THE MULLER LYER ILLUSION IN NORMAL AND PSYCHOTIC CHILDREN
AND

THE CORRELATIONS BETWEEN THE MULLER LYER RANGE VALUES, AND THE SCORES FROM THE BENDER GESTALT AND TRAIL MAKING TESTS IN THE SAME SUBJESTS (Part II)

NORMAL VE PSİKOTİK ÇOCUKLARDA MULLER LYER İLLUZYONU
VE
AYNI DENEK GRUBUNUN MULLER LYER YAYILIM GENİŞLİĞİ PUANLARI İLE, «TRAIL MAKING» VE BENDER GESTALT TEST PUANLARI ARASINDAKİ KORELÂTİF İLİŞKİLER (2. Kısım)

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The Muller Lyer Illusion Test (MLI) was administered to the 30 normal and 30 psychotic children between the ages of 8-12. The aim was to measure the strength of the MLI and see differences between two groups. And also to compare the results with the performances of them in the Bender Gestalt and Trail Making Tests.

As a result the differences in the strength of the illusion between the normal and the psychotic children, were found, but not in the significant level. On the other hand, it was seen highly significant differences between two groups across the 20 trials. Such variability was highly related to Distortion Errors on the Bender Gestalt Test and in the average level in the Time Score on the Trail Making Test. Additionaly, there were highly significant differences, between those trials of MULI where the Comparison was initially set longer than the

Standard and the trials where the Comparison was initally set shor-
ter, the former condition yielding far larger errors than the latter.
This finding was a bit stronger in the psychotic children than the
normal.

Muller Lyer İllusyon Testi (MLI), 8-12 yaşlarında 30 normal
ve 30 psikotik çocuğa uygulanmıştır. Gaye iki grup arasındaki fark-
lılıkları görmek, illüzyonun derecesini ölçmek ve ayrıca, MLI testi
bulgularını aynı denek grubunun «Trail Making» ve Bender Gestalt
testi Performansı ile karşılaştırmak idi.

Sonuç olara, normal ve psikotik grup MLI testinde farklılık
gösterdiler. Fakat bu fark istatistiksel anlamlılık düzeyine ulaşacak
ölçüde değildi. Diğer taraftan iki grup arasındaki, 20 deneme bo-
yunca, MLI testi yayılım genişliği yönünden yüksek anlamlılık
gösteren farklılık, ilginçtir. Bu farklılık, Bender Gestalt Testi Şe-
kilde Bozulma hatası ve Trail Making Testi, Zaman Puanı ile yüksek
bir korelatif ilişki göstermiştir. Diğer önemli bir bulgu da MLI testi,
mukayese kısmı deneğe kısa olarak verildiğine nazaran uzun olarak
verildiği denemelerde, her iki denek grubunda da fazla hatanın varlı-
ğı idi. Bu hata normal gruba göre, psikotik grupta biraz daha fazla
idi.

Research on geometrical illusions has a long history, dating
back well into the 19th century; for a review of these early studies,
as well as of more recent work, see Robinson (1972). Since Judd's
(1899, 1902, 1905) classic investigations, much of this research has
been centered on the Muller-Lyer Illusion (MLI). Interestingly, while
the MLI has played a prominent role in the development of percep-
tual theories (Robinson, 1972), it has only rarely been used as a
measure of individual differences, in spite of repeated observations
of large differences in the initial strength of the illusion and of large
differential effects of prolonged practice (e.g., Eysenck and Slater,
1958; Gardner, 1961).

Moreover, there have been relatively few studies comparing
clinical samples. Weckowicz and Witney (1960) found significant
differences between schizophrenic patients and normals, the schi-
zophrenics showing more illusion than the normals. Arık (1971)

divided university students into four samples according to their scores on the MMPI : These were *(a)* many high scores, *(b)* one high score, *(c)* «normals», and *(d)* low scores. Samples *(a)* and *(b)* showed significantly less illusion than the «normals.» Ormanlı (1972) compared a psychosomatic sample with normals : The amount of error was almost 30 % in the psychosomatic sample, only 10 % in normals. Aşkın (1972) obtained more accurate responses from extroverted subjects than from introverts: Illusion errors averaged over 20 % for the introverts, and less than 10 % for the extroverts.

In the present study, the MLI was included in a battery along with two more popular measures of clinical differences-the Bender-Gestalt Test (BGT) and the Trail Making Test (TMT) to compare the performance of psychotic and normal children. Results based on the BGT and the TMT have already been published (Ormanlı, 1975), and therefore the present report will focus primarily on the MLI.

METHOD

Subjects

The subjects for this study were 60 children, aged from 8 to 12 years, 30 normal subjects and 30 psychotics. The normal sample consisted of 15 boys and 15 girls, 3 boys and 3 girls at each of five age levels: 8, 9, 10, 11, and 12. Normal subjects were volunteers from the Jefferson Road School in Rochester, New York. The teachers selected the children for testing by excluding students with either very high or very low intelligence test scores. The psychotic sample was composed of 22 boys and 8 girls, approximately equally divided between two hospitals, the Rochester State Hospital and the Convalescent Hospital for Children, both in Rochester, New York. Almost all subjects were white; there were two black children in the normal sample and three in the psychotic sample. No patients were included in the psychotic sample if they were acutely ill, disoriented, confused, or uncooperative at the time of testing. The diagnosis for each of these patients was based on the information in their hospital records, including a detailed medical history, a psychiatric examination, a psychological evaluation, and any neurological reports. The Ame-

rican Psychiatric Association's *Diagnostic and Statistical Manual* was generally used as a diagnostic guide. Additional characteristics of two samples are presented in Table 1.

TABLO 1

CHARACTERISTICS OF THE TWO SAMPLES

| | Psychotics (N = 30) | | Normals (N = 30) | |
	Males (N = 22)	Females (N = 8)	Males (N = 15)	Females (N = 15)
Age in years				
8	(5)	(1)	(3)	(3)
9	(4)	(2)	(3)	(3)
10	(5)	(1)	(3)	(3)
11	(4)	(2)	(3)	(3)
12	(4)	(2)	(3)	(3)
Age in months				
Mean	127	129	123	122
S.D.	19	19	16	15
IQ				
Mean	92	89		
Range	68 - 124	69 - 110		

Stimulus Materials

The MLI apparatus (see Figure 1) consisted of two sections, each made of white cardboard 21.3 cm. in length. On one of these sections, the Standard, there was a 10 cm. chaft, at the ends of which were outpointing fins 2 cm. in length, each set at a 45° angle to the shaft. On the other section, the Comparison, there was a shaft that was adjustable in length (up to a maximum of 20 cm.), with

inpointing fins at one end. All lines were drawn in black ink, 1 mm. wide. The Comparison section could easily slide into the Standard section by pulling it out or pushing it in. A ruler was affixed to the reverse side of the Comparison section, allowing readings to be taken in millimeters. During testing, a neutral gray piece of cardboard (27 X 40 cm.) was placed under the MLI apparatus.
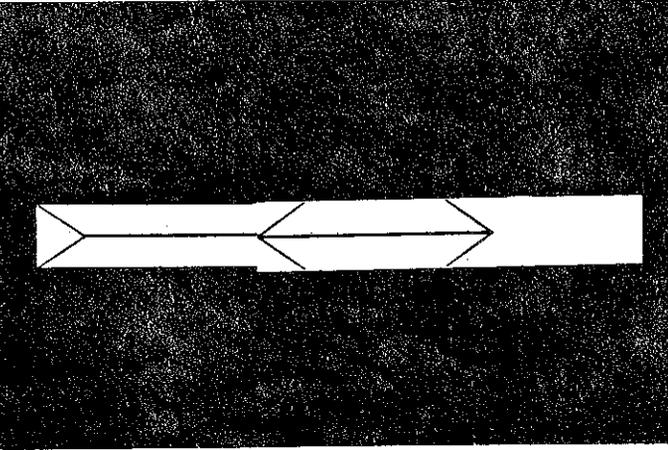
ŞEKİL 1 : The Muller Lyer Illusion

Procedure

All patients were tested either before or at the very beginning of any treatment. The children were seen individually, in sessions lasting five to ten minutes. The child was seated to the left side of the experimenter at a table. Before the MLI was administered, an easy task was given in order to make the child feel confident and relaxed. Then each subject was given 20 trials on the MLI, ten trials in which the Comparison stimulus was initially set longer than the standard, and ten trials in which it was initially set shorter. On five of each of these ten trials, the standard was to the subjects' right, and on the other five to their left. Subjects were instructed to make the Comparison shaft equal in length to the Standard shaft, by adjusting the Comparison section. Thus, there were four test conditions :

(A)   Standard on the right, and Comparison longer (five trials).
(B)   Standard on the right, and Comparison shorter (five trials).
(C)   Standard on the left, and Comparison longer (five trials).
(D)   Standard on the left, and Comparison shorter (five trials).

The four test conditions were administered in the following order :

D A B C B C B A D C B A D C B A D A D C

RESULTS

Since the Standard was 100 mm. in length, the illusion should
tend to produce Comparison settings *less* than 100 mm. Indeed,
100 % of the 600 observations (30 subjects X 20 trials) from the
normal sample, and 95 % of the 600 observations from the psychotic
sample, were less than 100 mm. Figure 2 shows the effects of trials
on the strength of the illusion for the average psychotic and normal
subject; higher scores (i. e., closer to 100) indicate less illusion,
while lower scores indicate more illusion. As one can see from Figure
2, there did not sem to be any substantial practice effects, nor were
there any substantial differences between the two samples. On the
other hand, it is obvious that there was a *far* stronger effect on the
even-numbered trials (Conditions A and C, where the Comparison
was initially set longer than the Standard) than on the odd-num-
bered trials (Conditions B and D, where the Comparison was initi-
ally set shorter than the Standard).

Table 2 presents the mean settings as a function of sample and
of sex. Table 3 presents the means and standard deviations in each
of the four testing conditions. Table 4 presents the results of a three-
way analysis of variance, contrasting sample, sex, and condition
(as a repeated measure). The differences between samples, and bet-
ween boys and girls, were not significant. On the other hand, there
was a very large and highly significant effect associated with the
testing conditions. None of the interactions were statistically sig-
nificant, however.
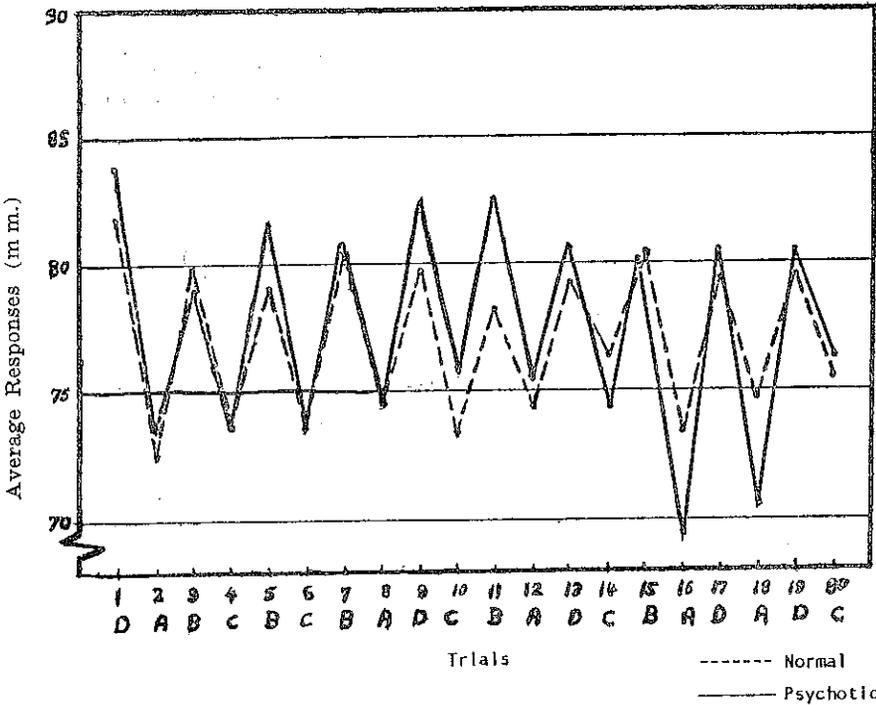
ŞEKİL 2 : Average Responses to the Muller-Lyer Illusion on Each of the
20 Trials in the Two Samples

TABLO 2

**AVERAGE MULLER LYER SETTINGS IN THE NORMAL
AND PSYCHOTIC SAMPLES**

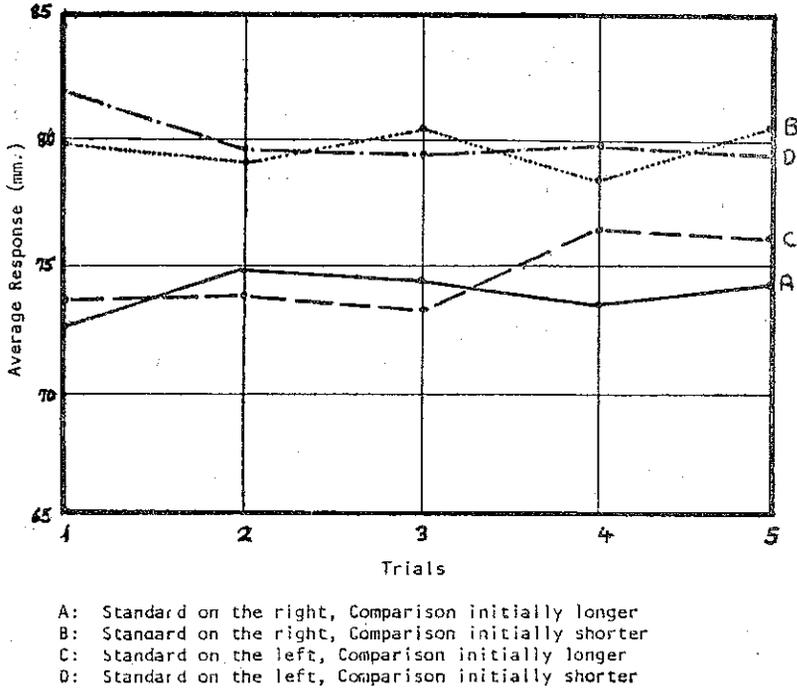|	Normal	Psychotic	
Boys	76.1	77.7	77.1
Girls	77.8	77.2	77.6
Total	77.0	77.6	77.3

TABLO 3

MEANS, (AND STANDARD DEVIATIONS) FOR FOUR DIFFERENT CONDITIONS IN THE NORMAL AND PSYCHOTIC SAMPLES

Sample	Sex	Condition A	B	C	D
Normal	Boys (N=15)	74.1 (6.6)	78.8 (7.4)	73.2 (3.3)	78.6 (5.9)
	Girls (N=15)	73.6 (4.9)	80.4 (5.2)	76.4 (6.2)	80.8 (4.8)
Psychotic	Boys (N=22)	74.0 (5.4)	80.0 (8.9)	75.0 (6.6)	81.8 (8.0)
	Girls (N=8)	70.0 (12.6)	82.2 (12.6)	74.6 (11.3)	82.2 (7.4)
	Total	73.4	80.1	74.8	80.8

TABLO 4

RESULTS OF THE ANALYSIS OF VARIANCE : SAMPLE, SEX, AND TESTING CONDITION

Source	df	MS	F	P
Between Subjects	59			
Sample (A)	1	12.15	0.08	—
Sex (B)	1	18.63	0.12	—
A x B	1	59.76	0.39	—
Subjects within groups	56	151.43		
Within Subjects	180			
Condition (C)	3	833.07	44.60	.001
A x C	3	45.09	2.41	—
B x C	3	48.63	2.60	—
A x B x C	3	12.75	0.68	—
C x Subjects within groups	168	18.68		

Since the effects of the testing conditions were so large, it may be instructive to examine these effects as a function of practice. Figure 3a presents these results for the normal sample, Figure 3b for the psychotic sample. There do not seem to be any substantial and cinsistent effects of practice for any of the four testing conditions.

A: Standard on the right, Comparison initially longer
B: Standard on the right, Comparison initially shorter
C: Standard on the left, Comparison initially longer
D: Standard on the left, Comparison initially shorter

ŞEKİL 3a : Practice Effects for Each of The Four Conditions ın the Normal Sample

The large effects associated with the testing conditions can be further analyzed as a function of the two experimental factors making up those conditions: *(a)* the right vs. left orientation of the Standard *(Orientation)*, and *(b)* the initial length of the Comparison (longer vs. shorter), relative to the Standard *(Length)*. The *Orientation* effect contrasts test conditions A and B with C and D; the *Length* effect contrasts test conditions A and C with B and D. Table 5 presents the means and standard deviations for each of these ex-
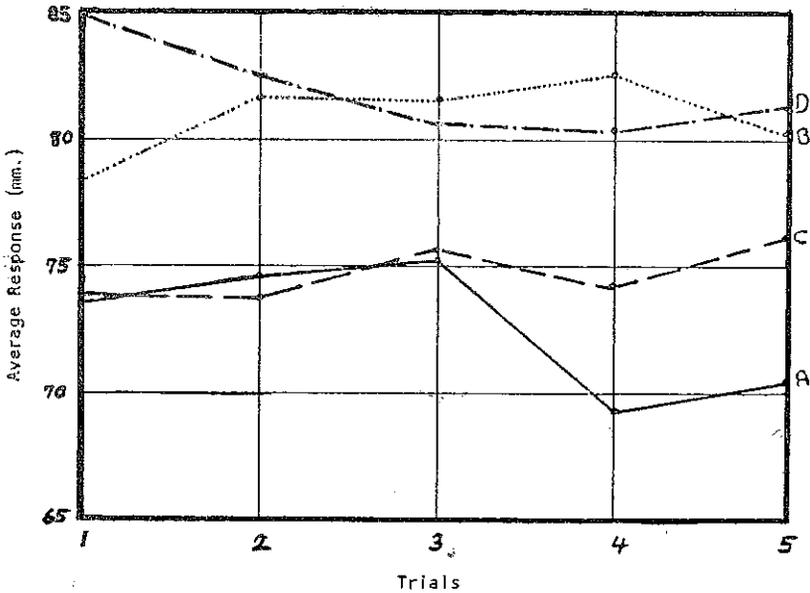
A: Standard on the right, Comparison initially longer
B: Standard on the right, Comparison initially shorter
C: Standard on the left, Comparison initially longer
D: Standard on the left, Comparison initially shorter

**ŞEKİL 3b : Practice Effects for Each of the four Conditions ın the
Psychotic Sample**

perimental factors, and Tables 6 and 7 present the results of analyses
of variance contrasting each factor with sample and sex. While
there were no significant differences for the *Orientation* factor
(Table 6), there were highly significant differences associated with
the *Length* factor (Table 7). Specifically, when the Comparison shaft
was initially set longer than the Standard, there was substantially
more error than when it was initially set shorter than the Standard.
In addition, there appears to be a weak Sample x Length interaction
effect, the psychotic sample showing a greater effect of initial
Length manipulation than the normal sample. Figure 4a shows the
effects of *Orientation* and *Length* as a function of practice in the
normal sample, while Figure 4b shows the same effects in the psy-
chotic sample. Again there do not seem to be any substantial or
consistent effects associated with practice.

TABLO 5

MEANS (AND STANDARD DEVIATIONS) FOR THE ORIENTATION AND THE LENGTH FACTORS IN THE NORMAL AND PSYCHOTIC SAMPLES

Sample	Sex	Orientation		Length	
		Right	Left	Comparison Longer	Standard Longer
Normal	Boys (N=15)	76.4 (6.6)	75.9 (4.2)	73.6 (4.8)	78.7 (6 2)
	Girls (N=15)	77.0 (4.6)	78.6 (4.8)	74.9 (5.1)	80.7 (4.7)
Psychotic	Boys (N=22)	77.7 (6.6)	78.4 (6.7)	74.5 (5.8)	80.9 (8.1)
	Girls (N=8)	76.1 (11.9)	78.4 (8.9)	72.2 (11.3)	82.2 (9.8)
	Total	77.0	77.8	74.1	80.5

TABLO 6

RESULTS OF THE ANALYSIS OF VARIANCE : ORIENTATION FACTOR

Source	df	MS	F	P
Between Subjects	59			
Sample (A)	1	11.36	0.15	—
Sex (B)	1	4.68	0.06	—
A x B	1	40.18	0.52	—
Subjects within groups	56	76.97		
Within Subjects	60			
Orientation (C)	1	26.52	2.60	—
A x C	1	7.13	0.70	—
B x C	1	22.72	2.22	—
A x B x C	1	0.43	0.04	—
C x Subjects within groups	56	10.22		

Note :--All F-ratios are nonsignificant.

TABLO 7

RESULTS OF THE ANALYSIS OF VARIANCE : LENGTH FACTOR

| Source	df	MS	F	P
Between Subjects	59			
Sample (A)	1	5.74	0.07	—
Sex (B)	1	9.74	0.13	—
A x B	1	30.63	0.40	—
Subjects within groups	56	77.46		
Within Subjects	60			
Length (C)	1	1220.38	83.52	.001
A x C	1	49.25	3.37	.05
B x C	1	30.20	2.07	—
A x B x C	1	13.06	0.89	—
C x Subjects within groups	56	14.61		

So far, all of these analyses have indicated that the MLI performance of psychotic and normal children was virtually identical. However, while the *mean* responses of the average child in both samples were quite similar, there was a considerable difference between the samples in intraindividual variability about each subject's mean. Specifically, if we index such variability by computing the *range* of responses for each subject in turn (that is, the subject's highest setting among the 20 trials minus his/her lowest setting), we find the two samples differing substantially. Figure 5 shows the univariate frequency distributions for these range values in the two samples. Note that there are *no* normal children with range values higher than the median value for the psychotic sample, and only four (of 30) psychotic children with range values below the median value for the normal sample. Table 8 presents the means and standard deviations of these range values in the two samples. An analysis of variance of these values indicates that the sample differences were *highly* significant ($p < .001$), while the effects of sex (and the interaction of sex and sample) were not significant.

Orientation Factor	Length Factor
1/2 (A + B) = Right (R)	1/2 (A + C) = Comparison Longer (C)
1/2 (C + D) = Left (L)	1/2 (C + D) = Standard Longer (S)
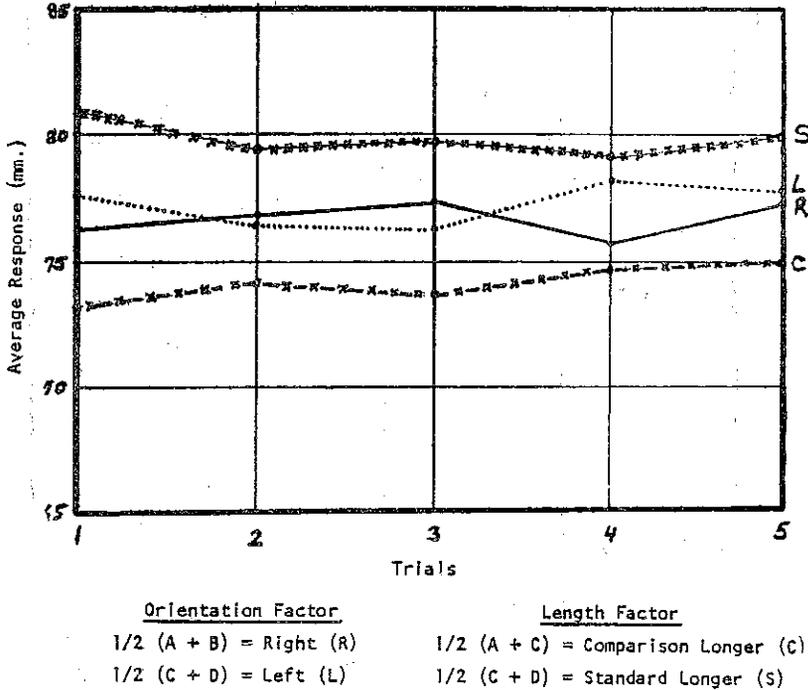
ŞEKİL 4a : Pratice Effects for the Orientation and Length
Factars in the Normal Sample

Table 9 presents analogous measures of intra-individual vari-
ability, now computed separately for each of the four testing con-
ditions, and for each of the two experimental factors used to create
those conditions. Since there were no significant sex differences, only
the results for the total samples are presented. Surprisingly, the
largest differences in range between the two samples occurred in
Conditions A and B, where the Standard was placed to the right of
the Comparison.

Finally, Table 10 presents the correlations between the MLI
range values (based on all 20 trials) and scores from the Trail Ma-
king and Bender-Gestalt tests. The intercorrelations among the
TMT and BGT scores are already published (Ormanlı, 1975). Since
none of the TMT or BGT scores were significantly correlated with
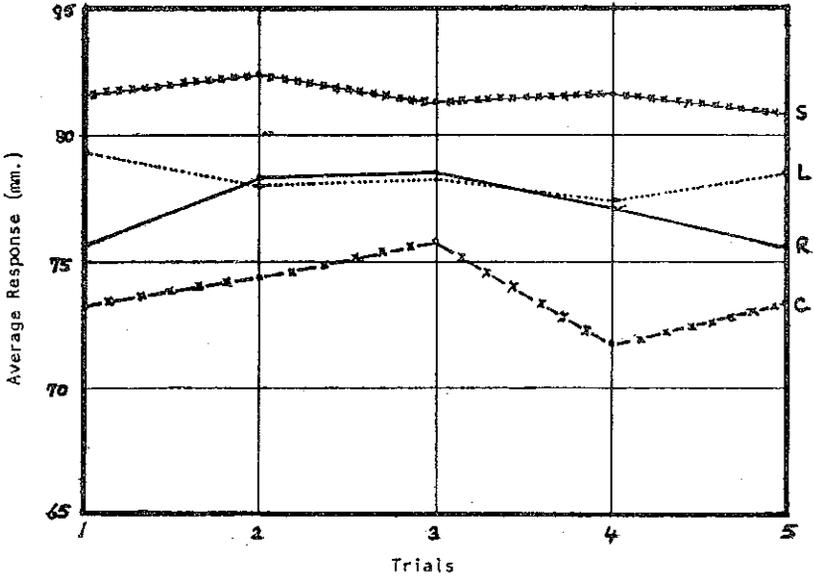
Orientation Factor	Length Factor
1/2 (A + B) = Right (R)	1/2 (A + C) = Comparison Longer (C)
1/2 (C + D) = Left (L)	1/2 (C + D) = Standard Longer (S)

ŞEKİL 4b : Practice Effects of the Orientation and Length
Factors in the Psychotic Sample
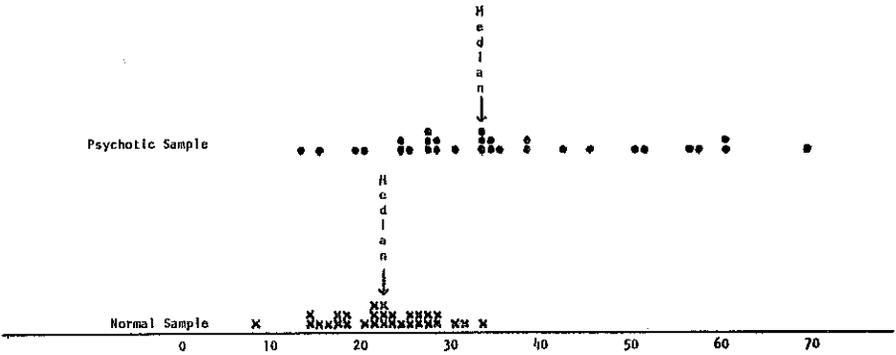
ŞEKİL 5 : Intra - Individual Range of Responses across the
20 trials

TABLO 8

MEANS (AND STANDARD DEVIATIONS) OF THE RANGE VALUES IN THE TWO SAMPLES AND THE RESULTS OF THE ANALYSIS VARIANCE

Sample

	Normal	Psychotic	Total
Boys	23.1 (5.8)	33.7 (14.2)	29.4
Girls	21.7 (5.2)	41.8 (14.2)	28.7
Total	22.4	35.8	29.1

Results of the Analysis of Variance

Source	df	MS	F	p
Samples (A)	1	3088.7	26.72	.001
Sex. (B)	1	143.5	1.24	–
A x B	1	299.3	2.59	–
Error	56	115.6		

TABLO 9

MEAN RANGE VALUES IN THE TWO SAMPLES AS A FUNCTION OF TESTING CONDITION AND OF EACH OF THE TWO EXPERIMENTAL FACTORS

Sample	Condition				Orientation		Length Comparison Standard	
	A	B	C	D	Right	Left	Longer	Longer
Normals	2.6	2.4	4.4	3.5	2.4	2.5	2.8	2.6
Psychotics	6.0	6.9	3.0	5.8	5.3	2.5	4.2	4.0

TABLO 10

**CORRELATIONS BETWEEN THE MULLER-LYER RANGE VALUES
AND SCORES FROM THE BENDER-GESTALT AND TRAIL
MAKING TESTS (N = 60)**

	Sample	Trail - Making		Time	Bender-Gestalt Errors				
		Part	Part		Dist.	Rotat.	Integ.	Persev.	Total
		A	B	Total					
MLI	.54**	.32	.40*	.39*	.50**	.27	.32	.29	.47**

* $p \le .05$

** $p \le .01$

the *mean* MLI setting, these values are not tabled. Table 10 indica-
tes that the MLI range values were most highly associated (r-= .54)
with the diagnostic sample (see Figure 5) and with Distortion errors
on the BGT (r = .50). They were also significantly related to the
amount of time spent on the Trail Making Test, especially Part B.

DISCUSSION

The main findings of this investigation can be easily summarized:
(a) Differences in the strength of the Muller - Lyer illusion--the
mean amount of error--between psychotic and normal children were
not significant, but there were substantial and highly significant
differences between the two samples in intra-individual response
variability across the 20 MLI trials. *(b)* Such variability, here in-
dexed by response range, was highly related to Distortion errors on
the Bender-Gestalt Test and moderately related to time spent on
the Trail Making Test; on the other hand, the *mean* of the MLI res-
ponses was not related to any of the TMT or BGT measures. *(c)* The-
re were substantial and highly significant differences, for both nor-
mal and psychotic subjects, between those trials where the Compa-
rison was initially set longer than the Standard and those trials
where the Comparison was initially set shorter, the former condition
producing far larger errors than the latter. *(d)* Moreover, this effect

was a bit stronger in the psychotic than the normal sample. *(e)* Finally, there did not seem to be any substantial effects associated with the sex of the subject, or with practice on the task.

Clearly, these preliminary findings virtually demand replication. This sample of subjects was small (N = 60), and not necessarily representative of either normal or psychotic children. Moreover. in this task the subjects adjusted the movable Comparison themselves; it would be interesting to discover if the effect of the initial setting would be as strong under experimental conditions where no such movement was permitted. And, finally, the considerable differentiation between samples achieved by MLI range values should certainly be checked further, for if this finding holds up on replication, it could add a significant new predictor to the diagnostician's clinical test battery.

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FOOTNOTES