EFFECTS OF PRACTICE AND REST ON FLUCTUATIONS IN THE MÜLLER-LYER ILLUSION

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Fifty subjects are given sixty trials each with an apparatus exhibiting the Müller-Lyer illusion. The first forty trials (divided for analysis into four periods of ten) are uninterrupted; a 30 sec. pause for fixation is followed by a fifth period of ten trials; and a rest pause of 30 min. by a final period. On the group as a whole, practice produces scarcely any effect. The means differ very little from trial to trial or from period to period, and the amount of variation about them tends to remain constant. The effect of the illusion varies greatly on different individuals. The variance between the subjects' means for the experiment as a whole constitutes 63 % of the total. There are also striking differences in the effects of practice on different subjects; these person:period interactions account for another 14 %. The error variance forms almost the whole of the remainder (22 %).

To classify the person:period interactions, a principal component analysis was employed. The first latent root, accounting for 59 % of the variance due to interaction, describes a course of change which retains the same direction for any particular subject (whether upwards or downwards, towards or away from the point of zero illusion) up to the end of the fifth period but is reversed by the rest pause. The authors do not consider the terminology of satiation or improvement with practice suitable for describing the whole range of such phenomena, but suggest a description in terms of habit reinforcement. However, the phenomena exhibited by subsequent components, which cannot be neglected as statistically non-significant, do not seem so explicable. All such performances constitute patterns of search, and it is noteworthy that none of them accord with the oscillatory pattern suggested by cybernetic theory. Scores on scales of neuroticism and extraversion-introversion failed to correlate significantly with individual differences either in the effect of the illusion over the experiment as a whole or in the progressive changes induced by practice.

I. Introduction

Few experimental variables in the field of learning have been studied more assiduously than the effects of practice and rest upon the development of the particular function under investigation. Experimental work in the field of perception, on the other hand, has not usually been concerned with variables of this type. Possibly due to the phenomenological bias of many workers in this field, massed or spaced repetition of trials has usually only been resorted to in order to increase the reliability of individual observations, and not in order to study the effects of such repetition on the dependent variable.

In previous contributions Eysenck (1955, 1957*a*) has suggested that certain effects in the perceptual field, which Köhler calls *satiation* effects, resemble certain other effects in the field of learning theory, which Hull calls *inhibition* effects. It was further hypothesized that inhibition-satiation effects are more strongly evoked in persons lying on the extraverted end of the extraversion-introversion dimension than those towards the introverted end. This hypothesis has been verified in several studies at an acceptable level of statistical significance (Eysenck, 1957*a*). Satiation phenomena present one of the few instances where the effect of practice upon perception has been studied, and the possibility of finding a link here between learning theory, perception, and personality theory may be worth investigating.

One of the phenomena which may be studied in this connexion is that of the so-called visual illusions. While most interest has, from the beginning, been aroused by the phenomenon itself and its possible relations to the analytic-synthetic modes of approach of different personality types, several workers have none the less been interested in the course of development taken when the illusion patterns are presented a large number of times. The work of Judd (1902, 1905), Seashore (1908), Lewis (1908) and Brown (1953) on the Müller–Lyer Illusion, that of Cameron & Steele (1905) on the Poggendorf Illusion, and that of Judd & Courten (1905) on the Zoellner Illusion, may be mentioned in this connexion. These writers put forward the general hypothesis that, as Köhler & Fishback (1950*a*, 1950*b*) put it, 'all such illusions represent errors of judgements rather than actual distortion of visual objects. From this point of view, it may seem natural to assume that when subjects deal with the illusion patterns in a great many trials, they gradually learn to avoid these errors, and that the illusions disappear for this reason.' Traditionally, then, although perception is involved in the experiment, the interpretation is in terms of learning, and comparatively little interest would attach to the alleged disappearance of the illusion with practice. But the only type of fluctuation with practice such a simple theory would be adequate to explain, would be a progressive decline in the amount of the illusion from some initially large positive value to a final value approximately zero. This is far from being the only possible origin, direction of change, or termination to be found described in the literature or observed by us.

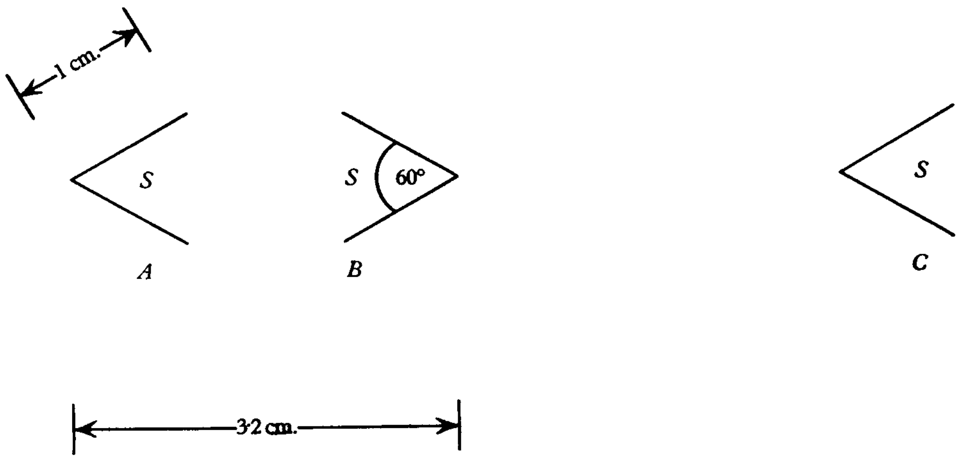

Fig. 1

In a brilliantly argued series of deductions, Köhler & Wallach (1944) and Köhler & Fishback have maintained: (1) that the explanation in terms of learning is inadmissible because subjects do not know where, and to what extent, their judgements are in error, and cannot therefore correct this; and (2) that the phenomenon of the disappearance of the illusion with repeated trials could be accounted for in terms of the general principles of satiation. This explanation, briefly, is that satiation develops more quickly inside the angles formed by the arrowheads, so that, as satiation develops, the apparently shorter distance included within the arrowheads will appear to become extended until it equals, or even exceeds, the distance between the oblique angles. In terms of Fig. 1, satiation develops most strongly at the points marked with an '*S*', pushing, in terms of the subject's visual experience, point *A* to the left, point *B* to the right and point *C* to the left.

So long as the only phenomenon to be explained is a progressive diminution in the effect of the illusion with practice, a choice between 'satiation' and 'learning' as descriptive terms cannot be guided by the evidence, and must rest on the relative strength of the logical arguments in support. But Köhler and his colleagues note a wide variety of other phenomena, and while they adduce such evidence as in conflict with the learning theory, they run into difficulties in attempting to extend their own satiation theory to accommodate it. Particularly with massed practice, and at least in some people, it has been reported that the illusion *increases* rather than *decreases* with time. This is acknowledged by Köhler and Fishback when they say: 'The obstacle which develops when many trials are given without rest periods does not merely delay the process by which the illusion is destroyed. Often its disturbing effect becomes so strong that for a while the direction of the development is actually reversed.' They also quote Seashore's report that one of his subjects showed no change in the size of the illusion even after measurements had been made for 24 days. The modified hypothesis they propose to account for such phenomena is by no means clear-cut and obvious. They point out (footnote on p. 274) that at first sight it might appear that, in such subjects, satiation must be exceptionally weak or that it must fade particularly fast, 'but if we are not mistaken one could also make the opposite assumption. There can be little doubt that, as a consequence of everyday vision, the visual cortex as a whole is in a state of quasi-permanent satiation, and that local satiation as established in special fixation periods is merely added to the level of that persistent condition.... Now satiation is a self-limiting process.... It therefore seems at least possible that, with some subjects, temporary and local satiation effects are found to be weak because the more persistent satiation of the tissue as a whole is unusually strong.'

We find it very difficult to operate with this modified hypothesis. It seems to mediate alternative expectations without specifying the conditions under which one or another is to be preferred, and thus to be of a kind repugnant to science. Moreover, the properties Köhler attributes to satiation are not at all in agreement with common findings which are that satiation effects disappear relatively rapidly. Long-lasting effects are much more typical of learning phenomena.

Köhler & Fishback's major objection, that when subjects are precluded from comparing their results with the objective situation they cannot learn, implies a restriction to the connotation of the term learning which may not be psychologically tenable. Learning in the sense of habit formation may occur without any such facilities, as long as a *reinforcement* is provided. Köhler himself, in a footnote on p. 278 of his paper with Fishback (footnote 13), has given a clue as to a possible source of reinforcement and our own observations are in agreement with his. This is what he writes: 'When subjects have sufficient time to do so, they will usually try to make sure that their first impression is reliable, and will therefore postpone their final decision. Since, during this period, satiation can change the appearance of the pattern, they may find themselves disturbed by contradictory impressions.' We have frequently found in our experiments that a subject may become discontented with the setting he has chosen while the experimenter is writing it down; if so, a reinforcement is provided for a change in that direction on the next occasion, and a habitual trend of change may thus be built up. This may be towards a decrease in the illusion if the initial effect is positive and the direction taken is downwards; but even so it may continue beyond the point of objective equality and terminate in a negative effect. Or the trend may equally well be in the opposite direction. The relationships of such trends to the point of equality will differ according to their starting points, directions and rates of change; but they may all be instances of habit formation.

However, if an ethical implication is considered inseparable from the term learning, in the sense that, at the end of a learning process, performance must in some way be *better* than at the beginning, its application to the patterns of behaviour we are considering must be withdrawn. In that case, it might be better to employ the term exploration to describe them. The adoption of a plan of search is found to be normal in subjects with a mental age of 13 years or over; and it may therefore be normal for an adult subject, dissatisfied with a particular setting during a series of trials with the Müller-Lyer illusion, to try modifying it systematically rather than at random What we are suggesting then, is that, among such subjects, an orderly trend is observable in exploratory behaviour, not necessarily following the same pattern in all cases; that it may be maintained by some reinforcing stimulus as long as no obstacle or interruption disturbs it; and that there are consequently some similarities between exploratory and learning processes.

Such theories do not enable a particular sequence of performances to be defined as the most probable one for a particular subject on any evidence available prior to the experiment, but lead to some expectations concerning the performances of groups of subjects which can be verified. No general tendency need be expected for the illusion to increase or decrease during a period of massed practice, nor for the variance about the mean effect to increase or diminish; differences in starting points, directions and rates of change, being free to vary for different subjects, will operate as that multitude of small independent causes which tends to stabilize a normal distribution. But the performances of individual subjects may be expected to show systematic changes, demonstrable by dividing a long series of trials into a few periods of several trials each and testing whether the individual's mean performances differ significantly from one period to another. There is no particular reason for expecting that the systematic changes exhibited by different individuals will be related to their scores on measures of extraversion-introversion if the satiation theory is untenable.

On any form of the satiation theory, however much modified, it would seem reasonable to expect some general tendency in a group of subjects towards convergence on the point of objective equality at some time during a long series of trials, more probably nearer the end. If the initial effect of the illusion is large, it should tend to decrease; if small, to remain small or decrease further, possibly to a negative end-point. The exceptional cases should be relatively few.

II. EXPERIMENT

(*a*) *Subjects.* Fifty male subjects between 18 and 25 constituted the experimental group; nearly all were University students and all were experimentally naïve and had no knowledge of the aim of the investigation.

(*b*) *Apparatus.* An illusion pattern was housed in a wooden box, 45 in. long, 4 in. high and 6 in wide. A special face-mask made of rubber enabled the subject to press his face against the open end of the box to the virtual exclusion of all extraneous light, thus reducing external clues. The inside of the box was painted matt black and the pattern was presented to the subject at the other end. It was illuminated from behind by means of a 25 W. lamp. The pattern was drawn on a double sheet of Perspex and was presented with the subjectively shorter distance on the left; this distance was kept constant. The subjectively longer distance could be varied by pulling out the part of the Perspex on which it was drawn and pushing it back again. The dimensions of the illusion, which was presented simply in terms of the angles and without a central line to connect them, were as shown in Fig. 1.

(*c*) *Technique of measurement.* The experimenter pulled the adjustable part of the apparatus out to a point where preliminary experiments had shown there would be no chance at all of any subject regarding the distance as equal. He then pushed it very slowly back until the subject said 'halt'. His instructions were to call out when the distance between the points of angles *A* and *B* appeared equal to the distance between the points of angles *B* and *C*. The experimenter recorded the amount of error shown by the setting (difference of constant minus adjustable distance in mm.) and removed the adjustable part again to an extreme position somewhat different from that previously used. The subject kept his eyes open throughout and fixated the angle at *B* in Fig. 1. Then the experimenter repeated the experiment immediately, leaving as little time as possible between successive judgements. Forty judgements were made in a row numbered below 1–40. Then the subject was instructed to fixate the illusion pattern by keeping his eye fixed on the point of the angle marked *B* in Fig. 1; this fixation had to be held for 30 sec., after which another ten readings were taken—numbered 41–50. After the fiftieth reading, a 30 min. rest pause was introduced; then another ten readings were taken, numbered 51–60.

(*d*) *Instructions.* The subjects were told throughout to fixate the point of the angle marked *B*. They were not told of the nature of the illusion or the fact that an illusion was being presented to them at all. They were simply asked to estimate the distances between three points at the tips of the angles and to say halt whenever they considered the distances to be equal. They were shown the mechanism before starting and none made any errors during the run of the experiments. All subjects filled in an extraversion-introversion and neuroticism questionnaire, specially designed by one of us (H.J.E.) and described briefly in another publication (Eysenck, 1957*b*). It was considered possible that the 'analytic' and 'synthetic' types of subjects mentioned in the literature might be found to differ from each other in one or both of the personality dimensions, but no scale relating directly to this trait was used.

III. Description and analysis of the results

The group mean for the entire experiment, i.e. the mean of all 3000 measurements, is 1·551 mm., and the sum of squares of deviations from it is 66,106·09 (cf. Table 2). The average effect of the illusion is thus not great compared with the amount of variation about it. Readings range from +16 to −14 mm. and 39·8% are negative. Their standard

Table 1. *Results illustrating periodic fluctuations in the effects of the illusion*

During period	All subjects		Means of subjects		
	Mean	S.D.	S1	S2	S3
1	1·14	4·88	9·8	2·9	−8·4
2	1·28	4·78	9·2	4·0	−8·6
3	1·75	4·44	4·2	2·7	−6·8
4	2·13	4·61	1·7	4·5	−3·9
5	1·56	4·90	0·2	3·4	−1·4
6	1·43	4·48	2·0	3·1	−5·6
All periods	1·55	4·69	4·52	3·43	−5·78

Table 2. *Analysis of the variance of the measurements*

Source	Sum of squares		Degrees of freedom		Mean square variance	
Total variance		66,106·09		2999		850·40
Variance between—Persons		41,669·53		49		
Periods		315·57		5		63·11
Person: period interactions						
First latent root	5620·50		49		114·70	
Second latent root	1991·07		49		40·63	
Third latent root	960·14		49		19·59	
Fourth latent root	616·17		49		12·57	
Fifth latent root	302·99		49		6·18	
Total		9,488·99		245		38·73
Variance between trials within period		248·80		54		4·61
Person: trial interactions within period		14,383·20		2646		5·44

deviation is 4·692 mm. The form of the distribution approximates to the normal, though it does not conform exactly. The value of β_1, $-0{\cdot}1933$, indicates slight negative skewing (mean below mode), the maximum frequencies occurring at 2 and 3 mm. The value of β_2, 2·561, shows that the form is also slightly platykurtic.

The individual means for the entire experiment, obtained by summing the sixty measurements for each subject, have a very wide range, from +8·90 to −5·78 mm.; fourteen are negative. Their sum of squares, 41,669·53, accounts for 63% of the total variance. Subjects thus differ greatly in their susceptibility to the illusion; and such individual differences are the most important observations for any adequate theory of the Müller–Lyer illusion to explain. Their relationship to our personality measurements is very slight, if any: they correlate 0·1860 with the extraversion scale and −0·1151 with the scale for neuroticism. Neither correlation is significant for fifty cases.

The literature on the relation between susceptibility to the illusion and personality (Schiller, 1942) suggests that it is the synthetic type of person who is susceptible to the illusion as opposed to the analytic type. Personality descriptions given by continental authors suggest that the synthetic type is more extraverted than the analytic type, as well as less neurotic. The direction of the two correlations is in line with this hypothesis, but only the former appears worthy of further investigation, being almost significant on the one-tail test. Accordingly, our subjects were divided into three groups, made up of the ten most extraverted subjects ($E+$), the ten least extraverted subjects ($E-$), and the intermediate thirty subjects ($E0$). The mean errors for these three groups were 3·525 for the $E+$ group, 0·820 for the $E-$ group, and 1·142 for the $E0$ group. This order of the means is in line with the hypothesis. Analysis of variance, however, gives a P value somewhat higher than 0·05. The data may be suggestive, particularly in view of the fact that the order of the means would agree with prediction by chance only in one case out of six, a fact which is not taken into account by the analysis of variance technique. Further work along these lines might be promising.

To distinguish between the irregularities and the systematic changes in the measurements obtained during the course of the experiment the sixty trials have been divided into six periods of ten. Periods 1 to 4 succeed uninterruptedly; then comes the 30 sec. pause for fixation; then period 5; then the rest pause; then period 6. The variation between periods registers the relatively long-term changes, and the variation between trials within periods the momentary irregularities in individual performances. A comparison of the mean-square variances (M.S.V.) from these two sources excludes some classes of hypothesis altogether, though it leaves the choice between others open.

If the two M.S.V.'s do not differ significantly, no evidence of any systematic component is disclosed. If the M.S.V. between periods is significantly greater than the M.S.V. between trials within period, the evidence is consistent with some progressive change of the kind discussed in the introduction. If the latter exceeds the former, oscillation of some kind is suggested: this might be consistent with an attempt to arrive at the true length by cybernetic methods, overshooting it alternately in opposite directions.

In calculating the total variance (sum of squares) for this comparison, the sum assigned in Table 2 to person:period interactions should be included with the variance between periods; and the person:trial interactions within period are to be included with the variance between trials within period. The two M.S.V.'s are 39·22 with 250 D.F. and 5·42 with 2700 D.F., respectively. As the former is very much the greater, progressive change of some kind is indicated; neither of the alternative kinds of hypothesis is acceptable.

If a single direction or course (not necessarily common to all the subjects or rectilinear over the entire experiment, but sufficiently common and consistent to be statistically significant) is to be found in the progressive changes in the measurements obtained from different subjects during successive periods, it will be shown in the group means per period. But if the directions taken by different subjects vary independently, they will tend to obliterate one another, and the variation in the group means will tend to be small and erratic. Thus consistent changes will augment the variance between periods and independent changes will augment the person:period interactions.

The observed effects are illustrated in Table 1, where the period means for the first three subjects are tabulated alongside the means for the entire group. S 1, as can be seen, is markedly affected by the illusion at the beginning of the experiment; as it proceeds, the illusion appears to wear off and during period 5 its effect is very slight; after the rest pause it appears to have returned, though not in its original strength. A graph of this performance would resemble Köhler's Fig. 3 (1950*a*) very closely. S 3's performance is almost the exact reverse: he starts with a substantial underestimate of the distance the illusion supposedly lengthens; his estimates increase as the experiment proceeds, approaching the true value most closely again at period 5; and again, after the rest pause, there is a relapse. But no such course is followed by S 2; in his case the illusion appears to be comparatively stable. The group means, which are the net resultant of such divergent courses, also show little fluctuation.

That the courses followed by different subjects vary from one another and do not cumulatively define any single predominant direction of change is shown by the fact that the M.S.V. between periods (due to differences in the group means per period) is not significantly greater than the M.S.V. of the person: period interactions. This disposes of the simpler forms of the learning and the satiation theories discussed in the introduction, together with any other theories which postulate that a single course of change will be found to predominate during a period of massed practice. Even it it succeeded in accounting exactly for all the variations in mean measurements from trial to trial as well as from period to period, any such theory would leave over 99 % of the total variance unaccounted for: the variance between the sixty trials is only 0·85 % of the total.

To discover any common characteristics among the courses followed by different subjects it is necessary to analyse the person:period interactions. Next to the differences between individual experimental means, they are the largest source of variance outside the experimental error, comprising 14·4 % of the total. Detailed tabulations were made. For example, S 1's mean for the entire experiment is +4·52 (cf. Table 1); it exceeds the group mean by 2·97 mm. If his course had conformed with the group's, his means per period would have been 4·11, 4·25, 4·72, 5·10, 4·53 and 4·40. The deviations of his observed means from these expectations, viz: +5·69, +4·95... −2·40, measure his period interactions. Tabulating them for each subject provides a matrix of 6 × 50 measurements with, however, only 5 × 49 D.F. between them. Significant interactions were not found to be confined to a few of the subjects. They lie beyond the 0·01 probability limit in thirty-three cases and between the 0·05 and 0·01 limits in three more; it is the absence of any interaction, as in the case of S 2, which is unusual.

Their variances and covariances per period are given in Table 3. Looking along the leading diagonal it is noticeable that the largest deviations occur towards the beginning and end of the experiment; the smallest variance is at period 3. Deviations in the first three periods tend to correlate positively with one another and negatively with those in subsequent periods. There is evidently a general tendency for the subjects to give responses at the start of the experiment which lie at a considerable distance away from what subsequently prove to be their mean points for the experiment as a whole; to converge on these points as the experiment proceeds, coming nearest usually in period 3; and continuing roughly in the same direction to move on past them away again. Subjects 1 and 3 (cf. Table 1) follow courses which conform approximately with this description.

Table 3. *Matrix of the total variances and covariances* of the person: period interactions*

3309·5	762·5	−262·7	−1574·1	−1737·2	−498·4
—	1092·5	109·5	−456·8	−910·6	−597·6
—	—	617·5	291·5	−306·5	−448·8
—	—	—	1359·3	331·6	47·8
—	—	—	—	2118·8	503·9
—	—	—	—	—	993·3

* Sums of squares and products, with 49 D.F.

It might be supposed, if this is the general tendency, that there will be some point during the experiment when the measurements obtained lie closer, if not to the true value, at least to the experimental mean for the group. But this is not the case. As the S.D.'s noted in Table 1 show, the amount of variation about the period mean for this group is approximately the same at all stages during the experiment. This is because the convergence which tends to occur over the first thirty trials is of the individual's responses towards their own experimental means, which vary widely about the mean of the group; nor is period 3 always the point at which convergence is closest; and indeed persistence in the same direction does not remain uninterrupted in every case.

To reduce vagueness in discussing what general tendency or tendencies are to be found among these interactions a technique is needed for abstracting common characteristics and measuring their importance. An adaptation of principal component analysis is submitted by one of us (P.S.) for this purpose. It leads to the latent roots of the components included in Table 2 and the weights proportionate to factor loadings given in Table 4.

Table 4. *Latent vectors of the person: period interactions**

CI	CII	CIII	CIV	CV
0·731	−0·309	0·107	−0·371	−0·231
0·279	0·311	−0·421	0·686	−0·107
−0·007	0·429	−0·102	−0·387	0·700
−0·341	0·469	0·413	−0·150	−0·552
−0·492	−0·463	−0·560	−0·201	−0·151
−0·171	−0·436	0·563	0·424	0·344

* Scaled appropriately for calculating component measures from preceding residuals. To obtain loadings for extracting components from the matrix of total variances and covariances (Table 3) multiply each vector set by the square root of its latent root, given in Table 2.

When multiplied into S1's interaction measurements, the weight for the first component gives his C1 index, thus:

$$5{\cdot}69\times 0{\cdot}73+\ldots+(-2{\cdot}40)\times(-0{\cdot}17)=9{\cdot}244$$

and the C1 index, multiplied by the weights, gives the modified expectation of his performance during the successive periods illustrated in Fig. 2. The fit is evidently improved substantially in this case.

The C1 index for the group as a whole varies about 0 with a S.D. of 3·387, i.e. $(5620{\cdot}50\div 490)^{\frac{1}{2}}$. Particular values designate individual specimens of the same general type of performance, analogous to members of a family of curves designated by a particular choice of constants. A positive index describes a course dropping, like S 1's, to a trough at period 5, but the point of the trough may be located anywhere above or below the base line of equality (no illusion). Conversely a negative index describes a course rising, like S 3's, to a crest at period 5; and this too may be located anywhere above or below the base line. The position of trough or crest relatively to the base line depends, for any given CI index, on the subject's experimental mean.

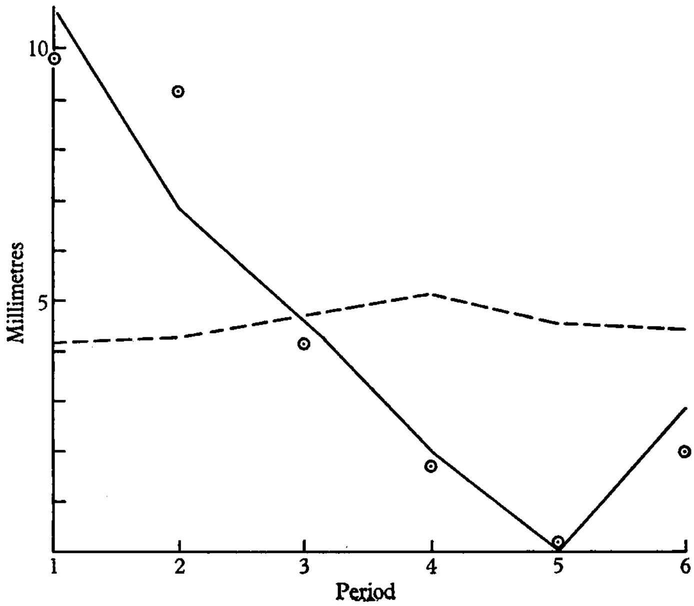

Fig. 2. Period means for S 1. ⊙, Observed; – – –, expected from group means; ——, expected taking C 1 into account.

While the terminology of satiation may apply approximately to the course followed by S 1, trying to extend it to S 3 may be felt to strain it. The terminology of learning, in the sense of improvement with practice, might apply equally well to both subjects' performances; but it too would be strained if extended to cases where a positive experimental mean occurs concomitantly with a negative CI index, or a negative mean with a positive CI index, i.e. where the course towards the crest or trough takes the subject *away* from the base line. Such occurrences could be readily exemplified from our data, and the statistical analysis shows that they can be regularly expected and all referred to a common form. However, in terms of the modified learning theory outlined in the introduction, that is to say as phenomena of simple habit reinforcement, all courses of the CI type are equally explicable, and the reversal of direction which occurs after the 30 min. rest pause is also intelligible. If a psychological description is to be attempted, these terms would seem preferable.

Expectations derived from CI naturally do not coincide with the observed measurements at every point in every case; the deviations from expectation give rise to a matrix of residual variances and covariances from which a second principal component, CII, can be extracted. The process concludes only after the extraction of five components. Just as the CI index modifies the expectations based only on the experimental and group means, the CII index modifies again the modifications introduced by CI until, finally, with CV the whole variance of the interactions is taken up, and an exact fit is obtained to every subject's observed mean performance per period. The significance of the improvement in fit provided by each modification is tested in the analysis of variance (Table 2). CV is the only component that falls short of significance at the 0·01 probability level.

There thus appear to be types of course which deviate significantly from CI and are not readily ascribable to habit reinforcement. In particular, the 30 sec. fixation period produces startling changes in courses of both the CII and CIII type which are not readily explicable in terms of any theory we have discussed. In accordance with satiation theory the prevalent tendency (downwards towards the base line) should be accelerated, while in terms of simple habit reinforcement no large change is to be expected: but it is evident from CII and CIII that complete reversals are quite common. While all the components could be described as classifications of common plans of search, it is not immediately evident that such a terminology will be helpful for purposes of inference.

One possible hypothesis to account for the reversal in the direction of change during the fixation period might be constructed with reference to reactive inhibition of those cortical elements active in the attention and judgement processes which are supposed to characterize the 'analytic' type of person. Such inhibition might be supposed to accumulate during the forty massed practice trials preceding the 30 sec. inspection period, and, apparently, to dissipate during this period. Experimental evidence is available to show the existence of reactive inhibition in relation to such cortical processes and a direction test of this hypothesis would not seem to be impossible (Eysenck, 1957*a*).

There is no evidence of any significant association between any of the components and scores on the scales for neuroticism or extraversion-introversion. The correlations are

	Scale	
Component	*N*	*E*
I	0·0804	0·0376
II	−0·1842	0·1711
III	0·2138	0·0606
IV	0·1905	0·0674
V	0·0871	−0·0864
All components multiple *R*	0·3605	0·2153

The 0·05 probability limit for a zero correlation is ±0·2829 in a sample of fifty cases and 0·5255 for a multiple correlation based on five independent variables. There may well be some other personality trait or traits with which these components are associated, e.g. the analytic/synthetic difference. But of this we have no evidence. We cannot at the moment say whether the components described have any significance for personality theory at all.

REFERENCES

BROWN, K. T. (1953). Methodology for studying figural after-effects and practice effects in the Müller-Lyer illusion. *Amer. J. Psychol.* **66**, 629–34.

CAMERON, E. H. & STEELE, W. N. (1905). The Poggendorf illusion. *Psychol. Rev.* (*Mon. Suppl.*), **7**, 83–111.

EYSENCK, H. J. (1955). Cortical inhibition, figural after-effect, and the theory of personality. *J. Abn. Soc. Psychol.* **51**, 94–106.

Eysenck, H. J. (1957*a*). *The Dynamics of Anxiety and Hysteria.* London: Routledge and Kegan Paul.
Eysenck, H. J. (1957*b*). The questionnaire measurement of neuroticism and extraversion. *Riv. Psicol.*, **50**, 113–140.
Judd, C. H. (1902). Practice and its effects on the perception of illusion. *Psychol. Rev.* **9**, 27–39.
Judd, C. H. (1905). The Müller–Lyer illusion. *Psychol. Rev.* (*Mon. Suppl.*), **7**, 55–81.
Judd, C. H. & Courten, H. C. (1905). The Zöllner illusion. *Psychol. Rev.* (*Mon. Suppl.*), **7**, 12–39.
Köhler, W. & Fishback, J. (1950*a*). The destruction of the Müller–Lyer illusion in repeated trials. I. An examination of two theories. *J. exp. Psychol.* **40**, 267–81.
Köhler, W. & Fishback, J. (1950*b*). The destruction of the Müller–Lyer illusion in repeated trials. II. Satiation patterns and memory traces. *J. Exp. Psychol.* **40**, 398–410.
Köhler, W. & Wallach, H. (1944). Figural after-effects. *Proc. Amer. Phil. Soc.* **88**, 265–357.
Lewis, E. O. (1908). The effect of practice on the perception of the Müller–Lyer illusion. *Brit. J. Psychol.* **2**, 294–306.
Schiller, L. (1942). Ganzheitliche Auffassung und Persönlichkeitstypus. *R. Psychol.* **153**, 43–80.
Seashore, C. E. and others (1908). The effects of practice on normal illusions. *Psychol. Rev.* (*Mon. Suppl.*), **9**, 103–48.

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