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ABSTRACT

A study was designed to test the expectation that different individuals have different cognitive styles, which, if true, may be useful in investigating characteristics and psychological impacts of media utilization. Cognitive style refers to an individual's way of acquiring and processing information. Characteristics of the visual type and haptic type are identified based on an earlier study by Viktor Lowenfeld. The hypotheses were that the visual type could be expected to discriminate visual detail and to react impersonally, thus testing out as field-independent and reflective; and the haptic type could be expected to be unable to discriminate visual detail and to react emotionally, thus testing out as field-dependent and impulsive. Three tests (which are not included) were used to classify subjects as reflective, impulsive, or indefinite; field-independent, field-dependent, or indefinite; and visual, haptic, or indefinite. The results of the study imply that: (1) Visuals tended to be field-independent on a test of perceptual style, while haptics tended to be field-dependent; (2) Visuals tended to be reflective on a visual test of perceptual tempo, while haptics tended to be impulsive; and (3) Haptics made more errors on the tempo test than did visuals. It is suggested that further research be conducted to see if these trends appear in other samples. (KKC)

The Relationship of Perceptual Type to Perceptual Style and Tempo in College Students

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It is the contention of many researchers in the field of instructional media that media research should be related to contemporary psychological inquiry into cognition. It is the belief of these researchers that media is concerned primarily with stimulus presentation and that media research should therefore be concerned with the impact of various manipulations of stimulus presentation on the psychological variables of cognition that govern learning. What is needed in media research is to discover the existing interactions among media manipulations and individual differences in cognitive variables and to build them into a media design model and develop theories of media use.

One intriguing group of individual differences in cognition are collectively referred to as "cognitive styles." It seems likely that, since they are closely related to methods of perception, various dimensions of cognitive style may be particularly useful in investigating characteristics and psychological impacts of media utilization.

The concept of cognitive style refers to psychological dimensions which represent consistencies in an individual's manner of cognition; that is, to ways of acquiring and processing information. An individual's cognitive style is his typical manner of perceiving, remembering, thinking, and solving problems.

One dimension of cognitive style which, because of its very close ties to style of visual perception, appears to be of particular interest to media researchers is the dimension of field-dependence/field-independence. Field-dependence/field-independence may be referred to as perceptual style. Field-independence implies an analytical, as opposed to a global, way of perceiving stimuli. It involves a tendency to perceive items as discrete from their backgrounds and an ability to overcome an embedding context. Field-dependence, on the other hand, implies a global perceptual style which is heavily influenced by field factors and the complexity of the background.

The task most frequently used to determine the perceptual field-independence or field-dependence of an individual has been one which requires the subject to find a simple figure that is embedded within a more complex pattern. Those who are able to do this are identified as field-independent; those who are not are identified as field-dependent. It should be noted that these tests, such as the Hidden Figures Test (French, Ekstrom, and Price, 1963), are highly visual in nature and require fine discrimination and separation of visual stimuli.

A second area of cognitive style which may well be of particular interest to media researchers who are investigating the psychological impact of various manipulations of stimulus presentation is the area known as reflectivity/impulsivity. This aspect of cognitive style is commonly referred to as perceptual tempo. Perceptual tempo is basically concerned with the speed with which hypotheses are selected and information is processed. Impulsive individuals tend to offer the first answer to a problem that occurs to them, even though it is frequently wrong, while reflective individuals tend to consider all the various possibilities before deciding.

The task most commonly used to assess perceptual tempo is one such as the Matching Familiar Figures Test (Kagan, 1969), in which the subject is required to look at a drawing and then pick out an exact duplication of it from among numerous variant alternatives. It should be noted that the task for assessing perceptual tempo, like the one for assessing perceptual style, is highly visual in nature and requires the ability to perceive and differentiate visual detail.

There is another individual-difference variable which may have important relationships to perceptual style and tempo which has not been thoroughly investigated. This variable may be referred to broadly as perceptual type. In his work, Viktor Lowenfeld (1945 and 1957) identified individuals of two distinct perceptual types, which he called the visual type and the haptic type. He developed a battery of tests through which perceptual type may be identified for individuals (Lowenfeld, 1945).

An individual of the visual perceptual type has a tendency to use his eyes as the main intermediary for his sensory impressions. He is perceptually an observer, usually approaching things from their appearance and feeling as a spectator. His tendency is to transform kinesthetic and tactile experiences into visual ones.

A haptic individual is a normally-sighted person who uses his eyes as his primary sensory intermediary only when he is compelled to do so. He prefers to rely on touch and kinesthesis. The main intermediary for the haptic type is his "body-self" - muscular sensations, kinesthetic experiences, touch impressions, and other physical sensations. The haptic is a subjective type who does not transform kinesthetic and tactile experiences into visual ones.

The tests developed by Lowenfeld (1945) for identifying individuals of the two perceptual types are based on several important distinctions between them:

1. While the visual has the ability to see a whole, break it up and see its component details, and then resynthesize the details back into a whole, the haptic is unable to do this.

2. While the visual tends to react to stimuli as a spectator and to "see" experiences, the haptic tends to react emotionally, to "feel" stimuli, and to put himself into a situation.

3. While the visual has the tendency and ability to visualize tactile experiences and to visually complete partial experiences, the haptic has neither this tendency nor ability.

Studies have revealed that the distribution of visual and haptic perceptual types is stable across populations. In his extensive study, Lowenfeld (1945) found that while most people fall between the extremes of the two types, few individuals have equal tendencies toward visual and haptic perception. He found consistently that about 75% of the subjects he tested showed appreciable tendency toward one type or the other, with about 50% showing visual tendency and about 25% showing haptic tendency. He thus established the following theoretical distribution of perceptual types for any given population: visual, 50%; indefinite, 25%; and haptic, 25%. Lowenfeld (1945) reported that this theoretical distribution coincides completely with the distribution of "visualizers," "mixed types," and "non-visualizers" found by W. G. Walter in a completely independent study based on brain alpha rhythms.

The existence of these two distinct perceptual types bears directly on the theoretical model of cognitive processes proposed by Fletcher (1969). Fletcher's cognitive model consists of the following steps:

1. attentional processes: processes which serve to detect the cues relevant to the particular problem

2. transformation processes: processes which serve to encode appropriate information

3. generation processes: processes which serve to generate solutions to the problem

4. evaluation processes: processes which serve to determine if solution has been achieved.

Since an individual can respond only to encoded information and not to actual stimuli, the transgeneration step in the cognitive process is fundamental and vital. The generation of solutions is based upon how input stimuli are transgenerated by the learner. Fletcher (1969) identified two principal types or styles of transgeneration: the analytic style, in which stimuli are broken down into individually meaningful elements; and the synthetic style, in which stimuli are grouped globally into wholes. The manner in which solutions to problems are generated are necessarily dependent upon which type of transgeneration is used by an individual. It therefore follows that a task which requires a specific type of transgeneration for its solution cannot be satisfactorily performed by a learner who is incapable of the necessary type of transgeneration.

It should be recalled that the nature of the tasks used in identifying field-dependence-independence and reflective-impulsive tempos require the discrimination and separation of visual stimuli. This means that, in Fletcher's terminology, analytic transgeneration of visual stimuli is required of the subject for correct generation of the solution to these tasks. It should also be recalled that this method of handling visual stimuli is usually readily available to persons of the visual perceptual type, but are not usually readily available to persons of the haptic type. This suggests that performance on these tasks could be expected to be influenced by an individual's perceptual type. The visual type could be expected to discriminate visual detail and to react impersonally, thus testing out as field-independent and reflective. Lowenfeld's theoretical distribution should therefore be present among field-independent and reflective populations. The haptic type could be expected to be unable to discriminate visual detail and to react emotionally, thus testing out as field-dependent and impulsive. The theoretical distribution should therefore not be present among field-dependent and impulsive populations. These expectations are consistent with the theory behind Fletcher's model of cognitive processes. This study was designed to test these expectations. The hypotheses under consideration in the study (based on Lowenfeld's theoretical distribution) are as follows:

H_1: The obtained frequency of visual types among field-dependent subjects is smaller than the expected frequency.

H_2: There is no difference between the obtained and expected frequencies of visual and haptic types among field-independent subjects.

H_3: There is no difference between the obtained and expected frequencies of visual and haptic types among reflective subjects.

H_4: The obtained frequency of visual types among impulsive subjects is smaller than the expected frequency.

H_5: The number of errors made by visual subjects is smaller than the number of errors made by haptic subjects on a visual test of cognitive tempo.

Method

Subjects. The subjects for the study were a group of 32 undergraduate students enrolled in Education 4160, Media and Technology in Teaching.

Procedure. The subjects were administered three separate tests: Matching Familiar Figures (MFF), Hidden Figures Test (HFT), and Successive Perception Test I (SPT1). These three tests were all administered to the subjects (Ss) by the same examiner, and each test had a set of standard written instructions.

The MFF (Kagan, 1969) is a visual discrimination task which is frequently used to determine the reflectivity or impulsivity of cognitive tempo. In the task, pictures of familiar objects are presented along with eight similar variants. S must select the one variant which is identical to the standard. The test consists of 12 separate items For each S, a record is kept of response latency to first answer given and number of errors on each item. A mean response latency and an error total is then computed for each S.

HFT (French et al., 1963) is also a task involving visual discrimination. It is used to determine the field-independence or field-dependence of S. S is presented with a group of five simple geometric figures and a series of complex figures. For each complex figure, S is to find the simple figure which is concealed within it. The score made on the test is determined by totalling the number of correct responses and subtracting from that total a fraction of the number incorrect. Items for which no response is made are not counted as either correct or incorrect.

The third test given to the Ss was SPT1 (U. S. Air Force, 1944). This is a test of visual ability which is used to determine the presence of visual or haptic perception. It is a motion picture form of the test developed by Lowenfeld (1945) and was refined for military use. It consists of 35 items in which S is shown a pattern a small section at a time behind a moving slot. He is then shown five similar variants and must choose from among them the pattern which he saw behind the slot. Both the percentage of items correct and the percentage incorrect are recorded for each S.

After the Ss were administered all three tests, they were classified as reflective, impulsive, or indefinite; field-independent, field-dependent, or indefinite; and visual, haptic, or indefinite. Those Ss were identified as reflective who scored above median mean latency and below median errors on MFF. Ss were identified as impulsive if they scored below median mean latency and above median errors on MFF. Ss scoring in the upper one-third of the group on HFT were identified as field-independent; those scoring in the bottom one-third of the group were identified as field-dependent. Ss scoring 60% or more items correct on SPTI were identified as visual; those scoring 60% or more items incorrect were identified as haptic. Table 1 summarizes the classification procedures and number of subjects placed in each classification.

Table 1

Groups Identified by Testing Instruments

		n	Total N
PERCEPTUAL STYLE (Measured by HFT)	Field-Independent (upper 1/3 of group)	12	32
	Field-Dependent (lower 1/3 of group)	10	
	Indefinite (middle 1/3 of group)	10	
PERCEPTUAL TEMPO (Measured by MFF)	Reflective (above median mean latency and below median errors)	16	32
	Impulsive (below median mean latency and above median errors)	14	
	Indefinite (below median mean latency and below median errors)	2	
PERCEPTUAL TYPE (Measured by SPTI)	Visual (60% or more correct)	14	32
	Haptic (60% or more incorrect)	10	
	Indefinite (less than 60% in either direction)	8	

Data Analysis. All analyses were based on Lowenfeld's theoretical distribution of visuals (50%), haptics (25%), and indefinites (25%) in any given population. The obtained distribution of perceptual types was first tested against this theoretical distribution to see if it was significantly different. The test used was a chi square test for goodness of fit.

Next, the obtained distributions of visuals, haptics, and indefinites in the subpopulations of field-dependents, field-independents, reflectives, and impulsives were tested against the theoretical distributions in order to test the hypotheses of the study. For these tests, the Kolmogorov-Smirnov one-sample test for goodness of fit was used instead of chi square because the number of very small expected frequencies made the che square test inappropriate. For the tests which were one-tailed, Smirnov's modification in tabled critical values of D was used.

Finally, the number of errors made by visuals and haptics on MFF were compared. This was done with a Mann-Whitney U test. This test was chosen instead of a parametric t-test because the two groups had unequal N's and it was impossible to meet the assumption of homogeneity of variance. The combination of these two factors made the use of a t-test inappropriate.

Results and Discussion

It was decided that analysis of the data obtained on the 32 Ss tested would be profitable only if the obtained distribution of perceptual types did not differ significantly from the theoretical distribution upon which analyses would be based. The results of the chi square test for goodness of fit reported in Table 2 indicated that the obtained distribution was not significantly different from the theoretical one ($X^2=.7500$, $.50<p<.70$), and data analysis was therefore continued.

TABLE 2
Chi Square Test for Goodness of Fit of Distribution of Perceptual Types

		VISUAL	HAPTIC	INDEFINITE
N = 32	Expected frequency	16 (50%)	8 (25%)	8 (25%)
df = 2	Observed frequency	14	10	8

$\chi^2 = .7500$
$.50 < p < .70$

Kolmogorov-Smirnov goodness of fit tests supported H_1 (D=.4000; $p < .05$), H_2 (D=.1667; $p > .10$), and H_3 (D=.0625; $p > .25$). H_4 was somewhat supported (D=.2857; $.05 < p < .10$). The Mann-Whitney U test supported H_5 (U=38; $p < .05$). The results of these tests are shown in Tables 3, 4, 5, 6, and 7.

TABLE 3
Kolmogorov - Smirnov Test for Goodness of Fit of Distribution of Perceptual Types among Field-Dependents

	VISUAL	HAPTIC	INDEF.	N	Classifications Visual	Haptic	Indef
Expected f Observed f	5 (50%) 1	2.5 (25%) 6	2.5 (25%) 3	10			
f = number of S_s with classification					1	6	3
F_0 (X) = theoretical cumulative distribution of classifications under H_0					5/10	7.5/10	10/10
F_{10} (X) = cumulative distribution of observed classifications					1/10	7/10	10/10
$\lvert F_0 (X) - F_{10} (X)\rvert$					4/10	.5/10	0

D = .4000*
$p < .05$

*D = maximum value of $\lvert F_0 (X) - F_n (X)\rvert$

TABLE 4
Kolmogorov-Smirnov Test for Goodness of Fit
of Distribution of Perceptual Types
among Field-Independents

	VISUAL	HAPTIC	INDEF.	N	Classifications		
					Visual	Haptic	Indef.
Expected f Observed f	6 (50%) 7	3 (25%) 0	3 (25%) 5	12			
f					7	0	5
$F_0 (X)$					6/12	9/12	12/12
$F_{12} (X)$					7/12	7/12	12/12
$\lvert F_0 (X) - F_{12} (X) \rvert$					1/12	2/12	0

$D = .1667$
$p > .10$

TABLE 5
Kolmogorov-Smirnov Test for Goodness of Fit
of Distribution of Perceptual Types
among Reflectives

	VISUAL	HAPTIC	INDEF.	N	Classifications		
					Visual	Haptic	Indef.
Expected f Observed f	8 (50%) 9	4 (25%) 3	4 (25%) 4	16			
f					9	3	4
$F_0 (X)$					8/16	12/16	16/16
$F_{16} (X)$					9/16	12/16	16/16
$\lvert F_0 (X) - F_{16} (X) \rvert$					1/16	0	0

$D = .0625$
$p > .25$

TABLE 6
Kolmogorov-Smirnov Test for Goodness of Fit of Distribution of Perceptual Types among Impulsives

	VISUAL	HAPTIC	INDEF.	N	Classifications Visual	Haptic	Indef.
Expected f Observed f	7 (50%0 3	3.5 (25%) 7	3.5 (25%) 4	14			
f					3	7	4
F_0 (X)					7/14	10.5/14	14/14
F_{14} (X)					3/14	10/14	14/14
$\|F_0 (X) - F_{14} (X)\|$					4/14	.5/14	0

$D = .2857$
$.05 < p < .10$

Support of H_1 beyond the .05 level indicates that, as expected, considerably fewer than the theoretical 50% of field-dependents have a visual perceptual style, and considerably more than the theoretical 25% have a haptic perceptual style. This reversal of the theoretical distribution was hypothesized since the test for field-independence-dependence is a visual discrimination task which requires S to see detail and since visual Ss usually possess this ability while haptic Ss do not. It is important to note that only one visual S was also identified as field-dependent and that a full 60% of the field-dependents are haptic.

TABLE 7
Mann-Whitney U Test of Errors Made by Visuals and Haptics on MFF

VISUAL ERRORS	RANK	HAPTIC ERRORS	RANK
0	4	0	4
0	4	0	4
0	4	3	13
0	4	6	16.5
0	4	6	16.5
1	9.5	6	16.5
1	9.5	7	19.5
1	9.5	8	21
1	9.5	10	22
3	13	12	24
3	13	$N_1=10$	$R_1=157$
6	16.5		
7	19.5		
11	23		
$N_2=14$	$R_2=143$		

$U = 38$

$p < .05$

Support of H_2 suggests that, as hypothesized, many more visual than haptics are field-independent. While the obtained number of visuals was not much larger than could be theoretically expected, the obtained number of haptics was much smaller. In fact, not a single haptic was identified as field-independent. Of the 12 field-independent Ss identified, all of them were visual or indefinite in perceptual type, indicating the presence of at least some degree of visual aptitude beyond the haptic level. Over one-half were strongly visual.

The researcher hypothesized in H_3 that the theoretical distribution would hold among reflectives, that, is, that twice as many visuals as haptics would be reflective. This was hypothesized since the test for perceptual tempo is a task which requires fine discrimination of visual detail. This hypothesis was accepted. It is also important to note that the only difference in the obtained and expected frequencies of visuals and haptics was a shift from a 2:1 ratio to a 3:1 ratio.

H_4 indicates that the researcher expected to find a smaller number of visuals among impulsives than could be predicted from the theoretical distribution. The hypothesis was somewhat supported. It should be noted that while the .05 level of significance was not quite attained, the obtained distribution of visuals and haptics was the reverse of that theoretically expected. A larger sample of impulsive subjects, less subject to deviant scores, might well result in the reaching of the .05 level of significance. Even in this small sample; the trend is clear. It is important that seven out of the ten haptics in the sample (70%) were identified as impulsive (compared to only three of 14, or 21.4% of the visuals) and that the three (30%) who were identified as reflective had mean response latencies of 101.42, 119.42, and 199.42 seconds. These latencies are markedly above the over-all group mean of 69.84 seconds and suggest that the haptics found the perceptual tempo task a difficult one even if they were not impulsive. The support of H_5 also suggests that haptics make more errors on the task than do visuals, further indication that they find the task more difficult. The tendency of haptics to be impulsive could, perhaps, be due to two factors:

1. their lack of visual discrimination ability, and
2. the emotional reaction which is characteristic of haptics.

In summary, the results of this study imply that:

1. Visuals tended to be field-independent on a visual test of perceptual style, while haptics tended to be field-dependent.

2. Visuals tended to be reflective on a visual test of perceptual tempo, while haptics tended to be impulsive.

3. Haptics made more errors on the tempo task than did visuals.

It is suggested that further research be conducted to see if these trends appear in other samples. This research might take the form of further descriptive analysis in various populations or of experimental studies in which the effects of perceptual training is evaluated. If consistent relationships are shown to exist between perceptual type and performance on certain kinds of visual tests and stimuli presentations, the implications are important for the fields of visual testing and teaching with visual media. These implications include a reconsideration of the nature of the commonly-used cognitive style tests and a necessity for the selection of classroom learning tasks and presentation modes to match percpetual style preferences or to supplant perceptual weaknesses, perhaps through the use of specially designed media presentation of stimuli. As many as one-fourth of students may be inherently unable to perform certain types of tasks presented via visual stimuli.

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