LOWENFELD'S TESTS FOR VISUAL AND HAPTICAL APTITUDES:

REVISION, STANDARDIZATION, AND VALIDATION

by

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A Thesis Submitted to the Faculty of the

DEPARTMENT OF PSYCHOLOGY

In Partial Fulfillment of the Requirements
For the Degree of

MASTER OF ARTS

In the Graduate College

THE UNIVERSITY OF ARIZONA

1977
STATEMENT BY AUTHOR

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ACKNOWLEDGMENTS

First, I'd like to thank Dr. Dorothy Marquart, without whom I could not have completed this study. From the time of its conception to the final stages of its implementation, she stood by me and supported me with infinite time, patience, and encouragement.

Many thanks, also, to Drs. George Domino, Eric Gelber, and Chris Tanz, who served me faithfully as faculty advisers. Their suggestions and ideas were helpful and thought provoking.

In addition, I would like to thank the many subjects who volunteered their time to participate in this experiment.

I would also like to take this opportunity to express my appreciation toward my family. Without the constant caring and guidance of my dear grandparents and loving parents, I would not be what I am today. I would also like to say thank you to my sisters, Bonnie and Didi, whose closeness throughout the years has enriched my life.

Finally, I wish to thank Joe Perl, who lived through it all with me and made it all worth living through.
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ABSTRACT

Three tests were developed in an attempt to measure different aspects of visual and haptic perceptual aptitudes as described by Viktor Lowenfeld. The three preliminary measures, along with the Rotter Locus of Control Scale and Lowenfeld's Word Association Test, were administered to 30 college students. After some revision, the tests were readministered to another 30 Ss. It was expected that scores on those tests considered by Lowenfeld to be measuring visual aptitude would correlate positively with each other and negatively with tests of haptic aptitude. Also, based on Lowenfeld's descriptions of the psychological characteristics of the two types, it was hypothesized that visual orientation would be correlated with perception of an external locus of control, whereas haptic orientation would be correlated with perception of an internal locus of control. The data did not support these hypotheses. Though intratest reliability was adequate, significant correlations between tests did not emerge. Therefore, it was concluded that the visual/haptic distinction as embodied by this instrument does not appear to be a meaningful dimension. Furthermore, it is not related to perceived locus of control. However, Piaget's contention that translation of haptically
perceived stimuli into the visual modality is a part of haptic perception received some support,
INTRODUCTION

Throughout history, the relationship between body and mind has been of continuing interest. Since Hippocrates postulated a tie between body humours and personality characteristics, the relationship between physical and psychological events has been investigated by men such as Sheldon, Galton, and Wundt.

Psychology has found this issue of the relationship between body and mind to be of particular relevance, for psychology itself is rooted both in the experimental study of the process of perception and in psychiatry under the influence of Freud. Thus, psychology has had to contend with the unification and integration of these two divergent realms. In so doing, psychologists have sought to discover whether perception is related to personality in some systematic manner. Psychologists began to question: What is the relationship between personality structure and individual differences in perception? Is there a reliable way of predicting how someone will perceive something by knowledge of his personality? How does perceptual style contribute toward personality? With this focus on the interdependence of the physiological and the psychological came the emergence of a unified, integrated concept of the human being. As Witkin et al. (1954, p. 2) expressed it:
It is now coming to be recognized that the process of perception, in order to be fully understood, must be studied in the context of the overall psychological organization of the individual perceiver.

Witkin et al.'s statement would lead us to expect a consistent mode of perception within an individual, and such seems to be the case. Similarly, the assumption that there is a relationship between personality and perception leads us to expect individuals to be categorizable in terms of perceptual type or style. There appears to be some evidence to support this view, but what the most appropriate categories are is a subject of great controversy.

The Relationship Between Personality and Perception

Many personality and perceptual variables have been investigated, with as yet inconclusive results regarding their relationship. One variable which has received considerable attention is the analytic versus the synthetic approach characterized by Vernon (1970) in a discussion of the perception of visual constancies, illusions, apparent movement, and causality. However, people appear to be able to function in either the analytic or the synthetic mode and to change modes depending on the circumstances. Thurstone (1944) subjected the results of a large number of perceptual tests to factor analysis. He found two main factors: the ability to perceive closure rapidly and to maintain it during distraction, and the ability to
manipulate configurations flexibly. Vernon (1970), in studying tachistoscopic perception, isolated two separate abilities: the ability to discriminate and perceive simple shapes and patterns, and the capacity to make inferences as to the identity and meaning of representational and symbolic material. Later, however, evidence was obtained that these variables were influenced by education and previous experience. The introvert-extrovert dimension has also received considerable attention, and there appears to be some evidence to support this approach. Finally, Gardner, Klein, and others (in a number of studies, as analyzed by Vernon, 1970) developed a broad classification of principles of "cognitive control," the manner in which people perceive and react to the environment. They isolated five independent dimensions: field articulation, extensiveness of scanning, constricted/flexible, sharpening and leveling, and tolerance of perceptual ambiguity. Although some of the cognitive control factors appeared consistently, others did not, and because Gardner and Klein's prime interest was in relating these dimensions to unconscious defense mechanisms, their relationship to more global personality qualities remains unknown.

The Work of Witkin

The most comprehensive of all investigations of this type, however, was carried out by Witkin. He developed
several perceptual measures of interest: the rod and frame test (Witkin and Asch, 1948), the body adjustment test (Witkin, 1948), and the embedded figures test (Witkin, 1950). People's performances on these tests were found to vary greatly, though forming a continuum. At one extreme were people who were able to align both the rod and their bodies to the true upright and to perceive the simple embedded figures, while at the other extreme were people who aligned the rod with the tilted frame and their body with the surrounding tilted room and who were not able to perceive the embedded figures. The former Witkin called field independent, while the latter he called field dependent. Consistency of performance was demonstrated both on re-testing and across measures.

It became clear to Witkin et al. (1962, p. 1), at a certain point in the investigation,

... that the way in which each person orients himself in space is an expression of a more general preferred mode of perceiving, which, in turn, is linked to a broad and varied array of personal characteristics involving a great many areas of psychological functioning.

Indeed, Witkin extended his hypothesis to encompass not only perceptual but intellectual, emotional, motivational, defensive, and social operations of an individual. Field dependency, he found, is characterized by passivity, need for environmental support, submissiveness, and lack of self-esteem. Field independence, on the other hand, correlated
with activity, initiative, organizational ability and a mastery orientation, and was said to be characterized by an analytical attitude, acute self awareness, and high self-esteem. The important variable underlying the separation of the field independent from the field dependent is, according to Witkin, the extent to which the body is experienced as clearly separate from the field. This separation requires a differentiated body concept, one in which the self has clear boundaries and an inner structure. Differentiation, or "complexity of a system's structure" (Witkin et al., 1962, p. 9) is a characteristic of the field independent. In line with this, Witkin et al. (1954) found that field independence is roughly correlated with age. Thus, field independence is, to some extent, a product of maturation (although it is also influenced by social factors), and the perception of the self parallels perception of the world intimating a unified cognitive style.

The Transactionalists

Another approach to the question of the relationship between perception and personality is found in the work of the transactionalists. According to Kilpatrick (1953), visual perception can not be satisfactorily explained by either the immediate outside world of objects or by the impinging physiological stimulus patterns; the correspondence between object and percept is never absolute. Instead
we must look at the interaction of the organism-environment totality. In accordance with past experience, the organism builds up constructs which then serve as directives for further action. In other words, based on our assumptions derived from the past we form a probabilistic prognosis with regard to our percept. Our percept is then perceived with its significance. One demonstration of this phenomenon comes from the work of Ames (1951). In his experiment, a rotating trapezoid was perceived not according to what was occurring objectively, but rather in line with the assumptions and expectations of the observers. Similarly, Hastings (1952) was able to show that general level of personal security of an individual affects the perception of the distance of objects in the environment. Presented with an ambiguous stimulus situation, relatively insecure individuals perceived objects as closer to them than did secure individuals. From this it is clear that the organism does, indeed, function holistically.

As MacKinnon (1967, p. 60) said,

From such findings as these, and from similar results with other techniques of this kind, we are encouraged to believe that we shall eventually be able to tap and measure complex functions of personality with relatively simple tests of perceptual and cognitive processes, for it is clear that such processes, rather than being purely perceptual or cognitive in character, are vitally embedded in the total complex of personality and can be utilized to reveal significant aspects and dimensions of it.
Classification According to Sensory Imagery Characteristics

Another way of classifying individuals according to perceptual type is on the basis of sensory imagery characteristics. In modern times this scheme dates back to the work of Galton (1911). People who tended to imagine things in one sensory modality rather than another were classified into types on this basis. Consequently there were visual, auditory, and kinesthetic imagery types. Imagery psychology, as reflected in the development of the Rorschach technique, became quite popular and led to further attempts to classify man by his relative uses of the different sense modalities.

Hall (1966) divides man's sensory apparatus into two main categories: distance receptors, which include eyes, ears, and nose; and immediate receptors, which include the skin, membranes, and muscles. Touch is as old as life itself, while vision was the last and most complex sense to develop. Balint (1955) views touch and vision as two distinctly different perceptual worlds. He characterizes the touch oriented world as immediate and friendly, while the sight oriented world is friendly but it is filled with dangerous and unpredictable objects and people. Bartley (1969) describes the world of contact and motion as one in which information is gathered sequentially, bit by bit. To
the eyes, however, space is apprehended at a glance as a continuous whole.

According to Lowenfeld (1939), these two contrary impulses and styles have, throughout history, stood in opposition to one another. The dichotomy has been called by many names. For example, Herbert Kühn (1923, as cited by Lowenfeld, 1939) called the opposites "sensorial," referring to the type of people who use primarily distance receptors, and "imaginative." All views have a common core, however. What is visually perceptible in the external world is contrasted with what is experienced by the inward senses. This becomes apparent in comparing the work of impressionistic artists, who are fascinated by the world of appearances, with the expressionists, whose realm is that of self-expression. Similarly, the contrast manifests itself as a difference of technique and approach. According to Lowenfeld (1939), Richard Rothe of Vienna distinguished between two creative types. The first type, when modeling in clay, builds up its form out of separate parts; he calls this the "building" type. The other type, the "seeing" type, proceeds quite differently. While working he thinks of a specific visual image and molds this form out of one piece. Lowenfeld (1939) says Bühler described the first as the synthetic and the second as the analytic procedure. The distinction appears to roughly parallel the mode of
information gathering utilized in the processes of touching and seeing, which are directly antithetical to one another.

The further optical experience recedes into the background the less important does the eye become as the intermediary of the concept. To the same extent the importance of the environment diminishes and experience is more and more confined to the processes that go on in the body as a whole, bodily sensations, muscular innervations, deep sensibilities, and their various emotional effects. As the sense of sight diminishes so that of the sense of touch as the intermediary between sensations and the concept increases. In what follows we shall mean by "haptic perception" the synthesis between tactile perceptions of external reality and those subjective experiences that seem to be so closely bound up with the experience of self (Lowenfeld, 1939, p. 82).

Thus, Viktor Lowenfeld called the two perceptual types visual and haptic.

Lowenfeld's Visual/Haptic Dimension

With this preliminary introduction to the two types in mind, let us digress for a moment to examine the history and meaning of the word "haptic." Webster's Seventh New Collegiate Dictionary (1967) defines "haptic" as "relating to or based on the sense of touch." It is derived from the Greek word "haptein," which Gibson (1966) claims means "able to lay hold of." More recently, the term has been used technically by physiologists. According to Bartley (1969), the haptic system conventionally includes the muscles, joints, and skin; its functions are touch, kinessthesis, and possibly temperature and pain reception. It does not, however, overlap with the basic orienting system
involving the perception of the upright with respect to gravity (see Witkin's work). Gibson (1966) distinguishes between touch (a muscle sense) and kinesthesis (a joint sense) although both are subsumed under the haptic system. The first application of the word "haptic" to the field of art is unknown. Read (1955) claims the term was invented by an Austrian art historian, Alois Riegl, to describe types of art in which the forms were dictated by inward sensations rather than by outward observation. Langdon and Lunzer, however, in the translation of Piaget and Inhelder's (1956) work, substituted the term "haptic" for the French "stereognostique," claiming it was originally introduced by Revész in 1950. In any case, Piaget and Inhelder popularized it and their use of the word implied not only the ability to recognize objects by the sense of touch alone but also the ability to translate tactual perceptions into visual imagery.

Lowenfeld's field of expertise was teaching art to the blind. As a result, many of his observations are couched in terms of artistic creativity. All the same, his intention was for his classification system to be generally applicable, and his generalizations go far beyond the perceptual realm. His visual/haptic types correspond to psychological types, which can be characterized differentially. The visual type of person is an observer of the world's appearances. He is analytic, objective, and feels
like a spectator in the world. The haptic individual, on the other hand, is a subjective type, concerned with the expression of his inner feelings and values. He uses the world as a vehicle for self-expression. Most people, of course, fall between these two extremes. In spite of this, Lowenfeld found that only a few individuals have equal amounts of visual and haptic predisposition. Seventy-five per cent show an appreciable tendency toward one or the other. In the adult population tested (Lowenfeld, 1945), 47% were clearly visual, 23% were haptic, and 30% were in between. In other words, half of those tested reacted visually whereas not quite a fourth reacted haptically.

Lowenfeld's Tests for Visual and Haptic Aptitudes

The above findings are based on a series of tests conducted by Lowenfeld (1945) and described by him. The series of five tests measures visual versus haptical aptitudes. Each individual test measures a separate facet of the aptitude and can be given by itself if only one ability is of interest. In Lowenfeld's article, a short description of each measure was accompanied by an example or two. He also provided a scoring system and rationale. The tests are roughly as follows.

1. Test of Integration of Successive Impressions.

A small section at a time of a moving symbol is presented and the subject must integrate the
sections to form the whole symbol. Correct answers count toward visual aptitude.

2. Test of Subjective Impressions. Subjects were asked to make simple drawings and answer a question designed to reveal their mode of thought.

3. Word Association Test. Subjects were asked to complete 20 sentences. Each sentence was scored either visual or haptic.

4. Visualization of Kinesthetic Experience. Subjects, with their hand behind a screen, trace around the outline of a two dimensional shape with their forefinger. They must then recognize the shape visually when it is presented amongst a choice of similar shapes. Correct scores indicate visual aptitude.

5. Test of Tactile Impressions. Subject puts his hand into a bag (so that he can't see it) and feels a two dimensional shape with his whole hand. Simultaneously, he tries to recognize it visually from amongst a choice of figures. Correct scores indicate haptic aptitude.

Whether these tests, as Lowenfeld used them, were reliable is unknown. Whether they are theoretically valid, however, can be meaningfully debated. Consider, for example, Tests 4 and 5. Lowenfeld used Test 4 as a measure
of visual aptitude and Test 5 as a measure of haptical aptitude. The main difference between the tests is that on Test 4 subjects could only use one finger to encircle the shape, while on Test 5 they could actively touch the entire figure simultaneously. Does this difference in procedure matter? Whereas Lowenfeld believes it does, others disagree with him. Gibson (1966) considers touching the edges of a shape with one finger and active touching to both be forms of active haptic perception. Similarly, Piaget seems to use the two interchangeably. He states, "Outlines chiselled in wood worked even better... The child has only to follow the grooves instead of making a complete tactile exploration" (Piaget and Inhelder, 1956, p. 19). Both of these abilities Piaget considered to be in the realm of haptic perception. This is because Piaget's conception of haptic perception includes the translation of tactile-kinesthetic impressions into a visual image.

The Development of Sensory Perception in Childhood

According to Piaget, haptic perception develops in several stages. At first a child can only recognize by touch those objects which are already familiar to him. Next, he learns to recognize the topological relations of proximity, separation, order, enclosure, etc. During this stage the child can not distinguish between a circle and a square because they are both closed forms, although both
can be distinguished from an open form. Between the ages of 4 and 7 years, the child progressively learns to differentiate euclidean figures, although his exploration of them is still unsystematic. The final stage is then entered; complex forms can now be synthesized and visualized. Exploration is active and there is a decentration of attention. The approach is methodological and analytical. Partial support for this explanation is provided by Birch and Lefford's (1963) experiment in which they found that 5-year-old subjects were able to equate visual and haptic information and that beyond age 8 this ability to translate from one modality to another improved little with age.

Lowenfeld also proposed a method of analysis of the development of sensory perception in childhood. Based largely on the observation of children's art work, Lowenfeld's (1957) approach appears in considerable detail in the book Creative and Mental Growth. The developmental stages will be only briefly touched on here. To begin with, all children are haptically predisposed. Artwork begins with a preliminary scribbling stage, after which the 4- to 7-year-old can be characterized as portraying no order in space but rather ordering relationships according to emotional significance. Ages 7-9 years bring with them the achievement of a form concept during the schematic stage. Here we see the first recognition of spatial
relationships expressed uniformly as the "base line." The line itself actually represents three-dimensional space. The child at this time also develops a schemata, a constant way of portraying an object or space. This is deviated from only when subjective experiences dictate, which happens not infrequently, as we see in "folding over" and X-ray pictures. Finally, between the ages 9 and 11 the child drops the concept of the "base line" and attempts to depict reality naturalistically through the use of depth and overlapping. Between the ages of 11 and 13, however, a split occurs. This is the beginning of the visual/haptic preference. The visual type goes on to perfect his discovery of depth and perspective, portraying the environment and concentrating on the whole. The haptic type, however, makes an apparent regression to the "base line" concept, though actually achieving a higher form of non-visual consciousness; this type seeks to portray the self and emotions, and centers on the important details. In the next stage, the stage of decision, the road taken becomes a commitment and one's personality type is established.

**Visual versus Haptic Art**

Many explanations have been proposed elsewhere to account for the character of children's art. They are important here to the extent that children's art can be equated with haptic art and the majority of adult's art
with visual. (To a large degree this is so. What we are discussing then, is why haptics are the way they are.) The fundamental issue is rather simple: Why don't children draw things the way we see them? It is not only a problem of a lack of skill; their approach is entirely different than an adult's. Examples illustrating this difference of approach can be seen in Figure 1.

The child's conception of space is indeed unique. This phenomenon was classically explained by saying that drawing parallels cognitive development. The child draws what he knows, not what he sees, attempting to copy or imitate his own image of reality, rather than the one presented to the eye. From age eight onwards, however, the child becomes increasingly naturalistic in his orientation and begins to copy the visual image.

Several major theorists have disputed this hypothesis, each on his own grounds. The nature of art itself seems to be at stake. For the classical explanation assumes that art involves copying reality, be it a visual or conceptual image. However,

... something is wrong with the very notion of copying any of the ways an object is, any aspect of it. For an object is not just the object-from-a-given-distance-and-angle-and-in-a-given-light; it is the object as we look upon it or conceive it, a version or construal of the object. In representing an object, we do not copy such a construal or interpretation—we achieve it (Goodman, 1968, p. 9).
Figure 1. The Contrast Between a Child's and an Adult's Approach to Drawing a Cube and a Mountain with Trees.
Art, according to Gombrich (1961) is not intended to be a portrayal of the external form of an object. Its purpose is not to symbolize a reality outside itself, but to substitute for it. With the act of creation, the artwork becomes a reality in its own right. The common denominator of the original object and its artistic substitute is not form but function. The drawings of the child and the primitive reflect this fact that what is important is not visual likeness but the inclusion of relevant features and their interrelationships. Or, another way of putting it (Massachusetts Institute of Technology, 1972) is that mental images are basically descriptive rather than iconic in nature; that is, they resemble a model rather than a picture. In this sense, the child's portrayal of a cube is a better representation of its geometric properties than the adult's; each face is a square, the plane angles are right angles, etc.

Arnheim (1954), on the other hand, points out the inherent supremacy of sensory experiences over abstraction, especially for children. He claims children do, indeed, draw just what they see. According to him, the problem, quite on the contrary, lies with our notions of seeing. Physiologists used to equate seeing with the mechanical recording of the visual image, but we now know that seeing is an active process—we must extract the significant structural features of our environment. We perceive
generalities first and we don't see in linear perspective. The problem which faces the artist is how to embody these three-dimensional forms in two-dimensional space. He must create an equivalent form in the given medium. It is at this step, in translation, that children differ from adults due to their lack of experience.

It would be difficult, if not impossible, to reach conclusions on most of these theoretical issues, despite their intrinsic interest. The visual/haptic distinction proposed by Lowenfeld is of more immediate concern to this paper. As a variable, it holds promise of being applicable to many different phenomena. Some findings to which it may relate follow.

**Relevance of the Visual/Haptic Dimension to Cultural Phenomena**

Read (1955) suggests that as far back as during the Paleolithic period two distinct styles of art coexisted. The first of these is represented by the cave paintings in Southern France and Northern Spain. These paintings are determined by the outward projection of a visual memory image. The cave paintings found in Eastern Spain, however, are entirely different stylistically. Their main purpose is to indicate movement and they are determined by the inwardly felt sensation. Read refers to the latter as vitalistic, kinetic, or haptic art.
Even today, Snow (1959) suggests that we are living in the midst of two opposing cultures. His ideas were elaborated upon and expanded by Stark (1965). The first culture Stark describes as rationalistic, objective, analytical, experimental, and visual. The other culture is emotional, subjective, self-centered, and haptic. Stark hypothesizes that this distinction is paralleled by a difference in Rorschach movement responses; he suggests that those whom he calls haptic would produce significantly more movement responses than those whom he calls visual, who would produce fewer movement responses. Stark also hypothesizes that these differences would be expressed in two different types of creativity. The rational type is creative in the context of novelty (producing original Rorschach responses), which has its base in history. The emotional type (who gives movement responses) is creative within the context of meaning. His creativity is rooted in phenomenology, in the living and experiencing of life.

MacKinnon (1961, p. I-6), in his studies of creative individuals, acknowledges these two different cultures.

In designing our several studies of creativity we accepted the widely held though obviously simple and oversimplifying assumption that there are two rather opposed types of creativity, the artistic and the scientific.

In the first of these the product of the creation is clearly an expression of the inner states, e.g., the needs, perceptions, evaluations,
etc. of the creator. In artistic creativity the creator externalizes something of himself into the public field.

In the second type of creativity, the creative product is unrelated to the creator as a person who in his creative work acts largely as a mediator between externally defined needs and goals. In this type of creativity, the creator simply operates on some aspect of his environment in such a manner as to produce a novel and appropriate product, but adds little of himself to the resultant.

That artistic creativity as described above is related to a greater awareness of one's own body is supported by studies of Fisher (1973, p. 138).

Consistent positive correlations were found between degree of body awareness and amount of interest in artistic and aesthetic matters. This is one of the first bits of scientific evidence that an artistic orientation is tied to a special awareness of one's own body.

Keeping in mind that the term artistic creativity, as it has been used by MacKinnon and Fisher, refers to what we have been calling a haptic orientation, it will be clear that we have come full circle.

Relevance of the Visual/Haptic Dimension to Physiological Phenomena

Ornstein (1972), another contemporary writer, also believes that we are living in the midst of two opposing cultures. However, he hypothesized that both of these cultures dwell within each of us; that is, that the two modes of consciousness may actually reside in the two hemispheres of our brain. According to Ornstein, the left
hemisphere is the rational one; it reigns over our everyday lives. It is logical, verbal-intellectual, and scientifically inclined. It seems to correspond, in most respects, to what Lowenfeld referred to as the visual orientation. One discrepancy, however, is that while Lowenfeld claimed that his visual type processes information instantaneously in a Gestalt, Ornstein describes the rational consciousness as processing information linearly and sequentially. The right hemisphere of the brain, on the other hand, is more mysterious. Ornstein refers to it as mediating the intuitive side of our nature; it can be thought of as parallel to the haptic type, although it is holistic and simultaneous in its mode of processing information rather than sequential as is Lowenfeld's haptic type. The intuitive side is further characterized by Ornstein as that part of us which responds to music, enjoys crafts, and is responsible for our creativity. It is also the source of our ability to perceive spatial relationships, and is particularly sensitive to geometric forms and symbols like the mandala. In this respect, it seems especially close to Lowenfeld's concept of haptical ability, and it appears to be related to what is tapped by Tests 4 and 5. As such, Ornstein's two modes of consciousness may be very relevant for an understanding of visual/haptic orientation.

Another theorist, Colin Martindale, believes that even more important than the differential functioning of
the two hemispheres of the brain is their arousal level. Following Freud, Martindale distinguishes between primary process thinking, which is primitive in nature, and secondary process, which is rational, analytic, logical thought. The former may correspond to Ornstein's intuitive and Lowenfeld's haptic orientation, whereas the latter resembles Ornstein's rational and Lowenfeld's visual mode.

In his early work Martindale (1971, 1972) and Martindale and Greenough (1973) suggested that this continuum of primary and secondary process is correlated with arousal level of the reticular activating system; low levels of arousal parallel primary process, while high arousal is indicative of secondary process thinking. Given the importance of primary process in creativity, it seemed likely to Martindale that creative individuals would exhibit low levels of basal physiological arousal. In turn, this low level of arousal could be responsible for both the creative's oversensitivity to stimuli in the outside world and, simultaneously, the turning inwards to self-stimulation through the pursuit of novelty.

In 1975 Martindale published the results of several physiological studies. Using the electroencephalogram, alpha waves were assumed to represent the inverse of arousal. Basal frequencies were measured for the right and left hemispheres independently for low, medium, and high creative subjects. Low creative subjects were found
to produce low levels of alpha in both hemispheres. Whereas medium and high creatives both maintained a medium level of arousal in the left hemisphere (responsible for secondary process thought), in the right hemisphere (primary process) medium creatives emitted strong alpha waves (low arousal) while high creatives seemed to block these alpha waves thereby maintaining a high level of cortical arousal. From this it can be concluded that, relative to normals, creatives are more in touch with their right hemisphere, the seat of their primary process. Perhaps, in Lowenfeld's terminology, they are haptically inclined.

Martindale then gave his subjects two tasks, one requiring intellectual concentration, the other a test of imagination. On the intellectual task, all subjects decreased their alpha production thereby increasing their concentration. On the imaginative task, however, the groups responded differentially. While the low and medium creatives again decreased their alpha production, the high creatives increased their alpha level indicating that they were at a very low level of arousal, thereby permitting primary process material to break through. In summary, then, it can be said that most people produce alpha when they are relaxing and reduce it when working at a task. Creatives, on the contrary, begin with less alpha when relaxing and increase or decrease it depending on the
nature of the task. It is this differential response pattern that Martindale sees as the essence of creative thought. From the point of view of the present study, if the existence of a relationship can some day be established between visual/haptic functioning and brain behavior, Martindale's approach may prove very useful in fostering insights into the nature of visual and haptic modes of thought.

Statement of Problem

Lowenfeld's work has been the focus of considerable attention among art teachers and theorists. Psychologists, however, seem not to have discovered it, or, worse yet, to have ignored it. No studies have been reported which attempt to test his theories directly. This is due, perhaps, to their sheer complexity.

One study, however, which is related was conducted by Mackler and Shontz (1965). Though they were not interested specifically in Lowenfeld, they did study the interaction between visual/kinesthetic orientation and the effect of stimulation in visual versus kinesthetic modalities on creativity. They used five groups of subjects: high and low visual orientation, high and low kinesthetic orientation, and a control group. Visual treatment consisted of viewing a silent film; kinesthetic treatment was doing calisthenics. Contrary to their hypothesis that the
high visual group would respond primarily to the visual treatment (i.e., increasing their creative responses after viewing the film) and the high kinesthetic group to the kinesthetic treatment, all groups produced significantly more creative responses after activation of the body than after viewing the film. Moreover, the high visual and high kinesthetic groups were found not to have reacted differentially.

These unpromising results may be attributable to a flaw in the original experimental design. In the original organization of their subject groups, Mackler and Shontz used art majors for their high visual orientation group, and visually disabled for their low visual. In a parallel fashion, dance majors represented high kinesthetic and physically disabled low kinesthetic. The control group consisted of normals who fit none of the above categories. Lowenfeld, in his work, stressed that visual/haptic orientation is not rooted in acuteness or disability of sensory apparatus; some of his nearly blind students showed a pronounced visual predisposition. The fact of disability, in itself, therefore, says nothing with respect to orientation. Similarly, it would be unreasonable to assume that all art majors are visually inclined. It has been previously demonstrated that this is not the case. In short, the fact that this study did not achieve results
favorable to Lowenfeld's theory is of little importance to the validity of his theory.

The present study is of a different nature entirely. It is an attempt to get at the root of the matter by the construction of a reliable measure of visual and haptic aptitude. Because the items from Lowenfeld's tests are not available and no other tests have been developed, no measures of visual and haptic aptitudes currently exist. The tests developed herein, though conceptually based on the original tests developed by Lowenfeld, reflect item content attributable solely to the present author (with the exception of the Phrase Completion Test, which is Lowenfeld's). The measure, therefore, is actually a new test based on the ideas of Lowenfeld. An attempt has been made at standardization.

One issue which may be illuminated by the study is whether Tests 4 and 5 of Lowenfeld's series are measuring the same or different aptitudes. As discussed earlier, it can be argued that both Tests 4 and 5 tap haptic aptitude; Gibson (1966) and Piaget and Inhelder (1956) can be cited as setting precedents for such an interpretation. If Tests 4 and 5 are found to correlate positively with each other and with a haptic score on the Phrase Completion Test, and in addition they both correlate negatively with Test 3 (which is for visual aptitude), this can be assumed to be the case. Lowenfeld, however, maintained that Test 4
measures visual aptitude whereas Test 5 measures haptic aptitude. If he is correct, the two tests should correlate negatively with one another and Test 4 should correlate positively both with Test 3 and with a visual score on the Phrase Completion Test. On the contrary, Test 5 should correlate negatively with Test 3 and positively with a haptic score on the Phrase Completion Test. In the event that this is the case, the results would suggest that Lowenfeld's analysis is correct and that the two tests are, in fact, measuring different aptitudes.

A further purpose of the present study is validation of the differential psychological attributes of the visual and haptic types as described by Lowenfeld. For this purpose, perceptual aptitude as measured herein will be correlated with a well known measure of psychological orientation, the Rotter (1966) Locus of Control Scale. In accord with Lowenfeld's description of the psychological attitudes of the two types, the following logic has been adopted. Since visual individuals are primarily attuned to their external environment, it is assumed that they are more aware of environmental cues. This perception of and sensitivity to external stimuli would, in turn, lead the visual type to respond to, or to perceive himself as responding to, these cues, resulting in the perception of an external locus of control. Similarly, it is assumed that a haptic individual, who is more sensitive
to organismic cues, would respond, or perceive himself as responding, more often to these internal cues. Haptic types would therefore perceive themselves as internally controlled. In short, it is hypothesized that individuals who are visual will tend to be external on the locus of control dimension, whereas those who are haptic will tend to be internal.

One problem with this hypothesis is that children have been found to be external in their locus of control (Norwicki and Strickland, 1973) whereas Lowenfeld stated that children are haptic. Nonetheless, in other respects the parallel appears sound. Therefore, if a positive correlation between perceptual and psychological type can be established, this will constitute an important piece of evidence supporting not only the validity of Lowenfeld's visual and haptic aptitudes but also that of the author's standardized tests.
METHODS OF STUDY

The tests constructed by the author, based upon those of Lowenfeld, were developed, modified, and standardized in two steps. The preliminary standardization study involved construction of the tests and administration to a college population. After analyzing the data, it was deemed necessary to revise the tests. The revised measures were subsequently administered to a new group of subjects.

Preliminary Standardization Study

Subjects

Subjects for the experiment were 30 volunteers from two undergraduate, upper-division, psychology courses. Approximately half of the subjects were male and half were female. Though subjects were offered neither pay nor credit for their participation, they were assured of anonymity and were promised knowledge and interpretation of their scores. The series of five tests was individually administered by the experimenter and took approximately one hour for each subject.
Apparatus and Measures

In this section, the tests are described in turn with the interpretation which Lowenfeld ascribed to each of them. As has been pointed out elsewhere, what each test actually measures is unknown. Nevertheless, lacking evidence to the contrary, judgment will be temporarily suspended in the interests of clarifying the rationales of the tests, and Lowenfeld's interpretation will be assumed to be correct.

Test 1 is the Phrase Completion Test. It is identical to the Test of Visual vs. Haptical Word Association published by Lowenfeld (1945), but the directions have been modified. (See Appendix A for Test 1.) Scoring is based on Lowenfeld's criteria. A visual response is one which refers to the environment as perceivable by ocular means, whereas a haptical response is one which refers to the bodily self as indicated in actions. An example of the former, in response to the word "walking," is "walking to school"; an example of the latter is "walking fast." If a subject gave at least 12 answers of the 20 possible responses in one direction, he was considered to show visual or haptical aptitude. Scoring was done by the experimenter and intratest reliability was computed.

The second test administered to subjects was the Rotter (1966) Locus of Control Scale. This test is considered to measure the degree to which a subject perceives
himself as controlled by external, as compared to internal, reinforcement.

The remaining tests, 3, 4, and 5, are all based on those of Lowenfeld published in 1945. Directions to the subject and items for each of the three tests can be found in Appendices B through D. Items within each test are arranged roughly in order of increasing difficulty to accustom subjects to the task.

Test 3 is based on Lowenfeld's Test of Integration of Successive Impressions. It measures the ability to integrate partial impressions, which are visually perceived successively, into a whole. Two kymograph drums, manufactured by C. H. Stoelting Co. of Chicago, Ill., are set so that one revolution takes 35 seconds. Each drum, which has a circumference of 19.5", holds two rows of figures drawn on plain paper; each row, in turn, contains three 2" by 2" figures evenly distributed across the surface of the drum. In front of the subject is a screen with a 2" by 1/16" vertical slit, through which he views the moving figures. After viewing each figure, he is presented with a choice of four figures from which he must pick the one which is the same as the moving figure he has just seen. For each correct answer, the subject receives one point. The maximum score is 12, and high scores on this test are considered to indicate visual aptitude.
The fourth test, based upon Lowenfeld's Visualization of Kinesthetic Experience Test, is designed to measure visual aptitude. According to Lowenfeld (1945, p. 107), "visually minded persons have a tendency to transform kinesthetic and tactile into visual experiences. Haptically minded individuals are, however, completely content with the tactile or kinesthetic modality itself." In this test, a subject, whose view is blocked by a screen, encircles the outline of a two dimensional shape with his forefinger. After encircling the shape, a choice of five shapes is presented visually to the subject who must decide which shape he just touched. Since there are ten shapes, 10 is the maximum possible score.

The final test of the series, Test 5, is based upon Lowenfeld's Test of Tactile Objectification. In this test, the subject puts his hand into a bag and by holding, touching, and moving a two dimensional shape inside it, tries simultaneously to recognize it visually from amongst a choice of five shapes. He does this for each of ten shapes, receiving one point for each correct answer. High scores on this test are interpreted as indicating haptic aptitude.
Standardization of the Revised Measures

Subjects

Standardization of the revised measures involved 30 additional volunteers, half of whom were male and half of whom were female, recruited from beginning psychology classes in the same manner as those in the preliminary study.

Apparatus and Measures

As a result of analyzing the data obtained in the preliminary study, several changes in item content were made. The purpose of these changes was to increase intratest reliability. No changes were made in Test 1 because it seemed important to retain Lowenfeld's original version of this test if possible; the comparatively high split half reliability coefficient of .76 supported this approach. Changes in item content, therefore, involved only Tests 3, 4, and 5. Changes were made with the aim of increasing intratest homogeneity of item content, which was judged to be a desirable method of raising reliability. In a chi square analysis, passing or failing of each item was examined for each subject in relation to his score on each test as a whole. Those items which were of no value in discriminating between those who did well or poorly on each test as a whole were discarded. This included those items which were too easy or too difficult to be of utility. In
all, two items from Test 3, four items from Test 4, and one item from Test 5 were considered inappropriate. (See Appendix E for discarded items from the preliminary tests.) New items were designed and substituted for them. Also, the order of several items was changed to reflect item difficulty level.

In addition to the aforementioned changes, a procedural change was made in Test 3. From the item analysis, it became apparent that the test as a whole was too easy; the mean number of correct responses was 8.8 out of 12. An increase in the speed of the kymograph drums' rotation was decided upon with the expectation that this would increase the difficulty level of the items. The drums were set so that one revolution took 15 seconds. This procedure was successful and in readministration the mean number of items correct dropped to 6.9.
RESULTS AND CONCLUSIONS

Split half reliability coefficients were computed for both the preliminary and the revised measures. The coefficients, corrected by the Spearman Brown Prophecy formula, are presented in Table 1. On inspection of the data, several things are apparent. First, in spite of the fact that Test 1 was identical on both administrations, its reliability dropped from .76 to .60. This fluctuation may be said to reflect intergroup variation. On Tests 3 and 5, where only minimal changes were made between administrations, again little change in reliability was anticipated. This expectation was supported by the data. One might have been tempted to conclude that in the case of Test 3 revision of the item content improved reliability, whereas in Test 5 revision proved detrimental. In the light of the instability of data from Test 1, however, this assumption is probably unwarranted. Instead, let it suffice to say that revision of Tests 3 and 5 had little, if any, effect on reliability. On the contrary, revision of Test 4 does seem to have improved its intratest reliability considerably; $r$ increased from .36 to .62. On the whole, while reliability of the revised measures is relatively low, this can be accounted for, in part, by the small number of items comprising each test. At any rate, split half reliabilities were judged
Table 1. Split Half Reliabilities for the Preliminary and Revised Measures -- Data have been computed using product moment correlation coefficients corrected by the Spearman Brown Prophecy formula.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Preliminary Version</th>
<th>Revised Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phrase Compl.</td>
<td>.76</td>
<td>.60</td>
</tr>
<tr>
<td>Test 3</td>
<td>.45</td>
<td>.50</td>
</tr>
<tr>
<td>Test 4</td>
<td>.36</td>
<td>.62</td>
</tr>
<tr>
<td>Test 5</td>
<td>.72</td>
<td>.62</td>
</tr>
</tbody>
</table>

\( ^a \)For the Phrase Completion test, \( N = 24 \). For the other measures, \( N = 29 \).

\( ^b \)For all measures, \( N = 30 \).

sufficiently high to warrant further statistical analysis of the measures.

Scores on each test were intercorrelated with scores on each other test, for both the preliminary and the revised measures, to determine whether any correspondence between two scores differed significantly from chance. For Tests 2, 3, 4, and 5, this intercorrelation was accomplished by computing a product moment correlation coefficient for each pair of measures. Correlation coefficients can be found in Table 2. Table 3 represents comparisons of each measure with Test 1 by means of a chi square analysis. None of the chi square values reached statistical significance. From the data, the only pattern that appears is a slight
Table 2. Product Moment Correlation Coefficients for Scores on Each Pair of Measures in the Preliminary and Revised Versions

<table>
<thead>
<tr>
<th>Measure</th>
<th>Preliminary Version</th>
<th>Revised Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3,4)</td>
<td>.17</td>
<td>.16</td>
</tr>
<tr>
<td>(3,5)</td>
<td>.14</td>
<td>-.02</td>
</tr>
<tr>
<td>(4,5)</td>
<td>.43</td>
<td>.39</td>
</tr>
<tr>
<td>(I-E,3)</td>
<td>.15</td>
<td>-.33</td>
</tr>
<tr>
<td>(I-E,4)</td>
<td>-.10</td>
<td>-.17</td>
</tr>
<tr>
<td>(I-E,5)</td>
<td>-.11</td>
<td>-.15</td>
</tr>
</tbody>
</table>

Note: N = 30.

Table 3. Contingency of a Subject's Score on the Phrase Completion (P.C.) Test with His Score on Each of the Other Tests Using the Chi Square Statistic Corrected for Continuity -- N = 30.

<table>
<thead>
<tr>
<th>Measure</th>
<th>df</th>
<th>Preliminary Version $\chi^2$</th>
<th>Signif.</th>
<th>Revised Version $\chi^2$</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.C.,I-E</td>
<td>1</td>
<td>.0508</td>
<td>NS</td>
<td>.6535</td>
<td>NS</td>
</tr>
<tr>
<td>P.C.,Test 3</td>
<td>1</td>
<td>.7236</td>
<td>NS</td>
<td>.1704</td>
<td>NS</td>
</tr>
<tr>
<td>P.C.,Test 4</td>
<td>1</td>
<td>1.2500</td>
<td>NS</td>
<td>.0639</td>
<td>NS</td>
</tr>
<tr>
<td>P.C.,Test 5</td>
<td>1</td>
<td>.4520</td>
<td>NS</td>
<td>.1704</td>
<td>NS</td>
</tr>
</tbody>
</table>
correlation of .20 or less, either positive or negative, between most pairs of tests. The correlation between Tests 4 and 5, of approximately +.4, is an exception. It is statistically significant at the .01 level. This indicates that Tests 4 and 5 are more similar to each other than they are to any of the other measures.

Because low correlations between tests might have been attributable to the small variance within each test, it was decided to categorize each person as a visual, haptic, or mixed type utilizing their scores for the entire measure. First, each person was assigned a category for each individual test. For Test 1, categories were based on original scoring of visual, haptic, or mixed. For Tests 3, 4, and 5, each distribution of scores was divided into three categories. Although theoretically one might have expected a preponderance of visual types or at least an unequal distribution of visual and haptic types within the population, the experimenter had no justification for imposing this assumption on the data. The only alternative available was to arbitrarily assume an equal number of visual and haptic individuals. Therefore, scores within one unit in either direction from the mean were considered to be mixed; scores above or below this were considered to be visual or haptic. Tests were interpreted as Lowenfeld originally hypothesized, with the exception that interpretation of Test 4 took into account the fact that this test could be measuring either
visual or haptical aptitude. In the case of Test 4, therefore, it was first assumed that the test was measuring visual aptitude as Lowenfeld originally hypothesized; then, each person was reclassified utilizing the opposite assumption. In sum, then, each person received a classification of visual, haptic, or mixed on each test. If the difference between the number of visual and haptic designations equalled two or more, a subject was considered to be visual or haptic overall. The remaining subjects were called mixed. The visual, haptic, and mixed groups were then compared with respect to their Locus of Control scores. Means for each group, and the number of subjects in each group, are shown in Table 4. All means are similar, with the exception of the haptic subjects' mean scores. However, these data are discounted due to an N of 3 or less. It must be concluded, therefore, that the visual/haptic dimension, as measured by this study, is not significantly related to Locus of Control.
Table 4. Mean Locus of Control Scale Scores for Groups of Subjects with Visual, Mixed, and Haptic Aptitudes

In the upper section, Test 4 is assumed to be measuring visual aptitude, while in the lower section, Test 4 is assumed to be measuring haptic aptitude.

<table>
<thead>
<tr>
<th>Group</th>
<th>Preliminary Version</th>
<th>Revised Version</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I-E Score</td>
<td>N</td>
</tr>
<tr>
<td>Visual</td>
<td>11.6</td>
<td>9</td>
</tr>
<tr>
<td>Mixed</td>
<td>11.7</td>
<td>18</td>
</tr>
<tr>
<td>Haptic</td>
<td>6.0</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>11.1</td>
<td>30</td>
</tr>
<tr>
<td>Visual</td>
<td>12.0</td>
<td>9</td>
</tr>
<tr>
<td>Mixed</td>
<td>11.2</td>
<td>18</td>
</tr>
<tr>
<td>Haptic</td>
<td>8.0</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>11.1</td>
<td>30</td>
</tr>
</tbody>
</table>
DISCUSSION

The present study failed to find any evidence to support the visual/haptic distinction as presented by Viktor Lowenfeld. In spite of the fact that intratest reliabilities were adequate, no meaningful intertest correlations emerged. Theoretically, tests of visual aptitude should have correlated positively with other tests of visual aptitude and negatively with tests of haptic aptitude. Since this did not occur, it is impossible to say that the tests are measuring two different aptitudes. In fact, it appears from the data that each test is functioning relatively independently. This means that each test is measuring something different than any other. Apparently, the visual/haptic construct is inadequate for summarizing the phenomenon at hand. Whether the visual/haptic construct, itself, is at fault or whether the flaw resides in the tests which are proposed to measure it can not be determined. We can only conclude that the visual/haptic distinction, as described by Lowenfeld and reflected in his Tests for Visual and Haptic Aptitudes, is not substantiated herein.

Because Lowenfeld's distinction between visual and haptic aptitudes is not meaningfully reflected in the measures constructed, it is in line with expectation that classification of subjects according to this dimension as
measured by the tests is not meaningfully related to perceived locus of control. Even had the tests themselves been meaningful, their correlation with the locus of control dimension would still rest on the validity of our assumption that visual and haptic types are evenly distributed in the population. This assumption, too, may have been unwarranted.

One positive finding which emerged from the present study stems from the approximately +.4 correlation between Tests 4 and 5. Though this is not a high correlation, it is higher than the correlation between any two other tests. This finding is important because Lowenfeld considered the aptitudes measured by Tests 4 and 5 to be of an opposite nature (with Test 4 measuring visual aptitude and Test 5 measuring haptic aptitude), whereas Piaget claimed both of these abilities are haptic aptitude. In light of the data, one can conclude that ability to perform on one test is positively related to aptitude on the other. This would tend to support Piaget's, rather than Lowenfeld's, contention.
APPENDIX A

TEST 1

Phrase Completion

Assume each word below is a word in a sentence. After each word write down the first word or phrase which comes to mind which might follow that word in a sentence.

1. greeting ____________
2. walking ______________
3. looking ______________
4. climbing _____________
5. talking _______________
6. lifting ________________
7. thinking ______________
8. drawing _______________
9. catching ______________
10. hearing ______________
11. pulling ______________
12. swimming ____________
13. riding ________________
14. running ______________
15. jumping ______________
16. listening _____________
17. reaching ______________
18. touching ______________
19. stretching ____________
20. breathing ______________
APPENDIX B

TEST 3

Directions to Subject for Test 3

You are going to be viewing some shapes through this opening. Please adjust your position so that you can see comfortably. If, for any reason, you are having difficulty seeing the shapes, please speak up, because the machine can be adjusted. Feel free to close one eye if you want to. As I've said, you will see shapes through the opening. They will be moving, and you will only see a little bit at a time. After each shape, I will ask you to recognize the shape you saw from among a choice of several shapes. Watch closely. Here's the first one.
Items for Test 3 (Revised Version)
APPENDIX C

TEST 4

Directions to Subject for Test 4

On this test, you will put your arm through this opening in the screen. Using your forefinger, you are going to trace around the outline of a shape. After this you will try to recognize the shape you touched from among several shapes that I show you. There will be ten shapes in all.

I will start your finger by placing it on a little button that signifies the beginning. You are to trace clockwise around the shape until you get back to the button. Then stop. The only rule is that you can't go back over any area. Just keep going around.

Afterwards, when I give you the choices, keep in mind that they will be identical in size and shape to the original, but they may have a different orientation. In other words, you can't rely on the direction the shape is facing to recognize it.

Are you ready? O.K. Here's the button. Start off in this direction.
Items for Test 4 (Revised Version)
APPENDIX D

TEST 5

Directions to Subject for Test 5

Now I am going to put some shapes in this bag. I will put in one shape at a time and there will be ten altogether. You are to put your hand in the bag and feel the shape. At the same time, you can look at this page of shapes and try to decide which shape is the same as the one in the bag. The two shapes are identical in size, and you can turn the shape in the bag as you wish. Please use only one hand to feel the shape, and be sure not to put the bag down against anything. Try to hold it up in the air. Here is the first shape.
Items for Test 5 (Revised Version)
APPENDIX E

ITEMS FROM THE PRELIMINARY TESTS OMITTED FROM THE REVISED VERSIONS OF TESTS 3, 4, AND 5
REFERENCES


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