temporal characteristics like constancy, abruptness of appearance and disappearance, etc. We want to stress, however, that we are here airing thoughts that have to be considered as speculations only. The same is true of course, when it comes to our previous discussion of various types of psychic energies. We would like to add, that our speculations in this latter area are also growing out of somatic considerations, i.e., out of the assumption that different conditions of energy are related to different configurations of muscular tone qualities.

A Structural Viewpoint on Ego Psychology

In earlier chapters we have, in a couple of places quoted from Szasz's book: Pain and Pleasure. We have done so in order to illustrate how bodily feelings can be looked at from the point of view of psychoanalytic ego psychology. To continue the same line, we will begin this chapter by a brief quotation from the same book:

"I suggest that we consider that the ego relates not only to other people as objects but also to the body as an object ... The structural model of psycho-analysis encompasses the systems id, ego, super-ego, and external reality ... the body can in no way be fitted into this scheme." (p. 55).

We are going to show that the body not only may be fitted into the psychoanalytic structural model, but that the body, in fact, was conceived of by Freud as a point of reference in the development of this model and in his conception of how the ego emerges as a separate sub-structure of the personality.

Before approaching these questions we are going to visit briefly, the old philosophical problem - can the same organism be both a subject and an object of perception - can it be both perceiver and perceived at the same time?

If we are dealing with such concepts as 'the self' or 'the body image' the problem may relatively easily be 'solved'. We may simply follow the footsteps of Newcomb and others, and state that it is not 'the self' which is doing the perceiving but the organism. And we may add - the perceiver or the perceiving agent is the very same thing that perceives anything else. The self is the individual as known to the individual, not the individual as knower. As long as we are talking about knowing different types of objects, the question can be solved by introducing a knowing faculty as a property of the organism. In psychoanalytic theory one talks about knowing as an ego function.



What about non-cognitive internal perceptions? We may follow the same line as above and state that what we are confronted with is only a more primitive (less symbolically elaborated and integrated) form of knowing, and that the knowing agency is the same. However, it is also possible to adopt another position and maintain that what is perceived in this instance is the knowing agency itself, or the ego, psycho-analytically speaking. Our previous quotation of Selver illustrates this viewpoint:

"Our own organism, whose resources we had not known, who often was a stranger to us, generally becomes our friend. We actually discover that our organism is 'we' - our own living self." (p. 16).<sup>1</sup>

One may of course object to this formulation and say that to become consciously aware of something (inside or outside the organism) implies sensory receptors and integrative neural activity of a rather complex nature. For instance, Penfield (1954) states: 'Consciousness is made possible by the integration of the mechanisms of the cortex with those of the centrencephalic system. Consciousness does not vanish as the result of large destructions of the cortex ... but it does seem to vanish when there is direct interference with the (activating) function of the higher brain stem.'

As long as we are focussing upon conscious awareness in human beings there are good reasons to assume that perceiving is mediated through complex neural activity and that what is perceived is external to this activity. However, it should be emphasized that we are here talking about conscious awareness. It is a legitimate assumption that awareness is not one thing, but that it can be conceived of as something on a continuum going from higher to lower forms - from self-self-conscious awareness to unconscious awareness in the sense of a simple intrinsic reactivity. From this perspective awareness may be considered a characteristic of all animate beings. Since the single cell organism is reactive

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<sup>1</sup> A similar thought is implied by Schachtel's (1950) statement that in kinesthetic experience of his own body the person has the only direct, immediate, physical experience of himself. Later in the same article he writes:

"... kinesthetic experience of oneself and the inner experience of one's significant feelings and attitudes have in common the intricate relation to the self." (p. 72).

and selective (purposeful) in its activity it is possible to postulate awareness even on this level. The same is true of the single cell being a part of a complex organism such as a human being. However, in complex, multiple-celled organisms - especially where rudiments of or a more fully developed nervous system exist - different parts take over specialized functions, and as these new functions emerge we may talk about awareness on subsequently higher levels. For humans, the kind of awareness most frequently thought of is that connected with the highest cortical functions, cognitive perceptions, judgment, abstract thinking and symbolic differentiations and elaborations. However, it is also possible in the case of human beings to delineate another type of conscious awareness - namely, non-cognitive perceptions involving only to a very small extent or not at all higher associative and mnemonic cortical structures. Through this latter type of awareness one may possibly even reach some awareness of the structural basis of cognitive perceptions and functions. In this sense Selver may be correct in stating that "we actually discover that our organism is we" - meaning that through non-cognitive internal awareness one is discovering or feeling the organismic basis for one's own cognitive being or self perception.

In order to explain this a little further we may start out from our earlier quotation of Penfield. According to modern conceptions, the reticular formation in the brain stem is essential to the integration of the nervous activity of the brain as a whole, to consciousness, wakefulness and attention. To bring sensations to consciousness seems to imply the bringing into focus of a certain relationship between the reticular formation and the sensory cortex. How this focussing takes place is still obscure, but according to Kubie (1953), it may possibly operate through a process of synchronization of asynchronous nervous processes. Kubie even goes so far as to suggest that the reticular activation of the temporal cortex - a structure involving certain mnemonic centers - may be compared to the release or inhibition of spinal reflexes under the influence of upper motor neurons. In the same way as the relationship existing between higher and lower motor centers may result in inhibition, release and augmentation of spinal reflexes, so the relationship between the reticular formation and the cortex (and the temporal cortex in particular) may correspond to a repressed conscious or unconscious (Ucs.), a released conscious (Cs.), and an augmented preconscious (Pcs.) kind of

mental activity. The reticular activating system does not operate in a vacuum, however. It is heavily dependent upon the influx of internal excitation - and particularly upon proprioceptive stimulation. (Cf. Gellhorn, 1964.) But this very proprioceptive stimulation may become an object of internal perception. That is to say, those very stimulations giving rise to cognitive processes ("I am I") may to some extent become the object of a non-cognitive awareness.

We have used quite a few lines to discuss this 'philosophical' question, since it lies at the very bottom of the problem of what constitutes the structural basis of ego functions.

Freud's book The Ego and the Id, first published in 1923, is generally considered the origin of psycho-analytic ego psychology. In this book Freud suggests that he structural concepts of ego and id should replace his earlier topographic model of conscious, preconscious and unconscious mental systems. The term topographic itself refers to the spatial viewpoint which characterized Freud's conception of these mental systems, one system being deeper and one being more superficial than another. In spite of recent claims to the contrary (cf. Gill, 1963), Freud's psychic topography was not a pictorial model referring to metaphorical space.<sup>1</sup> As a matter of fact, it can be clearly shown by a study of The Ego and the Id that Freud even attempted to incorporate some of his anatomical topographic notions in his new structural approach. In the second chapter of the book, he writes:

"We have said that consciousness is the surface of the mental apparatus; that is, we have ascribed it as a function to a system which is spatially the first one reached from the external world - and spatially not only in the functional sense but, on this occasion, also in the sense of anatomical dissection." (p. 9).

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<sup>1</sup> This is brought out by the following quotation from Beyond the Pleasure Principle published in 1920: "... consciousness is a function of a particular system ... what consciousness yields consists essentially of perceptions of excitations coming from the external world and of feelings of pleasure and unpleasure which can only arise from within the mental apparatus; it is therefore possible to assign to the system Pcpt.Cs. a position in space. It must lie on the borderline between outside and inside; it must be turned toward the external world and must envelop the other psychical systems. It will be seen that there is nothing daringly new in these assumptions; we have merely adopted the views on localization held by cerebral anatomy, which locates the 'seat' of consciousness in the cerebral cortex - the outermost, enveloping layer of the central organ." (p. 24).

What is important to note is that Freud seems to have conceived of consciousness (or the Pcpt.Cs. system) as something more basic than the structural differentiation of the ego and the id. This is indicated by the following quotation from the same chapter:

"Another factor, besides the influence of the system Pcpt., seems to have played a part in bringing about the formation of the ego and its differentiation from the id. A person's own body, and above all its surface, is a place from which both external and internal perceptions may spring. It is seen like any other object, but to touch it yields two kinds of sensations, one of which may be equivalent to an internal perception. Psycho-physiology has fully discussed the manner in which a person's own body attains its special position among other objects in the world of perception." (p. 15).

One may interpret Freud as saying that stimulation of the system Pcpt. - itself a body surface phenomenon - from sources within the body surface - is bringing about the formation of the ego; i.e., that the ego, so to speak, basically is to be considered as a sub-structure of the body, defined in terms of the subject's internal sensation and awareness. That this is a reasonable interpretation is supported by Freud's statements (quoted from the same chapter):

"The ego is first and foremost a bodily ego; it is not merely a surface entity, but is itself the projection of a surface. (And as a footnote:) I.e., the ego is ultimately derived from bodily sensations, chiefly from those springing from the surface of the body." (p. 16).

By the notion that the ego is itself the projection of a surface, Freud is giving air to his belief that the neural processes behind the ego as a perceptual entity is to be found in the sensory cortex of the brain.

In his conception of the ego as the surface layer of the body, Freud is consistent with his contention that: "the functional importance of the ego is manifested in the fact that normally control over the approaches to mobility devolves upon it." The bodily organs of mobility, are of course, the striate muscles, and the location of these muscles is mainly within the surface layer of the body. Furthermore, a conscious awareness and control of these muscles is possible in principle through proprioceptive or kinesthetic stimulations and 'feed-backs'. In short, we may formulate (or interpret) Freud's viewpoint as follows: The ego has its bodily location in those very structures which are involved in the execution of various ego functions, and an organism's initial experience of these structures represents the basis for the formation of his ego. In other words - rudimentary experiences of the organism that it can start moving, continue moving or stop moving a certain body part

is something not learned from the outside but experienced from the inside - and just these immediate; direct, physical experiences are the basis for the differentiation of the ego.<sup>1</sup>

In psycho-analytic ego psychology, grasping, crawling, walking, judging, remembering, language and thinking, are all considered examples of ego functions.

All observers would easily agree that grasping, crawling and walking imply motor action and control, and that the activities in question have their structural basis in the relevant skeletal muscles.

Turning to judging, remembering, language, and thinking, the problem gets more difficult. However, what is of prime importance at this point is that Freud seems to have conceived of these functions, too, as having motoric aspects. For instance, Freud suggests that thought is principally to be considered as an abbreviated experimental micro-action to find out and to decide whether further macro-action is possible or desirable. He postulates that thought involves relative small amounts of energy (bound or aim-inhibited energy), and that in the process of thought there is some slight involuntary actions of the muscles concerned with speech. Also in discussing reality testing (an aspect of perception evolving through the development of the ego, or vice versa) and judgment, he implies that motoric components are involved. As perception becomes embedded in thought processes, it adopts the form of an active searching and investigating process, - a form which, according to Freud, may be compared to tasting and which originally and literally is modelled after the tasting (and motor action) of the mouth.

One of the main reasons for Freud's abandonment of his topographic model was the fact that it was incapable of distinguishing between two phenomena he came to consider sharply different - namely, repressed forces on the one hand and repressing forces on the other. In their relation to condition of energy and mode of organization, they were defined as different, but in relation to consciousness - they were seen as belonging to the same system, the Ucs. By the introduction of the structural model, Freud tried to solve this problem by referring the repressed to the id, and the repressing forces to the ego, disregarding their relationship to consciousness. He also postulated a third sub-

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<sup>1</sup> This formulation is not in any way inconsistent with Freud's (1923) statement that "the systems Pcpt.Cs. alone can be regarded as the nucleus of the ego." (p. 18).

structure - the superego - which he thought of as a differentiation within the ego, as a part of the ego being shut out from the rest through processes of energetic reaction formations (defensive identifications) against early id-inspired object choices (or libidinal identifications); the processes resulting in a subsequent repression of both identification-components, - and the development of a permanent norm-sending agency within the personality giving rise to ego-ideals, conscience, and guilt feelings in the case of norm-transgression. In terms of dynamic properties he conceived of the superego as identical to the id, while in terms of topographic location he thought of it - at least initially - as a property of the surface of the mind and of the surface of the body, i.e., as a substructure of the ego. Talking about the unconscious basis of the faculties of selfcriticism and conscience - mental activities that are usually ranked as extremely high ones, Freud states (at the very end of the same chapter from which we have taken our earlier quotations):

"If we come back once more to our scale of values, we shall have to say that not only what is lowest but what is highest in the ego can be unconscious. It is as if we were thus supplied with a proof of what we have just asserted of the conscious ego: that it is first and foremost a body-ego." (p. 17).

What Freud seems to be suggesting is that his concept of the ego does not refer to what is within conscious awareness but rather that it refers to the substructure of the body that might in principle be perceived, i.e., that the body may be used as a point of reference for the definition of the ego.

To sum up, Freud seems to have thought of bodily sensations stemming from external layers of the body as a crucial factor in the formation of the ego. It should be emphasized that we are here talking about the formation of the ego exclusively, and not about its further development. Freud seems to have been quite convinced that aspects of the early ego had to be shut off and repressed in order for a lasting superego to emerge, and his conception of the reality principle also implies, as noted earlier, energetic transformations (neutralizations) and impulse-defense configuration which might be conceived of as lasting restrictions on an initial ego formation (functioning according to the pleasure principle). Looked at from this angle, Freud's conception of ego development falls into two stages - an initial stage characterized by the infants growing awareness of his ego-structure (in terms of body perceptions), and a second stage, in which this initial awareness, is more or less lost and replaced by a cognitive orientation toward the body as well as toward external reality.

If the above interpretation is correct, White's (1959) assertion about the opposite position of Freud and Kardiner as regards the development of the ego, is only partly true. White summarizes Kardiner's position as follows:

"Kardiner's reflections arose from his work on the traumatic neuroses of war ... (He was) led to conclusions just about the opposite of Freud's: It is the successful and gratifying experiences, not the frustrations, that lead to increasingly integrated action and to the discrimination of self from outer world. Frustration produces chiefly disruptions and inhibitions which are unfavorable to the early growth of the ego. Children are gratified when they discover the connection between a movement executed and the accompanying and subsequent sensations. They are still more gratified when they carry out actions successfully, this gives rise to the triumphant feeling of making an organ obedient to the will of the ego. Such experiences build up a definite self- or body consciousness which becomes the center and the point of reference of all purposeful and co-ordinated activity. Growth of the ego, in short, depends heavily upon action systems and the consequences of action." (p. 311).

According to this train of thought, gratification may be conceived of as an affect accompanying ego gains in terms of increased mastery and competence. But we are also led to think about these gains in terms of bodily awareness and the assimilation of new action systems.<sup>1</sup> From this point of view we may even consider the early stages of psychosexual development - as described by Freud - as stages offering challenging opportunities as well as possible defeats for increased awareness and action pattern integrations. This is, of course, a viewpoint nearly identical to that launched by Erikson (1950). It doesn't directly oppose Freud's position, although it questions very much Freud's second hypothesis that further reality-adapted growth of the ego implies energetic transformations and neutralizations which can only be brought out through reality-imposed frustrations, restrictions and obstacles regarding immediate impulse gratification.

As previously mentioned, this latter point follows from Freud's assumption that reality (or secondary process) functioning is a product of various forms of defenses (like reaction formations, sublimations, identifications) being directed toward primary instincts and affects. From this viewpoint, the mature ego may be considered as the result of

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<sup>1</sup> This parallels of course our earlier discussion of pleasure as an experience of ego gain.

a hierarchical structuring of impulse-defence configurations. Following Hartmann we may talk about a primary ego autonomy (a primary conflict-free sphere of activity); and subsequent to this sphere of activity being utterly restricted through the all sorts of defense infiltrations necessitated by the developmental process - about a secondary ego autonomy characterized by drives, aims and interests being emancipated from their original defensive function.

What we consider to be of crucial importance is that it is possible to conceive of a reality adapted ego development as a process of growth not being necessitated by defenses and reality-imposed frustrations. That is to say, it is possible to conceive of a continuous process of ego autonomy not being based upon a primary-secondary dichotomization.

Implicit in the psycho-analytic model is the assumption that as the ego develops on the basis of impulse-defence configurations the ego's immediate awareness of its own structural (bodily) basis is increasingly lost. Although the process in question is not extensively elaborated in psycho-analytic theory, there are several hints about its nature.

Fenichel (1945) writes:

"Pathogenic defenses generally aim at barring the warded-off impulses from mobility (the barring from consciousness is only a means of achieving this); thus pathogenic defense always means the blocking of certain movements." (p. 246).

It should be noted that Fenichel is referring to pathogenic defenses, but we may assume that all sorts of defenses giving rise to energetic transformations have similar bodily effects.<sup>1</sup>

According to Freud, repression occupy a central position among the defense mechanisms. Basically, a repression may be looked upon as an exclusion from the process of thought. Since - as previously mentioned - thought is supposed to imply muscular actions, an exclusion from thought, may be effected through an immobilization of certain actions, and to the extent certain actions become permanently immobilized or

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<sup>1</sup> This implies that we are drawing a distinction between two types of defenses. On the one hand defenses giving rise to energetic dichotomizations and lasting alterations in the distribution of muscular-tone qualities and excitation patterns, and on the other hand, defenses involving cognitive functions exclusively - like denial, displacement, condensation, rationalization, etc.



blocked, their structural basis will cease emitting proprioceptive stimuli - resulting in a discontinuance of their immediate perceptability. Following this train of thought, and assuming that the impulse-defense constellations being of crucial significance for ego development do involve a repressive element, we end up with the conclusion that in the case of a stabilized (and dichotomized) secondary process mode of functioning, the body ego is lost and replaced by a cognitive notion of the body as an object exclusively.<sup>1</sup>

Our reasoning above is not in any way original, it is following a train of thought that has become widespread in recent years. For instance, to quote from a recent article by Shatan (1963):

"Repressions of anxiety arousing emotions and impulses induces involuntary changes in muscle tone, posture and movement ... we can conceive of the postural muscles as 'hiding places' for repressed emotions. The act of restraining such emotions leads to tensing and rigidity in the postural muscles ... inhibition of movement limits kinesthetic sensation and perception ... when excluded from awareness, these automatic regulatory patterns acquire a momentum of their own: they become perpetuated as autonomous behavior patterns which are difficult to reverse." (p. 27).

Keeping on to the hypothesis that ego functions are not primarily a matter of energetic reaction formations, but of growth and release (through favorable external stimulation) of functional potentialities inherent in a certain somatic substructure, we end up with a personality model which may be formulated as follows:

First and foremost we may distinguish between three substructures of the personality, and following the psycho-analytic tradition, we may denote these substructures as the ego, the id, and the super-ego respectively.

The substructure denoted the id we may conceive of as having its counterparts in 1) those somatic structures which on biological grounds are inaccessible to awareness and control, in 2) those somatic structures which have never been, but in principle are, accessible to awareness and control, and finally in 3) those somatic structures which have been, but not any longer are accessible to awareness and control. The first category would correspond to the non-repressed position of the id, and the last category to its repressed portion. However, both the

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<sup>1</sup> This is of course, a parallel to what we have claimed to have happened in modern psycho-analytic ego psychology.

second and the third category would reflect id in the sense referred to by Freud in his classical statement - 'where id was, there shall ego be'; the second category representing a potentiality from a developmental point of view, and both this and the third one - a target and a goal for therapeutic endeavors.

Turning to the ego, here too a certain differentiation would be called for. Following the psycho-analytic tradition of allocating the repressed to the id, and the repressing forces to the ego, we would have to define the somatic counterpart of the ego in terms of 1) the somatic structure presently being accessible to awareness and control, and 2) the somatic structure presently being unconscious because of its active employment in control.

In a sense, we are adopting Freud's notion that the ego shades into the id. However, we might just as well say that the id shades into the ego. What we are referring to is that in the case of a repression a portion of the ego and the id may be considered as dynamically and structurally interlocked. We have earlier (1965b) made some tentative formulations regarding this question. We suggested that the somatic counterpart of the unconscious ego (i.e., corresponding to repressing forces) consists of enduring and automatized muscular hypertonicities, and that the repressed portion of the id corresponds to muscular structures existing in a state of hypotonicity. Consequently, we suggested that a specific impulse-defense configuration would correspond to a pattern of muscular dystonicity (the simultaneous presence of hyper- and hypo-tonic qualities within the skeletal muscular system).

A final question concerns the position of the superego in our structural model. This is a difficult question which can not be answered in a few sentences. One possible line of demarcation is to consider the superego as a substructure of the ego, or more concretely, as the unconscious portion of the ego. This is the theoretical position adopted by Lowen (1958). The ego, he says, represents psychic processes of which we are conscious because they concern activities which relate us to the external world. And: "The depth and strength of the ego depend upon the degree of conscious control and co-ordination of voluntary musculature." The superego is conceived of as an ego defense formation. Lowen writes:

"The mechanism by which the superego exercises its control over action is also the musculature. The inhibitions imposed by the superego are unconscious and have nothing to do with the reality of the present day situation. They represent a limitation of mobility over which the ego has no control ... The muscles which are subject to the inhibition of the superego are chronically tense, chronically contracted and removed from perception, so that the individual is unaware that this part of his muscular system is non-functioning in certain ways." (p. 30).

According to this conception, the superego is merely that part of the ego which has become unconscious because of chronic and automatic involvement in control. This is of course, a superego concept quite different from the psycho-analytic one. In one sense, it is a much broader concept since it includes all sorts of early reaction formations, while in another sense, it is a narrower concept since it capitalizes on ego formations exclusively.

According to Freud, dynamically the superego is a part of the id. Whereas the ego is essentially the representative of the external world, of reality, the super-ego stands in contrast to it as the representative of the internal world, the id, he states. But at the same time, he suggests that the super-ego contentwise is related to the external world of early childhood, that it is the heir of the Oedipus complex. As regards its structural position, he writes (1923):

"What has belonged to the lowest part of the mental life of each of us is changed, through the formation of the ideal (or super-ego), into what is highest in the human mind by our scale of values. It would be vain, however, to attempt to localize the ego ideal, even in the sense in which we have localized the ego, or to work it into any of the analogies with the help of which we have tried to picture the relation between the ego and the id." (p. 27).

In spite of this statement, ten years later in the New Introductory Lectures (1933), he suggests a location of the super-ego. What he is doing here is in fact, only to draw the consequences of his conception of the super-ego as a simultaneous subsystem of both the ego and the id having obtained in the course of the development a certain functional identity and autonomy of its own. Keeping on to our earlier structural model, we would expect the super-ego to have its somatic counterpart in the tonic qualities of a specific bodily segment or muscular system.

Is it possible to delineate a particular segment or system being involved in self-judgment, conscience, moral censorship and the production of guilt feelings (the functions commonly attributed to the

super-ego)? Although we feel that a definite answer cannot yet be given to this question, we would like to mention that empirical observations indicate that the frontalis and the scalp muscles may represent the structural basis for some of these functions. In an earlier monograph (1963), we have described briefly some of these observations (mainly derived from EMG studies). The fact that headaches have frequently been interpreted psycho-analytically as 'Super-ego aggression' - fits into this scheme.

By concentrating on the somatic structure mentioned, we are considering the super-ego as literally speaking, a super-ego. Following our earlier line of thought we might distinguish between 1) an integrated super-ego - integrated in the sense that it does not represent an isolated substructure and that its somatic basis possesses a tonic quality that makes it accessible to awareness and control, 2) a defensive super-ego - based upon an energetic reaction formation corresponding to an enduring hypertonicity covering up an underlying dystonicity, and 3) a deficient super-ego - corresponding to an uncurtailed hypotonicity, i.e., the id taking charge of a potential ego structure.

As alluded to above, the second of the alternatives mentioned is the one corresponding to Freud's conception of the super-ego. It should be noted that this leaves us with a super-ego entirely anchored in cognitive and secondary processes. It is true of course, that such functions as self-judgment and idealization would always be cognitive in nature. This is not necessarily true, however, when it comes to functions like conscience and 'moral censorships', since it is possible to imagine these functions (being expressed as understanding, consideration, helplessness, etc.) as stemming from non-cognitive processes as well.

To explain: A distinction may be drawn between two types of object perception. A person may observe an external object (preferably another person) in a completely detached way and compare critically whether the object appearing in his mind and what he is observing are sufficiently alike; or he may feel the object in an immediate and direct manner, i.e. he may experience it not merely from the outside but from the inside as if he were for a moment and to some extent, inside the object seen. While the former type of perception refers to a cognitive process, in short, to a reality testing process; the latter

type refers to a non-cognitive process, to an instance of what Schachtel (1950) calls kinesthetic empathy. What is happening is that the person 1) experiences in himself the kinesthetic sensations he would have had, had he been in the object's place, and 2) that he projects these sensations and their associated feelings onto the object. Of course, he may not at all be aware of this process, i.e. his kinesthetic sensations may be inextricably fused with the object perception through the visual data received by the eye, and the projection involved - may be completely outside his awareness.

To say that the former type of perception is intrincically more veridical than the latter type, is difficult to defend. It is true that the former type has built in a sort of cognitive control against non-veridical inferences, but this very control represents at the same time an obstacle against the experience of an empathic feeling-together-with the object as well as with the world at large. And this latter experience may be considered as a moral censorship or moral control. From this point of view, we may think about a moral control existing on the non-cognitive level being substituted by a reality control on the cognitive level, and as a possible compensation for the loss of 'moral control' on the latter level, we may think of the formation of a defensively-inspired super-ego taking the place as a separate substructure of the personality.

As noted, empathic perception is based upon projection in the sense that the person's own qualities and feelings are attributed to objects (people or things) of his environment. In order for this type of perception to become veridical (to obtain a high degree of congruence between the feeling of object and subject) the perceiving person not only has to have an openness for perceptual cues emitted from the object, but also an openness and flexibility in his ability to take the role of the other, kinesthetically speaking. As pointed out by Schachtel, empathic perception (and projection) can help obtaining understanding of others (an understanding of a more genuine kind than that possible through cognitive processes) but it may also prevent understanding and lead to distorted perceptions. What is implied is always an auto-morphic (an individualized anthropomorphic) element - a tendency to perceive others in one's own image, to expect and find one's own likeness in others. Consequently, it is a type of autistic orientation in which the person's

own needs, wishes and interests may color the perceptual process, particularly if they are repressed or embedded in pathogenic defenses, or they are strongly aroused by situational factors. In both instances we may talk about an overriding of empathic abilities through the energies of the neuromuscular system being absorbed or captured by egocentric processes. However, a sharp difference is present. In the latter case, perceptual self-corrections might possibly be maintained in principle at least, through internal perception, while in the former case this is out of the question since the blocking out of internal awareness constitutes an integral part of the phenomena referred to. So much being said about the dangers of distortions, we would have to add that from a broader human perspective the dangers involved in the loss of interpersonal understanding might be tremendously greater on the individual as well as on the social scale. In some respects empathic understanding might be paralleled to effectance motivation. It is a mode of functioning which presupposes the non-existence of strongly aroused drives, pain, or anxiety, and like this type of motivation in contented children and adults, it may be looked upon as "persistent in the sense that it regularly occupies the spare waking time between episodes of homeostatic crisis." The assumption that empathic understanding represents a part of our biological heritage is given substantial support by recent laboratory experiments on monkeys (Miller et al., 1963).<sup>1</sup>

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<sup>1</sup> By stressing the importance of a role taking ability on the kinesthetic level we are indirectly referring to the degree of non-cognitive bodily awareness being present. It is interesting to note that Schilder (1931) seems to believe that 'the body image' may represent a similar crucial factor in relation to person perception on the cognitive level. He states: "Whenever there is trouble in the knowledge of one's body in the bodily schema; there is usually always a defectiveness in the perception of the bodies of others. The postural model of the body is the basis of our identification with others. Whatever makes a change in our experience about our own body is, at the same time, a social phenomenon."

We have tried to present in this chapter a somatic structural viewpoint on ego psychology. We have taken as our point of departure Freud's early conception of the ego as first and foremost a body ego, and indicated that bodily awareness and control may represent a very significant dimension of personality functioning. On several points we have been reasoning along the same lines as Lowen. We tend to agree with him that internal perception imply internal movement, that tolerance of tension probably develops as a result of motor control, and that the key to the proper functioning of the reality principle is not the repression of impulsive actions but the flexibility and elasticity of the voluntarous muscles. Although we are in agreement with him that the concepts of ego, id, and super-ego have counterparts in the somatic sphere, we find his definition of both the ego and the super-ego unsatisfactory. Perhaps the main difference between Lowen's and our own theoretical position is to be found in our distinction between two types of non-functioning (non-perceivable) muscular systems, between systems existing in a state hyper- and hypotonicity, respectively. The drawing of this distinction makes it natural for us to adopt a number of propositions inherent in classical psycho-analytic theory - proposition which cannot easily be fitted into Lowen's model. This doesn't mean that we end up with a minor revision only of psycho-analytic theory. Particular when it comes to structural and dynamic considerations concerning the super-ego we are suggesting rather extensive reformulations. In this latter area we have adopted several viewpoints put forward by Schachtel. Another deviation from psycho-analytic theory, is the distinction suggested between pathological and non-pathological defenses where we have taken the position that all defenses giving rise to lasting energetic transformations are pathological in nature. As the basis for such transformations we have postulated a process of repression having its somatic counterpart in muscular dystonicity.

According to this theoretical model one would expect that the release of chronically tense postural muscles may result in the regaining of a lost bodily awareness, but most importantly, that such a release - if the tense muscles constitute a dynamic element (a repressive agent) in a dystonicity pattern - may result in the reappearance of repressed affects and memories.

We have dealt with this hypothesis at some length in an earlier monograph (1963) and cited a number of confirmatory clinical observations. To round off our discussion, we will present one additional description pointing in the same direction.

In an earlier chapter we quoted some paragraphs from Hefferline's report on students reactions to his informal experiments in self-awareness. It might be recalled that Hefferline found that it turned out that subjects who had claimed that they could 'feel' their body were referring to visualizations rather than to proprioceptive discriminations. After having noted that many subjects when confronted with such a task 'remember more important things to do' (i.e., show resistances similar to those found in psycho-analytic hours), he continues:

"Some subjects, however, made curious by blank spots and hopeful of recovering some lost degrees of freedom in their system of voluntary control, do whatever is involved in paying closer attention to and acquiring interest in this peculiar private situation. A blank spot, they say, may gradually fill in. Or it may suddenly become the locus of sharp pain, paresthesias of one sort or another, 'electric' sensations, or the unmistakable ache of muscular cramp. Then what formerly was a blank may become as demanding of attention as an aching tooth. Further, and more detailed discriminations may be made. It soon becomes imperative to relax the cramp, but the subject says that he does not know how to do so; he is concerned with so-called voluntary muscles, but these are reportedly not under voluntary control ...

When a muscular block is definitely resolved, it is frequently claimed by the subject that there occur vivid, spontaneous recall of typical situations, perhaps dating back to childhood where he learned to tense in this particular manner." (p. 748).

Hefferline goes on to say that should the correlation between recovered movements and recovered memories turn out to be high under controlled laboratory conditions, it would afford substantial support to a motor theory of higher mental processes, - and generalize in ways not quite foreseeable. R. C. Davis's classical experimental finding that the 'stimulus trace' is conserved in the differential activity of striate muscles. It nearly goes without saying that our own theoretical position is based upon this assumption.



Respiration as Ego Mediated Instinctual Behavior

The supply of oxygen and the expulsion of carbon dioxide constitute a categorical drive for animals and humans alike. It is an unconditional necessity for continued existence or living. In this respect it is paralleled by the hunger, thirst, excreting and rest-sleep drives. Like these other drives it implies motoric and skeletal-muscular actions (or adjustments) for its satisfaction. Under normal conditions it operates on a reflex basis in the same way as the rest-sleep and excretion drive in early childhood, and maybe like the hunger-thirst drive in the pre-natal period. However, the fact that it operates on a reflex basis under normal conditions, that is - that it doesn't make itself felt as a need, doesn't make it classifiable as a simple reflex. The way the drive is being satisfied, i.e., the muscular actions implied in its satisfaction, varies from one situation to another, and also from one person to another. As pointed out by many observers a human being has relatively large opportunities to pattern his respiratory movements according to something else than his basic ventilation need. Consequently, different individuals breathe in their own characteristic way.

With growth and maturation breathing becomes subjected to internal awareness and submitted to conscious control. The influence of higher cortical centres is seen in breathing during speech and singing. In fact, it has been found that voluntary efforts may accomplish greater ventilation than the most strenuous muscular exercise. An individual may, to some extent, decide himself how fast he wants to breathe and how he wants to breathe, he may decide to hyperventilate or he may simply decide that he doesn't want to breathe at all. In this latter instance, we are confronted with the following situation: After a couple of minutes without breathing the individual's controlling power over his respiratory muscles becomes more and more difficult as the underlying need steadily increases in its categorical intensity. The individual may stubbornly keep on to

his intention, but after a while his self-consciousness diminishes and so does his controlling capacities. His breathing reappears on a strictly automatically regulated basis. Of course, we have parallels to this process in relation to other drives too. Under extreme need, both the excretory and rest-sleep drive may return to their original reflex status. A person may decide not to go to sleep, but after a while his controlling power successively fades away.

In talking about respiration as instinctual behavior we are following Freud's definition of an instinct as a continuous rhythmic stimulus to the mind emerging from the interior of the body, having its specific aim and its specific source. Following Freud one step further, we may consider the respiratory movements satisfying this particular instinct as a potential ego function in the sense that "the ego is manifested in the fact that normally control over the approaches to motility devolves upon it." In fact, in the case of respiration, we may follow Freud to the bitter end when he compares the ego's relation to the id in terms of a man on horseback, who, if he is not to be parted from his horse, is obliged to guide it where it wants to go.

One may ask if the oxygen-carbon dioxide condition in the organism really represents a stimulus to the mind. The answer, of course, depends upon what is meant by a stimulus and by the mind. That it stimulates motor action and that under specific conditions it may give rise to the experience of a categorical need, nobody would deny. But what about its psychic representation under normal conditions? We may look upon the accumulation of carbon dioxide in the blood (stimulating the respiratory centers in the medulla) as an excitation increasing phase, and the respiratory movements as an excitation decreasing phase (being followed by a brief expiratory pause comparable to a state in which excitation is below threshold intensity). What is important in the present context is that the drive instigated motor actions under normal conditions are elicited automatically and bring about an immediate excitation release so that the ebb and flow of excitation does not reach conscious awareness. However, if we think about excitation not in terms of energies pressing for discharge within the nervous system, but rather in terms of the tonic conditions of the respiratory muscles, one may certainly have an immediate awareness of the ebb and flow of excitation. One may experience directly the rhythmic tensing and relaxing of the respiratory muscles. Keeping on to Freud's pleasure principle one may even say that excitation decrease gives rise to an internally aroused feeling of pleasure and excitation increase to a feeling of unpleasure, and that this finely atuned

oscillation, in terms of excitation changes, is a prerequisite for our immediate awareness of the respiratory system.

We may recall still another of Freud's propositions, namely that the system Pcpt.-Cs. is located in the body exterior, and that excitations emerging from the body interior can only reach awareness through manifesting itself in striate muscles or other surface systems. It is well known, for instance, that deep organ 'pain' is always perceived as an irradiation on the body surface. Categorical as well as non-categorical needs are never experienced in terms of internal excitations. The same is true with a categorically felt need for breathing. It is always experienced or manifested in the external respiratory apparatus (e.g. in the throat muscles).

To sum up, although breathing under normal circumstances is not based upon a subjectively felt need, the breathing movements themselves can be directly and passively experienced. A person may, so to speak, by being in his respiratory movements, experience himself as something being "moved" by sources outside - or, strictly speaking, inside himself. Psycho-analytically considered, what is taking place is that the system Pcpt.-Cs. discriminates between two parts, namely that it belongs to a substructure of the body being moved by another substructure. This is, of course, exactly the condition postulated by Freud as being the starting point for the formation of the ego.

As long as the ego is operating in accordance with the pleasure principle we should expect no interference to take place in the respiratory rhythm, i.e., we may conceive of the ego as occupying the position of a passive perceiver of the processes going on. But from this early beginning another phenomenon emerges, namely the incipient experience of the ego that it is capable of controlling and regulating its own structural basis. As noted, it is assumed in psycho-analytic theory that these first controlling endeavors grow out of frustrations, i.e., of the child's experience that, in order to obtain gratification of his basic drives, it has to adapt to reality demands and modify its behavior accordingly. This is seen as the beginning of ego control, of delay processes, thinking, reality testing, etc., in short, as the beginning of "the self" and "the body image" as reference points in intrapersonal and social interaction. But psycho-analytic theory also makes another assumption: It postulates that reality adaptation and the development of cognitive functions imply defensive operations giving rise to energetic transformations (neutralizations). It claims, that by this very process the ego emerges as a substructure with its own 'borrowed' energetic properties. It conceives the

further development of the ego as a succession of impulse-defense and affect-defense operations, - and without this point being explicitly stated - as a parallel successive removal of the ego from its original biological foundation. Implicitly, this removal is considered a necessary consequence of the socialization process required for adapting human beings to citizens of civilized societies. Most pertinent in this connection is Freud's statement that "repressions in the price of civilization".

Although it is difficult to conceive of the respiratory movements as such being subjected to reality demands and socialization pressures in early childhood, they certainly don't operate in a complete vacuum. They are intimately connected with affect expressions and all sorts of reality oriented actions. The respiratory movements do not only operate within the framework of satisfying the individual's oxygen-carbon dioxide needs, but are involved in the gratification of all basic drives. Furthermore, we may assume that both eating, drinking, excretion and copulation have to be co-ordinated and integrated with respiratory movements in order to become firmly established ego functions. Conversely, we may suppose that both impulse and affect defenses will have repercussions on respiratory behavior, and that, in the case such defenses become permanently established, they will leave their specific impact on the respiratory system, - and most importantly - preclude the person's immediate non-cognitive awareness of his respiratory movements and diminish his ability to control and modify them on a voluntary basis.

As previously noted, we have found several reasons to doubt the psycho-analytic notion that the development of cognitive ego functions and reality adaptations presupposes defenses, energetic transformations and the abandonment of the pleasure principle - in the sense of a non-cognitive mode of awareness. Instead, we have suggested that reality adaptation and cognitive functioning may develop as an unfolding of inherent psycho-biological potentialities. This does not mean that we dismiss the influence of learning and education. Neither does it mean that we completely dismiss the idea of ego development taking place in accordance with the psycho-analytic conception under specific circumstances. What we do maintain is only that the psycho-analytic conception of ego development refers to a pathological, a non-optimal, kind of developmental process.

We mentioned above, that according to Freudian theory, the perception of the body exterior of being moved by the body interior may be seen as the starting point for the development of the ego. Of course,

this does not imply the perception of being moved per se, i.e., being moved as an abstract concept, but rather that the movement lays the basis for a primitive form of self-awareness, i.e., an awareness-of-Being being equal to Being-in-movement. It is a form of self-awareness not related to any cognitive concept of the self, but an awareness-of-being-an-entity without reference to anything else (outside the organism's own internal frame of reference).

Although we are not referring to breathing movements exclusively, we do believe that this particular kind of movements constitute a most important source of internal stimulation. We are talking primarily from a developmental viewpoint, but we believe the same to hold true on all age levels. Breathing movements provide a continues source for kinesthetic stimulation. They may even be considered as providing a continues basis for an organismic self-awareness. This is the position of Shatan (1963), when he writes: "From a kinesthetic standpoint, breathing is experienced as providing an inner base of support, for all out-lying parts of the body share in the ebb and flow of respiration."

At this point we would like to discontinue our theoretical discourse and ask a simple question: Isn't practically every human being in the position to experience his own respiratory movements? The answer depends upon what is meant by the term 'experience'. If it comes to thinking about oneself as a breathing entity, the answer would be that practically all adults have such a capacity. Most normal people can easily perceive their own breathing movements. But when it comes to perceiving breathing movements passively, that is, without controlling them but only perceiving them as they appear in their own intrinsically regulated way, the answer seems to be that this is not at all a common human capacity. Most readers will easily become convinced about the correctness of this contention if they start doing some informal experiments on themselves. They will experience the difficulty of letting their own breathing go without actively directing it or controlling it while they are focussing their attention upon it.

The following quotation of Selver (1957) elaborates on the same topic:

"In the center of our work on sensory awareness stands the study of breathing. Breathing is the central experience of being alive. Patience is necessary to get aware of what happens ... Our sensations may be vague at first, and only very gradually get clearer ... We learn to get interested in the different steps which lead toward more natural breathing ... We begin to distinguish between producing breathing, helping breathing, preventing and allowing breathing. Many people think of breathing only in terms of performance. They

have never stopped to realize that breathing is the first thing the baby does - and it certainly has not learned to perform it. So if breathing does not function satisfactorily there must be interference. We may discover the nature of such interference. There may be residual tensions, there may be resistance patterns caused by anxiety and fear ... Often signals we get aware of, help us to give up such resistances ... So no 'performance' is necessary, but more and more obedience to the genuine function as it wants to occur, without interfering 'help'." (p. 15).

Selver goes on to say that the study of breathing can help re-establishing an experience of organismic unity, and adds: "When we have learned to become permissive toward breathing as it wants to function, we can consciously allow it to influence any area which we feel is in need of refreshment, freeing or cleansing out." In order to fully understand what is implied by this statement we suppose one may really have had the experience referred to. On a more superficial level, what is implied is that a fully conscious control over breathing is only possible where breathing can be passively experienced, i.e., in a consciously uncontrolled (primary-process-like) way.

The significance of body awareness for mental functioning is formulated by Reich (1942) as follows:

"Every disturbance of the ability to fully experience one's own body damages self-confidence ... At the same time, it creates the need for compensation ... (The ability to fully experience the body) is disturbed in all neurotic individuals." (p. 319).

Reich too places great weight on respiratory awareness, and at one place (1948) he even states that "inhibition of respiration is the basic mechanism of the neurosis in general."

To get at an objective measure of proprioceptive awareness and control poses some very severe methodological problems. Subjective accounts on these matters are obviously not to be taken at face value as scientific data. Until they can be corroborated by objective measures they merely have to be ascribed as an introspectionistic standing.

The difficulty of measuring an ability to control not-to-control respiration is most striking. If we drop for the moment this particular ability, and concentrate on the ability for more active control, we are in a far better position. Holding on to the respiratory realm, we may consider the idea of constructing a test consisting of a series of respiratory tasks which are of such a nature that we can measure objectively a subject's ability to perform the tasks in question. We may even imagine the test as an instrument through which we may place

a given subject on a quantitative dimension going from a complete lack of control over breathing at the one end, to a fully conscious control over breathing as the other.

In order to illustrate the sort of control dimension we are hinting at, we are going to present a few quotations from psychiatric case reports. From Christie (1935), we may quote the following case description:

"Case E.G. male. Aged 46. He was working in a quarry when a 2,000 lb chain fell on the back of his neck and had he not clutched the automatic carrier, he would have been thrown some 40 feet to the ground below ... On examination, the only significant finding was a complete absence of costal movement; his breathing being wholly through the diaphragm ... We saw him for the first time two years later, his condition having remained unchanged. His breathing was still purely diaphragmatic in type but he gave a peculiar respiratory tracing ... which we had previously found to be typical for the anxiety neurosis --- an extreme irregularity in respiratory depth, rhythm, and level with an inability to co-operate in any form of respiratory gymnastics ... he inspires when told to expire ... he could only hold his breath for a few seconds ... when told to breath rapidly and deeply he breathed slowly and shallowly. At first sight a diagnosis of neurosis in this case seemed somewhat far fetched, considering that it is impossible for a normal individual consciously to inhibit thoracic respiration (?), but we were able to prove this point by giving him an oxygen-carbon dioxide mixture to rebreathe. His diaphragmatic excursions steadily increased under this stimulus. Respirations became more and more strained and irregular until ultimately a period of complete apnea appeared, lasting for about five seconds. He developed a coarse tremor of the hands and face, and the inhibitory mechanism then suddenly broke down. He burst into floods of tears and breathed freely with all his thoracic musculature. Two hours later he was back in his diaphragmatic breathing." (p. 428-249).

The description of the intimate connection being present between the patient's emotional and respiratory reactions should be particularly noted in view of our earlier discussion of the mechanism of repression. The patient described undoubtedly shows a profound inability to control his respiration.

Reporting on the case history of a 22 year old woman suffering from a lasting anxiety state, with heart sensations and apprehension, Braatöy (1947) states:

"In a supine position she draws her abdomen inward and pulls her chest upwards. Asked to 'breathe with her belly', she cannot. She writes her body awkwardly, pulls her chest still higher, while her abdomen is kept back as previously. She understands that there is something peculiar about this phenomena, but cannot explain what

is wrong. Asked to tense her belly and make 'big belly' as children do, she cannot. Her abdomen is still kapt back. Asked to push or 'bear down' with an effort similar to that of defecation, her abdomen still does not protrude. Without any instruction, she is lying tense with short, superficial, shallow, high-costal breathing." (p. 193).

Reich too has presented observations of patients unable to modify their respiratory pattern when asked to do so. Describing a female patient diagnosed as an incipient schizophrenic, he states (1950):

"On physical examination her chest appeared soft ... The softness of her chest would have appeared normal if it had not been accompanied by lack of respiration. Respiration was so shallow that it seemed altogether absent. When I asked the patient to inhale and exhale audibly, she refused; it was later shown that she was unable to do it." (p. 406).

In another context (1961) he presents observations of a female patient showing the picture of a neurotic resignation, i.e., lack of overt anxiety and a superficial compensated emotional balance. Here he writes:

"Respiration was severely disturbed ... The thorax was immobile. It did not perceptibly participate in respiration and remained constantly in an inspiratory position. When asked to breathe out deeply, the patient was unable to do so; more than that, she did not seem to understand what she was asked to do." (p. 240).

Thus one of Reich's patients was unable to breathe audibly, and the other unable to breathe out deeply. While Christie's patient was unable to breathe thoracically, Braatöy's patient showed the exact opposite pattern --- an inability to breathe abdominally. In all instances the patients exhibited their peculiarities of breathing "spontaneously", but the thing that was even more remarkable was their inability to modify their pattern of breathing when instructed to do so.

Christie emphasizes his patient's inability to cooperate in any form of respiratory gymnastics --- the patient inspiring when told to expire, breathing slowly when told to breathe rapidly, shallowly when told to breathe deeply, etc. Of course, this apparently complete lack of respiratory control is an extreme example. On the other hand, it should be noted that patients with anxiety-states quite frequently express spontaneously and unencouraged their inability to control their breathing (most commonly their hyperventilation), and that they sometimes even seek professional help mainly for this reason. "The neurotic who suffers anxiety-states simply cannot breathe," Perls et al. (1951) notes. He is unaware of what he is doing and what he is doing can therefore not be subjected to any kind of conscious modification.



The diversity of the type of control lacking in the patients referred to above, raises the very important question whether respiratory control is an unidimensional construct. This is a question that can only be answered through empirical studies.

Granted that we are confronted with an unitary dimension, we have no reason to believe that all mental patients are completely unable to control their breathing pattern voluntarily. Of course, this is not the real question. What we would like to know is whether a relative inability to control respiration is a characteristic trait of mental patients.<sup>1</sup>

In a study by Alexander and Saul (1946), focused upon psychiatric patients, we are told that: "Experiments showed imitation of another's spirogram to be extremely difficult." Do mental patients generally show greater difficulties than others in imitating different respiratory patterns?

The reason why we would like to have an answer to these questions is that according to our theoretical model, i.e. our conception of respiratory behavior as instinctual behavior being modifyable and accountable in terms of ego mediations, we would expect significant differences to be present. This follows from the assumption that mental patients by and large are characterized by more deficient ego-strength (psychologically considered<sup>2</sup>) than non-patients, and from the hypothesis (originally formulated by Lowen, but adopted by us) that "the depth and the strength of the ego depend upon the degree of conscious control and coordination of voluntary musculature."

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<sup>1</sup> According to our theoretical notions we would expect a complete deficiency of respiratory control to be associated partly with a state of severe anxiety (the person being paralyzed by fright) and partly with states of profound catatonia and melancholia (the person's ego system being completely engulfed in an armoring process).

<sup>2</sup> Ego-strength, psychologically considered, is of course not an easily defined concept. A common viewpoint is to emphasize the effectiveness with which the ego discharges its various functions, and particularly - its ability to mediate and integrate the influences stemming from id, super-ego and external reality. A person has been ascribed ego-strength to the extent to which his control mechanisms are functioning effectively and he is able to assert himself and function (experience and act) as an independent and consistent entity over time (cf. Rommetveit, 1958, pp. 106-7). From an operational viewpoint, the concept of ego strength, and the scale to measure the variable - developed by Barron (1953), should be specifically mentioned.

Taking this latter hypothesis as our point of departure, we may even raise the question whether it is possible to develop a respiratory test into a clinically useful psycho-diagnostic instrument, and eventually, into a more reliable instrument aiming at a global ego assessment than those commonly being used today in clinical psychological practice?

In the second part of this monograph we are going to present a tentative version of such a test.

## EMPIRICAL EXPLORATIONS

### The Development of a Respiratory Modulation Test

We are not the first ones to launch the idea that a respiratory test may have applicability in psycho-diagnostic practice. In the first part of this chapter we are going to describe three earlier psycho-diagnostically inspired respiratory tests. We will refer to them as Jones' breath holding test, Friedman's hyperventilation test, and Sutherland, Wolf and Kennedy's spiropoint test, respectively. After having discussed briefly their theoretical and empirical basis, we will suggest a new test - taking into account the experiences gathered through these earlier test versions.

#### Jones' Breath-holding Test

It might be recalled from Christie's case study (referred to in the last chapter) that the patient described "could only hold his breath for a few seconds". Jones' test is a very simple one. It only consists of measuring quantitatively the length of time a subject is able to hold his breath voluntarily. It is described by Jones (1948) as follows: 1) The subject is asked to stand, and 2) at the top of a normal inspiration he is asked to hold his breath as long as possible. The length of time he is capable of holding his breath is timed by a stop-watch. That is all.

Jones states that he has found the test to differentiate in a statistically significant way between neurotic patients and control subjects. In an empirical study he found the average breath-holding time for fifty neurotic patients to be 34.9 seconds, as compared to an average

of 57.0 seconds for twenty normal subjects; the difference between the two means giving a  $CR = 4.2$  and  $p < .0001$ . However, in spite of the group difference being highly significant there is still quite a large overlap between the groups.

The first question we would like to know more about is the composition of the patient group. What is meant by the term neurotic in this instance? We are told that the group consisted of 35 'effort syndrome' and 15 'anxiety state' patients. By effort syndrome patients, Jones refers to patients characterized by an effort phobia, the term effort syndrome to a large extent being synonymous with the American term neurocirculatory asthenia. In attempting to explain his findings, Jones rules out the possibility of factors pertaining to blood chemistry (like anaxaemia and respiratory alkalosis) being of importance. Instead, he emphasizes the likelihood of psychological factors being involved --- the patients giving up because of fear of continued breath-holding causing damage to their body generally and to their heart in particular. "The results ... indicate that the neurotic patients as a group lack persistence in the type of situation used for the test," Jones maintains.

As noted, the majority of the patients were diagnosed as effort syndromes. The fact that the test, requiring effort and thereby provoking an eventual effort phobia, shows these patients to perform worse than others --- in a way only substantiates that the initial diagnosis was correct. However, this is not an objection to the test. It should also be noted that not all the patients were diagnosed as effort syndromes. Nevertheless, the patient group seems to have been rather homogeneous.

Far from all neurotic patients suffer from chronic anxiety and effort phobia. How would these other mental patients respond to the test? That, we don't know, but it wouldn't be very surprising if the test should turn out to be far less discriminating in the case of a more heterogeneous group of mental patients.

#### Friedman's Hyperventilation Test

This test represents an elaboration of Jones' breath-holding test. It was first described by Friedman (1947). It consists of the

following steps: 1) The subject is asked after a preliminary deep inspiration to hold his breath as long as he is able to do so (the number of seconds being recorded); 2) after this initial breath-holding, the subject is asked to breathe normally for three minutes; 3) the subject is then asked to breathe deeply and rapidly for a period of 45 seconds at the speed of approximately one breath per second; 4) immediately after the end of this period of hyperventilation, the subject is instructed to hold his breath once more as long as he can, i.e., to refrain from breathing until it becomes utterly unendurable (the number of seconds again being recorded).

On the basis of the recordings made at step 1) and 4), a hyperventilation index is computed. The index states:

$$HI = \frac{\text{Breath-holding time after hyperventilation}}{\text{Breath-holding time before hyperventilation}}$$

According to Friedman, the index is able to discriminate very well between dyspneic patients with neurocirculatory asthenia (NCA) on the one hand, and normals and dyspneic patients with organic pulmonary and cardiac disease, on the other. If a patient obtains a HI below 1.30, it is said to be a clear sign of neurocirculatory asthenia.

By NCA, Friedman refers to patients displaying psychogenic cardiorespiratory symptoms, such as hand tremors, giddiness, frequent episodes of peripheral vasoconstriction, hyperthermia, transient sharp precordial pain, etc. In clinical work, it is often of great importance to differentiate between patients showing these symptoms on a psychogenic and on an organic basis, and Friedman thinks the index might be of great help in doing so. If the breath-holding time alone is used as a measure, patients with organic pulmonary and cardiac diseases, too, obtain very low values. However, these latter groups of patients do benefit significantly more from a short period of hyperventilation. In one of his empirical studies Friedman found 33 out of 34 dyspneic NCA patients to show lower HI than the lowest score observed in a control group of 30 patients.

It should be noted that Friedman does not suggest the HI to be a useful discriminator between non-dyspneic NCA patients and normals. It is true that NCA patients generally show shorter breath-holding time than normals. Even though a significant group difference is present in HI, there is at the same time such a great intragroup variations that it is not very well suited for picking out individual NCA patients. A very

low HI is a sign of a NCA, but a high IH does not rule out that a NCA might be present. The index's main discriminatory power is related to the dyspneic NCA patient, Friedman maintains.

Why is it that the dyspneic NCA patient cannot benefit from a short period of hyperventilation? Friedman points out that experiments show that the utilization or concentration of oxygen in the blood of these patients does not seem related to the genesis of their low HI, and neither does their low HI seem to be due to any peculiar or paradoxical sensitivity to a lowered blood concentration of carbon dioxide after the hyperventilation period. What seems to be at stake is not a deficiency in the gaseous exchanges but some peculiar effects of the hyperventilation per se. Among these patients hyperventilation seems to induce a neurogenical irritation nullifying in some manner the normally expected increase in breath-holding capacity.

One may ask what sort of processes are involved in this neurogenic irritation. Friedman does not discuss this aspect, but mentions that hyperventilation frequently causes strong reactions in the NCA patient, reactions consisting of an increase in hand tremor, an appearance of marked giddiness, axillary-palmar perspiration and peripheral vasoconstriction (cold hands). On the basis of these observations, we may suggest that what is taking place, is that hyperventilation in this particular type of patients mobilizes anxiety, and that the anxiety in turn makes it impossible for them to control or restrain their breathing.

It is well known that anxiety very often is accompanied by hyperventilation. For instance, Jones and Mellersh (1946) report that they found 'anxiety state' and 'effort syndrome' patients under rest to breathe approximately twice as fast as normal subjects. The speed being balanced, however, by the patients breathing only half as deeply, but after exercise (the exercise probably being anxiety provoking for this type of patients), to continue to breathe twice as fast, while at the same time increasing the volume per breath to a level above that found in the control subjects. Consequently, one may ask: Is it possible that voluntary hyperventilation triggers off a similar anxiety response as physical exercise? Furthermore: Is it possible that the anxiety response is accompanied by a feeling of breathlessness and suffocation --- and that this feeling gives rise to a need for a still more profound hyperventilation? If this should be true, one would certainly

understand why an instruction to stop breathing cannot be obeyed for any length of time. To the anxious patient the instruction would imply an instruction to stop being anxious. In short, what we are hinting at is that hyperventilation, may be considered an integral part of an anxiety response, a part that may trigger off the total response. This is, of course, to be considered as an hypothesis only, but it offers a reasonable explanation of Friedman's findings.

#### Sutherland, Wolf and Kennedy's Spiroprint Test

This test, described by Sutherland et al. (1938), is given while the subject lies on his back relaxing. It is a little more complex test than those mentioned earlier. It requires a spirometer of the type commonly employed in determining the basal metabolic rate.

The test consists of the following six steps: 1) The subject is asked to breathe naturally into the spirometer; 2) after about one minute, the subject is asked to take a deep breath --- just once; 3) after about 30 seconds of natural breathing, the subject is asked to breathe out just once --- as hard as he can; 4) after about 30 seconds of natural breathing, the subject is asked to hold his breath as long as he can; 5) after about 30 seconds of natural breathing following the breath-holding period, the subject is asked to keep breathing as deeply as he can; 6) after hyperventilating for about 30 seconds, the subject is told that the experiment is over.

Sutherland et al. report that the records of normal subjects are characterized by a clear differentiation of each period of the test; by even, regular respiration curves indicative of relaxation; by a sharp chasm for inspiration, and a well demarcated high peak for expiration; by an even straight line for breath-holding, and by equally deep and smooth respirations at the end of the test. We are told: "A series of records obtained from normal individuals were always of this type."

The records obtained from neurotic and psychotic patients show marked variations from the normal record - the variations being less among neurotics than among psychotics. Although 'abnormal' records show different patterns from patient to patient, they are all characterized by poor differentiation of each period of the test; by irregularities in the 'normal' respiration phase; by jagged, dicrotic

waves and gasps interrupting the deep breaths (the inspiration and expiration phases) and the straight line representing suspended respiration. "In our spiograms, every neurotic or psychotic patient produced at least some slight but detectable departure from normal respiration," Sutherland et al. state.

As regards the retest-reliability of the test, we are told that tracings taken several days apart from a given patient, reproduce each other with a very high degree of precision. "If duplicate records taken days apart in several hundred cases are shuffled, they can be paired quite easily," Sutherland et al. maintain. And they add: "These records could not be duplicated by any conscious process."

They also present some other interesting observations:

"Another important fact is that as a patient's mental state changed, so too did his accompanying spiogram. As a patient improved clinically, his respiratory 'finger print' or spioprint approached the normal. Conversely, if his mental state became worse, his spiometric tracing indicated it; i.e., became more regular and bizarre. In fact, from a glance at successive records, the progress of a case could be followed without actually seeing the patient. Clinical examination confirms this." (p. 103).

Why is it that respiration seems to be such a sensitive measure of a person's mental state? Sutherland et al. offer the following explanation: Abnormal mental states reflect an autonomic unbalance, and this unbalance is in turn expressed as an irregularity of the respiratory pattern. They state: "The pattern of respiration is, in a sense, as true an expression of thalamic and medullary activity as the Berger waves are of cortical rhythm."

The empirical observations of Sutherland et al. make it difficult to understand why more research efforts have not been invested in this area. As far as we know their observations have never been followed up by other investigators; neither have their findings been independently checked by others. One reason might have been that their findings sound too good to be true. Obviously, their causal conceptions leave much to be desired. Our own explanation of their findings runs as follows: A high degree of respiratory modifyability presupposes a smooth and integrated operation of efferent and afferent neural pathways. The subject has to have control over his respiratory muscles. He has to be able to innervate the muscles, to contract them at will and to relax them at will. But in order to do so he would have to know or perceive their present state of contraction or relaxation. If he does not feel



their present state of tension, if his actions do not give rise to feedback processes, he would never know how to go about modifying his respiratory pattern. In line with this, we would suggest that the main reason for the bad performance of mental patients on the test is their inability to keep in direct and immediate contact with their own body.

Although the test suggested by Sutherland et al., is a very primitive one - e.g., not providing any objective scoring procedure, etc., - their basic idea of a respiratory test approach to psychodiagnostics generally attracts considerable interest.

#### A New Test Version

The construction of a respiratory psycho-diagnostic test is a very fascinating objective. In order for such a test to be of real value it should be based upon a standardized instruction, an objective recording and scoring procedure, giving rise to quantitative scores which lend themselves to intra-personal, interpersonal and intergroup comparisons. Furthermore, the test ought to sample a broad range of respiratory behavior, that is, it ought to include items, i.e., specific respiratory tasks to be performed, tapping the degree to which the subject is able to control different aspects of his respiratory-related skeletal-muscular system.

The tests mentioned above specify several potential items; items referring to a subject's ability to hold his breath, to inspire and expire, and to hyperventilate. In the previous chapter we quoted some clinical observations also pointing to potential test items, - a subject's ability to breath with his thorax predominantly, or with his abdomen predominantly - at his own will, and to modify voluntarily his expiratory positions. Besides concentrating on the period dimension, the thoracic and abdominal amplitude dimension, the thoracic and abdominal expiratory position dimension, we would also like to include the subject's ability to control the time synchronization between his parallel thoracic and abdominal respiratory movements.

In order to obtain data about these different dimensions one would have to introduce a more complex recording device than a spirometer - the device used in the study by Sutherland et al. The mercury-in-rubber strain gauge technique (which we made use of in our earlier studies on spontaneous respiratory movements) seems to be a suitable method, however.

It is evident that the development of a workable respiratory test, requires pretests in order not only to ensure intelligible instruc-

tions but also to arrive at an appropriate timing and an appropriate succession of items.

The respiratory test to be obscribed below was developed on the basis of a number of informal pretests. Nevertheless, it has still to be considered as a preliminary test version.

The testing takes place with the subject lying in a supine position on a couch. The initial steps are the following ones:

- 1) The subject is told that we are going to examine his muscular tension. (This is of course, quite correct as far as it goes. It might very well be that it wouldn't make any difference to tell the subject that we want to examine his voluntary control over his respiratory muscles, although we don't think it is advisable to start elaborating on this topic at this time since it might involve giving examples touching on some of the later test items.)
- 2) The subject is told that the examination is not at all unpleasant, that he shall not undress except for outdoor things - coat, jacket, shoes. In addition, men are asked to loosen ties, collars braces, belts, and women to loosen tight-fitting garments. When this has been done, the subject is asked to lie down on the couch.
- 3) After the rubber tubings have been fastened around the pre-determined regions [The test implies records being taken from the following regions: 1) the subject's upper thorax (the gauge under the arm pits); 2) the lower thorax (the gauge over the Xipoid process); and 3) the abdomen (the gauge ca. 2 cm. above the crest of the illium)], the subject is encouraged to lie as comfortably as possible, not to talk; not to tense his muscles, in short, to try to relax as much as he can.

The instructions given up to this point can all be considered as introductory ones. The test might be thought of as a series of eleven items being prephased and postphased by a short instruction. Thus, the instructions to follow belong to the test proper:

Test Item	Timing	Instruction
0	Approximately two minutes after the last introductory instruction has been given:	"I would like you to do a few simple things for me. I will tell you what to do as we go along. Please, listen carefully to my instructions, because I am not going to repeat them. First, I want you to <u>breathe</u> as naturally as you can."
1	<u>Thirty</u> seconds later:	"Take one <u>deep breath</u> - as deeply as as you can."
2	<u>Fifteen</u> seconds later:	" <u>Breathe out</u> just once -- as hard as you can. In other words, I want you to <u>exhale all the air</u> that you possibly can."
3	<u>Fifteen</u> seconds later:	" <u>Start breathing as fast and as deeply</u> as you can."

Test Item	Timing	Instructions
4	<u>Thirty</u> seconds later:	"Okay, <u>hold your breath</u> as long as you can."
5	<u>Thirty</u> seconds later, after the subject resumes breathing:	"Now I want you to listen carefully. Please try to breathe with your <u>stomach</u> only, while keeping your <u>chest</u> in an <u>expanded, protruding</u> position."
6	<u>Thirty</u> seconds later:	"Okay. Now I want you to reverse the procedure and try to breathe with your <u>chest</u> only while keeping your <u>stomach</u> in an <u>expanded protruding</u> position."
7	<u>Thirty</u> seconds later:	"All right. Now try to breathe with your <u>stomach</u> only while keeping your <u>chest</u> in a <u>depressed</u> position."
8	<u>Thirty</u> seconds later:	"Okay. Now try to breathe with your <u>chest</u> only, while keeping your <u>stomach</u> in a <u>retracted</u> position."
9	<u>Thirty</u> seconds later:	"All right. Now ... I want you to breathe about <u>equally</u> with the <u>chest</u> and <u>stomach</u> . Try to keep both parts expanding and relaxing at exactly the same time."
10	<u>Thirty</u> seconds later:	"Now ... continue to move both your chest and stomach, but try to keep the movements of the two parts <u>out of pace</u> with each other in such a way that when you <u>expand</u> your <u>chest</u> , you <u>contract</u> your <u>stomach</u> , and when you <u>expand</u> your <u>stomach</u> , you <u>sink down</u> with your <u>chest</u> . Try to <u>inhale</u> by the <u>expansion</u> of your <u>chest</u> ."
11	<u>Forty</u> seconds later:	"Okay, continue to move your chest and stomach <u>out of pace</u> with each other; with the two parts moving in opposite directions, but now I want you to try to <u>inhale</u> by the <u>expansion</u> of your <u>stomach</u> . Previously, I wanted you to inhale by expanding your chest. Now I want you to inhale at the time that your chest is sinking down and your stomach is expanding."
00	<u>Forty</u> seconds later:	"Okay. That's all. You can breathe naturally again, and I'll remove the tubes."

A brief look at the items shows that we have borrowed freely from earlier test versions. Items 1 through 4 are slight modifications of items suggested by Sutherland et al. Instead of asking the subject to hyperventilate (to start breathing as fast and as deeply as he can)

some time after he has been holding his breath, we have adopted Friedman's procedure, namely, to let the breath-holding phase follow immediately after the hyperventilation phase.

Items 5 through 8 attempt to obtain data on the subject's "trunk-awareness" in a somewhat more differentiated manner than the previous items. They are also more complex, requiring the subject to do two things at the same time: to control his thoracic-abdominal amplitude as well as his thoracic-abdominal expiratory position. In later test versions it might be worthwhile to distinguish between these two dimensions in the sense of introducing them separately (as tasks to be performed) before they are combined into, what we may conceive of as composite items.

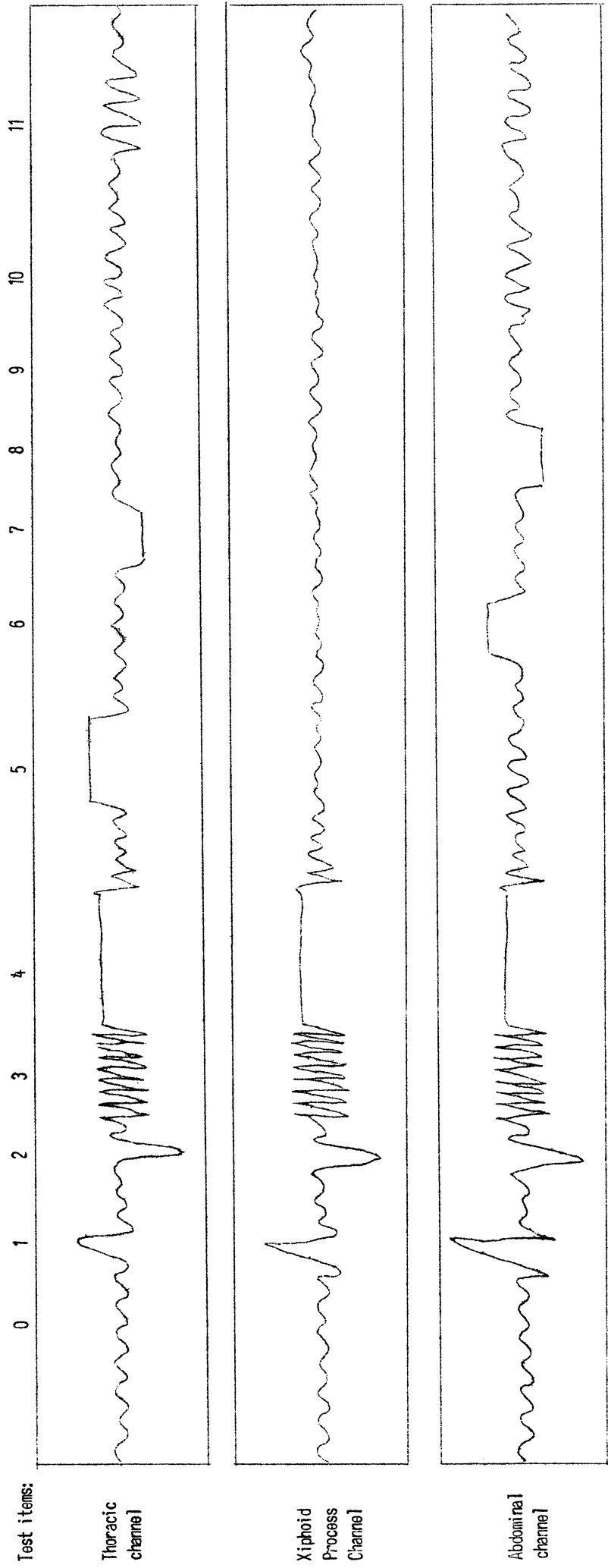
Items 9 through 11 also refer to composite items, asking the subject to control at the same time his thoracic-abdominal amplitude and his thoracic-abdominal time synchronization. Here too, it might be advantageous in later experiments to start out by focusing at first on each of the two respiratory dimensions separately. The two last items we thought of at the time of the construction of the test, as the most difficult ones in the whole series. These items have no forerunners in earlier test versions. They refer to a temporal aspect of respiratory behavior, an aspect which we have also included in our earlier respiratory studies.

Figure I (on the next page) presents a schematic outlook on the respiratory tracings evoked by the different test items.

The next question confronting us is how to score the test.

It is possible to think about the various items as tasks that can be 'passed' or 'failed' in accordance with pre-established scoring criteria, and to think about the test as a whole, as a scale, step-wise in difficulty and with a high internal consistency. However, it is also possible to adopt another perspective - and this seems to be a far more realistic one, namely, to consider the various items as tasks which will elicit a certain distribution of 'responses' and make the formulation of relevant 'cut-off' points for the different item scores an empirical question. Instead of thinking about the test as measuring one and the same underlying dimension, we may leave this problem open, and look at the test or the scale score (the sum total of the item scores) as an index primarily, - as a composite measure of the subject's ability to control his respiratory behavior. We decided to make use of this latter approach.

Figure 1  
A schematic outlook on the respiratory tracings evoked by the test



Before going into the problem of scoring criteria, we have to describe in detail how to proceed from the "raw" respiratory tracings to quantitative measures of the individual subject's task-performances.

### The Scoring Procedure

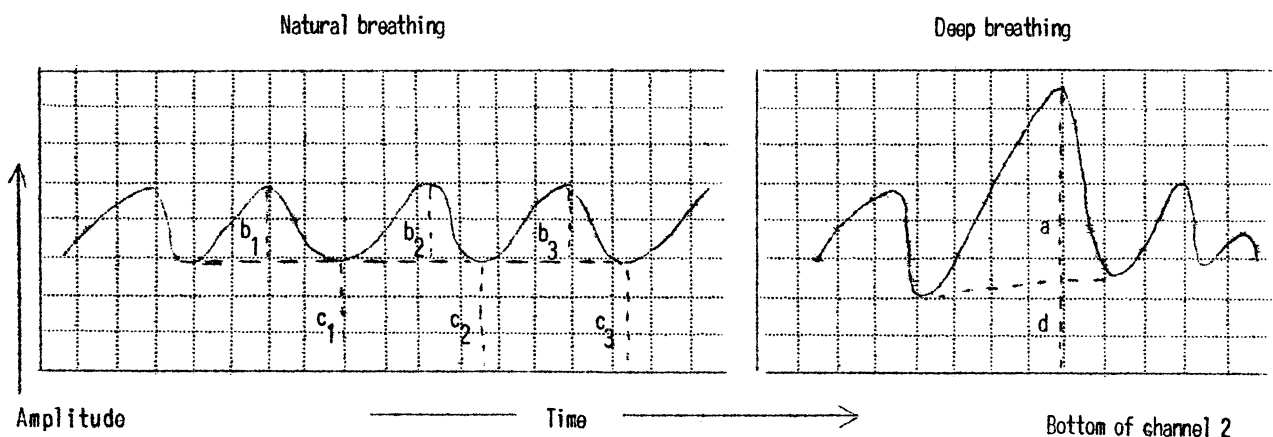
The purpose of item no. 1 is to ascertain the extent to which the subject is able to increase his inspiration level voluntarily. This implies a comparison between the subject's inspiration level when asked to maximize it and the inspiration level used during natural breathing.

As a quantitative measure of item no. 1 we will use the % increase in inspiration level from natural to single maximal inspiration. In order to measure this increase we will concentrate on the Xiphoid recording channel exclusively. The measure we are suggesting at can be described as follows:

$$\frac{a - b}{c} \times 100 \quad \text{[Item No. 1]}$$

where a is the Xiphoid amplitude during maximal inspiration, b the Xiphoid amplitude during natural respiration, and c the Xiphoid expiratory position, i.e., the body circumference at the place where the Xiphoid amplitude are being recorded.

In order to illustrate the scoring procedure let us assume we obtain the following respiratory curves:



As a starting point we have to take a sample of respiratory cycles from the "natural breathing" phase. To do so we select three successive cycles - free from movement artifacts - in the center of the recording period. We measure their amplitudes ( $b_1$ ,  $b_2$ ,  $b_3$  - defined as

the vertical distance from peak of a cycle to a line joining the beginning and end points of the cycle) and their terminal positions ( $c_1$ ,  $c_2$ ,  $c_3$  - defined as the vertical distance from the end of each cycle down to the bottom of the recording channel), and compute their respective means.

It is important to note that the terminal position is not equal to the expiratory position. To obtain this measure we would have first to convert the terminal position into real-trunk mm., and then add the real-body circumference in mm., corresponding to the bottom position of the recording channel.

As pointed out in an earlier monograph (1965a), it is possible to develop a calibration system making it possible to deduce the real-trunk circumference from the bottom position of a given channel. But we also pointed out that it is much simpler to obtain the absolute reference from tape measurement. It is true that this doesn't allow for as precise measures as the former method. On the other hand, very exact measures are not needed since the amplitudes (the changes in circumference) will always be extremely small as compared to the absolute circumference, - and since it is the relationship between these two measures we want to examine. Consequently, we have recorded the expiratory position by means of tape measurement, - the measurement being done simultaneously with the fastening of the rubber tubes.

The reason why we are interested in obtaining the mean terminal positions (as defined above) is to ascertain a fixed reference point for the Xiphoid amplitude during maximum inspiration. That is to say, instead of measuring  $\underline{a}$  (in the illustration above) we want to focus upon the distance  $\underline{a} + \underline{d}$ , and subsequently subtract the distance  $\bar{c}$ , thereby excluding the possibility of changes in the expiration level prior or subsequent to the deep-inspiration-task influencing the evaluation of the subject's performance. Thus, our earlier formula may be restated as follows (using the symbols from the illustration above):

$$\frac{[(a + d) - \bar{c}] - \bar{b}}{e} \times 100 \quad [\text{Item No. 1}]$$

where  $\underline{e}$  is the trunk circumference in mm., at the place from where the Xiphoid recordings are obtained.

A last step is the conversion of the numerator. Both  $a$ ,  $b$ ,  $c$ , and  $d$  are measured in mm. on the recording paper. After having done the

addition and subtraction called for by the formula, the result has to be converted into real-trunk mm. This can be accomplished through multiplying the result with a specific conversion factor. In our case, using an Offner polygraph Type RM, the factor in question was arrived at by multiplying the calibrated maximum sensitivity (with amplifier 'MULTIPLIER' at '1') by 'MULTIPLIER' setting used.

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Turning to test item no. 2 we may apply a scoring and measurement procedure parallel to that just described. We are here interested in knowing the per cent increase in expiration level from natural respiration to a state of maximum expiration. Using the same symbols as above, we have the following formula:

$$\frac{[(\bar{b} + \bar{c}) - a] - \bar{b}}{e} \times 100 \quad [\text{Item No. 2}]$$

where  $\underline{a}$  is the vertical distance from trough (maximum level) of deep expiration cycle down to bottom of Xiphoid recording channel (if trough should be found to lie a little below bottom of channel, the distance upwards has to be measured and ascribed a negative sign);  $\bar{b}$  is the mean Xiphoid amplitude during natural breathing,  $\bar{c}$  the mean Xiphoid terminal position during natural breathing, and  $\underline{e}$  the trunk circumference at the place from where the Xiphoid recordings are obtained. Since the  $\bar{b}$  measures counterbalance each other, the formula may be restated:

$$\frac{\bar{c} - a}{e} \times 100 \quad [\text{Item No. 2}]$$

What is important to note is that we are suggesting subtracting the single maximum expiratory level from the expiratory level during natural respiration, thereby ruling out the possible influence of temporary changes in inspiratory or expiratory levels prior or subsequent to the test performance. Finally, the numerator has to be converted into real-trunk mm., the procedure being exactly the same as described for item no. 1.

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Item no. 3 instructs the subject to breathe as fast and as deeply as he can. What we are interested in is to obtain a quantitative



measure of the subject's hyperventilating capacity. We may denote this capacity his hyperventilation level, defined as follows:

$$a \times b \quad \text{[ Item No. 3 ]}$$

where a is the respiratory rate, and b the mean Xiphoid amplitude, during the hyperventilation period. This latter period we defined as the ten respiratory cycles appearing subsequent to the first typical hyperventilation cycle (following the test instruction).

The first step in obtaining the respiratory rate is to measure the vertical distance on the recording paper from the start of the first to the end of the tenth cycle. The second step is to convert this distance into seconds. This can easily be done through multiplying the measure by a constant of 0.4 corresponding to a recording paper speed of 2.5 mm. per second. This is the speed used during the whole test, although for the pretest spontaneous breathing phase, we made use of a faster speed (5 mm. per second). Next, through dividing the converted measure by 10, we obtain the mean hyperventilation period, and subsequently, the rate by dividing 60 by the mean period in sec. To get at the mean amplitude we measured the amplitude of each of the ten cycles (from each peak vertically downwards to baseline of each cycle) and subsequently converted the mean (in terms of mm. on the recording paper) into a real trunk mm. measure by multiplying the raw mean by its corresponding conversion factor.

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Item no. 4 aims at the subject's breath-holding capacity (subsequent to hyperventilation). What we are interested in is the time of breath holding. It was obtained through measuring the vertical distance between the beginning and end of breath holding (appearing as a relatively straight line on the Xiphoid recording channel), and by a subsequent conversion of the measure into seconds, using the same procedure as described above.

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In relation to test item no. 5 two variables are involved. The first one is related to the subject's ability to breathe with his stomach only. In order to illuminate this variable we made use of the thoracic amplitude quotient, defined as  $a/a + b$ ; where a is the mean thoracic

amplitude and b the mean abdominal amplitude - being derived from the same respiratory cycles. As our sample of cycles, we used the three successive cycles (within a period of 15 seconds following the instruction) showing the smallest thoracic amplitude. No conversion is necessary in this instance since we are aiming at a ratio which to a large extent is independent of variations in real-trunk circumference.

The second variable implied in item no. 5 concerns the subjects ability to keep his chest in an expanded position - while he attempts to breathe with his stomach exclusively. As a measure of this latter variable we will suggest the per cent increase in the thoracic expiratory position. The measure is given by the following formula:

$$\frac{a - b}{c} \times 100 \quad \text{[Item No. 5b]}$$

where a is the mean thoracic terminal position found during the three cycles selected for examination, b the mean thoracic terminal position during the period of natural respiration (or more precisely - during the three respiratory cycles selected for study in this period), and c the thoracic circumference in mm. In both instances, the terminal position is measured in terms of the vertical distance from the end of each individual cycle down to the bottom of the recording channel (the thoracic one). Since the bottom line of the channel represents a fixed or constant point of reference, there is no need for measuring the expiratory position. However, after having subtracted b from a, the result has to be converted into real trunk mm. measure. As previously mentioned, this can be done by multiplying the raw score by its corresponding conversion factor.

It should be recognized that the above procedure allows for obtaining negative scores - indicating that the subject's mean thoracic expiratory position was higher during natural breathing than during the test period when he was asked to increase his chest expansion, i.e., his thoracic expiratory position.

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Item no. 6 also requires scoring in relation to two independent variables. The first one relates to the subject's ability to breathe with his chest only. We made here use of the thoracic amplitude quotient - the same measure as we employed on the previous item. At that time we

expected or wanted the quotient to be as low as possible, preferably zero, - indicating that the subject was breathing with his stomach only, while in the present context, we want it to be as high as possible, preferably one, indicating that the subject is breathing with his chest only.

The second variable requires data about the subject's ability to keep his stomach in an expanded position. We decided to make use of the per cent increase in the abdominal expiratory position. The measure might be stated as follows:

$$\frac{a - b}{c} \times 100 \quad \text{[ Item No. 6b ]}$$

where a is the mean abdominal terminal position during the test session, b the mean abdominal terminal position during natural respiration, and c the abdominal circumference in mm. derived from tape measurement. For natural breathing we selected the same sample of cycles as before, and for the test condition, we made use of the three successive cycles showing the smallest abdominal amplitude within a period of 15 seconds following the test instruction. After having made the subtraction called for by the formula, a conversion into real-trunk measure is required. Finally, the converted score is divided by the trunk circumference, and the result multiplied by 100.

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Item 7 also confronts us with two variables. The first one is the subject's ability to breathe with his stomach only. Again the thoracic amplitude quotient supplies us with the information needed. As previously, we have made use of three parallel cycles selected on the basis of 1) being successive ones, and 2) being the three cycles showing the comparatively smallest thoracic amplitudes in the series of cycles appearing in a 15 second period following the test instruction.

The second variable relates to the subject's ability to keep his chest in a depressed position (while he is breathing abdominally). An appropriate measure here is the per cent decrease in the thoracic expiratory position, that is, the per cent decrease found when the mean thoracic expiratory position during test condition is compared with that during natural breathing. The procedure for obtaining this measure follows the same principles as described for items 5b and 6b.

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Item no. 8 again implies two variables: The subjects' ability to breathe with his chest only, and his ability to keep his stomach in a retracted position. The former variable is covered by the thoracic amplitude quotient, and the latter one by the per cent decrease in the subject's abdominal expiratory position. The sampling procedure required for computation of means, and the conversion needed after the two terminal position means have been subtracted, follows the same lines as described earlier.

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Item no. 9 instructs the subject to breathe about equally with his chest and stomach, and furthermore, to show no time lag between the start and termination of his thoracic and abdominal respiratory movements.

As regards the former variable the thoracic amplitude quotient once more comes to the fore as a possible measure. In this instance, however, what we are mainly concerned with is not the quotient's size, but its deviation from some optimal medium value. We decided beforehand to put this medium value equal to .50 (indicating the presence of equal thoracic and abdominal circumference changes). Consequently, we decided to concentrate on the thoracic amplitude quotient in terms of deviation scores - disregarding whether the quotients were high or low. The optimal score becomes zero, and the score indicating a complete failure on the item, becomes .50.

With regard to the second variable, we have made use of the mean abdominal-thoracic dissynchronization. We are referring to the difference in time between the beginning of the same respiratory cycle in the abdominal and thoracic region. Here too we have concentrated on three successive respiratory cycles, preferably the optimal ones falling within 15 seconds after the test instruction was given. The distance between the beginning of parallel cycles in the abdominal and thoracic recording channel was measured in mm., and the result converted into seconds by multiplying with a factor of 0.4 (since 2.5 mm. on recording paper equals 1 second). It should be noted that in measuring the abdominal thoracic dissynchronization we defined an abdominal precedence in time as a positive dissynchronization, and a thoracic precedence, as a negative dissynchronization. However, in comparing subjects on this variable we decided to concentrate mainly on the numerical size of the dissynchronization score, leaving out its directional aspect.

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Item no. 10 requires the subject 1) to to move both his thorax and abdomen, and 2) to show a certain time lag between his parallel thoracic and abdominal inspiratory (circumference increasing) movements. As regards the subject's ability to 'solve' the first problem we once more made use of deviation from .50 scores on the thoracic amplitude quotient. In order to quantify how successful he was in 'solving' the second problem, we decided to make use of the following index of paradoxical movement:

$$\frac{a - b}{c} \quad [\text{Item No. 10b}]$$

where a is the mean thoracic inspiration time, b the mean dissynchronization time, and c the mean respiratory period. Once more, a sample of respiratory cycles is involved, and we have followed our earlier practice, and concentrated on the three successive cycles following the test instruction with 15 seconds, which, relatively speaking, represented the subject optimal test performance.

By the thoracic inspiratory time we refer to the horizontal distance between the beginning of a thoracic respiratory cycle (its inspiratory phase) and the beginning of its expiratory phase (the measure being derived from extending vertically downwards on a horizontal base line the two starting points - the one representing the trough and the other the peak of the inspiration curve), the distance subsequently being converted into seconds and fraction of seconds.

By the dissynchronization time, we refer to the time interval between the beginning of a thoracic cycle (its inspiratory phase) and the beginning of the associated abdominal cycle (its inspiration phase) - the two starting points being extended vertically downwards on a horizontal base line, the distance being measured in mm., and subsequently converted into seconds and fraction of seconds.

As regards the test item under discussion we would, in the successful subject, expect the thoracic inspiratory time to be approximately equal to the dissynchronization time, that is, we would expect the subject to start his thoracic inspiration at approximately the same time as he starts his abdominal expiration movements. If his thoracic inspiration time is shorter than his dissynchronization time, the index becomes negative, otherwise it becomes positive. Under natural breathing we would, of course, expect the thoracic inspiration time to be much,

much greater than the dissynchronization time, and consequently, the index to approach relatively high positive values.

It should be noted that the movement index suggested implies a fraction, the difference between the thoracic inspiration time and the dissynchronization time being divided by the respiratory period. We are referring to the respiratory period (in sec.) of the cycles used for deriving the two other measures. By introducing this latter factor we intended to neutralize the effect of variations in respiratory rate, since a given difference between inspiration and dissynchronization time would imply a proportionately greater difference the faster the subject's rate of breathing (or the smaller his respiratory period). Generally, we will be concerned with the index only in terms of its numerical size, leaving out whether it is positive or negative.

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Item no. 11 asks the subject to do two things. It instructs him 1) to move both his chest and stomach, and 2) to show a certain time lag between his parallel abdominal and thoracic inspiratory (circumference increasing) movements.

How well the subject manages to fulfil the former requirement can be evaluated through a study of his thoracic amplitude quotient, again considered from the point of view of deviation scores.

When it comes to the second variable, we made use of a similar index of paradoxical movement as that described above. In this instance, the index sounds as follows:

$$\frac{a - b}{c} \quad [ \text{Item No. 11b} ]$$

where a is the mean abdominal inspiration time, b the mean dissynchronization time, and c the mean respiratory period of the cycles being used for deriving the two other measures.

The procedure of obtaining the different measures parallels the procedure described above. What we would like to reemphasize is only that the index becomes higher (in a positive or negative direction) the less able the subject is to perform the respiratory task confronting him, and conversely, that it becomes lower and approaches zero, the more capable the subject is in modifying his respiratory pattern in accordance with the test instruction given.

To sum up, what we have attempted to do above is to describe a sort of a scoring manual for the respiratory test suggested earlier in this chapter. We have described procedures for objectifying the responses to each of the test items in terms of specific quantitative variables.

### A Preliminary Validation Study

In this chapter we are going to report on a small empirical study designed to explore to what extent the respiratory modulation test suggested above does possess any differentiating power. We will focus upon two groups of subjects, one consisting of 24 patients at the Menninger Clinic, and another consisting of 24 employees (non-patients) at the same institution. Both groups include an equal number of males and females of approximately the same age. Our selection of these two groups for study doesn't imply that we believe comparisons between psychiatric patients and normals to be a very fruitful line of research - at least not in the long run - but we think, nevertheless, that it may represent a suitable starting point for finding out whether the test does measure the psychological dimension we had in mind when we constructed it. There is good reason to believe that psychiatric patients and non-patients generally do differ in certain aspects of psychic functioning. We have assumed that one such aspect is the degree of immediate bodily awareness. If this holds true, and furthermore, that the respiratory test does in fact provide a measure on this factor, we should expect the test to discriminate between patients and normals.

It should be noted that if we find a difference between the two groups going in the expected direction we cannot be completely sure that the result reflects an underlying difference in body awareness. It might be caused by differences in motivation, the patients being less motivated or willing to carry out the various test instructions (and not necessarily less capable of doing so). Furthermore, if we should find no significant difference, we cannot rule out that body awareness might still be a crucial discriminating factor. Our test procedure does not measure proprioceptive discrimination directly. The test allows the



subject to amplify proprioception by making actual movements, and it might be the case (although we don't find it very likely) that a test allowing (and in a sense requiring) the subject to amplify proprioception does not provide a true picture of body awareness proper. It should also be noted that we are dealing exclusively with respiratory modifications, and it might be the case (although we don't find this objection either to be very likely) that respiratory awareness is not highly related to body awareness generally.

What we want to emphasize at this point is only that whatever results should come out of our group comparisons we would be confronted with unanswered questions. However, should our results come out as expected we would in any case have laid down one corner-stone for subsequent attempts to verify our theoretical frame. Of course, working within a hypothetical-deductive system, the most we can hope for in any single study is to check just one or a few predictions stemming from the system. Continuing this line of reasoning, we would assert that the respiratory test is not strictly a test in the traditional sense, but that it is primarily an instrument through which we hope to test certain hypotheses. This being said, it should be added that the test through further studies possibly may be developed into a psychometric test satisfying the common requirements for such a device.

As hinted at above, we expect mental patients to be less able than non-patients to modify their respiratory pattern when asked to do so in an experimental situation. What we are expecting in a sense, is that mental patients will obtain 'lower' scores on a respiratory modulation test than normals. So far our expectation sounds quite clear-cut. But when it comes to translating it into operational terms we are faced with several uncertainties. What should be required in order to conclude that our expectation has been verified? Our respiratory test consists of a number of items, eleven in all, and more than half of the items, to be exact - seven, comprise two rather independent respiratory variables. Altogether the test consists of 18 quantitative variables. Should it be required that each one of these variables can be shown to discriminate significantly at the 1% or 5% level between patients and normals? Should it be required that normals, to a significantly larger extent than patients, actually do succeed in passing the different test items - the question of what constitutes passing being defined on the

basis of some pre-established norms derived from expert opinion? Or should it be required that the sum of test scores obtained on the various variables (the test scores being defined as scores falling within specified intervals or cut off points shown empirically to discriminate optimally) by patients and normals, does differ significantly, and that this difference is maintained in a subsequent cross-validation study, i.e., in a study making use of a new sample of subjects?

Although these three types of requirements are definitely different in terms of their degree of "strictness" or 'demandingness', they all, in our opinion, refer to acceptable criteria for hypothesis-verification. The third type of requirement mentioned is of course, the softest one, but even this one, we find to be fully acceptable. In the following sections we are going to describe our empirical results in relation to the first and the last types of requirements mentioned.

Before starting on this presentation we would like to add that all the subjects participating in the study did it on a voluntary basis. The respiratory test instructions were given by a nurse - the only person present besides the subject in the experimental room.

Although the room was the same as used in our earlier studies, the setting was different - the testing this time taking place within a copper screened cage of about 2.8 m. x 2.8 m. (constructed for EMG recordings) filling up more than 3/4 of the floor area. The test instructions and the preliminary orientation given the subjects followed the line described in the preceding chapter, except that the subject was kept lying on the couch for approximately two minutes before the first 'breathe naturally' instruction was given. This was done in order to record a sample of respiratory cycles from the time before the subjects' attention was directed towards their breathing movements. The recording equipment used was mercury-in-rubber strain gauges of the type described earlier (1965a). The recording proper was done by an Offner polygraph placed in another room - this room and the experimental room being connected with a two-way loudspeaker system. Finally, it should be mentioned that the scoring of the records was done manually, and that according to the nurse administering the test, there was no apparent difference in motivation between the two groups of subjects - both being cooperative and eager to perform as well as they could.

Comparison Between Group Means on Individual Test Variables

As a first step in this analysis we have computed the mean scores obtained by the patient and the non-patient group on the various test variables. See table I.

Table I  
Group differences in mean scores on various test items

Item	Variable	Males	Females	Patients	Normals
1	% increase inspiration	3.60	2.94	3.07	3.48
2	% increase expiration	1.43	0.90	1.11	1.21
3	Hyperventil. level	583	342	423	502
4	Time breathe-holding	51.2	36.0	42.3	44.9
5a <sup>x)</sup>	Th. amplitude quotient	.32	.24	.29	.27
5b	% increase th. exp. pos.	1.26	0.91	1.06	1.11
6a <sup>y)</sup>	Th. amplitude quotient	.64	.53	.56	.61
6b	% increase ab. exp. pos.	0.72	0.17	0.28	0.60
7a <sup>x)</sup>	Th. amplitude quotient	.38	.33	.37	.33
7b	% decrease th. exp. pos.	0.01	-0.34	-0.20	-0.14
8a <sup>y)</sup>	Th. amplitude quotient	.59	.53	.53	.59
8b	% decrease ab. exp. pos.	0.76	0.52	0.59	0.69
9a <sup>z)</sup>	Th. ampl. quot. (D.S.)	.157	.205	.185	.177
9b <sup>æ)</sup>	M. dissynchronization	.339	.349	.295	.394
10a <sup>z)</sup>	Th. ampl. quot. (D.S.)	.216	.211	.233	.193
10b <sup>æ)</sup>	Index paradox. movem.	.114	.220	.207	.126
11a <sup>z)</sup>	Th. ampl. quot. (D.S.)	.148	.201	.190	.179
11b <sup>æ)</sup>	Index paradox. movem.	.208	.218	.230	.196

x) On this item the subject is instructed to breathe with his stomach only, i.e., to minimize his thoracic amplitude quotient.

y) On this item the subject is asked to breathe with his chest only, i.e., to maximize his thoracic amplitude quotient.

z) We are here making use of deviation scores, i.e., the lower the D.S., the better the subject's test performance.

æ) We are here concentrating on the variable's numerical size; the lower its size - the better the subject's test performance.

Besides concentrating on the patient and non-patient group, we have also divided our total sample according to the subjects' sex. As mentioned, both the patient and the non-patient group consisted of an equal number of males and females.

Studying the mean values presented in Table I, we discover that on all variables except one, the normal group shows better test performance. It shows higher percentage increase in inspiration when asked to inspire forcefully; it shows higher percentage increase in expiration when asked to expire maximally; it shows higher ventilation level when asked to hyperventilate, it shows higher breath-holding capacity; it shows lower thoracic amplitude quotient when instructed to breathe abdominally, and higher thoracic amplitude quotient when instructed to breathe thoracically; it shows higher thoracic expiratory position when asked to keep the chest in an expanded position, and a lower expiratory position when asked to keep the chest in a depressed position, and so on.

The exception to the general trend is item no. 9b. Somewhat surprisingly, the patient group obtains a lower mean dissynchronization score than the normal group. It should be noted that we are here focusing upon the numerical size of the dissynchronization score. If we take into account the direction of the scores as well, we find a tendency for the patient group to obtain higher negative scores and a tendency for the normal group to obtain higher positive scores, that is, to show greater abdominal precedence in breathing. The mean scores in the two groups being .139 and .305, respectively.

The fact that we find the difference between means in 17 out of 18 instances to go in the expected direction leads considerable support to our guiding hypothesis. However, most of the group differences found are rather small, and by and large - smaller than those emerging from our sex comparison.

We find males generally to be superior in their test performance. On three variables only do we find females to obtain 'superior' scores, the three variables being test item nos. 5a, 7a and 10a. That is to say, on 15 out of 18 variables do we find the male group to surpass the female group. It is worth noting that the three exceptional variables are all related to the thoracic amplitude quotient, and that on two of the three variables, the subject is instructed to breathe with his stomach only.

In order to find out to what extent the differences between the group means attain statistical significance, we have made use of a double-classification analysis of variance. The results of this analysis are presented in tables II through XIX on the following six pages.

The results show that on one test variable only do we find a statistical significant difference at the 5% level, between patients and non-patients. The variable in question is test item no. 10b. Since we are comparing the two groups on 18 variables in all, the fact that we find one of the variables to elicit a significant difference might very well be a product of chance. On the other hand, it should be re-emphasized that we did find the normal group to surpass the patient group on 17 of the 18 variables, and that this can scarcely be accounted for on a chance basis. Consequently, we may assert that the different test variables seem to differentiate between patients and normals, but that the differentiating ability of the individual test variable is too weak to be ascertained through a comparison between groups of 24 subjects each.

On seven variables we find statistical sex differences below the 5% level of significance. The variables are item nos. 2, 3, 4, 6b, 8b, 10b, and 11b. On all the variables except one, the male group shows significantly better performance than the female group. The exception being test item no. 10b, where the opposite is true. In other words, our statistical analysis indicates that nearly 40% of the variables show significant sex differences. If we look upon the test as consisting of 11 items in all, we may even conclude that on nearly 2/3 of the items significant sex differences are present.

The fact that we find more pronounced sex differences than differences related to hospital status (patient versus non-patient status) indicates that 'mental health' or 'psycho-pathology' is not the only factor involved in determining the subjects' test performance. One may even wonder whether 'mental health' is a potent factor at all. On the other hand, it should be noted that by comparing means and group scores on various test variables we may be losing sight of important differences between the individual subjects comprising the groups. We would like to recall that in our earlier analysis of spontaneous breathing records we frequently and typically found more psychiatric patients than normals to show deviating scores - in spite of the fact that in terms of group

Table II

Analysis of variance for item no. 1: % increase inspir. level

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	20.460	1	20.460	0.67	N.S.
Sex	52.470	1	52.470	1.71	N.S.
Interaction	6.604	1	6.604	0.22	N.S.
Individual diff.	1.348.682	44	30.652	-	-
Total	1.428.216	47	-	-	-

x) In order to avoid decimals, each raw score (in per cent) has been multiplied by a constant,  $k = 100$ .

Table III

Analysis of variance for item no. 2: % increase expir. level

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	1.102	1	1.102	0.15	N.S.
Sex	33.602	1	33.602	4.68	.05
Interaction	7.752	1	7.752	1.08	N.S.
Individual diff.	315.942	44	7.181	-	-
Total	358.398	47	-	-	-

x) In order to avoid decimal and negative values, to each raw score (in per cent) has been added a constant,  $k = 1.00$ , and the sum multiplied by another constant,  $m = 100$ .

Table IV

Analysis of variance for item no. 3: Hyperventilation level

Source	Sum of Squares	df.	Variance Estimate	F	P
Hospital status	75.923	1	75.923	1.39	N.S.
Sex	692.881	1	692.881	12.69	.001
Interaction	53.000	1	53.000	0.97	N.S.
Individual diff.	2.402.520	44	54.603	-	-
Total	3.224.324	47	-	-	-

Table V

Analysis of variance for item no. 4: Breath-holding time

Source	Sum of Squares	df.	Variance Estimate	F	P
Hospital status	7.597	1	7.957	0.16	N.S.
Sex	278.161	1	278.161	5.47	.05
Interaction	114	1	114	0.00	N.S.
Individual diff.	2.237.822	44	50.859	-	-
Total	2.524.054	47	-	-	-

x) In order to avoid decimals each raw score (in sec.) has been multiplied by a constant,  $k = 10$ .

Table VI

Analysis of variance for item no. 5a: Thoracic ampl. quotient

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	52	1	52	0.91	N.S.
Sex	920	1	920	1.62	N.S.
Interaction	2	1	2	0.00	N.S.
Individual diff.	25.058	44	569	-	-
Total	26.031	47	-	-	-

x) In order to avoid decimals, each raw score has been multiplied by a constant,  $k = 100$ .

Table VII

Analysis of variance for item no. 5b: % increase thor. exp. position

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital Status	352	1	352	0.04	N.S.
Sex	13.669	1	13.669	1.73	N.S.
Interaction	102	1	102	0.01	N.S.
Individual diff.	346.875	44	7.884	-	-
Total	360.998	47	-	-	-

x) In order to avoid decimals and negative values, to each raw score (in per cent) has been added a constant,  $k = 1.00$ , and the sum multiplied by another constant,  $m = 100$ .

Table VIII

Analysis of variance for item no. 6a: Thoracic ampl. quotient

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	320	1	320	0.77	N.S.
Sex	1.220	1	1.220	2.92	N.S.
Interaction	1.180	1	1.180	2.82	N.S.
Individual diff.	18.375	44	418	-	-
Total	21.095	47	-	-	-

x) In order to avoid decimals each raw score has been multiplied by a constant,  $k = 100$ .

Table IX

Analysis of variance for item no. 6b: % increase abd. exp. position

Score	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	11.719	1	11.719	1.59	N.S.
Sex	35.752	1	35.752	4.85	.05
Interaction	18.019	1	18.019	2.44	N.S.
Individual diff.	324.458	44	7.374	-	-
Total	389.948	47	-	-	-

x) In order to avoid decimals and negative values, to each raw score (in per cent) has been added a constant,  $k = 1.00$ , and the sum multiplied by another constant,  $m = 100$ .

Table X

Analysis of variance for item no. 7a: Thoracic ampl. quotient

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	209	1	209	0.37	N.S.
Sex	408	1	408	0.72	N.S.
Interaction	300	1	300	0.53	N.S.
Individual diff.	25.083	44	570	-	-
Total	26.000	47	-	-	-

x) Each raw score has been multiplied by a constant,  $k = 100$ .



Table XI

Analysis of variance for item no. 7b: % decrease thor. exp. position

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital Status	52	1	52	0.01	N.S.
Sex	11.719	1	11.719	1.95	N.S.
Interaction	6.302	1	6.302	1.05	N.S.
Individual diff.	264.125	44	6.003	-	-
Total	282.198	47	-	-	-

x) To each raw score (in per cent) has been added a constant,  $k = 3.00$ , and the sum multiplied by 100.

Table XII

Analysis of variance for item no. 8a: Thoracic ampl. quotient

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	533	1	533	0.92	N.S.
Sex	300	1	300	0.52	N.S.
Interaction	1.633	1	1.633	2.83	N.S.
Individual diff.	25.400	44	577	-	-
Total	27.866	47	-	-	-

x) Each raw score has been multiplied by a constant,  $k = 100$ .

Table XIII

Analysis of variance for item no. 8b: % decrease abd. exp. position

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	1.200	1	1.200	1.31	N.S.
Sex	7.008	1	7.008	7.63	.01
Interaction	300	1	300	0.33	N.S.
Individual diff.	404.017	44	918	-	-
Total	412.525	47	-	-	-

x) To each raw score has been added a constant,  $k = 5.00$ , and the sum multiplied by another constant,  $m = 100$ .

Table XIV

Analysis of variance for item no. 9a: Thor. ampl. quot. (dev. scores)

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	752	1	752	0.06	N.S.
Sex	28.519	1	28.519	2.30	N.S.
Interaction	1.302	1	1.302	0.11	N.S.
Individual diff.	545.475	44	12.397	-	-
Total	576.048	47	-	-	-

x) Each raw score has been multiplied by a constant,  $k = 1000$ .

Table XV

Analysis of variance for item no. 9b: Abd.-thor. dissynchr. (num. size)

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	118.008	1	118.008	0.71	N.S.
Sex	1.200	1	1.200	0.00	N.S.
Interaction	476.008	1	476.008	2.87	N.S.
Individual diff.	7.294.550	44	165.785	-	-
Total	7.889.766	47	-	-	-

x) Each raw score has been multiplied by a constant,  $k = 1000$ .

Table XVI

Analysis of variance for item no. 10a: Thor. ampl. quot. (dev. scores)

Sources	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital Status	19.200	1	19.200	1.25	N.S.
Sex	300	1	300	0.02	N.S.
Interaction	1.633	1	1.633	1.06	N.S.
Individual diff.	678.333	44	15.417	-	-
Total	699.466	47	-	-	-

x) Each raw score has been multiplied by a constant,  $k = 1000$ .

Table XVII

Analysis of variance for items no. 10b: Paradox. movem. index (num. size)

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	79.219	1	79.219	6.92	.05
Sex	133.352	1	133.352	11.65	.01
Interaction	7.252	1	7.252	0.63	N.S.
Individual diff.	503.508	44	11.443	-	-
Total	723.331	47	-	-	-

x) Each raw score has been multiplied by a constant, k = 100.

Table SVIII

Analysis of variance for item no. 11a: Thor. amp. quot. (dev. scores)

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	1.302	1	1.302	0.08	N.S.
Sex	63.802	1	63.802	4.15	.05
Interaction	1.519	1	1.519	0.99	N.S.
Individual diff.	676.158	44	15.367	-	-
Total	742.781	47	-	-	-

x) Each raw score has been multiplied by a constant, k = 1000.

Table XIX

Analysis of variance for item no. 11b: Paradox. movem. index (num. size)

Source	Sum of Squares <sup>x)</sup>	df.	Variance Estimate	F	P
Hospital status	13.669	1	13.669	0.65	N.S.
Sex	1.102	1	1.102	0.05	N.S.
Interaction	3.502	1	3.502	0.17	N.S.
Individual diff.	925.058	44	21.024	-	-
Total	943.331	47	-	-	-

x) Each raw score has been multiplied by a constant, k = 100.

means, no differences could be ascertained. May be the same is true in the present context. May be what is typical of mental patients is not an inability to modify their respiration generally, but to do so in relation to specific respiratory variables, while on other variables, they completely overlap (or even surpass) the normal subjects? In this instance, we would not expect to find any clear-cut differences in terms of the mean scores obtained on the various variables, but that such differences would emerge when we started to look into which subjects are falling 'behind' on the individual variables. Furthermore, we would expect the scores obtained on the various variables to be rather moderately intercorrelated. In order to explore these problems, we have to analyze our empirical data along other lines than those employed so far.

#### Comparisons Between Groups in Terms of Scale Scores

The respiratory test described can be thought of as a scale consisting of a number of items, each of which might be passed or failed by the individual subject. For each item failed the subject might be ascribed a penalty or failure score. Consequently, we might define a subject's test performance as being better, the lower his scale score total, that is, the smaller the number of items he fails and on which he obtains failure scores.

In order to make the respiratory test into such a scale, the first step is to formulate scoring criteria concerning the passing and failing of the various items. The criteria have to consist of critical score values on the respiratory variables to which the different test items are related. They have to represent definitions stating that scores above or below a particular value are to be considered a failure. To arrive at such critical score values one possibility is to make use of expert opinions, and another possibility - and that seems to be the only realistic one in the present instance where no experts exist, is to derive the values from empirical data, from a study of the actual distribution of scores obtained by patients and normals. Consequently, the first step in our analysis will be to look for those values or cut-off points on the different variables which discriminate maximally between patients and normals - but always within the framework of the normal subjects showing a superior performance.

To avoid making our study solely an ex post facto analysis, we will start out by formulating sex-specific cut-off points; i.e., cut-off points discriminating optimally among males and females respectively. By this procedure we will be in the position to test the criteria arrived at from one group on another independent group of subjects.

Of course, this objective does not require that we start out by formulating sex specific criteria. It could also have been accomplished by dividing our total sample into two groups on a random basis. By concentrating initially on males and females separately, and by subsequently cross-validating our criteria on the other sex group, we hoped, however, to reduce maximally the possibility of sex differences influencing in an uncontrolled way our criteria formulations and evaluations. We considered this an important precaution in view of our finding that relatively large sex differences seem to be present on a number of the variables.

Table XX presents a survey of the cut-off points found to discriminate optimally among our male subjects, and Table XXI, the cut-off points found to discriminate optimally in the other sex group. The tables show the resulting number of patients and non-patients being ascribed failure scores on each variable. It should be noted that the distribution of failure scores among females in the first table, and the distribution of failure scores among males in the second table, stems from criteria derived from the score distributions in the opposite sex group.

Looking at the distribution of failure scores, we find, as we would expect from our earlier analysis, that none of the variables show a strikingly high discriminatory power. On the other hand, this is not the crucial question. What is most significant is the cumulative effect of the failure scores obtained on the different items. Before turning to this question, we are going to comment briefly on some of the individual variables.

Table XX

A penalty scale derived from male records only

Test Item	Variable	Criterion for Failing	Distribution of Failure Scores among			
			Males		Females	
			pat.	norm.	pat.	norm.
1	% increase inspir.	Below 1.92	2	0	6	2
2	% increase expir.	y)	-	-	-	-
3	Hypervent. level	Below 251	2	0	6	2
4	Time breath-holding	Below 24.1	3	0	4	3
5a	Th. ampl. quot.	Above .45	5	2	3	2
5b	% incr. th. ex. pos.	Below .23	4	0	3	2
6a	Th. ampl. quot.	Below .57	5	3	10	4
6b	% incr. ab. ex. pos.	Below .36	8	2	10	7
7a	Th. ampl. quot.	Above .57	3	0	3	2
7b	% decr. th. ex. pos.	Below .68	12	8	12	12
8a	Th. ampl. quot.	Below .62	8	7	8	5
8b	% decr. ab. ex. pos.	Below .09	2	0	2	1
9a	Th. ampl. quot. (DS)	Above .25	3	1	3	5
9a <sup>x)</sup>	Th. ampl. quot.	Above .65 or below .23	4	1	6	5
9b	Mean dissynchr. (DS)	Above .80	1	0	0	1
9b <sup>x)</sup>	Mean dissynchr.	Below -.13	3	1	1	1
10a	Th. ampl. quot. (DS)	Above .36	3	0	1	1
10a <sup>x)</sup>	Th. ampl. quot.	Above .79	5	2	3	1
10b	Index paradox mov.	Above .194	4	0	8	4
11a	Th. ampl. quot. (DS)	Above .27	3	1	4	3
11a <sup>x)</sup>	Th. ampl. quot.	Below .23	2	0	3	2
11b	Index paradox mov.	Above .282	4	1	6	3

x) Variable not dealt with in our earlier analysis.

y) On this variable there is no cut-off point resulting in higher proportion of failure scores among male patients than among normal males.

Table XXI

A penalty scale derived from female records only

Test Item	Variable	Criterion for Failing	Distribution of Failure Scores among			
			Females		Males	
			pat.	norm.	pat.	norm.
1	% increase inspir.	Below 1.81	6	2	2	0
2	% increase expir.	Below .49	5	2	1	2
3	Hypervent. level	Below 226	5	1	1	0
4	Time breath-holding	Below 20.0	3	0	2	0
5a	Th. ampl. quot.	Above .44	3	2	5	2
5b	% incr. th. ex. pos.	Below .31	3	2	4	0
6a	Th. ampl. quot.	Below .48	8	2	2	2
6b	% incr. ab. ex. pos.	Below .06	10	4	3	2
7a	Th. ampl. quot.	Above .57	3	2	3	0
7b	% decr. th. ex. pos.	Below .07	8	7	6	7
8a	Th. ampl. quot.	Below .54	7	3	4	6
8b	% decr. ab. ex. pos.	Below .09	2	1	2	0
9a	Th. ampl. quot. (DS)	Above .39	1	0	0	0
9a <sup>x)</sup>	Th. ampl. quot.	Above .86 or below .15	2	1	0	0
9b	Mean dissynchr. (DS)	y)	-	-	-	-
9b <sup>x)</sup>	Mean dissynchr.	Below -.13	1	1	3	0
10a	Th. ampl. quot. (DS)	Above .28	4	2	5	4
10a <sup>x)</sup>	Th. ampl. quot.	Above .68	6	3	7	5
10b	Index paradox mov.	Above .305	5	1	2	0
11a	Th. ampl. quot. (DS)	Above .39	3	0	0	0
11a <sup>x)</sup>	Th. ampl. quot.	Below .11	2	0	0	0
11b	Index paradox mov.	Above .269	7	3	4	2

x) Variable not dealt with in our earlier analysis.

y) On this variable there is no cut-off point resulting in a higher proportion of failure scores among female patients than among normal females.

We find one variable to be non-discriminating both in the male and in the female criterion group. That is to say, in these two instances we don't find any cut-off points among males and females respectively, that result in a higher proportion of failure scores among patients than among normals.

The non-discriminating variable in the male group is the one related to item no. 2 - the per cent increase in expiration level. We have been wondering quite a bit why this particular variable turns out the way it does. The reason we have found most likely is that normal males customarily breathe more deeply than male patients, i.e., that their expiratory position during natural breathing (which we made use of as our reference point for evaluating the subjects test performance) is lower and consequently, that they have less residual air to expire when asked to breathe out maximally. Although we don't consider it a conclusive evidence, the fact that we find the mean Xiphoid expiratory position in normal males to be somewhat lower than in male patients (894 vs. 926 mm.) fits into the picture, and the more so, since the difference does not seem to be related to body size generally. (This is brought out by the fact that the two groups show practically the same mean thoracic expiratory position, 987 vs. 984 mm.). Whatever the final answer to this problem should be, we feel that the slightest possibility that an item is of such a nature that its 'solution' pre-supposes or is favored by an "unnatural" natural breathing, makes it unsuitable as a component of the scale. Consequently, we have decided to drop the item in question.

The non-discriminating variable in the female criterion group is one of the variables related to item no. 9, i.e., the numerical size of the mean abdominal-thoracic dissynchronization. Instead of dropping this item, we have reformulated the variables involved, and we have done this on the basis of some more general theoretical considerations.

Test item no. 9 instructs the subject to breathe about equally with his chest and stomach and to keep both parts expanding and relaxing at the same time. To measure the former aspect of this pattern, we have made use of deviation-from-50-scores on the thoracic amplitude quotient, and to measure the latter aspect, we have, as noted, made use of the numerical size of the subject's mean dissynchronization score. A .50 score on the thoracic amplitude-quotient implies that the thoracic and the abdominal amplitude are of equal absolute size. It might be questioned, however, whether an equal absolute size and deviation from this basis, is necessarily the most appropriate measure of an equal in-



volvement of the chest and the stomach in the respiratory movements. Instead of looking for an equal absolute size we might just as well look for an equal relative size; i.e., the extent to which the two amplitudes are of equal size when considered in relation to the circumference of the body at the places from where they are recorded, or -- in relation to the maximum size of the amplitudes being possible from the two body parts in question. Since, for most people, the abdominal and the thoracic expiratory position are not of equal size, but the latter one about 12% larger than the former, a thoracic amplitude quotient of .50 (in terms of absolute amplitude measures) would correspond to an abdominal amplitude predominance in terms of relative circumference changes. On the other hand, a quotient of .50 would represent a definite thoracic predominance if we start out from an equal thoracic and abdominal involvement in terms of actual-to-maximum amplitude size. This follows from the fact that for most people the maximum abdominal amplitude is much greater than the corresponding thoracic one. For instance, it has been suggested that in the full vital capacity only about one-quarter of the ventilation is due to chest expansion and three quarters to diaphragmatic movement. On the basis of these considerations we found it appropriate to start to look for cut-off points, not in terms of deviation-from-.50-scores, but in relation to the thoracic amplitude quotient variable per se as well. As noted in Table XX, we are suggesting under  $9a^x$ , the use of two critical values ("above .65" and "below .23") in relation to this latter variable. The corresponding cut-off points appearing as optimally discriminating for females are "above .86" and "below .15". Since these new criteria turn out to discriminate (within the groups used for their determination) a little better than the old deviation-scores, we will from here on concentrate exclusively on the new ones.

Furthermore, we will suggest replacing the numerical size of the mean dissynchronization by the mean dissynchronization variable proper. In making this suggestion we are implicitly arguing against looking upon a numerically identical positive and negative dissynchronization score as representing an equal deviation from what is required by the test item. Consequently, we will in the following concentrate on the mean dissynchronization variable only and the cut-off points suggested in relation to this variable. This implies that we will continue to make use of test item no. 9, although we will relate it to a couple of other variables than those initially considered to be most relevant.

Our reasoning above makes us feel a little doubtful as to whether deviation-from-.50-scores in terms of thoracic amplitude quoti-

ents represent the most appropriate variable in relation to test items nos. 10 and 11 as well. Both of these items ask the subject to breathe paradoxically, but they differ with respect to which body part should be involved in inspiration. Item no. 10 instructs the subject to inhale by the expansion of his stomach, while item no. 11 instructs him to inhale by the expansion of his chest. At neither item is the subject instructed to breathe equally with his chest and stomach, only to move both his chest and stomach. Consequently, the subject is failing the items if he immobilizes either his thorax or his abdomen. But to record this failure we would not need to consider his amplitude quotient at all - since it would prevent our computation of an index of paradoxical movement. When, in spite of these considerations, we still want to include a measure of the amplitude ratio it is due to our wish to control that the subject is moving substantially both his chest and stomach, and particularly, that he is moving substantially the body part he is instructed to use as a vehicle of inspiration. From this viewpoint, it might be asserted that what is to be penalized, is not primarily a high deviation-from-.50-score on the amplitude quotient variable, but a high amplitude quotient in response to item no. 10 (where the subject is instructed to inspire by expanding his stomach), and a low quotient in response to item 11 (where he is instructed to inspire with his chest). In both instances, the relevant cut-off points would have to be formulated in relation to the amplitude quotient as such, and not in relation to deviation scores.

As shown in tables XX and XXI we have made use of both of the scoring procedures just mentioned. Although the number and the distribution of failure scores obtained by the two methods are nearly identical, we will on principal grounds in the following paragraphs concentrate on the criteria related to the amplitude quotient variable per se only.

- - -

After having decided upon which variable to study and upon which score values on these variables to consider as criteria for failing, our next problem is to examine how well the male criteria discriminates among females and the female criteria among males.

If we look back on Table XX, we find that most of the male criteria result in a larger number of failure scores among female patients than among normal females. If we leave out, as suggested above,

the variables related to test items nos. 2, 9a, 9b, 10a and 11a, we find the preponderance of failure scores in the patient group to hold true for all variables except two. The two variables being related to item no. 7b and 9b<sup>x</sup> respectively. In both instances, we find an equal number of failure scores among female patients and non-patients.

Turning to Table XXI we discover the same overall pattern. On 12 of the 17 variables related to specific test items, we find the female criteria to result in a larger number of failure scores among male patients than among non-patients. On three variables (the variables related to items nos. 6a, 9a<sup>x</sup>, 11a<sup>x</sup>) we find an equal number of failure scores in the two groups of subjects. Finally, on two variables (the variables related to items nos. 7b and 8a) we find the number of failure scores to be larger among normal males than among male patients.

Looking over our cross-validation results on the individual variables, the numbers and the differences are too small to possess any statistical significance. However, the consistencies of the trend being present are very striking and it makes us wonder whether the scale as a whole might be shown to possess a significant discriminatory power.

In order to let each item count the same, we have ascribed a failure score on items nos. 1, 3 and 4 a weight of two, and a failure score on each of the two variables comprising all the other test items - a weight of one. Consequently, we end up with a scale having 10 items and a maximum range of scores going from zero to 20. On seven of the items, a subject may obtain a score of two, one or zero; and on three of the items, a score of either two or zero.

Table XXII presents the distribution of scale scores - derived from our male criteria, in various groups of subjects.

Table XXII

The distribution of scale scores (based on male criteria)  
in various groups of subjects

Group (N = 12)	Scale score														M	t	p	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13				14
Male-pat.				1	1	1	3	1	1	3	0	1				6.92	} 6.42	.001
Male-norm.		1	1	6	3	1										2.17		
Female-pat.						1	2	2	0	0	3	1	2	0	1	9.17	} 3.64	.01
Female-norm.		1	0	3	4	1	1	1	0	1						5.42		

The fact that we find the male patient group to obtain significantly higher scores than normal males is not very surprising since the criteria behind the scores were formulated in such a way as to discriminate optimally between these two groups. What is of primary importance, is the significant difference found between female patients and normals. This is a difference which cannot be explained by reference to the method used for developing the scale's scoring criteria. In other words, we are here faced with a result indicating that there is a statistical significant difference in the test performance of female patients and normals.

The next table shows the corresponding figures when female criteria are employed.

Table XXIII

The distribution of scale scores (based on female criteria)  
in various groups of subjects

Group (N = 12)	S c a l e s c o r e											M	t	p	
	1	2	3	4	5	6	7	8	9	10	11				12
Female-pat.			1	0	2	1	2	1	1	1	1	2	7.92	} 4.92	.001
Female-norm.	2	2	4	1	2	1							3.17		
Male-pat.	3	0	1	2	1	1	2	2					4.58	} 2.88	.01
Male-norm.	3	6	2	0	1								2.17		

Turning to Table XXIII we might extend our earlier conclusion to apply for males as well. We find that scale scores - based upon criteria derived from the female samples, differentiates in a statistical significant manner not only between patient and non-patient females, but also between patient and non-patient males. That is to say, the very same criteria which was developed in such a way as to differentiate optimally between female patients and normals, do also discriminate between two corresponding groups of male subjects.

It should be noted that the scale's discrimination between patients and non-patients among males, as well as among females, is not strikingly high, but leaves the groups with a relatively large overlap. In the case of our female criteria, we find ca. 50% of the patient males to obtain scores falling within the range of scores obtained by normal males, and in the case of our male criteria we find ca. 66% of the female patients to overlap the score range of normal females. Consequently, the scales do not appear to be suitable instruments for differentiating between individual patients and normals.

So far, we have been dealing with two parallel scale versions. Since both versions have been found to possess some independent discriminatory power, we might for the sake of further empirical studies merge the two versions into one. This might be accomplished most conveniently by simply adopting either the existing male or female criterion on each variable. We might, for instance, consistently adopt the strictest criterion of the two, i.e., the one being the most demanding in relation to the individual test item. For example, in relation to item no. 4 the male criterion is stricter than the female criterion since it requires the subject to hold his breath for a longer period of time (24.1 versus 20.0 seconds). Altogether, we find the male criterion to be stricter on 10 variables, the female criterion to be stricter on 4 variables, and the male and the female criterion to be alike on 3 variables.

Table XXIV presents the scoring criteria to be included in the new, composite scale version if we make use of the method of criterion selection just mentioned. The table also shows each criterion's discriminating ability in terms of the number of failure scores obtained by patients and normals. Altogether the criteria suggested give rise to a sum total of 176 failure scores among patients as compared to 90 among normals.

Table XXV presents the distribution of scale scores in different groups of subjects. The scale scores have been computed in the same way as described for the sex specific scale versions.

As expected, we find each of the patients group to differ significantly from the same sex non-patient groups, with the patients generally attaining higher scale scores. It is also interesting to note the significant sex difference being present. We find females generally to obtain higher scale scores than males. To check on whether any interaction effect is also present, we have computed a double-classification analysis of variance. - The results of this analysis are presented in Table XXVI.

The results confirm that very significant differences are present between patients and non-patients, and between males and females, but they do not indicate any significant interaction effect. Furthermore, it appears that the F-ratio for hospital status is more than twice the size of the F-ratio for sex. It should be emphasized that the former F-

Table XXIV

Composite scale version: Criteria for failing and the distribution of failure scores on various items

Test Item	Variable	Criteria for Failing	Distribution of Failure Scores among	
			Patients	Normals
1	% increase inspir.	Below .192	8	2
2	Hyperventilation	Below 251	8	2
3	Breath-holding	Below 24.1	7	3
4	Th. ampl. quot.	Above .44	8	4
	% incr. th. ex. pos.	Below .31	7	2
5	Th. ampl. quot.	Below .57	15	7
	% incr. ab. ex. pos.	Below .36	18	9
6	Th. ampl. quot.	Above .57	6	2
	% decr. th. ex. pos.	Below .68	24	20
7	Th. ampl. quot.	Below .62	16	12
	% decr. ab. ex. pos.	Below .09	4	1
8	Th. ampl. quot.	Above .65 or below .23	10	6
	M. dissynchronization	Below -13	4	1
9	Th. ampl. quot.	Above .68	13	8
	Paradox mov. index	Above .194	12	4
10	Th. ampl. quot.	Below .23	5	2
	Paradox. mov. index.	Above .269	11	5

Table XXV

The distribution of scale scores (based on strictest sex-specific criterial) in various groups of subjects

Group	Scale scores														M	t	p	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14				
Male-pat.			1	1	0	4	1	1	3	0	0	1			7.08	}	5.89	.001
Male-norm.	2	4	5	0	1									2.50				
Female-pat.				1	2	1	1	0	2	2	0	2	1	9.50	}	3.70	.01	
Female-norm.	1	0	1	6	1	1	1	0	1					5.58				
All males	2	4	6	1	1	4	1	1	3	0	0	1		4.79	}	3.06	.01	
All females	1	0	1	7	3	2	2	0	3	2	0	2	1	7.54				
All patients			1	1	1	6	2	2	3	2	2	1	2	1	8.29	}	5.58	.001
All normals	2	5	5	1	7	1	1	1	0	1				4.04				

Table XXVI  
Variance table for data on composite scale version

Source	Sum of Squares	df.	Variance Estimates	F	p
Hospital status	217	1	217	43.4	.001
Sex	91	1	91	18.2	.001
Interaction	1	1	1	0.3	N.S.
Indiv. difference	227	44	5	-	-
Total	537	47	-	-	-

ratio might be spuriously high, due to the fact that we are not dealing here with a sample of subjects completely independent of that used for specifying the scoring criteria. On the other hand, we are not making use of optimal criteria in relation to hospital status. Consequently, we find the difference in F-ratio to be very remarkable.

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This last remark brings us over to the question of how sensitive the scale is in relation to the specific scoring criteria used. Would we obtain very much the same distribution of scale scores if we made some changes in these criteria, or would even relatively small changes result in a total break-down of the scale's discriminating ability? To get an answer to this question we have computed the correlations between the subjects' scale scores (their test performances) on the three scale versions described above. We find the composite scale version to correlate .99 and .89 with the male and female versions respectively, and the two latter versions to show an inter-correlation of .88. This latter coefficient is again of considerable interest since the male and female scale versions were developed independently of each other.

To examine the problem still further, we have computed the correlations between the scale scores obtained on the composite scale version on the one hand, and the 'raw scores' obtained on the various variables comprising the scale on the other.

Table XXVII presents the result of this correlational analysis.

A brief look at the table shows that most of the correlations found are relatively small. However, nearly all of the coefficients go in the direction expected, that is, the lower the subject's scale score the better is generally his performance on the individual variable. For instance, we find the scale scores to be negatively correlated with "%

Table XXVII

The correlation (r) between the composite scale version and the 'raw' scores obtained on various test variables<sup>x)</sup>

Test Item	Variable	Failure Score if	Among males (N=24)	Among females (N=24)	Total sample (N=48)
1	% incr. inspir.	Low	-.22	<u>-.52</u>	<u>-.39</u>
2	Hyperventilation	Low	-.30	<u>-.72</u>	<u>-.57</u>
3	Breath-holding	Low	-.28	-.14	<u>-.43</u>
4	Th. ampl. quot.	High	.23	.24	.12
	% incr. th. ex. pos.	Low	-.31	-.20	<u>-.31</u>
5	Th. ampl. quot.	Low	-.00	-.30	<u>-.24</u>
	% incr. ab. ex. pos.	Low	-.21	-.22	<u>-.31</u>
6	Th. ampl. quot.	High	<u>.35</u>	.03	.09
	% decr. th. ex. pos.	Low	<u>-.23</u>	-.10	<u>-.24</u>
7	Th. ampl. quot.	Low	.02 <sup>y)</sup>	-.30	-.18
	% decr. ab. ex. pos.	Low	-.03	-.15	-.14
8	Th. ampl. quot. (DS)	High	-.04 <sup>y)</sup>	.17	.17
	M. th. dissynch.	Low	-.14	-.20	-.17
9	Th. ampl. quot. (DS)	High	.19	.13	.14
	Paradox. mov.	High	<u>.36</u>	.20	<u>.40</u>
10	Th. ampl. quot. (DS)	High	.04	.21	<u>.24</u>
	Paradox mov.	High	<u>.39</u>	.23	<u>.29</u>

x) The correlation coefficients approaching statistical significance have been underlined, and the coefficients going in the opposite direction of that expected have been marked by y).

increase in inspiration" (following the instruction to inspire maximally), negatively correlated with "hyperventilation level" (following the instruction to breathe as fast as and as deeply as possible), and so on. Accepting a one-tail-criterion, we find that for our total sample of subjects, 10 of the 17 correlations reach the 5% level of statistical significance, and that all the remaining coefficients too are going in the 'right' direction. Furthermore, it should be noted that the first of the two variables referred to by items nos. 8, 9 and 10, is deviation-from-.50-scores in terms of the thoracic amplitude quotient, and that this variable has not been used in the construction of our scale criteria. When included in the table it is due to the fact that in the present context it is a more appropriate variable than the amplitude quotient per se, since the latter variable does not take into account at all the expected bi-model distribution of inferior test performances.



Looking a little further on the correlations found in the total sample, we discover that two items in particular seem to be founded on rather non-discriminating variables. We are referring to items nos. 7 and 8. None of the variables related to these two items are significantly correlated with the scale as a whole. These two items are the only ones showing this characteristic. Turning to the other extreme, we find that items nos. 1, 3, 4, 6 and 11 are probably the most reliable ones. It should be pointed out that these items are related to rather different respiratory features.

On seven of the items the subject is instructed to do two things at the same time. Generally speaking, these fourteen variables seem to be less discriminating than the variables related to the more simple uni-dimensional tasks implied by items nos. 1, 2 and 3. Consequently, our data indicate that in a later test revision the complex items should be split up, at least initially, and that the items' discriminatory power is not related - at least not positively related, to their level of 'complexity'.

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In connection with the items requiring two things at once, the subject may concentrate all his attention on 'solving' either one of the two problems confronting him. This raises the question about the inter-correlation being present between the scores obtained on complementary variables.

Table XXVIII shows the correlations found in this area.

Table XXVIII  
The correlation (r) between variables related  
to the same test item<sup>x)</sup>

Test item no.	Among males	Among females	Total samples
4	.07	-.20	-.08
5	-.12	-.05	-.01
6	.93	.12	.47
7	-.24	-.04	-.09
8	.17	.24	.20
9	.58	-.10	.17
10	.28	-.10	.07

x) The signs of some of the coefficients have been changed in order for a positive relation in terms of test achievement, consistently to be given a positive sign.

Focussing on the total sample, we find that except for item no. 6, none of the seven variable-correlations reach statistical significance. In this sample, one half of the correlations goes in a positive direction and one half in a negative direction. Although our results do not show 'complementary variables' to be negatively related, the complete lack of correlation generally found attracts considerable interest. It points in the direction of thoracic-abdominal amplitude control, and thoracic-abdominal expiratory position control being relatively independent phenomena.

In order to examine whether these different types of control really constitute separate dimensions we have computed a few additional correlation coefficients. We have inter-correlated the amplitude quotients obtained on items nos. 4, 5, 6 and 7, and the expiratory position changes on the same items.

The results of the latter analysis are presented in Table XXIX.

Table XXIX  
Intercorrelation between expiratory position  
changes on various items

Test Item	Variable	4	5	6	7
4	% increase th. ex. pos.	-	.17	-.20	-.13
5	% increase ab. ex. pos.		-	.23	-.07
6	% decrease th. ex. pos.			-	.28
7	% decrease ab. ex. pos.				-

As regards the changes in thoracic and abdominal expiratory positions, we find, as shown in the table above, no consistent positive or negative relationships. There is a tendency for subjects who are most able to decrease their thoracic expiratory position also to be most able to decrease their abdominal expiratory position, but by and large, one gets the impression that control over thoracic and abdominal expiratory positions is a very complex phenomena that is not related to any one specific underlying capacity.

Turning to the changeability of the thoracic and abdominal amplitude, we find, when we intercorrelate the thoracic amplitude quotients obtained on items 4, 5, 6 and 7, the results presented in Table XXX.

All the correlation coefficients found are positive ones. This is a very important finding since the subjects, as previously noted, are asked on two of the items to maximize and on two of the items to minimize their amplitude quotients. The positive correlations found between items

Table XXX

Intercorrelation between thoracic amplitude  
quotients on various items

Test Item	Th. ampl. quot.	4	5	6	7
4	Low	-	.16	.65	.38
5	High		-	.36	.65
6	Low			-	.49
7	High				-

4 and 6, and between items 5 and 7, are not very surprising since the subjects are here confronted with similar instructions. The fact that we find high positive correlation between these items, and relatively higher correlations than between other items, lend some support to the reliability of the test. The positive correlations found even between items requiring the subject to do quite opposite things might be interpreted as a sign that a large proportion of the subjects are unable to modify their thoracic amplitude quotient. Regardless of the instruction given they continue to breathe in very much the same manner.

In order to explore this question we have specified the following types of amplitude-quotient changes on the four items under consideration:

Alternative 1: The subject's highest and lowest amplitude quotient differ by at least .50. Subjects fulfilling this criterion will be referred to as flexible.

Alternative 2: The subject's highest and lowest amplitude quotient differ by less than .50, and his highest quotient is below .51. Subjects falling in this category will be considered as abdominally fixated.

Alternative 3: The subject's highest and lowest amplitude quotient differ by less than .50, and his highest quotient is above .50 and his lowest, below .51. Subjects showing this characteristic will be defined as evenly fixated.

Alternative 4: The subject's highest and lowest amplitude quotient differ by less than .50, and his lowest quotient is above .50. Subjects fulfilling these criteria will be designated as thoracically fixated.

Scoring and classifying the individual subjects in accordance with these criteria, we find the distribution shown in Table XXXI.

The table shows that 50% of our non-patient subjects can be considered as flexible, while the same is true for only 12.5% of our patient subjects. The Mood likelihood ratio test of the two distribu-

Table XXXI

Classification of subjects in terms of thoracic-  
abdominal amplitude changeability

Group	Flexible	F i x a t e d		
		Abdominally	Evenly	Thoracically
Patients (M + F)	3 (3+0)	7 (1+6)	9 (5+4)	5 (3+2)
Normals (M + F)	12 (5+7)	3 (1+2)	7 (5+2)	2 (1+1)

tions, gives a Chi-square of 9.01, which reaches the 2% level of statistical significance. In other words, the results indicate that there is a significant difference present between patients and non-patients in terms of thoracic-abdominal amplitude changeability.

Furthermore, dichotomizing between flexible and non-flexible subjects, we find this variable to be significantly related to the scores obtained on the composite scale version. We here find a biserial correlation,  $r_b = .50$ , giving  $p < .01$ .

The classification procedure described above makes use of criteria of a more principal nature than those employed in the construction of our respiratory scales. The fact that we find even these criteria to discriminate significantly between patients and normals substantiates our earlier findings that real differences are present between the groups.

We have attempted a similar cross-validation in terms of 'principal scores' in relation to the expiratory position modulation variables. Instead of using empirically derived cut-off points being different from one test item to another, we have analysed and scored our subjects records in terms of a constant criterion. We have defined as "failing" all the test performances showing a percentage change in expiratory position (in the direction required) below +.30. Since we are dealing with four items in all, we arrive at a brief scale having a potential range of scores from 0 (all items passed) to 4 (all items failed). Relating the scores obtained on this very short scale to the scores obtained on the composite scale version, we find a correlation coefficient of .56, a coefficient reaching the 1% level of statistical significance. Finally, comparing the score distribution obtained by patients and normals on this new scale, we find even in this instance a difference approaching statistical significance ( $X^2 = 4.70$ ,  $p < .10$ ).

To sum up, our results indicate that many of the variables comprising the composite scale are relatively unrelated to each other. We find changeability of the thoracic-abdominal amplitude ratio to be

relatively independent of the degree of thoracic-abdominal expiratory position control, and furthermore, that each of these two dimensions are far from internally consistent. For instance, we find that the ability to increase and decrease the thoracic expiratory position are relatively unrelated phenomena, and that the same is true when it comes to the ability to increase and to decrease the abdominal expiratory position, and to modify the thoracic and the abdominal expiratory positions in either direction. We also find that the ability to increase and to decrease the thoracic-abdominal amplitude ratio is not highly related; in fact, we find that a large proportion of the subjects is relatively unable to modify their own amplitude ratio and that this overshadows the correlational matrix.

The low intercorrelation found between many of the variables, and the finding that in spite of their unrelatedness, they all tend to be positively related to the composite scale, stand out most clearly. We are inclined to interpret our findings as providing evidence that respiratory control is related to 'mental health', but that the relationship is a rather complex one, and not unlike the type of relationship found in our earlier study of 'spontaneous breathing'. Consequently, what we have come to consider characteristic of psycho-pathology is not a general inability to control respiration, but the existence of certain blank spots evoking deficiencies, varying from individual to individual, within specific and rather circumscribed dimensions of control.

### Summary and Conclusion

The main purpose of our empirical study has been to test the hypothesis that mental patients generally are less able than non-patient subjects to control their breathing pattern.

In order to test this hypothesis we have constructed a respiratory modulation test consisting of 1) a number of respiratory tasks which the subject is instructed to perform, and 2) a recording device making it possible to examine the subject's task performances in relation to a set of quantitative variables. Altogether, we have concentrated on eleven tasks and on eighteen different variables.

Our data analysis has followed two lines. Partly, we have compared the scores obtained by different groups of subjects on the individual variables, and partly, we have suggested specific scoring criteria related to the individual variables and compared the groups in terms of the number of subjects passing and failing the different criteria. On

the basis of these latter findings we have constructed an objective respiratory modulation scale reflecting the number of items failed by the individual subject. We have made use of a reearch design making it possible to cross validate on the other sex group the criteria found to discriminate optimally among males and females, respectively. We have also cross-checked some of the criteria in relation to scoring procedures developed on the ground of more principle or theoretical considerations. Finally, we have launched a composite scale derived from the two sex-specific test versions. This final scale has still to be considered a preliminary version, however.

Whether concentrating on individual quantitative variables or on the proportion of subjects failing a certain test item, we generally find a clear tendency for normals, as compared to patients, to show a superior respiratory modifyability. Our results indicate, however, that any one respiratory variable or test item considered alone is not able to discriminate sharply between patients and non-patients. But by combining variables or items, and by analyzing the respiratory performance at large, significant differences can be demonstrated.

The fact that we find the differences between patients and non-patients generally to increase as we enlarge the sample of respiratory variables being studied, lends additional support to the hypothesis that mental illness is associated with deficient sensory "feed-back" from respiratory muscles.

One of our findings is in need of further comment. We are referring to the fact that in comparing the score distributions on various variables in different groups, we found the difference between males and females to be more pronounced than the difference between patients and normals. It is true that the size of the differences became reversed when we compared the groups in terms of scale scores and F-ratios (indicating that the differences involved are of a different order), but even in this latter instance, we found a very significant sex difference to be present. We found male patients generally to show better test performance than female patients, and normal males generally to show better performance than normal females. How can this consistent sex difference be explained?

The first explanation that comes to one's mind is that respiratory control is dependent upon athletic training and physical exercise and that sex differences exist in this area.

One may even raise the question whether the differences found between patients and normals can also be explained by the same factor.

However, we find it difficult to conceive of physical training playing a significant role in this latter instance. As mentioned, we controlled for the age factor. Furthermore, it is our strong impression that the patient subjects, by and large, not only had greater opportunities but that they also participated more frequently and regularly in physical games and activities.

The influence of systematic physical training on respiratory variables has been studied by Clausen (1951). Comparing a sample of males and females with and without such training he was not able to ascertain any significant differences or any specific effect cutting across the very significant sex-difference found also in his study. Furthermore, Clausen argues strongly against the popular conception of males generally having more physical exercise than females, and he doubts that mental patients in modern hospitals are more restricted in physical exertion than the rest of the population.

It should be emphasized that Clausen's empirical investigation was focussed upon respiratory feature in a resting non-demanding situation. Granted that physical training (being enrolled as a student of a gymnastic or athletic school) doesn't produce any specific effects as regards the respiratory pattern during rest, the problem still remains that it might have definite consequences with respect to respiratory control in the sense of gross postural control. It might for instance, have the effect of strengthening the subject's ability to maintain physical control always and everywhere.

Discussing the topic of physical exercise, various types of training should be differentiated. On the one hand, we have the training involved by the subject simply going through our respiratory test. It is likely that a subject's second performance would be a little better than his first performance. It might even turn out that the ability to benefit from this type of training is dependent upon 'mental health' status, and that a comparison between groups in terms of retest data might be more discriminating than their initial test performances. At the other extreme, we have differences in everyday physical exertion not reflecting any systematic training at all, but possibly an innate activity drive.

As stated, it might be the case that a respiratory modulation test is more subjected to physical exercise than respiratory behavior under resting conditions. Consequently, we don't want to rule out that differences in physical exercise in a broad sense, may explain a part of the group differences found, particularly the sex differences although we would at the same time, like to stress that several studies have in

fact found more psycho-pathology among females than among males and that this difference might possibly be explained in terms of differences in socialization practices.

Comparing a respiratory modulation test with recordings of spontaneous breathing, each of the two methods have their specific advantages and disadvantages. An analysis of spontaneous breathing preferably has to be based upon several recording sessions, and it is usually very difficult to say whether a certain breathing pattern is a fixated or a flexible pattern. On the other hand, a modulation test will always require an active concentration on the part of the subject, and it might very well be the case that such a test can never provide information about the subject's ability to surpass this level of psychic functioning, that is, provide information about his ability to indulge in passive concentration as well (i.e., his ability to control not-to-control). What we are saying is, in fact, that a modulation test might, by the single fact that it is a test, prevent us from obtaining the specific type of information which we might possibly obtain from a study of spontaneous breathing in a non-demanding situation. This being true, we might still be left, however, with the possibility of making a number of specific psycho-diagnostic inferences from such a test - which cannot be made from a study of spontaneous breathing. We are thinking here particularly about the possibilities for differentiating between flexible and inflexible breathing patterns, and the possible diagnostic value of this differentiation.

This latter speculation brings up the problem whether it is at all possible on the basis of different test responses to make inferences about more specific psychological dispositions? We have already demonstrated that on the basis of a comparison of a subject's performance on different test items, we may distinguish not only between a flexible and a non-flexible thoracic-abdominal amplitude ratio, but also between different types of a non-flexible ratio. Do the subjects being classified by us as abdominally, evenly and thoracically fixated in their amplitude ratio, show any characteristic difference in their personality make-up? It should be recalled that in an earlier monograph (1965b) we have presented some tentative hypothesis as regards the psychological interpretation of just this dimension.

It is reasonable to think that a further, more systematic inter-item correlational analysis than we have done so far, may bring out additional respiratory dimensions which can be hypothetically linked to psychological variables.



Another problem is the extent to which our tentative modulation scale is related to any one specific psychological variable. As mentioned, the scale provides us with a potential range of scores going from zero to twenty. We have shown that psychiatric patients generally tend to obtain higher scores than normals. The question emerges: Does the scale reflect a specific psychological dimension like 'ego strength', or - 'degree of mental health'? Is it really so, that those obtaining the lowest scores among the patients are more healthy or have more ego strength (broadly clinically defined) than those obtaining the highest scores? Is the same correspondence true with respect to the normal subjects obtaining relatively low and relatively high scores? Would we have consistently to make use of separate norms for males and females? Is it possible to delineate some particular patterns or scatters of item scores differentiating between the patients and the normal subjects overlapping each other in terms of total scale scores? Several additional questions could be stated.

We have in this concluding section been concerned with pointing out problems for further research. This is due, partly to the fact that our preliminary findings raise many more questions than they settle, and partly to our wish to make explicit some of the problems we want to take up for further empirical analysis in forthcoming monographs.

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