# THE ORGANISMIC-DEVELOPMENTAL MODEL OF SUCCESSIVE TRIALS EFFECTS: PREDICTIONS FOR LOCUS OF CONTROL AND INSTRUCTIONAL VARIABLES

A Dissertation

Presented to

Faculty of Graduate Studies

University of Manitoba

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

by

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University of Manitoba

May, 1975

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A dissertation submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

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ABSTRACT

This study was designed for several purposes: assessment of the predictive capacity and generality of the organismic model of trials effects (Bayer, 1972a); determination of the utlity of illusions in locus of control research; examination of the effects of objective versus apparent instructions on the Poggendorff and Ingoing Mueller-Lyer illusions; and replication of a trials effect on the Ingoing Mueller-Lyer figure with a method of production.

The trials model was assessed along two dimensions--the locus of control personality variable and instructional set. The model depicts a successive trials effect as a sequential two-factor phenomenon. First, the illusory response is established, and secondly, with repeated presentation of the same data the illusory effect dissipates--information-processing is efficient. Locus of control studies indicated that internals were more adept perceptual learners, more efficient processors of visual information, and more perceptually vigilant than externals. Internals were conceptualized as articulate perceivers,and externals were conceptualized as global perceivers within a Werner-Wapnerian (1957, 1961) framework. Fit into the organismic model, it was essentially predicted that internals would perceive both illusions more accurately over trials than externals. This first set of major predictions was generally confirmed but,

in addition, externals performed more effectively than expected. Instructional set studies suggested that high-cue, objective instructions would be more facilitative of performance than low-cue, apparent instructions. Locus of control findings revealed that internal-external differences are attenuated in structured situations. Therefore, it was essentially predicted that objective instructions would facilitate performance over trials, and that locus of control differences would be maximal under apparent instructions. This second set of major predictions was partially confirmed, and only for the Mueller-Lyer task.

On a post-hoc basis, it was determined, after raw Mueller-Lyer data was examined, that a control condition minimized between subjects error. Further *a posteriori* analyses challenged an implicit basic assumption of the study: replication of the experiment with different illusions. It was contended that there is no simple relationship between cognitive variables and perception of geometric illusions. The model's predictive capacity was considered fairly adequate, but its generality was limited. Suggestions for future research regarding a variety of information, organismic, and perceptual learning variables were made. Clinical implications were discussed.

ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to his committee: Drs. Brodsky, Martin, Aftanas, and Brockman for their able assistance in this endeavor. Special thanks is extended to Marvin Brodsky, Chairman, for his supervision, support, and friendship over the years. Professor Brodsky's professionalism and creativity as a clinical psychologist has been a source of stimulation to the author during his graduate training. Special thanks is also extended to Dr. Joseph DuCette who served exceptionally well as an external examiner.

Aside from the Committee, Drs. Becker and Peastrel, Senior Staff Psychologists at Norristown State Hospital, were very helpful during the completion of this project. Paul Becker provided excellent editorial comment, and August Peastrel was invaluable as a data analysis consultant. In addition, Terry J. Prociuk provided outstanding criticism during all phases of this project.

Most importantly, my wife, Nancy, and son, Robert, deserve a deluge of thanks and affection for enduring this task with me.

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# CHAPTER I

## INTRODUCTION

This study was concerned with assessing the predictive capacity of the organismic-developmental model of successive trials effects (Bayer, 1972a) for two variables: locus of control and instructional set. Essentially, perceptual performance on successive trials of two different types of geometric illusions (one of direction and one of extent) was investigated as a function of the locus of control personality variable under different instructional conditions. In general, the phenomenon of successive trials effects can be categorized under the rubric of perceptual learning (Epstein, 1967). Subjects become less susceptible to a variety of illusions with repeated exposure; there is a comparatively stable and durable change in percpetion of the illusory targets which results in more effective responding.

Locus of control and instructional variables were of particular interest to the present study for several reasons. Primarily, the original model of trials effects is an explanatory one derived from previously unexplained data from studies in which the organismic variable of age had been manipulated in the investigation of an illusion of direction. At this point, however, the model has not been employed predictively, and a personality variable has not been used

to test the model for other perceptual illusion tasks. Secondarily, basic information-processing concepts contribute heavily to the theoretical structure of the model. Therefore, instructional set was manipulated along a dimension of explicitness of information conveyed to the subject.

As noted above, the phenomenon of successive trials effects can be categorized as an example of perceptual learning. In the present study, however, since the trials effects model is an organismic one and since perceptual functioning was investigated as a function of a personality variable, the more general theoretical framework of the study is within the subject area of perception and personality.

## Historical Background: Perception and Personality

Historically, the study of perceptual processes and their relation to personality variables developed out of a movement in psychology known as the "New Look in Perception" (Dember, 1960; Klein & Schlesinger, 1949). The basic rationale for placing the perceiver back into the study of perception developed in an effort to systematically account for individual differences in perceptual processes, rather than assign these differences to random error.

Early "New Look" researchers were interested in how a variety of cognitive and/or experiential states influenced the individual's perception of his world. During the late 1940's and 1950's, investigators began to focus on organismic

variables (such as personality style, age, sex, diagnostic classification, and level of motivation) as an approach to studying the origins and mechanisms of perceptual processes. Frenkel-Brunswick (1949) delineated a distinction between "perception-centered" and "personality-centered" perceptual research. The former approach concentrated on personality variables and their manifestation in perceptual functioning. Gradually, the research emphasis shifted to developing personality-oriented theories of perception (Blake & Ramsey, 1951). The central thesis of this approach was that the study of perceptual functioning provides a basic empirical approach to an understanding of personality and interpersonal relations.

The conceptual impetus for the "New Look in Perception" was closely aligned with the development of the psychoanalytic theory of projective techniques (Chaplin & Krawiec, 1960). Analytic theory hypothesized that responses to unstructured or vague stimuli would be characteristic of the individual's personality. From this theoretical vantage point, psychoanalytically oriented clinicians and test constructors attempted to study unconscious motivation through the modality of perceptual functioning.

Witkin, Lewis, Hertzman, Meissner, and Wapner (1954) were among the first investigators to systematically use controlled S-O-R (stimulus-organism-response) paradigms in the investigation of perception and personality. These researchers developed a theoretical construct of field

dependence-independence which differentiated between individuals who relied on internal, or bodily, cues for perceptual decision-making in the extraction of an item from the field in which it appears, as contrasted with individuals who relied on external cues. The former individual was identified field-independent, whereas the latter individual was designated field-dependent. Field-independent individuals were conceptualized as having more effective categorical abilities.

After Witkin, et al's (1954) initial research, another team of investigators (Gardner, Holzman, Klein, Linton, Spence, 1959) began to approach the subject area of perception and personality from a cognitive perspective. The basic thesis of their work was that a wide range of behaviors, with which an individual encounters reality, may be encompassed by relatively few dimensions of organization. These investigators were interested in studying individual consistencies in cognitive behavior. They articulated the concept of cognitive style, an organizational constant which refers to the arrangement of controls within a personality which represents a relatively stable and durable mode of functioning. More broadly, how an individual copes with and adapts to reality can be considered representative of his cognitive style. The notion of style reflects the pattern of cognitive controls which are relatively stable features of personality organization. The notion of control implies an embeddedness of cognitive functions arranged for

regulation purposes. Another assumption of the Gardner group's research was the individual characteristics expressed in cognitive style are evident over a variety of tasks, situations, and psychological states.

Gardner (1959) further indicates that while earlier research found that individuals can be characterized by enduring response dispositions, termed "perceptual attitudes," that can be expressed in various perceptual behaviors, it was also discovered that these consistencies reflected broader principles of cognitive organization. Essentially, these data supported the personality-centered model of Frenkel-Brunswick (1949) which concentrated on personality (and other higher order cognitive) variables and their manifestation in perceptual functioning. Later, Gardner (1961) found that the cognitive control principles of Field Articulation and Scanning differentially predicted performance on geometric illusions. For example, subjects low in Field Articulation were similar to children in their inability to produce differential responses to parts of stimulus fields which contained conflicting information. Gardner concluded that "these subjects can be conceived of as relatively inefficient in attending to relevant cues and inhibiting attention to misleading irrelevant cues (1961, p. 126)." The crucial point is that cognitive constructs are capable of predicting perceptual performance on geometric illusions. The basis of this theoretical orientation is that perception can be said to depend in

part upon enduring organizations, or cognitive styles, which are superordinate to the actual physical perceptual system itself. Moreover, as cognitive styles are considered to be relatively stable states, one can make precise and consistent predictions based on knowledge of a subject's or group of subjects' cognitive style. Locus of control was the hypothetical cognitive style construct employed here to differentially predict perceptual performance on geometric illusions within the framework of the organismic model of trials effects. After the locus of control construct is explicated, it will be shown how locus of control can be conceptualized to correspond with the trials effect model, and then pertinent locus of control and illusion research will be reviewed.

## The Locus of Control Construct

The variable of internal versus external control is most widely known as the locus of control construct (Rotter, 1954, 1966). Essentially, the construct refers to the degree to which an individual believes that reinforcement (or more broadly, what happens to him and/or what he does) is contingent upon his own behavior. The construct is concerned with a person's perception of contingency relationships between his own behavior and events which follow that behavior.

With regard to theory construction, Rotter (1954) and Rotter, Chance, and Phares (1972) have taken a social learning

approach in developing a personality theory. A concept of expectancy learning is considered to play a central role in generating individual differences in behavior change and performance. The notion of expectancy refers to the individual's assessment of the probability of success of a specific behavior. Early research focused on differential expectancy learning as a function of the experimental situation which was usually an ambiguous task that required subtle discrimination (Blackman, 1962; Holder & Rotter, 1962; James & Rotter, 1958; Phares, 1957). With further research, it was determined that systematic changes in expectancy learning were related to the internal or external control orientation of the individual subject (Rotter, 1966). The data revealed that internals exhibit stable expectancies characterized by strong use of previous experience for determining future expectancies whereas externals did not (Petzel & Gynther, 1970).

Rotter's (1954) early model of generalized expectancy can be applied to the later research findings. The conditions of internality and externality can be conceptualized as consequences of prior learning history which, theoretically, should be generalized to a variety of present and future situations (Rotter, 1966). In other words, individuals enter situations with pre-established internal or external control orientations. In this sense, locus of control is considered a personality variable, and can be viewed more broadly as a cognitive style (Lefcourt, 1972). Also, different situations

can be construed by the experimenter and/or perceived by the subject as being an internal or an external control situation. In this sense, locus of control is considered as a situational variable.

More precisely, Rotter (1966) distinguished between individuals who believe they control their reinforcements, and individuals who believe their reinforcements are not under their control. The first individual is considered internally oriented (internal), while the second individual is considered externally oriented (external). Internals are further described as perceiving that their reinforcements are contingent upon their own behavior, whereas externals are described as perceiving that their reinforcements are (comparatively) independent of their own behavior. Thus, an internal may view his reinforcements as a function of his own skill, effort, or ability; and an external may view his reinforcements as a function of fate, luck, chance, or powerful others. In other words, internals appear to perceive what happens to them, or how they perform, in terms of their own behavior, skill, etc. On the other hand, externals seem to perceive what happens to them, or how they perform, in terms of factors outside themselves such as fate, chance, etc.

Rotter (1966) also distinguished between internal and external types of situations. A situation may be perceived by an individual as demanding skill or effort. A different situation may be seen by an individual as demanding chance,

luck, or the control of others. The first situation is designated a skill situation, while the second situation is termed a chance situation. In this case locus of control is determined primarily by the situation or task.

In summary, the trend of the locus of control research has been in two directions. Early work focused on the locus of control situational variable. Tasks were structured so as to induce high or low control expectancies (e.g., skill or chance conditions), and schedules of reinforcement were controlled in learning paradigms. With the development and refinement of the Internal-External Control Scale, or I-E Scale (Rotter, 1966), the performance of individuals, categorized according to the locus of control personality variable, was investigated in a variety of experimental situations in addition to skill-chance ones. Methodologically, then, the locus of control personality variable has been employed primarily as a selction variable.

When locus of control is considered as a personality variable, it appears predominantly cognitive in nature. That is, cognitive processes such as information-processing, thinking, judging, and believing are assumed to mediate the behavior of internals and externals. Of particular interest to students of perception is the perceptual functioning of individuals categorized as internal or external, especially in light of DuCette and Wolk's (1973) contention that the locus of control construct was originally conceptualized and posited as a general, higher order (or cognitive) construct

which was found to be capable of predicting lower level (or attentive) behaviors. For example, internals were found to be more "perceptually sensitive" than externals in a study investigating awareness of reinforcement contingencies (Ude & Volger, 1969). Interestingly, the field dependence-independence variable appears to be related conceptually to the locus of control personality variable. Essentially, both variables can be viewed as hypothetical congitive style constructs which imply that a variety of behavior can be conceived of as a function of internal or external stimulation, and investigated as a consequence thereof. To continue, it has been implied that the individual's perception of positive and/or negative events as being, or not being, a consequence of his behavior is his locus of control (Lefcourt, 1966; Rotter, 1966). Similarly, in terms of the locus of control situational variable, perception is again implied to serve a central mediational function since the theory suggests that the individual perceives the task as a skill or chance situation (Rotter, 1966). Thus, it appears that some form of perceptual functioning serves an important, if not central, role in the theoretical-conceptual network of the locus of control construct. However, comparatively little attention has been paid to the possible empirical role of perceptual functioning for the locus of control construct. As a result, there have been relatively few systematic studies of the relationships between locus of control and basic perceptual functioning. The organismic

model of trails effects provided a framework in which to conduct a systematic study of the relationships between locus of control (considered as a personality variable) and perceptual changes on geometric illusions.

## The Organismic-Developmental Model of Successive Trials Effects

Recently, an organismic model has been derived in an effort to explain developmental differences in the successive trials effect of the Poggendorff illusion (Bayer, 1972a). The model depicts successive trials effects as a sequential two-factor phenomenon. First, the percept, or illusory response, is established. Second, with repeated trials, the percept (information) is assumed to be integrated (processed) so that the figure is seen more veridically, or accurately. Although the illusory effect is present at first, it decreases with successive trials. In other words, the response is flexible; it changes with repeated presentation of the same data, and information is assumed to be processed more efficiently. This type of perceptual activity is empirically and conceptually associated with articulate perceptual functioning. Lack of a successive trials effect is conceived of as rigid perceptual activity which is empirically and conceptually associated with global perceptual functioning. The illusory effect is present initially, and does not change significantly with successive trials. In other words, the response is rigid; it remains stable with repeated presentation of the same data, and information is assumed

to be processed less efficiently.

Originally, the model was formulated to explain age differences; children did not demonstrate a successive trials effect on the Poggendorff illusion while adults did (Pressey & Sweeney, 1969, 1970). In terms of organismic-developmental theory (Waper & Werner, 1957; Werner, 1961), children are considered to be at a lower, or more global, level of perceptual development than adults who are considered to be at a higher, or more articulate, level of perceptual development. However, it is important to point out that the theory does not presuppose that all adults perceive articulately, or that all children perceive globally. Clearly, organismic variables other than age can also affect perceptual functioning. It has been pointed out that organismic variables such as personality and cognitive style may mediate the successive trials effect in illusions (Bayer, 1972a).

The distinction between articulate versus global perceptual functioning was originally formulated within an organismic-developmental framework by Wapner and Werner (1957), and Werner (1961). Essentially, the major thesis of their theory is that development proceeds in terms of an increase in differentiation and hierarchic integration. The function of perception develops on two levels: the organism differentiates itself from the environment, and there is a shifting along hierarchically ordered genetic levels through which exploration and/or understanding of the

world occurs. For example, the shift from sensory-motor exploration to more sophisticated visual perceptual activity as a means of processing and integrating certain data in the environment is a demonstration of this principle. An essential assumption of Werner and Wapner's theory is that of individuality, the developmental formation of consistently stable differences between people. These researchers make the assumption that individuals do differ with regard to levels of functioning, levels to which they have matured or developed. Such levels may be categorized in cognitive terms and perceptual terms.

Articulate perceivers, as contrasted with global perceivers, have been found to be more able to effectively integrate perceptual data, and therefore respond more accurately on perceptual tasks (Wapner & Werner, 1957; Werner, 1961). Specifically, global perceivers have been found to be more susceptible to geometric illusions than articulate perceivers (Wapner & Werner, 1957). Essentially, this research supports the notion of the development from diffuse perceptual organization to organization in which a specificity of parts standing in clear relationships is observed. Interestingly, Werner (1961) also discusses a concept of primitive personality, which he derived from anthropological findings:

> The diffuseness of the primitive personality has an internal and an external aspect. Internally considered (i.e., the structure of the personality is more 'homogenous,' more globally determined

> with respect to personality as known on higher levels. At the same time it is less articulated with respect to central as against peripheral characteristics (p. 419).

This concept of personality has clear implications for perceptual functioning. Global, diffuse perception is implied in cases where the parts are not well differentiated from the whole, and where information is not processed on a relatively high level of efficiency. Articulate perceptual functioning, and more effective information-processing are implied in a more highly developed personality structure. As Werner (1961) further states:

> In primitive experiences the personality is diffuse in its external relations (that is, the personality considered in relation to the world in which it is embedded). The boundary line shutting off the personality from external spheres is far less definite than it is at the level of highly developed man (p. 421).

Again, one would expect more global, undifferentiated perceptual functioning from a primitive personality structure. It is assumed that increasing individuation of the personality corresponds with more sophisticated perceptual functioning. In line with this, as Rotter (1966) also implies, one would expect internality and ego-control to develop as a function of the organismic variable of age. Generally, as the child develops it would be expected that he would increasingly attribute causality to intrinsic factors, and that his reality contact would become more sophisticated. In fact, it has been found that individuals

do become more internally-oriented (in Rotter's sense) with age (Crandall, Katovsky, & Crandall, 1965).

In light of the above, and empirical findings to be discussed, one may conceptualize internals as articulate perceivers and externals as global perceivers. Locus of control research in the general areas of perception and information-processing will be reviewed in support of this contention.

## Locus of Control Research in Perception and Information-Processing.

Field dependence-independence. Locus of control and field dependence-independence appear to have common behavioral referents and conceptual similarities, but the devices for measuring the variables differ greatly (Lefcourt & Telegdi, 1971). Assertiveness, self-reliance, and the experiencing of oneself as a source of causative power seem to characterize both field-independent and internal individuals (Lefcourt & Siegel, 1970b). However, there is a lack of conclusive evidence that the methods which purport to measure the variables have common variance (Arbuthnot, 1971; Deever, 1968; Fitz, 1970; Willoughby, 1967).

Although an early experimental study (Feather, 1967) did not find a significant relationship between field dependence-independence (as measured by the Gottschalt Figures Test) and internal-external control, more recent studies have demonstrated predicted relationships between the variables. Chance and Goldstein (1971) found that

internality was related to improvement in performance on the Embedded Figures Test as indicated by a significant decrease in discovery time. Internals were considered more effective learners than externals. Lefcourt and Telegdi (1971) employed the variables as independent predictors of cognitive activity. Internals who were also field-independent were found to be more cognitively active on a series of tasks designed to assess detail of verbal production. They also demonstrated a greater readiness (in terms of visual scanning) to perceive relevant task-oriented information. Externals who were field-dependent, however, did not behave as predicted. Crandall and Lacy (1972) found, particularly in girls, that internal children were more able to identify embedded figures correctly in less time than their external peers. They contended that for internals, the information gained from errors appears to be better utilized in ruling out inaccurate responses efficiently. Lefcourt, Gronnerud, and McDonald (1973) found that internal field-independent subjects showed earlier awareness of dissonant elements in a double-entendre word association task. Externals responded almost instantly; they demonstrated practically no time delay to note alternative word meanings. Cohen and Farley (1973), in an investigation of self ("centered") versus other ("decentered") locus of perception, found that field-independence and internal control were related to the decentered locus of perception. These subjects were more differentiated perceptually, and performed both more accurately and flexibly on the test task.

It appears that the research which has attempted to examine the relevant variables has produced mixed results which point to more explicit relationships between internality and field-independence compared with externality and field-dependence.

Attention. Lefcourt (1967) varied directions from high to low cue with regard to defining what reinforcements were available in a level of aspiration task. It was found that externals appeared perceptually deficient; they did not adequately search for reinforcement opportunities. He interpreted his findings as indicating that externals "fail to maintain the kind of internal dialogue that would facilitate cognitive sorting and categorizing...the more explicit directions in the high cue condition, however, allow for the missing cognitive link for external control subjects (p. 377)." In another level of aspiration study, Lefcourt, Lewis, and Silverman (1968) found that internals were more visually attentive than externals. They also demonstrated a greater quantity and variety of visual activity than externals, and reported more task relevant thoughts. The authors concluded that externals may not be able to make full use of their own sensory apparatuses. Subsequently, Lefcourt and Wine (1969) found that internals and externals differ in their deployment of attention as measured by frequency and duration of eye movements, and actual observations. Internals were found to be more perceptually vigilant than externals when encountering problematic events. They were also more likely to be attentive to cues which

provided them with information needed to resolve uncertainty. This was reflected in a greater number of eye movements, and actual observations. Internals were found to be more perceptually viligant than externals when encountering problematic events. They were also more likely to be attentive to cues which provided them with information needed to resolve uncertainty. This was reflected in a greater number of eye movements, and a tendency to make a greater number of detailed observations of the stimulus.

Research findings have indicated that internals are more attentive and vigilant perceivers than externals. It also appears that internals are more adept at processing visual information within a cognitive task than externals.

Recognition processes. Phares (1962) related skill-chance variables to changes in visual recognition thresholds of pain associated stimuli. Employing a verbal learning paradigm, he found that perceptual vigilance developed more rapidly for subjects in a skill-controlled condition than for subjects in a chance-controlled condition. Blackman (1962) also found that subjects in a skill condition were more accurate in recognizing changes in the task than chance condition subjects. Strickland and Rodwan (1964) employed a card-guessing task in a signal detection paradigm to study perceptual threshold decision making by internals and externals. They found that the greater the externality of the individual, the stronger the likelihood of a false positive error. Interestingly, if one extrapolates this finding

to an illusion task, externals could be described (if they do not demonstrate a successive trials effect) as accepting a signal and continuing with it despite prior information. Lipp, Kolstoe, James and Randall (1968) found, contrary to prediction, that physically disabled externally-oriented subjects were more perceptually vigilant (as indicated by a lower threshold of recognition) than internals in a perceptual defense paradigm. The authors interpreted their results as suggesting that an internal's performance in an external situation (i.e., actually being disabled and therefore unable to exercise the degree of control one is accustomed to) is disrupted more easily than for an external. On the other hand, McDonald and Hall (1969) reported that internals perceived emotional disorders as relatively more threatening and debilitating to themselves than did externals. Contrary to prediction, disabilities other than emotional disorders were not viewed as more debilitating by externals. Type of disability may be an important variable to consider in the investigation of perceptual vigilance in internals and externals. More recently, Sauber (1971), employing a perceptual defense paradigm, found, as Lipp et al (1968) had predicted, that normal externals had higher recognition thresholds than normal internals. Jones (1973) found that externally-oriented schizophrenics were more likely to demonstrate a perceptual defense effect whereas internally-oriented schizophrenics were more likely to show a vigilance effect.

Despite some mixed findings regarding perception of disability, internals have been found to have lower recognition thresholds, and have been found to be more capable of recognizing changes in thresholds than externals.

Reaction time. Cromwell, Rosenthal, Shakow, and Zahn (1961) compared schizophrenic patients to normals on a reaction time task. They conceptualized schizophrenics as externally-oriented subjects who would not perform at normal levels because the task involved taking advantage of autonomous (or self-control) conditions. It was found that normals, unlike schizophrenics, were able to improve their reaction time performance. Lefcourt and Siegel (1970a) found that field-independent males performed more successfully on a reaction time task under self-control conditions than did field-dependent males. This relationship, however, did not hold for females.

Although it appears that no particular study has directly compared normal internals to normal externals, the data suggest that internals are more capable of modifying their reaction time performance, and that they react more quickly in experimental conditions.

Environmental perception. Kish, Solberg, and Uecker (1971) found that internally-oriented hospitalized psychiatric subjects perceived their environment as significantly more supportive, practical, affiliative, involving, clear in its expectations, and allowing of more patient autonomy than did their external counterparts. Interestingly, internals per-

ceived the same environment as more custodial. Somewhat in line with this, Ferguson and Kennelly (1974) found that normal internals perceived authority figures as more supportive and encouraging of constructive manipulations particularly when they were experiencing difficulty manipulating successfully within their environment. Environmental issues focused on school-related activities.

In sum, the majority of the research findings from varied vantage points indicate that internals are more likely to be field-independent, more attentive and vigilant perceivers, have lower perceptual rcognition thresholds, be quicker perceptual reactors, and in general be more effective perceptual learners than externals.

Information-processing and learning. Seeman and Evans (1962) found that in a hospital setting differences in alienation were associated with differential learning. More alienated tubercular subjects (externals) scored lower on objective tests of knowledge regarding tuberculosis in contrast to less alienated subjects (internals). Subsequently, Seeman (1963) found that reformatory inmates, demonstrated differential knowledge from three sources: information regarding immediate reformatory situation, parole matters, and long-range post-reformatory opportunities. Internals were superior in the retention of parole material. Seeman contended that this type of material most clearly implied personal control over events, and that expectancies for control govern subsequent attention and acquisition of information.

Davis and Phares (1967), using an attitude influence task, varied the explicit environmental cue structure of the task so that there were three task situations: skill, chance, and ambiguous conditions. In general, it was found that internals engaged in more information-seeking behavior than externals when they perceived the information as being useful in controlling the environment; and in ambiguous situations internals sought more information about the person they were attempting to influence, and learned more about the content of the issues involved in the task. Phares (1968), using a computer simulation learning task, found that internals utilized more information extracted from an ambiguous situation than externals. Interestingly, no difference was found between internals and externals for information acquisition, but information retention tended to be more accurate for internals.

In a group problem solving experiment, Sutherland (1972) employed a block design task. Internal and external subjects were paired and required to coordinate their efforts to solve the task. In the low information condition, it was found that internals predictably asked more questions directed at problem solving than did externals.

In a study aimed at investigating information-processing strategies of internals and externals, Bartell, DuCette, and Wolk (1972) employed a free recall paradigm. Subjects did not differ in their total recall scores. It was found, however, that internals manifested significantly more

clustering in their free recall. Internals also employed a greater variety of different strategies, or organizational processes, compared to externals. The authors contended that internals were more active in the organization and utilization of the given information. In another recall study, Pines and Julian (1972) found that internals were more responsive to varied levels of information difficulty. In a serial anticipation task, internals focused on task requirements as a way of maximizing information pursuant to successful performance, and performed more effectively in the relevant cue condition. The authors concluded that internals learn to profit from experience, and modify their original cognitive sets more effectively than externals.

DuCette and Wolk (1973) found that internals demonstrated greater ability to extract information from the environment in order to solve a given problem. Tasks were constructed to warrant either skill or chance, and it was found that internals were more sensitive to environmental stimuli; they demonstrated an ability to use experience to improve their performance. Internals were also more quick to grasp a rule in an ambiguous situation in order to solve a problem.

Pines (1973) studied storage and retrieval of information from memory in a free recall task. It was found that internals responded more to task opportunities to organize the recall words than did externals, and additional time for recall was a more potent facilitator for internals' memory performance. In addition, the performance of internals was

more flexible; their information-processing activity varied as a function of successive encounters with the task material. Pines concluded that internals and externals differed in direct and successive encounters with problem material both in terms of seeking and processing task-relevant information.

Studies investigating differential learning strategies of internals and externals have also provided data pertinent to the information-processing dimension of the locus of control construct. Baron, Cowan, Ganz, and McDonald (1974) studied simple form discrimination under differential informational feedback conditions. It was found that both children and adults who were classified as internals performed more effectively when feedback was intrinsic (their success was self-discovered). Externals, on the other hand, were more effective when feedback was extrinsic (the experimenter provided verbal praise). Wolk and DuCette (1974) investigated intentional performance and incidental learning as a funcion of locus of control and task dimensions. It was found that internals consistently found more errors in the task (the intentional performance), and thus appeared more perceptually sensitive. Internals also demonstrated higher levels of incidental learning than externals. The authors suggested that internals demonstrate more effective preattentive processes than externals. Wolk and DuCette concluded that the data "demonstrate the ability of the internal to use his cognitive system to extract information and then to use this information more efficiently (1974, p. 98)." In terms

of task dimension, it was also found that externals, under high cue conditions, can shift their attention in a task more readily than internals but attention to other task aspects is reduced.

In sum, the majority of the findings indicate that internals are more efficient processors of task-relevant information than externals. Internals tend to seek, utilize, and process information relevant to task success more effectively than externals. Internals also appear to perform more effectively when they rely on their own feedback while learning, and put information learned to more efficient use.

At this point, research on successive trials effects in the Poggendorff and Mueller-Lyer illusions will be reviewed. The major findings of interest to the present study involve organismic variables, particularly age, since the organismic model of trials effects was derived on the basis of studies which have employed age as an independent variable.

## Successive Trials Effects in the Poggendorff and Mueller-Lyer Illusions.

Poggendorff illusion. Several studies have investigated the effect of practice on the Poggendorff illusion in adult subjects. Cameron and Steele (1905) initially attempted to determine the effect of repeated measures on the magnitude of the illusion. After some initial pre-training, one subject served in the study. Employing a method of adjust-

ment, it was found that the illusory effect of the figure disappeared over an extended series of 3,200 trials.

Pressey and Sweeney (1969) employed a method of production and a variation of the Poggendorff illusion, which was highly correlated with the classical figure, to investigate successive trials effects for adult (college student) subjects. Across six trials, a highly significant practice effect was found.

In two experiments, Pressey, Bayer, and Kelm (1969) used a method of adjustment and production to investigate the magnitude of the illusion in a pathological population (schizophrenics) and normals (Hospital domestic and nursing staff). Across eight trials, a significant trials effect was found in both subject groups, but it did not demonstrate a practice effect. It is difficult to generalize from this finding, especially in light of the phenomenon of institutionalization which often affects both patients and staff in mental institutions (Goffman, 1961; Stanton & Schwartz, 1954). Furthermore, domestic staff in mental hospitals are frequently former patients.

Other studies have investigated the problem from a developmental perspective. Vurpillot (1957), and Leibowitz and Gwozdecki (1967) have found,employing group designs and methods of adjustment, that the illusion decreases as age increases from approximately five years to adulthood. In Vurpillot's study, the different age groups (5 to 26 years) were combined and given 20 practice trials. Practice

effects were not demonstrated. However, the possibility of demonstrating any systematic practice effects may have been confounded by collapsing groups across the organismic variable of age since there is data which indicate that various age groups differentially perceive the illusion over trials (Pressey & Sweeney, 1969, 1970).

Lastly, Pressey and Sweeney (1970) studied trials effects in children and young adolescents (approximately 8 to 14 years old). Although the illusion decreased with age, it did not change as a function of successive trials.

Muller-Lyer illusion. A large number of studies have investigated the effects of practice on the Mueller-Lyer illusion in contrast with the limited number of reports for the Poggendorff illusion.

Judd (1902) initially found, employing a method of adjustment, that with repeated trials the illusion dissipated and even reversed after an extended series of 980 trials. Lewis (1908) replicated Judd's findings with a larger sample of subjects who were given 100 trials a day until the illusory effect disappeared.

Subsequent studies have found successive trials effects for the Mueller-Lyer illusion while also investigating a variety of other variables. Lewis (1908), and Mountjoy (1958a) investigated the effect of exposure time, and also demonstrated successive trials effects. They found that increased exposure to the stimulus figure is related to a greater amount of illusion decrement over trials. Mountjoy

(1961) manipulated visual field size while studying successive trials effects. He did not demonstrate an interaction between illusion decrement over trials, and the size of the visual field within which the figure lies. Parker and Newbigging (1963) demonstrated successive trials effects and transfer effects for the Mueller-Lyer illusion. Dewar (1967c) found a markedly significant practice effect over 50 trials. He also demonstrated a significant transfer effect.

Dewar (1967b, 1967c, 1967d) manipulated physical characteristics of the targets in his investigation of successive trials effects. Practice effects were greatest when the angle formed by the obliques was smallest, 30 degrees (1967d). The effects of lengths of the obliques, however, did not interact with the decrease in illusion over trials (1967b, 1967c).

Organismic variables have also been studied in relation to the Mueller-Lyer illusion's successive trials effect. Crossland, Taylor, and Newsom (1929) demonstrated a practice effect, but did not find that the effect varied as a function of intelligence. Eysenck and Slater (1958) did not find a successive traisl effect nor were neuroticism, and the introversion-extroversion dimension related to magnitude of the illusion or changes in the illusion with repeated exposure. Investigating sex differences, Dewar (1967a) found a trials effect but no main effect for sex. However, it was found that while males showed a steeper decline over trials, females performed on the same level with males after

300 trials.

Interestingly, the organismic variable of age has provided relatively consistent data which indicate that the older the subjects the larger the decrease in illusion with repeated trials. Noetling (1960) found that over 20 trials adults destroyed the illusion more effectively than six groups of children (aged 5 to 10 years). More recently, Barclay and Comalli (1970) supported this finding in another age comparison study. Adults, unlike children (aged 8 to 10 years), demonstrated greater illusion reduction over 52 trials.

At this point, only one investigator (Sweeney, 1973) has systematicallly evaluated practice effects in the two forms (Ingoing and Outgoing) of the Mueller-Lyer illusion in a well-controlled experimental study. Nearly all other investigators have studied the Mueller-Lyer illusion by measuring one form in terms of the other. In other words, an illusion was measured with another illusion. Binet (1895), however, did study the forms of the Mueller-Lyer illusion separately, but he did not use appropriate control conditions. In any event, Sweeney found that both forms of the illusion decreased significantly with practice, and that differential rates of decrease for each form were not present.

## Statement of the Problem

The primary purpose of the present study was to assess the predictive capacity of the organismic-developmental model of successive trials effect (Bayer, 1972a) for two

variables: the locus of control personality variable and instructional set. The model was derived originally as an explanatory effort to integrate data from previous studies which employed the organismic variable of age in the investigation of the Poggendorff illusion, which is an illusion of direction (Pressey, 1970).

The findings cited on trials effects on illusions indicate that learning can take place in the Poggendorff illusion, but that the learning mechanism appears to interact with organismic variables, particularly age. Other organismic variables may also influence the learning mechanism of this illusion. The organismic model of trials effects conceptualizes a major component of the learning mechanism of illusions within an information-processing framework. In line with this,the locus of control personality variable was a viable organismic variable to employ in studying practice effects in illusions because of the large body of data which demonstrate a variety of consistently differential perceptual information-processing behavior as a function of internal-external control.

In general, the demonstration of successive trials effects for the Mueller-Lyer illusion has been documented more systematically than for the Poggendorff illusion. At this point, however, the specificity of the successive trials effects for adults, in contrast with children, on the Mueller-Lyer illusion has not been adequately explained. A similar set of findings was reported for the Poggendorff illusion,

and the organismic model of trials effects was developed to explain these results. The model can be applied in the same manner to this similar set of findings for the Mueller-Lyer illusion. But the problem still exists as to whether or not the model can predict differential effects as a function of other experimentally specific organismic variables when they are fit into the model. It has already been pointed out that internals can be conceptualized as articulate perceivers, and externals can be conceptualized as global perceivers. The major question is: will internals perform articulately by demonstrating a successive trials effect, and will externals perform globally by demonstrating little, if any, successive trials effect on different geometric illusions when the organismic variable of age is held relatively constant at an adult age level? Furthermore, can these effects, if present, be modified by instructional set?

The first experiment to investigate the major question was a pilot study (Bayer, 1972b). The performance of internals and externals was compared over trials on the Poggendorff illusion, and the Outgoing form of the Mueller-Lyer illusion. The prediction of most interest was that internals should demonstrate greater successive trials effects on both illusions. In other words, with repeated trials, it was contended that internals should be able to destroy the illusions more readily than externals because previous research had demonstrated that internals were more perceptually vigilant, attentive, and more efficient at

processing visual information than externals. The pilot findings strongly tended to support this prediction, at least with regard to the Poggendorff illusion. In the analysis of variance of the Poggendorff illusion data, there was one significant main effect: trials. The F value for trials was 2.15 (df = 9/117; p .05). None of the remaining F values was significant at the .05 level. However, the F value for the locus of control by trials interaction was 1.92 (df - 9/117; p .06). The relationship of the Poggendorff illusion to locus of control across trials is shown in Figure 1. It is important to note that the functions in Figure 1 were obtained from a relatively small sample of adult subjects. The group of internals comprised eight subjects, and the group of externals comprised eight subjects. Subjects were defined by the lower and upper quartiles of the distribution of 32 subjects' scores on Rotter's (1966) I-E Scale. It is also important to note that only ten trials were employed with the illusion. Apparently, this number of trials was sufficient enough to demonstrate a significant trials effect, and a substantial, though not statistically significant, locus of control by trials interaction.

The relationship of the Outgoing Mueller-Lyer illusion to locus of control over trials is shown in Figure 2. Clearly, a successive trials effect exists, but it does not demonstrate a practice effect. Interestingly, Sweeney (1973) found that there is a significant trials effect for the Outgoing Mueller-Lyer illusion. It appears, however, that

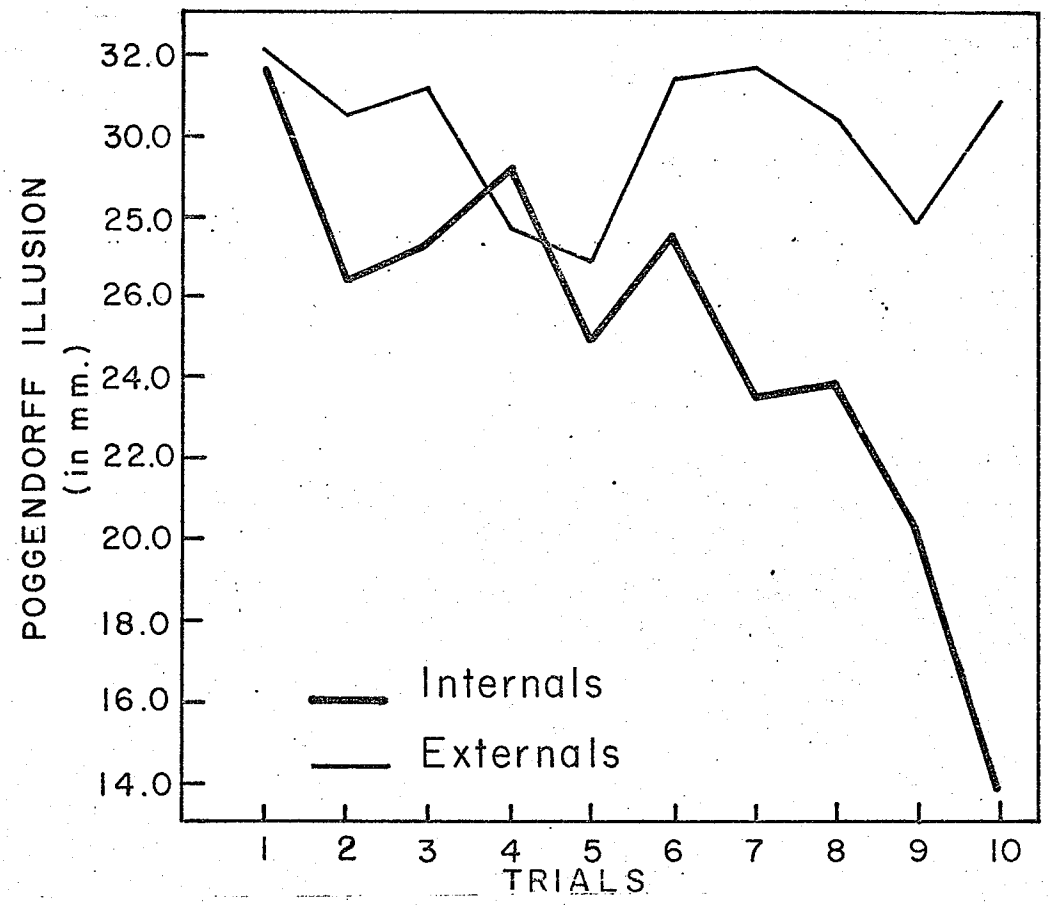


FIGURE. 1. Relationship of the Poggendorff to locus of control.

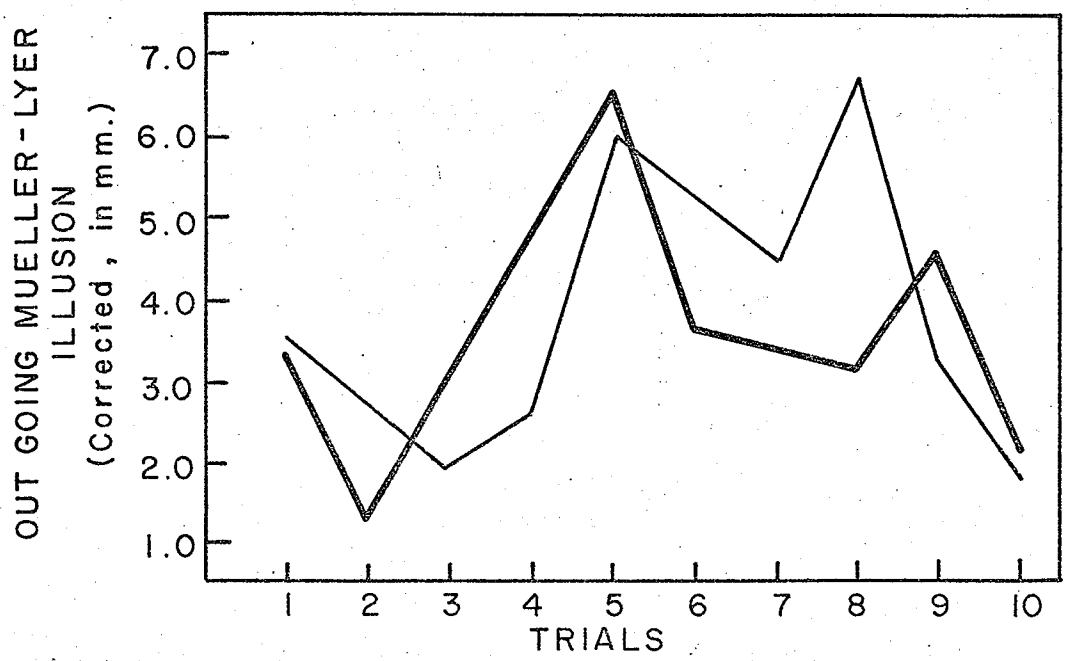


FIGURE. 2. Relationship of the Outgoing Mueller-Lyer to locus of cibtrik. control.

a greater number of trials are required in order for the practice effect to be demonstrated. Sweeney demonstrated the effect within 36 trials, and Mountjoy (1958a, 1958b) has shown the effect for the full Mueller-Lyer figure within 31 trials. However, the question of differential learning of either form of the Mueller-Lyer illusion as a function of locus of control still remains to be tested adequately.

The present study intends to examine perceptual changes on two geometric illusions--the Poggendorff illusion and the Ingoing form of the Mueller-Lyer illusion. The Poggendorff illusion has been chosen because the organismic model of trials effects was derived from Poggendorff illusion data, and the pilot research for the present study indicated very encouraging results. The Ingoing form of the Mueller-Lyer illusion was chosen for two reasons. First, it is important to assess the predictive generalizability of the organismic model of trials effects. Therefore, a form of the Mueller-Lyer illusion was chosen as it is an illusion of extent (Pressey, 1970). Second, the Ingoing Mueller-Lyer illusion, in contrast with the Outgoing form, may be more appropriate to employ when testing organismic variables since a greater magnitude of illusion is present throughout successive trials, and the function is more linear (Sweeney, 1973). In other words, the Ingoing Mueller-Lyer provides a greater range within which any differential effects may be demonstrated.

The second variable of interest to the present study

is instructional set. Comparatively little research has concentrated on the effect of instructions on perception of geometric illusions. The earliest researcher to study the problem was Benussi (1904, 1912, 1914). He found that the Ingoing and Outgoing Mueller-Lyer illusions were greater when the subject was instructed to perceive the whole figure as it subjectively appeared to him. The illusory effect decreased when the subject was given real, or objective, instructions with an emphasis on isolating the figure into parts, and thereby perceiving the figure as it actually was in reality. In two other experiments, Day (1962) focused on the effect of apparent versus objective instructions for the Mueller-Lyer illusion practice effect. In the first experiment, a method of adjustment was employed. One group of subjects was instructed to adjust the distances until they appeared equal (apparent instructions condition), and the other group was instructed to adjust the distances so that they would be physically equal (objective instructions condition). Over 55 trials, the results indicated no differences as a function of instructional set. However, another aspect of the study may have confounded the findings. Subjects focused on fixation points, which logically limited their ability to scan the figures. In the second experiment, a method of adjustment was again employed, and target size was also manipulated. Groups of subjects were given differential instructions along the apparent-objective dimension. Over 45 trials, the difference between instructions

between instructions was not statistically significant. Descriptively, however, apparent instructions were not related to an illusion decrement while objective instructions weres. Supportive of this observation was a significant effect on the trend in trial means as a function of the differential forms of instructions.

In the pilot for the present study, instructions were apparent, or phenomenological. In the present study, instructional set was manipulated along a general dimension of apparent versus objective instructions. Instructions were futher defined within a framework of explicitness of information. The major question is: what effect, if any, will instructional set have on the perception of geometric illusions over trials for internal and external control subjects when task-relevant cue explicitness is manipulated?

Essentially, apparent instructions were conceptualized as providing only global information for the subjects. This information did not elaborate any of the explicit task-relevant cues subjects would require to perform successfully on the task. Thus, the subject processed the visual information contained in the task on her own. Objective instructions, on the other hand, provided articulate information for the subjects. This information elaborated some of the explicit task-relevant cues subjects would require to perform successfully on the task. Thus, the subject processed the visual information contained in the task with the aid of

factors (cues) outside herself.

Research on illusions and instruction set (Benussi, 1904, 1912, 1914; Day, 1962) leads to the prediction that, generally, objective instructions should facilitate more effective performance over trials on geometric illusions. Several research reports, however, provide a framework from which to make more specific predictions for the effects of instructional set on the locus of control personality variable.

Cromwell, et al (1961) initially found that externals performed most poorly when they were granted some autonomy in completing the task. On the other hand, internals performed most effectively under authomous conditions. Crowne and Liverant (1963) found that externals defer to the judgment of others and benefit more from the structuring of a task by others. Internals, on the other hand, were more likely to be self-reliant, and actually benefit from greater opportunity for control. These authors concluded that externals should be more affected by experimental instructions that explicate the purpose of and method by which to succeed in a given task. Later, Rotter (1966) hypothesized that the presence of explicit environmental cues regarding the contingency between behavior and outcome should diminish the importance of the subject's generalized expectancy for internal or external locus of control.

Lefcourt (1967) found, in a level of aspiration task, that as task directions became more explicit in clarifying

the task, externals performed like internals. He concluded that the more explicit directions in the high cue condition allowed for the missing "cognitive link" for externals. Subsequently, Lefcourt and Wine (1969) reported that externals, again, shifted their performance up to the level of internals in an attention deployment task when the experimenter's directions provided the subject with more explicit task-relevant cues. In both of the above studies, low cue conditions were related to differential internal-external performance, while in the high cue conditions externals performed like internals.

Another set of studies (Nickels & Williams, 1970; Williams, 1971) manipulated scheudles of reinforcement in skill-chance paradigms in the investigation of task structure and locus of control. Essentially, it was found that when the task is highly structured and unambiguous, performance differences for internals and externals are attenuated.

In sum, research reports indicate that increasing the structure of the task by clarifying explicit task-relevant cues attenuates internal-external differences. It also appears that greater clarification of the task increases the efficacy of externals' performance, elevating it to the level of internals who already perform more effectively.

In general, the present study was expected to contribute to psychological knowledge in several unique ways: (a) to assess the predictive capacity <u>and</u> generality of the

organismic model of trials effects; (b) to determine if geometric illusions can be employed to differentiate perceptual performance of internals and externals; (c) to determine if apparent versus objective instructions defined along a dimension of task-relevant cue explicitness affect perception of the Pöggendorff illusion as well as the Ingoing Mueller-Lyer illusion; and (d) to determine if a successive trials effect can be replicated with the Ingoing Mueller-Lyer illusion when a psychophysical method of production is employed.

Hypotheses

Two sets of hypotheses were made for each illusion. The first set involved locus of control, and the second set involved instructional set.

1. (a) It was hypothesized that internals would perceive both illusions more accurately than externals.
   (b) It was predicted that with successitve trials internals would be progressively more accurate in their perception of both illusions than externals.
   (c) It was predicted that with successive trials both illusions would be perceived more accurately.
2. (a) It was hypothesized that objective instructions would facilitate more accurate performance on both illusions as contrasted with apparent instructions.
   (b) It was predicted that internals and externals would differ as a function of objective versus apparent

instructions. Under objective instructions less internal-external difference were anticipated. Under apparent instructions, it was anticipated that internals would perform more effectively than externals.

(c) Consistent with previous research, it was predicted that under the condition of objective instructions, individuals would perform more accurately over trials on both illusions than under the condition of apparent instructions.

(d) It was predicted that with objective instructions there would be less difference in the performance of internals as compared to externals over trials, but with apparent instructions there would be progressively increasing differences between internals and externals, over trials, with externals performing progressively less effectively.

In view of the study's large number of hypotheses, the reader is alerted to the fact that throughout the Results and Discussion chapters the hypotheses will be followed by their respective identifying number and letter. Thus, the reader will be able to refer back to the hypotheses section, and get a precise reading of each prediction if needed.

# CHAPTER II

## METHOD

### Subjects

Subjects (Ss) comprising the experimental sample were 37 women enrolled in introductory psychology at the University of Manitoba, and 47 paid female volunteers. In all, there was 84 experimental Ss. Only Ss with normal vision, with or without glasses, were permitted to participate in the experiment. Ss who normally wore glasses did do during testing. The age of the Ss ranged from 18 to 44 years, with a mean age of 27.18 years. Before the experiment, Ss completed a Basic Information Sheet (see Appendix A).

Females were employed as experimental Ss for several reasons. It is well known that females are more field-dependent than males (Witkin, et al., 1954), and that locus of control and field dependence-independence have been found to be empirically related along some perceptual dimensions (Chance & Goldstein, 1971; Lefcourt & Telegdi, 1971). In addition, one of the tasks which was used in the present study is the Poggendorff illusion which has been found to be significantly correlated with the Embedded Figures Test (a traditional measure of field dependence-independence) for women (Pressey, 1967). Therefore, in an attempt to demonstrate maximal effects, females should demonstrate a greater

range of response on at least one of the test tasks. In addition, it has been found that the greater the degree of field-dependence, the greater the susceptibility to geometric illusions (Gardner, 1957), and women perceive a larger Poggendorff illusion than men (Pressey, 1965).

The Internal-External Scale: Recent Developments

Ss were individually administered the Internal-External Control Scale (see Appendix B) at the completion of the experiment so that the E would not know if a S was classified internal or external. The I-E Scale is a 29-item (six of which are fillers) forced-choice paper and pencil test, composed of internal and external statements, which measures how an individual views the control of his reinforcement. In other words, the scale categorizes an individual's generalized expectancy of how reinforcement is controlled into one of two categories: internal or external. The scale is scored as a function of the total number of external statements the S chooses. Thus, a high score represents an external orientation, and a low score represents an internal orientation. Ss were classified as a function of the conventional median-split. The median for the total sample was 10.5. Therefore, Ss with a score of 11 and above were designated externals and Ss with a score of 10 and below were designated internals. Thus 42 Ss were classified as externals, and 42 Ss were classified as internals. The total sample mean I-E score was 9.85, and the standard deviation was 4.51. The median of the student sub-sample

was 10.5. The mean was 10.03, and the standard deviation was 4.16. The median of the paid volunteer sub-sample was 11.5. The mean was 9.70, and the standard deviation was 4.80. A t-test (two-tailed) of the independent means (Bruning & Kintz, 1968) of the I-E scores of the student sub-sample and the paid volunteer sub-sample indicated a t-score of 0.14, which was not significant at the .025 level.

The I-E Scale, currently in widespread use, was developed by Rotter (1966). Recently, several research developments have shed new light on characteristics of this instrument. The scale was originally assumed to be measuring one bipolar locus of control factor--internality-externality. Some of the earliest research which questioned this assumption approached the issue from a broad theoretical framework focusing on such issues as race (Gurin, Gurin, Lao, & Beattie, 1969), social group norms (Thomas, 1970) and social action involvement (Levenson, 1972).

One of the major psychometric issues involving Rotter's (1966) original scale concerns its dimensionality. Mirels (1970) factor analyzed the scale, and derived two factors. The first described the respondent's inclination to assign greater or lesser importance to hard work and ability qualities, rather than emphasizing luck and chance as determinants of success. The second described the respondent's acceptance or rejection of the idea that an individual citizen can exert some control over political and/or world affairs. Recently, Viney (1974) replicated Mirels' findings

in an Australian sample, and suggested study of item predictiveness rather than generalized expectancy.

Joe (1972) also investigated the scale's dimensionality and derived two factors: one relating to a political conservatism ideology, and another relating to an optimism-pessimism dimension. Abramowitz (1973) approached the issue from a utility perspective, and found that political commitment was accurately predicted by Mirels' (1970) factor describing political and world affairs. Reid and Ware (1973) employed Canadian women as a normative sample, and derived two factors: Fatalism and Social Systems Control.

Levenson (1973) investigated the issue in a psychiatric sample. Hospitalized psychiatric patients, in general, were found to be more external than neurotics. Factor analysis data indicated that the dimensions of Powerful Others and Chance Control were consistent factors in hospitalized patients, but not for normals. Kleiber, Veldman, and Menaker (1973) questioned the original scale's item pairing to assess whether the pairing truly represented the opposite ends of a bipolar continuum.

Other investigators have questioned the standardization of the original James-Phares I-E Scale. James and Shepel (1973) employed a large sample of Canadian university students, and derived two factors. The first dealt with the generalized expectancy that personal events in one's life are governed largely by luck and fate. The second dealt with the generalized expectancy concerning the ability

to predict and control the behavior of other people. Abramson, Schludermann, and Schludermann (1973) also employing a Candian student sample essentially verified Mirels' (1970) findings.

Lastly, Collins (1974) factor analyzed the scale from a theoretical perspective of perception-self-perception. This perspective leads to two dimensions along which observers may differ in their casual attributions of events: predictability and lawfulness versus chance, and situational versus dispositional attributions. Four world-view factors were found to be superimposed on a common theme. Interestingly, however, Boor (1974) found that relationships between internality and externality and other dependent variables can depend on the specific behaviors assessed in the study. For instance, he found that Mirels' (197) factors were not differentially related to academic achievement. This finding argues for unidimensionality of the scale, at least with regard to academic achievement.

In conclusion, it appears that Rotter's (1966) original scale may not be entirely unidimensional. A variety of factors have been derived from the scale. Clearly, a major defect of the scale is the fact that it includes items at both personal and ideological levels. Theoretically, however, it is possible that while the I-E Scale may be multidimensional in nature, the locus of control construct may still be a unidimensional one. The scale may not yet be pure enough to measure the generalized expectancy of internal

versus external control of reinforcement, and different phenomena may or may not be differentially related to the factor structure of the scale. A general criticism of the research which has evaluated the scale is that factor-analytic methodologies have been employed inconsistently, and that different proportions of the variance have been accounted for by different factors in different subject populations. Joe and Jahn (1973) also indicated that phi correlation coefficients, which have been previously employed in factor-analytic studies of internal-external items, may not be as appropriate as product-moment correlations. They contend that the phi correlation technique may limit the variability in item scores and the size of the item correlations.

In the present study, internality-externality was treated as a unidimensional construct. It was not expected that a factor breakdown would affect perceptual performance. In essence, at this time, there is no basis to make differential predictions regarding perceptul performance as a function of I-E Scale factor components. If no internal-external differences are found, however, then the data can be reanalyzed as a function of the scale's factor structure.

## Appartus

The apparatus was a target holder for the geometric illusions. It consisted of a white board that was 36.8 cm wide and 39.5 cm high. The face of the target holder was tilted backward 20 degrees from the perpendicular so that

it was easier for the S to mark her response directly on the target. A chin rest was placed in front of the holder (and perpendicular to the line of sight) so that the distance between the S's eyes and the face of the target was approximately 41 cm.

Materials

Two test target cards, one control card, and two practice cards were prepared (see Figures 3 to 7). The cards were printed in black ink on 21.5 cm by 28.0 cm sheets of white paper. All lines and dot(s) on every card were .5mm wide. The Mueller-Lyer cards (i.e., test target, control, and practice)were prepared with the sheets positioned widthwise. In other words, these figures were drawn on 21.5 cm high by 28.0 cm wide sheets of paper. The Poggendorff cards were prepared with the sheets positioned lengthwise. In other words, these figures were drawn on 28.0 cm high by 21.5 cm wide sheets of paper.

The first test target was the Ingoing Mueller-Lyer illusion in horizontal orientation (see Figure 3). This illusion was also chosen because, at a moderately large visual angle, it is more capable of demonstrating a larger magnitude of illusion than the Outgoing Mueller-Lyer illusion (Bayer & Pressey, 1972; Sweeney, 1973). As such, it was again thought that a more flexible learning task might allow for unique data which would contribute to psychological knowledge in a new manner. The distance between the apices of the

of the target was 60 mm, and its maximal dimensions were approximately (horizontal by vertical) 8 deg 18 min by 3 deg. The obliques were one-quarter of the length of the distance between the apices, or 15mm; and the angles formed by the obliques were 45 degrees. The test target was centered about an imaginary point 60 mm from the top of the sheet, and 14 cm from either side. A dot was located to the left and below the right apex of the target. The location of the dot was determined in part by the length of the obliques, and the distance between the apices. Thus, the dot was located 15 mm to the left of the target's right apex, and 60 mm below the (imaginary line of ) distance between the apices of the test target. The purpose of this dot was to serve as an initial point which the S employed in her reproduction of the actual target figure above. Essentially, the S was required to reproduce the distance between the apices of the illusion by placing a dot to the right of the given dot.

The psychophysical method of production, which was employed in the present investigation, has been found to be a reliable and valid technique for measuring geometric illusions (Bayer & Pressey, 1972; Pressey & Sweeney, 1969, 1970; Pressey, Bayer, & Kelm, 1969).

A control card was used for the Mueller-Lyer test target (see Figure 4). It served as a control for length--the horizontal distance between the apices of the test target. The control card was identical, in terms of placement,

to the Mueller-Lyer test target except that no angles were drawn; only dots are drawn where the apices had been.

The logical necessity of employing a control condition, especially when organismic variables are being investigated, has been pointed out by several investigators (Bayer & Pressey, 1972; Pressey, personal communication, 1969; Sweeney, 1973). In the present study it was possible that locus of control affects measurement of non-illusory figures. In other words, a S may have a pre-experimental response bias to underestimate a standard (or non-illusory) line. Hence, when arrowheads are added to a standard line, the illusory effect of shrinkage could combine with a S's underestimation bias yielding a disproportionately large illusion. Similarly a S may have a pre-experimental response bias to overestimate a standard line. Hence, when arrowheads are added to the standard line, the illusory effect of shrinkage could combine with a S's overestimation bias yielding a disproportionately small illusion. The same argument holds for other illusions of extent, but not for the Poggendorff illusion which is an illusion of direction. At this time, a control condition has not been devised for the Poggendorff illusion. However, it seems reasonable to assume that if a S does not have a response bias regarding estimation of length then it may be less likely that she will have a response bias regarding estimation of direction. This is true unless, of course, estimation response biases are limited to either length or direction. In any event, recent research on the

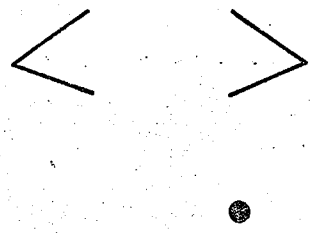

Figure. 3. Ingoing Mueller - Lyer illusion.

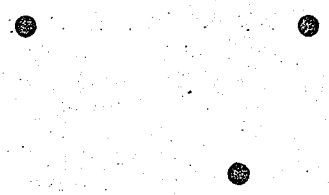

Figure. 4. Ingoing Mueller - Lyer control card.

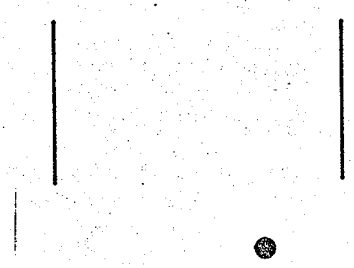

Figure. 5. Practice Ingoing Mueller - Lyer illusion card.

Figure. 6. Poggendorff illusion.

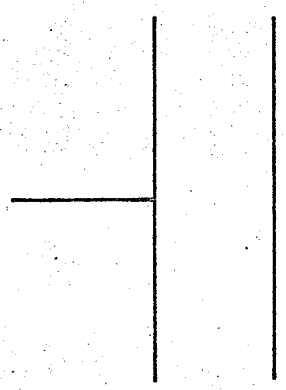

Figure. 7. Practice Poggendorff illusion card.

Poggendorff illusion has replicated previous findings with other psychophysical methods (Pressey & Sweeney, 1970; Pressey, Bayer, & Kelm, 1969).

A practice Mueller-Lyer card was also prepared (see Figure 5). This card was identical, in terms of placement, to the Mueller-Lyer test card except that the obliques were 180 degree angles, or lines which were perpendicular to the (imaginary line of) distance between the apices of the figure and parallel to each other. These obliques were 30 mm in length.

The second test target was the Poggendorff illusion in vertical orientation (see Figure 6). Again, this illusion was selected because it was from research with this illusion that the organismic model of trials effects was derived. Moreover, in terms of the generalizability of the results, it was contended that two types of illusions were appropriate to study. The test target consisted of two 18 cm vertical lines which were parallel to each other, and located 2.85 cm apart. A 3.8 cm diagonal line joined the vertical line on the left at a distance 3.8 cm from the top of that line. The angle formed by the diagonal and vertical lines was 20 degrees. The maximal dimensions of the target were approximately (vertical by horizontal) 23 degrees 42 minutes by 6 degrees. The target was centered about an imagined vertical line which divided the sheet equally (i.e., at the 10.75 cm point). The vertical lines began at points 60 mm from the top of the sheet.

A practice Poggendorff card was also prepared (see Figure 7). This card was identical, in terms of placement, to the Poggendorff test target except that the diagonal was perpendicular to the left vertical line, and joined at a distance 9 cm from the top of the line.

## Experimental Design

Two 2 x 2 x 36 analyses of variance with repeated measures on one variable were employed (Winer, 1962). In each analysis there were two between factors: locus of control (internal, external), and instructional set (objective, apparent); and one within factor: trials.

Four groups, as follows, comprised the study's experimental sample:

| Group | Unpaid S's | Paid S'S |
|---|---|---|
| 1 Internal (N = 21), Objective instructions (IO) | 9 | 12 |
| 2 Internal (N = 21), Apparent instructions (IA) | 11 | 10 |
| 3 External (N = 21), Objective instructions (EO) | 8 | 13 |
| 4 External (N = 21), Apparent instructions (EA) | 9 | 12 |

Order of presentation of the test targets, control card, and instructional set were counterbalanced to experimentally control for sequence effects. Therefore S's, alternately, were randomly assigned to an internal or external experimental group. Ss reported for testing in the order in which they signed up.

Procedure

All Ss received 36 successive trials of each illusion, and the Ingoing Mueller control card. Each S was tested individually in a small experimental room. The S sat in front of the target holder, and went through the following procedure:

(a) S was given a practice card sequence (Ingoing Mueller-Lyer, Poggendorff, and Ingoing Mueller-Lyer control) which was arranged in the order in which she was to be tested, and oriented to objective or apparent instructions. (See Appendix C for the Ingoing Mueller-Lyer practice card instructions, Appendix D for the Poggendorff practice card instructions, and Appendix E for the Ingoing Mueller-Lyer control card instructions.) Ss marked the practice cards and all other stimulus figures with a black ink pen.

(b) S was given a test card sequence (Ingoing Mueller-Lyer illusion, Poggendorff illusion, and Ingoing Mueller-Lyer control card) in an order which corresponded to the practice card sequence. The difference between this sequence and the practice card sequence was that, here, illusions were used. S was read the appropriate experimental instructions depending on the experimental group to which she had been assigned. (See Appendix F for the objective, and apparent instructions for

the Ingoing Mueller-Lyer illusion; Appendix G for the objective, and apparent instructions for the Poggendorff illusion; and Appendix E for the objective, and apparent instructions for the Ingoing Mueller-Lyer control card.)

(c) S was then given the actual 36 trial test series with the Ingoing Mueller-Lyer illusion, the Poggendorff illusion, and the Ingoing Mueller-Lyer control card in the same order corresponding to the sequences in (a) and (b).

(d) S was individually administered the Internal-External Control Scale (see Appendix B).

(e) S individually complete a post-experimental awareness questionnaire (see Appendix H).

Throughout phases (a), (b), and (c), target viewing time was controlled. Ss viewed each target for ten seconds, after which they were instructed to make their judgment on the figure itself. A small battery operated electronic timer was programmed in ten second intervals. At the beginning of the first interval, S began to view the target. A click indicated this point. At the end of the interval, S made her judgment. A click indicated this point. The second interval was used to replace the target with a new one.

## Dependent Measures

Poggendorff illusion score. Reproductions of direction for the Poggendorff illusion targets was measured by a

transparent millimeter scale, and these measurements were accurate to within 0.5 mm. For each response, the position of the dot was subtracted from the point of objective equality (i.e., that point at which the diagonal line would truly intersect the second parallel line on the right if it continued) to obtain a measure of the magnitude of the illusion. The direction of error is towards underestimation since phenomenologically the illusion has the effect of making the S underestimate the diagonal's point of intersection with the second parallel line. Therefore, scores which showed underestimation were scored as positive, and scores which showed overestimation were scored as negative.

Ingoing Mueller-Lyer illusion score. Reproductions of length for the Ingoing Mueller-Lyer targets and control cards were measured by a transparent millimeter scale, and these measurements were accurate to within 0.5 mm. Magnitude of illusion was calculated by subtracting from each target its counterpart control score. Thus, the first control score was subtracted from the first target score yielding a controlled (or unbiased) magnitude of illusion score which was the major dependent measure. As the direction of error is towards underestimation, magnitude of illusion scores which showed underestimation were scored as positive, and scores which showed overestimation were scored as negative.

The dependent measures (Poggendorff Illusion Score, and corrected Ingoing Mueller-Lyer Illusion Score) occurred

over 36 trials. As is normally done in this kind of research, scores were blocked in terms of successive trials. For all Ss, the 36 trials were grouped in nine blocks of four trials. Therefore each dependent measure had nine summary scores for the purpose of data analysis.

# CHAPTER III

# RESULTS

## Preliminary Analyses

Initially, analyses of variance (unweighted means solution, Winer, 1962) were conducted on each set of illusion and control task data to determine whether type or renumeration (course credit versus money) affected performance. There were 37 unpaid students and 47 paid participants in the study. Their scores on the Internal-External Scale were essentially identical. Appropriate calculations of means, standard deviations, and a t-test between these sub-sample groups have already been reported (see subjects section of Chapter II).

On each set of data a 2 x 4 factorial analysis of variance was conducted. The first factor termed Payoff, had two levels: (a) course credit, and (b) money. The second factor, termed Group, had four levels: (1) Internal-Objective, (2) Internal-Apparent, (3) External-Objective, and (4) External-Apparent. These four levels corresponded directly to the study;s four experimental groups. The results of these analyses are summarized for the control-corrected Mueller-Lyer Illusion data in Table 1, for the Poggendorff Illusion data in Table 2, and for the Ingoing Mueller-Lyer control task data in Table 3.

It is clear from Table 1 that neither Payoff not its

TABLE 1

SUMMARY OF ANALYSIS OF VARIANCE (UNWEIGHTED MEANS SOLUTION) OF THE INGOING MUELLER-LYER ILLUSION FOR TWO FACTORS: PAYOFF AND GROUP

| Source of Variance | Sum of Squares | df | Mean Square | F |
|---|---|---|---|---|
| Payoff (P) | 978.89 | 1 | 978.89 | 0.71 |
| Group (G) | 13978.59 | 3 | 4659.53 | 3.38* |
| PXG | 1459.09 | 3 | 486.36 | 0.35 |
| Error | 104721.35 | 76 | 1377.91 | |
| Total | 1221137.91 | 83 | | |

*P < .05

TABLE 2

SUMMARY OF ANALYSIS OF VARIANCE (UNWEIGHTED MEANS SOLUTION) OF THE POGGENDORFF ILLUSION FOR TWO FACTORS: PAYOFF AND GROUP

| Source of Variance | Sum of Squares | df | Mean Square | F |
|---|---|---|---|---|
| Payoff (P) | 17321.29 | 1 | 17321.29 | 0.1450 |
| Group (G) | 609063.81 | 3 | 203021.27 | 1.6997 |
| PXG | 56013.18 | 3 | 18671.06 | 0.1563 |
| Error | 9077543.07 | 76 | 119441.36 | |
| Total | 9759941.35 | 83 | | |

TABLE 3

SUMMARY OF ANALYSIS OF VARIANCE (UNWEIGHTED MEANS SOLUTION) FOR THE INGOING MUELLER-LYER ILLUSION CONTROL SCORES FOR TWO FACTORS: PAYOFF AND GROUP

| Source of Variance | Sum of Squares | df | Mean Square | F |
|---|---|---|---|---|
| Payoff (P) | 40.30 | 1 | 40.30 | 0.0027 |
| Group (G) | 30649.94 | 3 | 10216.65 | 0.6993 |
| PXG | 21540.62 | 3 | 7180.21 | 0.4914 |
| Error | 1110266.34 | 76 | 14608.77 | |
| Total | 1162497.20 | 83 | | |

interaction differentially affected performance on the corrected Ingoing-Mueller illusion. Only the Group effect, with an F value of 3.38 (df=3/76, $P < .05$) was significant. This finding is not surprising since the Groups received separate experimental treatment, in terms of locus of control and instructional set.

Regarding the Poggendorff illusion, Table 2 reveals that no effects, including Payoff and its internaction, were significant at the .05 level. Similarly, no significant effects were found in the analysis of performance on the Ingoing Mueller-Lyer control task (Table 3). As a result of these analyses, there was no evidence to indicate that type of renumeration affected performance in this study. Therefore, in subsequent analyses sub-sample scores were combined and treated as one sample.

Main Data Analyses

Separate analyses of variance were conducted on the Poggendorff illusion data, and the corrected Ingoing Mueller-Lyer illusion data for two reasons. The mechanisms of the illusions may be logically expected to differ (one is an illusion of extent, and one is an illusion of direction), and thus they may differentially affect the locus of control and instructional variables. Furthermore, if it is found that locus of control and instructions differentially affect the perception of illusions, then support for increased generalizability of these effects will come from two separate comparisons.

The Poggendorff Illusion

The mean and standard deviation for each block of trials in each experimental group are presented in Table 4. A graphic representation of the means is shown in Figure 8. An inspection of the figure reveals some overall trends that are consistent with the hypotheses: the illusion decreases markedly over trials, and internals appear to destroy the illusion more rapidly than externals. The analysis of variance of these results is summarized in Table 5. Reference to the table indicates significant locus of control ($F=5.26$, $df=1/80$, $P<.05$) and trials effects ($F=31.22$, $df=8/640$, $P<.01$). The locus of control by trials interaction is also significant ($F=4.34$, $df=8/640$, $P<.01$). No effect or interaction involving instructional set was significant.

A graphic representation of the locus of control by trials interaction is presented in Figure 9. Again, as in the main analysis, the graph shows that internals destroy the illusion more rapidly over trials than externals. Analysis of simple effects revealed that the decreasing trials effect for both internals and externals was significant. The F value for internals was 27.55 ($df-8/640$, $P<.05$), and for externals the F value was 7.99 ($df-8/640$, $P<.05$). Next, the nine means of the internal subjects were compared with each other on an *a priori* basis using the Bonferroni t statistic multiple comparison technique (Kirk, 1968) to determine specifically where significant changes had occured over trials, and to assess the progressive aspect of these

TABLE 4

MEANS AND STANDARD DEVIATIONS FOR EACH BLOCK OF FOUR TRIALS IN EACH EXPERIMENTAL GROUP ON THE POGGENDORFF ILLUSION ( IN MM.)

| | BLOCKS OF TRIALS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Group | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| IO | | | | | | | | | |
| $\bar{X}$ | 116.43 | 114.74 | 92.31 | 95.40 | 86.05 | 80.95 | 73.52 | 69.07 | 61.45 |
| SD | 39.53 | 41.48 | 46.21 | 39.62 | 46.43 | 32.20 | 35.19 | 42.46 | 39.75 |
| IA | | | | | | | | | |
| $\bar{X}$ | 117.93 | 115.19 | 98.24 | 95.69 | 93.33 | 94.17 | 85.48 | 85.29 | 81.98 |
| SD | 42.47 | 35.83 | 36.04 | 34.07 | 34.07 | 42.41 | 35.42 | 34.95 | 34.43 |
| EO | | | | | | | | | |
| $\bar{X}$ | 119.05 | 120.21 | 114.33 | 108.29 | 110.90 | 106.38 | 105.67 | 102.02 | 90.64 |
| SD | 35.83 | 42.87 | 35.58 | 35.54 | 39.42 | 43.46 | 44.69 | 43.45 | 44.93 |
| EA | | | | | | | | | |
| $\bar{X}$ | 118.29 | 122.86 | 120.62 | 118.38 | 116.40 | 111.69 | 108.38 | 102.33 | 99.24 |
| SD | 37.97 | 40.02 | 45.39 | 49.30 | 52.06 | 50.99 | 52.66 | 47.30 | 49.89 |

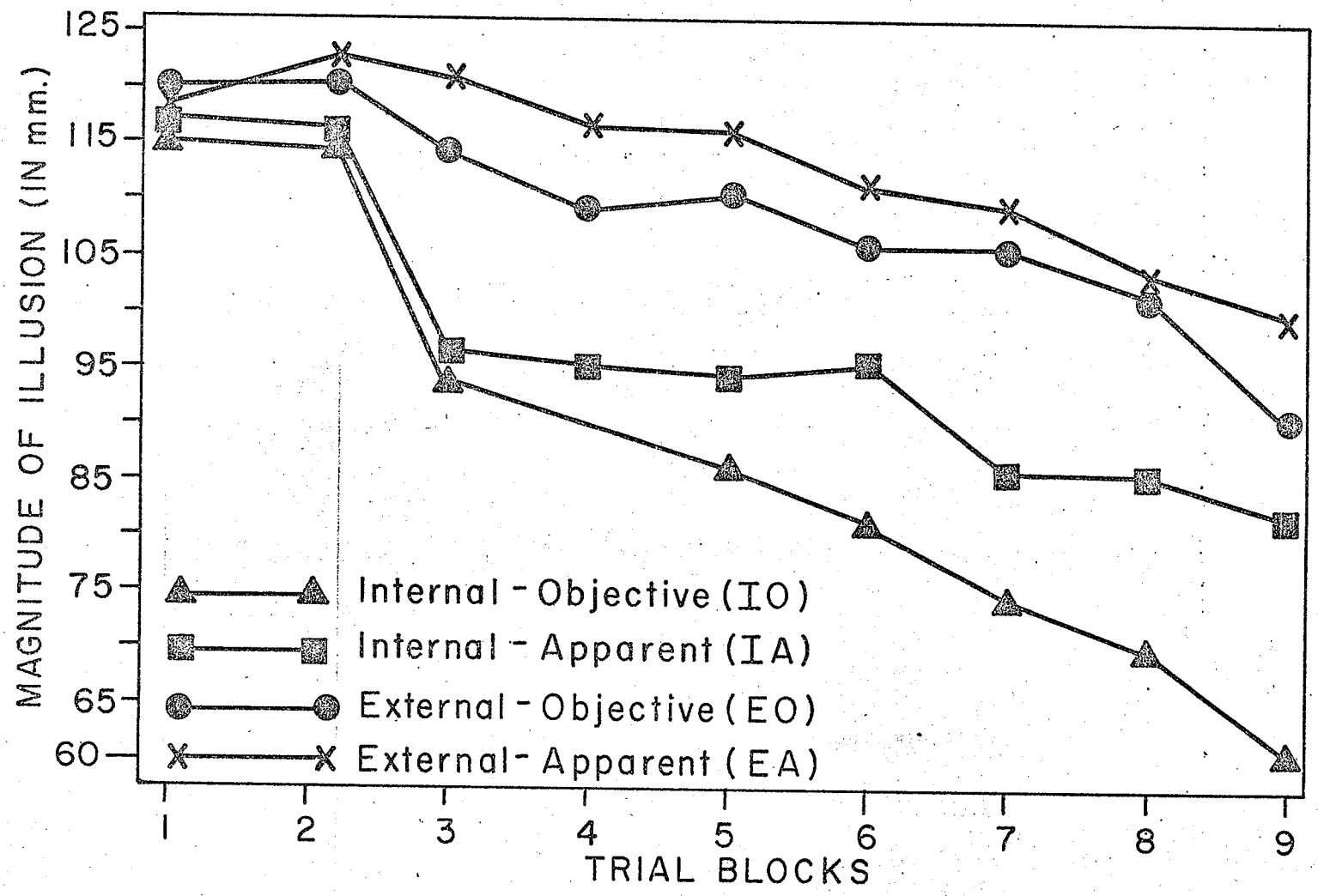


FIGURE. 8. THE POGGENDORFF ILLUSION FOR ALL GROUPS

TABLE 5

SUMMARY OF ANALYSIS OF VARIANCE PERFORMED ON THE POGGENDORFF ILLUSION

| Source of Variance | Sum of Squares | df | Mean Square | F |
|---|---|---|---|---|
| Between Subjects | 1092376.58 | 83 | | |
| Locus of Control (LC) | 66839.65 | 1 | 66839.65 | 5.26* |
| Instructional Set (IS) | 8132.17 | 1 | 8132.17 | 0.64 |
| LC x IS | 783.24 | 1 | 783.24 | 0.65 |
| Error | 1016621.53 | 80 | 12707.77 | |
| Within Subjects | 357284.00 | 672 | | |
| Trials (T) | 95004.51 | 8 | 11875.56 | 31.22** |
| LC x T | 13217.41 | 8 | 1652.18 | 4.34** |
| IS x T | 2944.21 | 8 | 368.03 | 0.97 |
| LC x IS x T | 2642.02 | 8 | 330.25 | 0.87 |
| Error | 243475.86 | 640 | 380.43 | |
| Total | 1449660.58 | 755 | | |

*$P < .05$
**$P < .01$

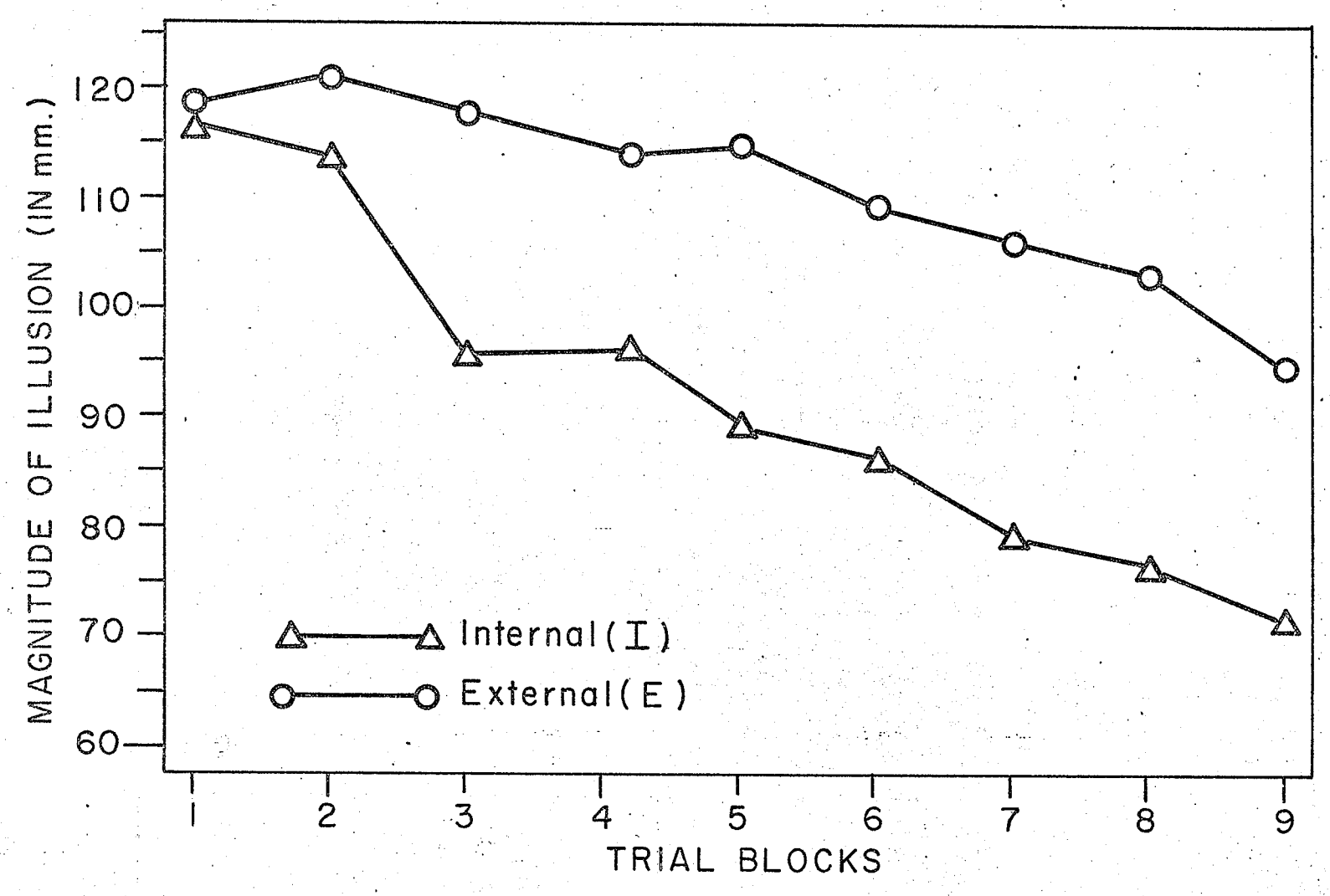


FIGURE. 9. LOCUS OF CONTROL BY TRIALS INTERACTION FOR POGGENDORFF

changes. These results are presented in Table 6. Similarly, the nine means of the externals were compared with one another. These findings are presented in Table 7. For internals, a much greater number of comparisons were significant in contrast with external subjects. Again, this indicated that internals perceived the illusion more accurately and rapidly over trials. Perceptual learning during the first three blocks of trials was greatest for internal subjects with a tapering off after the third block of trials. Externals, on the other hand, perceived the illusion less accurately and at a slower rate throughout the experiment. Post-hoc t-tests (two-tailed) were also performed, comparing the two conditions of locus of control for each trial block, to determine at which blocks internals and externals differed. For these a posteriori tests the alpha level was evenly divided for the nine comparisons yielding a critical value of .006. Table 8 reveals a marked increase in differences after the second block of trials. However, the only significant difference was found at the seventh trial block ($t=2.98$, $df=82$, $P \leqslant .006$). In sum, the statistical analyses of the locus of control by trials interaction confirmed the hypothesis (1b) that with successive trials internals will be progressively more accurate in their perception of the Poggendorff illusion than externals.

The significant main effect of locus of control, which combines the effects of all other variables, confirmed the hypothesis (1a) that internals would perceive the Poggendorff

TABLE 6

BONFERRONI TEST OF MEANS INVOLVED IN THE LOCUS OF CONTROL BY TRIALS INTERACTION FOR INTERNALS ON THE POGGENDORFF ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$ = 117.18 | 2.21 | 2.90* | 21.63* | 27.49* | 29.62* | 37.68* | 40.00* | 45.46* |
| $\bar{X}_2$ = 114.97 | - | 19.69 | 19.42 | 25.28* | 27.41* | 35.47* | 37.79* | 43.25* |
| $\bar{X}_3$ = 95.28 | | - | - .27 | 5.59 | 7.72 | 15.78 | 18.10 | 23.56* |
| $\bar{X}_4$ = 95.55 | | | - | 5.86 | 7.99 | 16.05 | 18.37 | 24.13* |
| $\bar{X}_5$ = 89.69 | | | | - | 2.13 | 10.19 | 12.51 | 17.97 |
| $\bar{X}_6$ = 87.56 | | | | | - | 8.06 | 10.38 | 16.14 |
| $\bar{X}_7$ = 79.50 | | | | | | - | 2.32 | 7.78 |
| $\bar{X}_8$ = 77.18 | | | | | | | - | 5.76 |
| $\bar{X}_9$ = 71.72 | | | | | | | | - |

*$P < .01$

TABLE 7

BONFERRONI TEST OF MEANS INVOLVED IN THE LOCUS OF CONTROL BY TRIALS INTERACTION FOR EXTERNALS IN THE POGGENDORFF ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$ = 118.67 | -2.87 | 1.19 | 5.33 | 5.02 | 9.63 | 11.64 | 16.49 | 23.73* |
| $\bar{X}_2$ = 121.54 | - | 4.06 | 8.20 | 7.89 | 12.50 | 14.51 | 19.36 | 26.60* |
| $\bar{X}_3$ = 117.48 | | - | 4.14 | 3.83 | 8.44 | 10.45 | 15.30 | 22.54* |
| $\bar{X}_4$ = 113.34 | | | - | -.31 | 4.30 | 6.31 | 11.16 | 18.40 |
| $\bar{X}_5$ = 113.65 | | | | - | 4.61 | 6.62 | 11.47 | 18.71 |
| $\bar{X}_6$ = 109.04 | | | | | - | 2.01 | 6.86 | 14.10 |
| $\bar{X}_7$ = 107.03 | | | | | | - | 4.85 | 12.09 |
| $\bar{X}_8$ = 102.18 | | | | | | | - | 7.24 |
| $\bar{X}_9$ = 94.94 | | | | | | | | - |

*$P < .01$

TABLE 8

POST-HOC T-TESTS COMPARING INTERNALS AND EXTERNALS OVER TRIALS ON THE POGGENDORFF ILLUSION

| TRIAL BLOCK | df | t |
|---|---|---|
| 1 | 82 | 0.18 |
| 2 | 82 | 0.75 |
| 3 | 82 | 2.50 |
| 4 | 82 | 1.95 |
| 5 | 82 | 2.55 |
| 6 | 82 | 2.31 |
| 7 | 82 | 2.99* |
| 8 | 82 | 2.72 |
| 9 | 82 | 2.48 |

*$P < .006$

illusion more accuately than externals. Figure 9 shows that internals, in general, perceive the illusion more accurately than externals. However, the locus of control by trials interaction modifies interpretation of the hypothesis (1a) to the extent that it is supported in the middle and later parts of the trails sequence, and not over the entire experiment.

The significant main effect of trials confirmed the hypothesis (c) that with successive trials the Poggendorff illusion will generally be perceived more accurately. In Figure 8, it is clear that the amount of illusion decreases over trials. Furthermore, some decrease appears in all experimental groups.

## The Ingoing Mueller-Lyer Illusion (Corrected with Control Scores

The mean and standard deviation for each block of trials for all groups are presented in Table 9, and a graphic representation of the means is shown in Figure 10. The figure reveals some apparent trends that are consistent with the hypotheses: the illusion decreases markedly over trials; internals destroy the illusion more rapidly than externals; and objective instructions facilitate destruction of the illusion more effectively than apparent instructions. The analysis of variance of these results is summarized in Table 10. Reference to the table indicates three significant main effects: locus of control ($F=6.29$, $df=1/80$, $P<.05$), instructional set ($F=5.14$, $df=1/80$, $P<.05$), and trials

TABLE 9

MEANS AND STANDARD DEVIATIONS FOR EACH BLOCK OF FOUR TRIALS IN EACH EXPERIMENTAL GROUP FOR THE INGOING MUELLER-LYER ILLUSION (CORRECTED WITH CONTROL DATA, IN MM.)

| | BLOCKS OF TRIALS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Group | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| IO | | | | | | | | | |
| $\bar{X}$ | 31.83 | 27.29 | 27.29 | 25.48 | 20.00 | 20.76 | 17.48 | 13.93 | 12.79 |
| SD | 16.59 | 4.58 | 14.28 | 4.51 | 5.21 | 4.22 | 4.57 | 2.86 | 2.86 |
| IA | | | | | | | | | |
| $\bar{X}$ | 35.57 | 29.74 | 26.88 | 26.07 | 22.76 | 22.24 | 13.67 | 15.71 | 15.43 |
| SD | 5.86 | 5.89 | 4.78 | 9.44 | 5.50 | 4.37 | 4.45 | 2.98 | 2.98 |
| EO | | | | | | | | | |
| $\bar{X}$ | 31.33 | 29.36 | 25.19 | 31.00 | 24.81 | 22.00 | 15.95 | 16.00 | 14.36 |
| SD | 7.06 | 6.59 | 11.77 | 6.12 | 7.02 | 3.18 | 3.23 | 2.54 | 2.20 |
| EA | | | | | | | | | |
| $\bar{X}$ | 31.71 | 29.19 | 25.52 | 28.43 | 24.48 | 28.93 | 22.74 | 23.45 | 20.50 |
| SD | 14.01 | 7.32 | 7.42 | 11.66 | 10.76 | 10.73 | 8.71 | 3.95 | 3.91 |

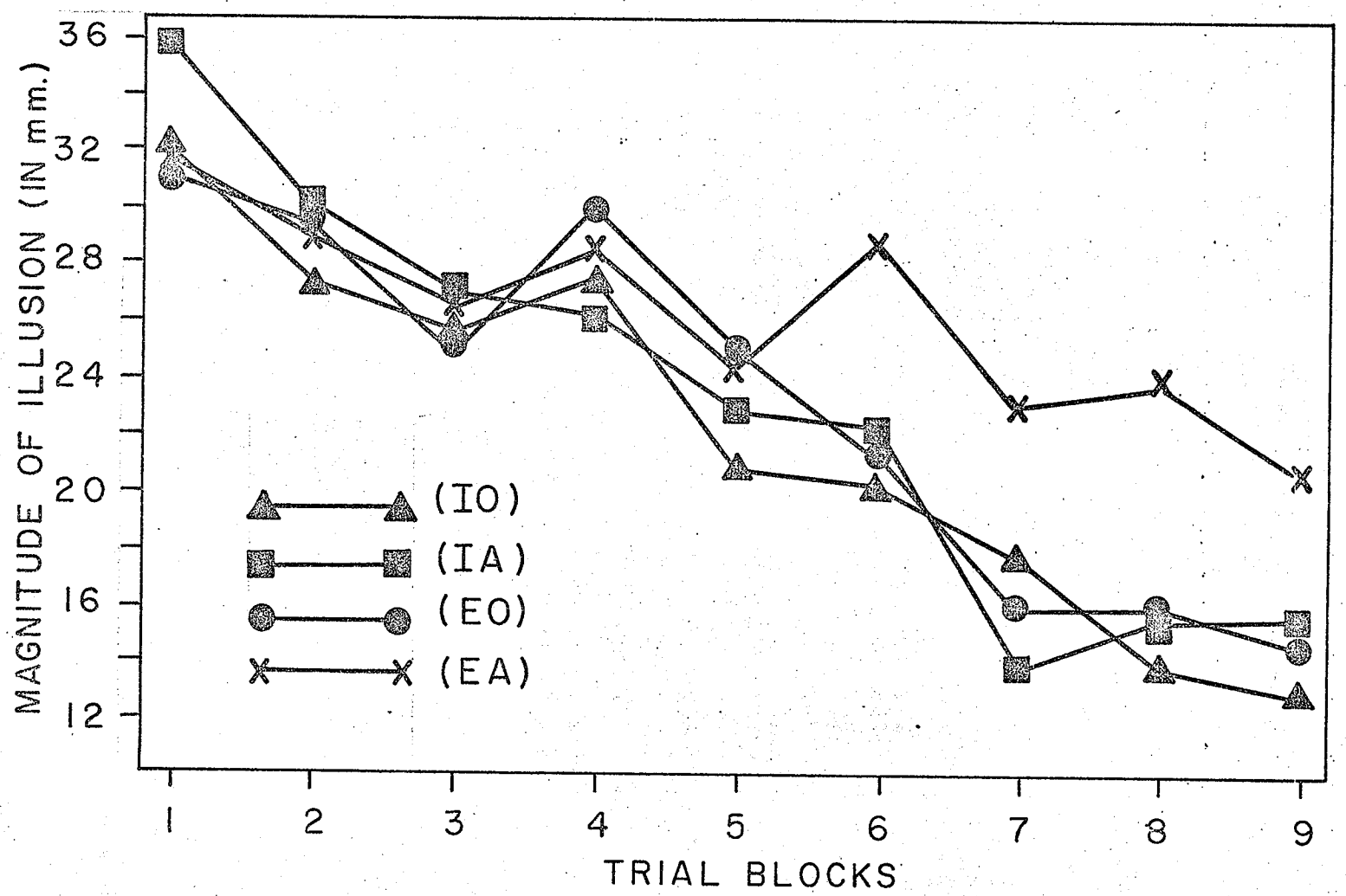


FIGURE. 10. CORRECTED INGOING MUELLER - LYER FOR ALL GROUPS

TABLE 10

SUMMARY OF ANALYSIS OF VARIANCE PERFORMED ON THE INGOING MUELLER-LYER ILLUSION (CORRECTED WITH CONTROL DATA)

| Source of Variance | Sum of Squares | df | Mean Square | F |
|---|---|---|---|---|
| Between Subjects | 13708.26 | 83 | | |
| Locus of Control (LC) | 935.56 | 1 | 935.56 | 6.29* |
| Instructional Set (IS) | 764.02 | 1 | 764.02 | 5.14* |
| LC x IS | 109.71 | 1 | 109.71 | 0.74 |
| Error | 11898.97 | 80 | 148.74 | |
| Within Subjects | 53830.81 | 672 | | |
| Trials (T) | 22909.45 | 8 | 2863.68 | 65.40** |
| LC x T | 1154.35 | 8 | 144.29 | 3.30** |
| IS x T | 674.63 | 8 | 84.33 | 1.93 |
| LX x IS x T | 1069.60 | 8 | 133.70 | 3.05** |
| Error | 28022.78 | 640 | 43.79 | |
| Total | 67539.07 | 755 | | |

*$P < .05$
**$P < .01$

($F=65.40$, $df=8/640$, $P<.01$). Two interactions were also significant; the locus of control by trials interaction ($F=3.30$, $df=8/640$, $P<.01$), and the triple interaction ($F=3.05$, $df=8/640$, $P<.01$).

Beginning with the higher order interaction, analyses of simple effects were performed. The way of examining this interaction which is most relevant to the hypothese (2d) is to explore the locus of control by trials interaction for both levels of instructional set. A graphic representation of the interaction for each instructional condition is presented in Figure 11. Both internals and externals appear to improve with practice at a similar rate under objective instructions; while internals seem to improve more rapidly than externals under apparent instructions, especially during the later trials blocks. The orthogonal comparisons indicated that the locus of control by trials interaction was significant under apparent instructions ($F=4.73$, $df=8/640$, $P<.05$), but not under objective instructions. Analysis of simple effects produced additional findings. The F-test of trials for internals under apparent instructions was significant ($F=25.54$, $df=8/640$, $P<.05$). For externals, the F-test of trails under apparent instructions was also significant ($F=6.42$, $df=8/640$, $P<.05$). Next, the nine means of the internal subjects were compared with each other on an _a priori_ basis using the Bonferroni t statistic multiple comparison prodedure (Kirk, 1968) to determine specifically where significant changes had occurred over trials, and to

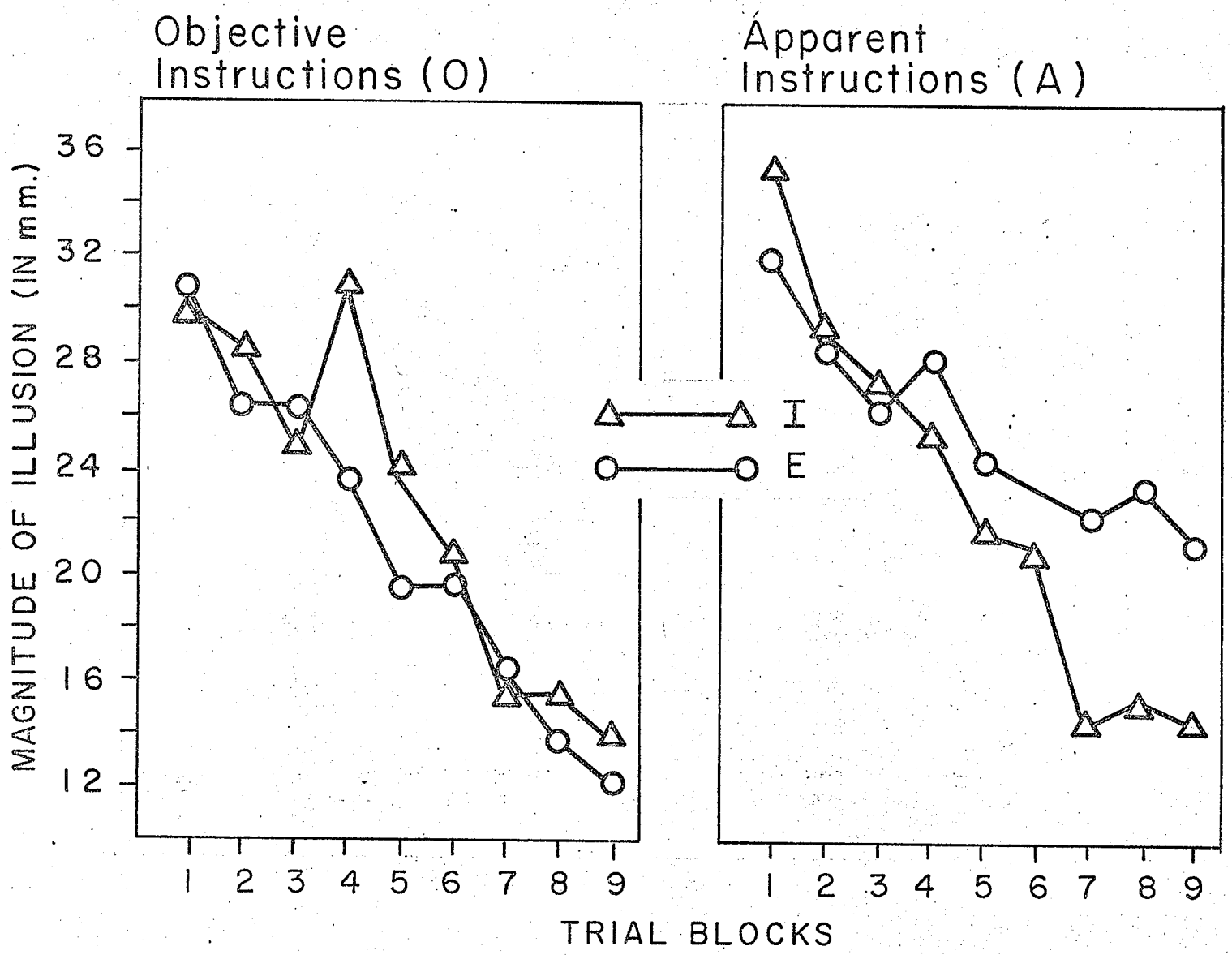


FIGURE. 11. LOCUS OF CONTROL BY TRIALS INTERACTION FOR INSTRUCTIONS ON IML - CORRECTED

assess the progressive aspect of these changes. The results are presented in Table 11. Likewise, the nine means of the externals were compared with one another; these findings are presented in Table 12. For internals, a much greater number of comparisons were significant in contrast with external subjects. This indicated that under apparent instructions internals perceived the illusory figure more rapidly and accurately over trials. Perceptual learning was rapid during the trials sequence until the sixth block, after which it taper off quickly. Externals, on the other hand, perceived the illusion fairly accurately during the early blocks, but less accurately after the third block of trials. Post-hoc t-tests (two-tailed) were performed to determine at which blocks significant differences existed between internals and externals under apparent instructions. Table 13 reveals increasing differences beginning at trial block seven ($t=4.25$, $df=40$, $P<.006$). Ohter differences were found at block eight ($t=7.16$, $df=40$, $P<.006$), and block nine ($t=4.73$, $df=40$, $P<.006$). In sum, these results partially confirm the hypothesis (2d). More specifically, under objective instructions, the data failed to provide support for differential performance over trials as a function of locus of control--internals and externals appeared to perform with similar efficacy. On the other hand, under apparent instructions, progressivley increasing differences between subject groups were found in the later trial blocks, and both internals and externals performed effectively. Externals <u>did not</u> perform progressively

TABLE 11

BONFERRONI TEST OF MEANS INVOLVED IN THE LOCUS OF CONTROL BY TRIALS INTERACTION UNDER APPARENT INSTRUCTIONS FOR INTERNALS ON THE CORRECTED INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$=35.57 | 5.83 | 8.69* | 9.50* | 12.81* | 13.33* | 21.90* | 19.86* | 20.14* |
| $\bar{X}_2$=29.74 | - | 2.86 | 3.67 | 6.98 | 7.50 | 16.07* | 14.03* | 14.31* |
| $\bar{X}_3$=26.88 | | - | 0.81 | 4.12 | 4.64 | 13.21* | 11.17* | 11.45* |
| $\bar{X}_4$=26.07 | | | - | 3.31 | 3.83 | 12.40* | 10.36* | 10.64* |
| $\bar{X}_5$=22.76 | | | | - | 0.52 | 9.09* | 7.05 | 7.33 |
| $\bar{X}_6$=22.24 | | | | | - | 8.57* | 6.53 | 6.81 |
| $\bar{X}_7$=13.67 | | | | | | - | -2.04 | -1.76 |
| $\bar{X}_8$=15.71 | | | | | | | - | 0.28 |
| $\bar{X}_9$=15.43 | | | | | | | | - |

*P < .01

TABLE 12

BONFERRONI TEST OF MEANS INVOLVED IN THE LOCUS OF CONTROL BY TRIALS INTERACTION UNDER APPARENT INSTRUCTIONS FOR EXTERNALS ON THE CORRECTED INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$=31.71 | 2.52 | 6.19 | 3.28 | 7.23 | 2.78 | 8.97* | 8.26* | 11.21* |
| $\bar{X}_2$=29.19 | - | 3.67 | 0.76 | 4.71 | 0.26 | 6.45 | 5.74 | 8.69* |
| $\bar{X}_3$=25.52 | | - | -2.91 | 1.04 | -3.41 | 2.78 | 2.07 | 5.02 |
| $\bar{X}_4$=28.43 | | | - | 3.95 | -0.50 | 5.69 | 4.98 | 7.93* |
| $\bar{X}_5$=24.48 | | | | - | -4.45 | 1.74 | 1.03 | 3.98 |
| $\bar{X}_6$=28.93 | | | | | - | 6.19 | 5.48 | 8.43* |
| $\bar{X}_7$=22.74 | | | | | | - | -0.71 | 2.24 |
| $\bar{X}_8$=24.45 | | | | | | | - | 2.95 |
| $\bar{X}_9$=20.50 | | | | | | | | - |

*$P < .01$

TABLE 13

POST-HOC T-TEXTS COMPARING INTERNALS AND EXTERNALS OVER TRIALS UNDER APPARENT INSTRUCTIONS ON THE CORRECTED INGOING MUELLER-LYER ILLUSION

| TRIAL BLOCK | df | t |
|---|---|---|
| 1 | 40 | 1.64 |
| 2 | 40 | 0.27 |
| 3 | 40 | 0.72 |
| 4 | 40 | 0.72 |
| 5 | 40 | 0.64 |
| 6 | 40 | 2.65 |
| 7 | 40 | 4.25* |
| 8 | 40 | 7.16* |
| 9 | 40 | 4.73* |

*$P < .006$

less effectively as predicted.

Even though the locus of control by trials interaction was only significant under apparent instructions, it was also predicted (hypothesis 1b) that with successive trials internals would be progressively more accurate in their perception of the illusion than externals, regardless of instructional set. The locus of control by trials double interaction is graphically represented in Figure 12 in which the data are combined across instructions. Consistent with the hypothesis (1b), internals appear to destroy the illusion more rapidly than externals, especially after trial block three. The orthogonal comparisons revealed that the decreasing trials effect was significant for both groups of subjects. The F value for internals was 44.73 ($df=8/640$, $P < .05$), and for externals the F value was 23.97 ($df=8/640$, $P < .05$). Next, the nine means of the internals were compared with each other on an a priori basis using the Bonferroni t statistic multiple comparison procedure (Kirk, 1968) to pinpoint significant changes over trials, and to assess the progressive nature of these changes. These findings are summarized in Table 14. Similarly, the nine means of the externals were compared with one another. Table 15 summarizes these results. Both subject groups produced a very large number of significant comparisons, although internals performed more accurately and rapidly over trials. Post-hoc t-tests (two-tailed) were also conducted, comparing the two conditions of locus of control for each trial blocks, to specify

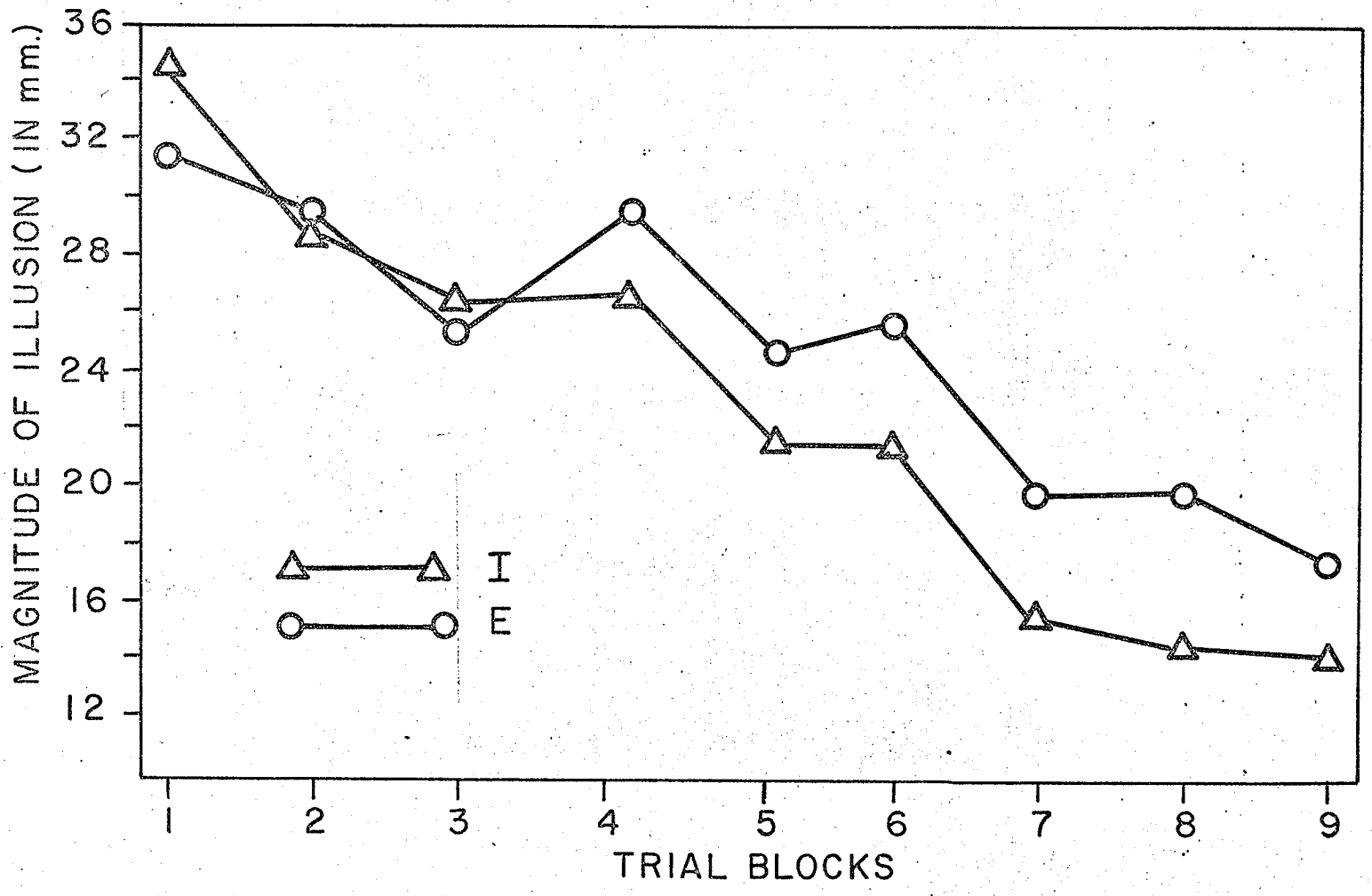


FIGURE. 12. LOCUS OF CONTROL BY TRIAL INTERACTION FOR IML - CORRECTED

TABLE 14

BONFERRONI TEST OF MEANS INVOLVED IN THE LOCUS OF CONTROL BY TRIALS INTERACTION FOR INTERNALS ON THE CORRECTED INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$=33.70 | 5.19 | 6.62* | 7.93* | 12.32* | 12.20* | 18.13* | 18.88* | 19.59* |
| $\bar{X}_2$=28.51 | - | 1.43 | 2.74 | 7.13* | 7.01* | 12.94* | 13.69* | 14.40* |
| $\bar{X}_3$=27.08 | | - | 1.31 | 5.70* | 5.58* | 11.51* | 12.26* | 12.97* |
| $\bar{X}_4$=25.77 | | | - | 4.39 | 4.27 | 10.20* | 10.95* | 11.66* |
| $\bar{X}_5$=21.38 | | | | - | -0.12 | 5.81* | 6.56* | 7.27* |
| $\bar{X}_6$=21.50 | | | | | - | 5.93* | 6.68* | 7.39* |
| $\bar{X}_7$=15.57 | | | | | | - | 0.75 | 1.46 |
| $\bar{X}_8$=14.82 | | | | | | | - | 0.71 |
| $\bar{X}_9$=14.11 | | | | | | | | - |

*$P < .01$

TABLE 15

BONFERRONI TEST OF MEANS INVOLVED IN THE LOCUS OF CONTROL BY TRIALS INTERACTION FOR EXTERNALS ON THE CORRECTED INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$=31.52 | 2.25 | 6.16* | 1.81 | 6.88* | 6.06* | 12.17* | 11.79* | 14.09* |
| $\bar{X}_2$=29.27 | - | 3.91 | 0.44 | 4.63 | 3.81 | 9.92* | 9.54* | 11.84* |
| $\bar{X}_3$=25.36 | | - | -4.35 | 0.72 | -.10 | 6.01* | 5.63* | 7.93* |
| $\bar{X}_4$=29.71 | | | - | 5.07 | 4.25 | 10.36* | 9.98* | 12.28* |
| $\bar{X}_5$=24.64 | | | | - | -0.82 | 5.29* | 4.91 | 7.21* |
| $\bar{X}_6$=25.46 | | | | | - | 6.11* | 5.73* | 8.03* |
| $\bar{X}_7$=19.35 | | | | | | - | -0.38 | 1.92 |
| $\bar{X}_8$=19.73 | | | | | | | - | 2.30 |
| $\bar{X}_9$=17.43 | | | | | | | | - |

*$P < .01$

where internals and externals differed. Reference to Table 16 indicates an increase in differences after the third trial block. For these a posteriori tests, the alpha level was divided evenly for the nine comparisons yielding a critical value of .006. Employing this criteria, three significant differences were found: at the sixth trial block (t=2.86, df=82), the eighth trial block (t=5.44, df=82), and the ninth trial block (t=3.96, df=82). In sum, these results confirm the hypothesis (1b) that with successive trials internals would be progressively more accurate in their perception of the illusion than externals. In line with this hypothesis, it was also predicted (1a) that internals would perceive the illusion more accurately than externals, and that with successive trials the illusion would be perceived more accurately (1c). The significant main effect of locus of control, which combines the effects of all other variables, confirmed the first prediction (1a). In Figure 10 it can be seen that internals, in general, perceive the illusion more accurately than externals, but the locus of control by trials interaction modifies interpretation of the hypothesis to the extent that it is supported in later trial blocks, and not over the entire experiment. The significant main effect of trials confirmed the second prediction (1c). In Figure 10 it is clear that the amount of illusion decrement is evident under all experimental conditions.

The hypothesis (2c) concerned with instructional set and trials was not supported in the main analysis of variance

TABLE 16

POST-HOC T-TESTS COMPARING INTERNALS AND EXTERNALS OVER TRIALS ON THE CORRECTED INGOING MUELLER-LYER ILLUSION

| TRIAL BLOCK | df | t |
|---|---|---|
| 1 | 82 | 0.85 |
| 2 | 82 | 0.57 |
| 3 | 82 | 1.01 |
| 4 | 82 | 1.53 |
| 5 | 82 | 1.92 |
| 6 | 82 | 2.86* |
| 7 | 82 | 2.78 |
| 8 | 82 | 5.44* |
| 9 | 82 | 3.96* |

*$P < .006$

since no significant instructional set by trials interaction was obtained. However, data snooping of the triple interaction revealed some support for the hypothesis under the condition of externality. Figure 13 graphically represents the double interaction at each level of locus of control. For internals, both sets of instructions seem to facilitate a decrease of the illusion over trials. For externals, though, objective instructions appear to facilitate a decrease of the illusion over trials more than do apparent instructions. A posteriori analyses of the simple effects of the interaction were conducted with the alpha level evenly divided by the number of comparisons (two) so that the critical value was .025. The interaction was not significant for the condition of internality, but it was significant for externality ($F=3.75$, $df=8/640$, $P<.025$). Analysis of simple effects found that performance over trials for externals under objective instructions was significant ($F=21.30$, $df-8/640$, $P<.025$). The analysis of trials under apparent instructions was also significant ($F=6.42$, $df=8/640$, $P<.025$). Next, the Tukey HSD a posteriori multiple comparison test (Kirk, 1968) was employed to determine where significant changes had occurred over trials for each instructional set, and to assess the progressive nature of these changes. Table 17 summarizes the results for objective instructions, and Table 18 summarizes the findings for apparent instructions. For objective instructions, a much greater number of comparisons were significant compared to apparent instructions.

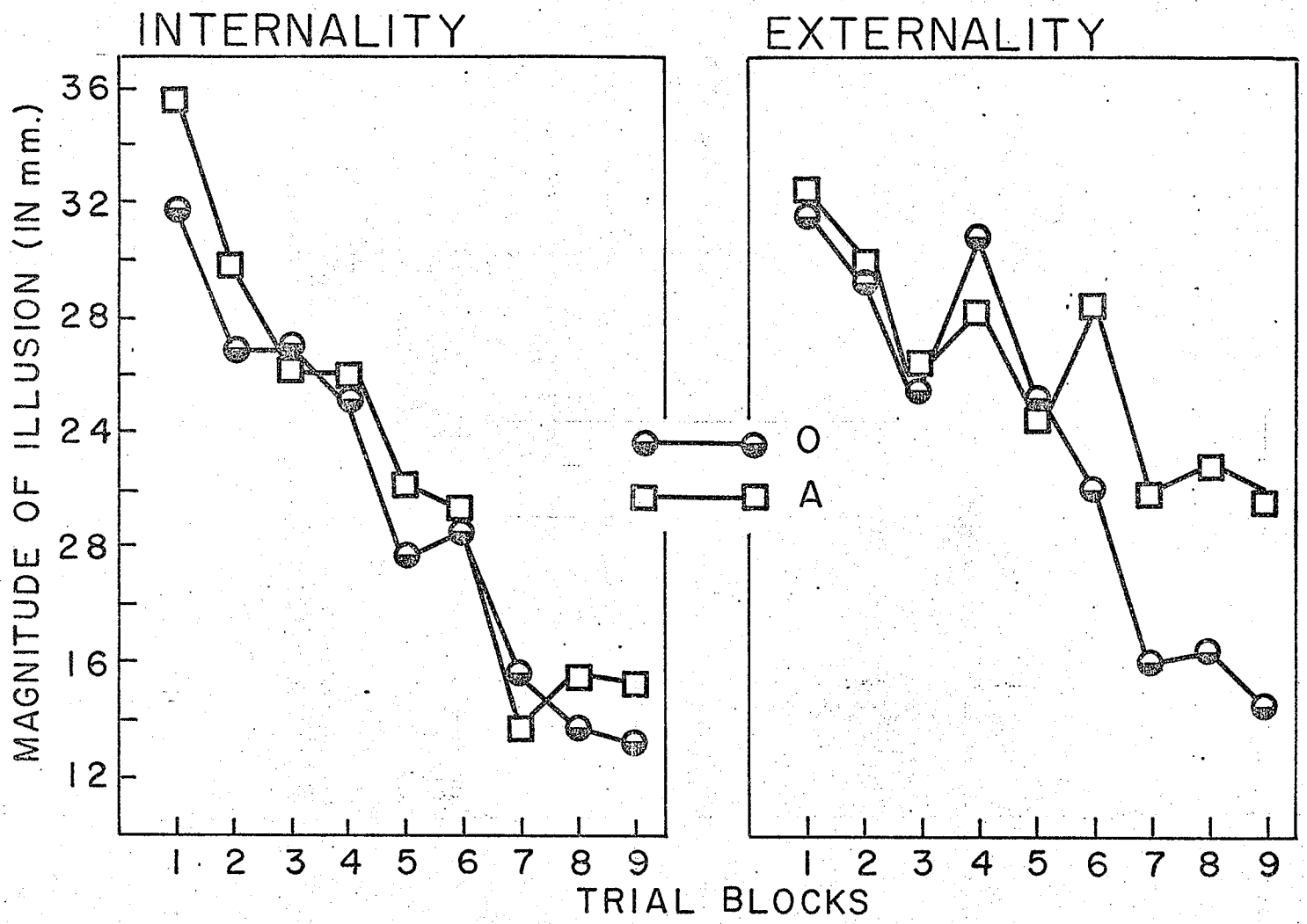


FIGURE. 13. INSTRUCTIONAL SET BY TRIALS INTERACTION FOR LOCUS OF CONTROL ON IML - CORRECTED

TABLE 17

TUKEY HSD TEST OF MEANS INVOLVED IN THE INSTRUCTIONAL SET BY TRIALS INTERACTION UNDER EXTERNALITY FOR OBJECTIVE INSTRUCTIONS ON THE CORRECTED INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$=31.33 | 1.97 | 6.14 | -0.33 | 6.52 | 9.33* | 15.38* | 15.33* | 16.97* |
| $\bar{X}_2$=29.36 | - | 4.17 | -1.64 | 4.55 | 7.36 | 13.41* | 13.36* | 15.00* |
| $\bar{X}_3$=25.19 | | - | -5.81 | 0.38 | 3.19 | 9.24* | 9.19* | 10.83* |
| $\bar{X}_4$=31.00 | | | - | 6.19 | 9.00* | 15.05* | 15.00* | 16.64* |
| $\bar{X}_5$=24.81 | | | | - | 2.81 | 8.86* | 8.81* | 10.45* |
| $\bar{X}_6$=22.00 | | | | | - | 6.05 | 6.00 | 7.64* |
| $\bar{X}_7$=15.95 | | | | | | - | - .05 | 1.59 |
| $\bar{X}_8$=16.00 | | | | | | | - | 1.64 |
| $\bar{X}_9$=14.36 | | | | | | | | - |

*P < .01

TABLE 18

TUKEY HSD TEST OF MEANS INVOLVED IN THE INSTRUCTIONAL SET BY TRIALS INTERACTION UNDER EXTERNALITY FOR APPARENT INSTRUCTIONS ON THE CORRECTED INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$=31.71 | 2.52 | 6.19 | 3.28 | 7.23 | 2.78 | 8.97* | 8.26* | 11.21* |
| $\bar{X}_2$=29.19 | - | 3.67 | 0.76 | 4.71 | 0.26 | 6.45 | 5.74 | 8.69* |
| $\bar{X}_3$=25.52 | | - | -2.91 | 1.04 | -3.41 | 2.78 | 2.07 | 5.02 |
| $\bar{X}_4$=28.43 | | | - | 3.95 | -0.50 | 5.69 | 4.98 | 7.93* |
| $\bar{X}_5$=24.48 | | | | - | -4.45 | 1.74 | 1.03 | 3.98 |
| $\bar{X}_6$=28.93 | | | | | - | 6.19 | 5.48 | 8.43* |
| $\bar{X}_7$=22.74 | | | | | | - | -0.71 | 2.24 |
| $\bar{X}_8$=24.45 | | | | | | | - | 2.95 |
| $\bar{X}_9$=20.50 | | | | | | | | - |

*$P < .01$

Again, this indicated that objective instructions were more facilitative, particularly in the later trial blocks, under the condition of externality. Post-hoc t-tests (two-tailed) were also performed, comparing performance with objective and apparent instructions for each trial block for externals, to specify at which blocks instructional set significantly affected performance. Reference to Table 19 reveals an increase in differences after the fifth trial block. For these a posteriori tests, the alpha level was divided evenly yielding a critical value of .003 for the nine comparisons. Using this stringent criteria, only three significant differences were found: at the seventh trial block (t=3.35, df=40), the eighth trial block (t=7.27, df=40), and the ninth trial block (t=6.28, df=40). In sum, the hypothesis (2c) which predicted that under objective instructions subjects would perform more accurately over trials than under apparent instructions was not supported in the main analysis of variance. However, post-hoc analyses determined that the hypothesis was paritially salvagable. It was found that the hypothesis was supportable in the case of external subjects, but the data failed to provide support for the hypothesis in the case of internals. In line with hypothesis 2c, it was also predicted (2a) that objective instructions would facilitate more accurate performance on the illusion than would apparent instructions. The significant main effect of instructional set, which combines the effects of all other variables, seems to confirm this prediction. In Figure 10,

TABLE 19

POST-HOC T-TESTS COMPARING PERFORMANCE OVER TRIALS UNDER OBJECTIVE AND APPARENT INSTRUCTIONS FOR EXTERNALS ON THE CORRECTED INGOING MUELLER-LYER ILLUSION

| TRIAL BLOCK | df | t |
|---|---|---|
| 1 | 40 | 0.11 |
| 2 | 40 | 0.08 |
| 3 | 40 | 0.10 |
| 4 | 40 | 0.90 |
| 5 | 40 | 0.12 |
| 6 | 40 | 2.84 |
| 7 | 40 | 3.35* |
| 8 | 40 | 7.27* |
| 9 | 40 | 6.28* |

*$P < .003$

it appears that objective instructions, in general, are more facilitative of a decrease in the amount of illusion. However, other findings modify the supportability of the hypothesis (2a). The analysis of the instructional set by trials component of the triple interaction revealed that objective instructions in contrast with apparent instructions facilitate destruction of the illusion over trials for externals, but the data do not provide support for this phenomenon in the case of internals. These findings provide support for the hypothesis (2a), more specifically, in the case of externals and over the trials sequence. Thus, the hypothesis (2a) is only partially confirmed.

Further data snooping of the locus of control and instructional set hypothesis (2b) was essentially unproductive. The hypothesis was not supported in the main analysis, and only at one trial block in a posteriori analyses. This component of the triple interaction was examined at each of the nine trial blocks with the alpha level evenly divided so that the critical value for the nine comparisons was .003. Only one significant comparison was found. At trial block seven, the F value was 10.62 (df=1/720). This finding has little importance since no other interactions were significant at any of the other eight trial blocks.

## The Ingoing Mueller-Lyer Illusion Control Scores

These data were examined on a post-hoc basis for two reasons. First, simply to determine if a control score trials effect was demonstrable when a psychophysical method

of production is employed to measure an illusion. Sweeney (1973) found a control score trials effect while investigating successive trials effects of both forms of the Mueller-Lyer illusion using a method of adjustment. Second, to assess the possibility that personality differences found in the study are not related to illusory tasks per se. These differences may also exist for non-illusory tasks.

The mean and standard deviation for each block of trials in each experimental group are presented in Table 20, and the means are graphically represented in Figure 14. The figure does not reveal any easily discernible or systematic trends.

The design of the analysis of variance was identical to the analyses of both sets of illusion data. A summary of the analysis of variance of the control task data is shown in Table 21. Reference to the table indicates a significant locus of control by instructional set by trials interaction ($F=2.47$, $df=8/640$, $P<.05$). No other main effect or interaction was significant. Since only the triple interaction was significant, data snooping was initiated for the various components of this interaction.

One way of exploring the higher order interaction was to probe the locus of control by trials interaction for both conditions of instructional set. A graphic representation of the interaction at each level of instructional set is shown in Figure 15. It appears that internals and externals perform similarly over trials under objective instructions.

TABLE 20

MEANS AND STANDARD DEVIATIONS FOR EACH BLOCK OF FOUR TRIALS IN EACH EXPERIMENTAL GROUP FOR THE INGOING MUELLER-LYER ILLUSION CONTROL SCORES (IN MM.)

| | BLOCKS OF TRIALS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Group | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| IO | | | | | | | | | |
| $\bar{X}$ | 240.46 | 242.05 | 235.33 | 234.81 | 234.79 | 239.40 | 239.26 | 240.48 | 240.29 |
| SD | 15.85 | 13.95 | 17.70 | 15.51 | 16.48 | 14.09 | 12.23 | 11.98 | 16.82 |
| IA | | | | | | | | | |
| $\bar{X}$ | 236.74 | 237.26 | 237.45 | 238.95 | 237.10 | 241.98 | 243.05 | 240.29 | 239.29 |
| SD | 10.07 | 7.94 | 10.58 | 12.40 | 10.44 | 12.67 | 12.54 | 11.35 | 13.25 |
| EO | | | | | | | | | |
| $\bar{X}$ | 237.88 | 237.48 | 237.88 | 236.86 | 241.48 | 239.31 | 242.19 | 239.71 | 236.24 |
| SD | 17.86 | 17.10 | 18.17 | 19.17 | 20.28 | 19.68 | 18.66 | 15.59 | 17.18 |
| EA | | | | | | | | | |
| $\bar{X}$ | 241.98 | 238.57 | 240.02 | 236.38 | 237.40 | 240.10 | 234.10 | 234.74 | 236.29 |
| SD | 16.60 | 21.28 | 19.42 | 15.54 | 17.08 | 15.84 | 16.47 | 14.72 | 12.92 |

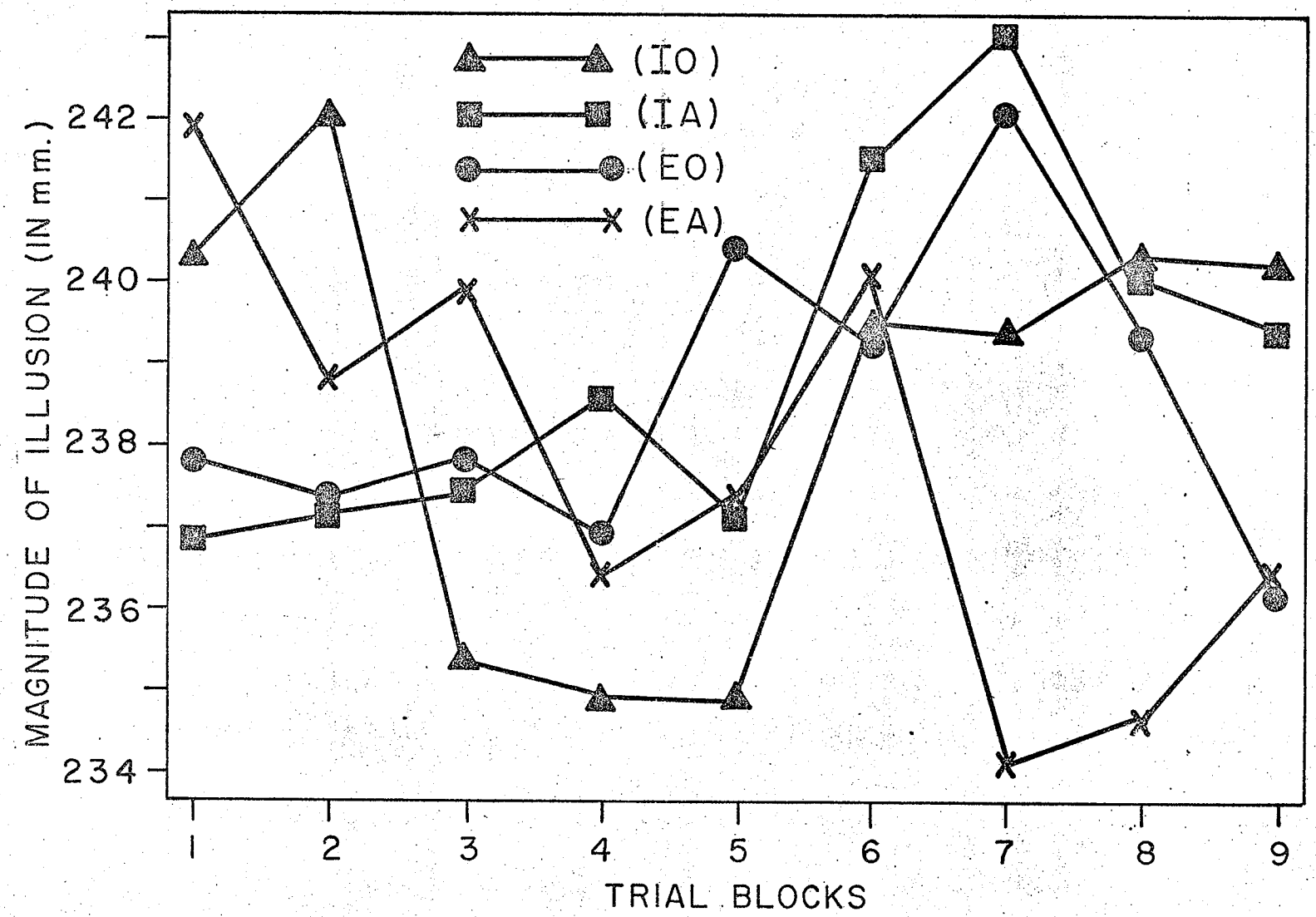


FIGURE. 14. INGOING MUELLER - LYER CONTROL SCORES FOR ALL GROUPS

TABLE 21

SUMMARY OF ANALYSIS OF VARIANCE PERFORMED ON THE INGOING MUELLER-LYER ILLUSION CONTROL SCORES

| Source of Variance | Sum of Squares | df | Mean Square | F |
|---|---|---|---|---|
| Between Subjects | 124468.90 | 83 | | |
| Locus of Subjects (LC) | 60.29 | 1 | 60.29 | 0.04 |
| Instructional Set (IS) | 9.44 | 1 | 9.44 | 0.01 |
| LX x IS | 129.18 | 1 | 129.18 | 0.08 |
| Error | 124269.98 | 80 | 1553.37 | |
| Within Subjects | 54680.28 | 672 | | |
| Trials (T) | 800.64 | 8 | 100.08 | 1.26 |
| LC x T | 1115.46 | 8 | 139.43 | 1.78 |
| IS x T | 547.60 | 8 | 68.44 | 0.86 |
| LX x IS x T | 1556.76 | 8 | 195.84 | 2.47* |
| Error | 50649.83 | 640 | 79.14 | |
| Total | 179149.18 | 755 | | |

*$P < .05$

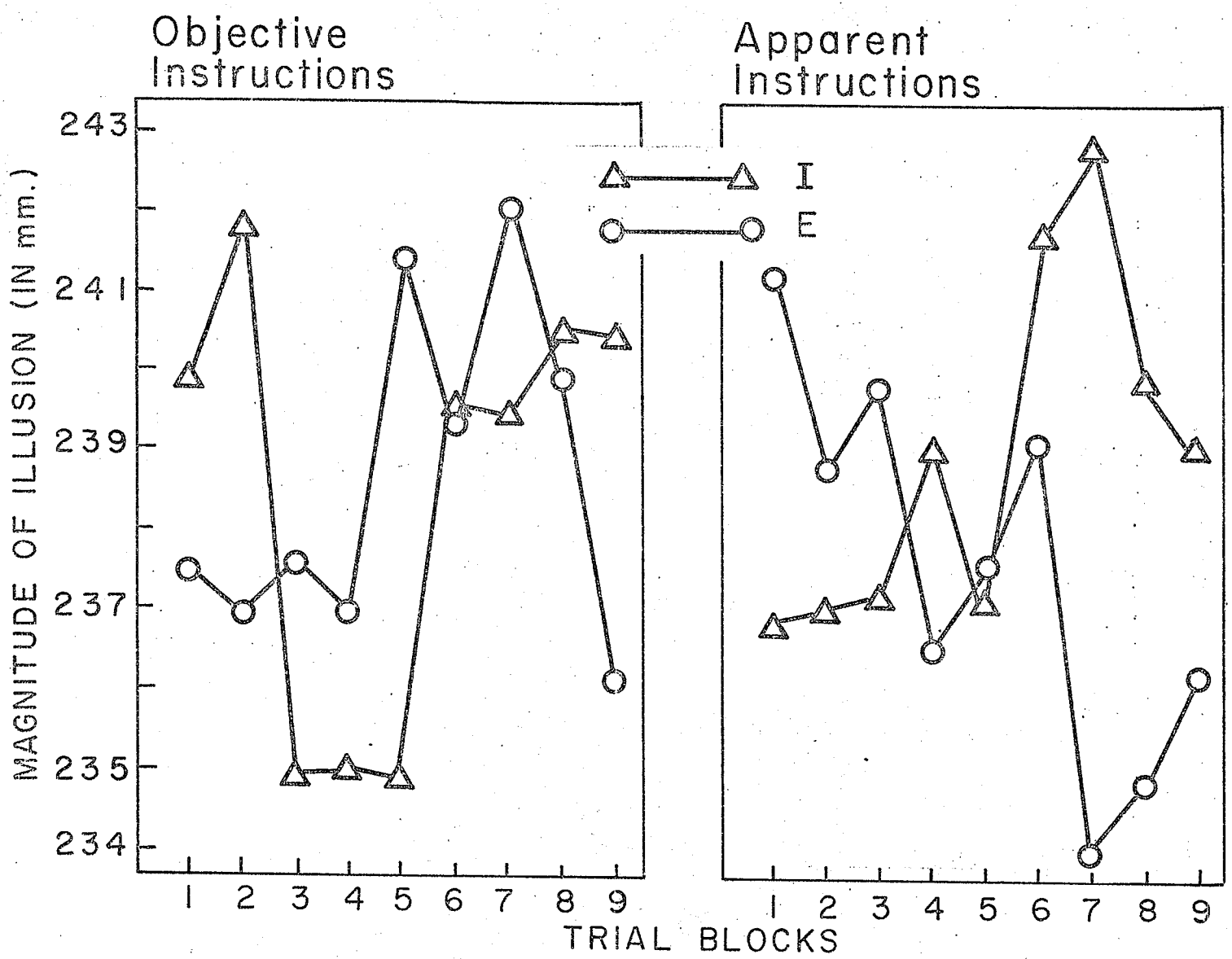


FIGURE. 15. LOCUS OF CONTROL BY TRIALS INTERACTION FOR INSTRUCTIONAL SET ON IML CONTROL TASK

On the other hand, under apparent instructions, it seems that the performance of internals decreases little with practice, while the performance of externals decreases at least until the seventh trial block. A posteriori analyses of the simple effects of the interaction were performed with the alpha level evenly divided by the number of comparisons (two) so that the critical value was .025. The locus of control by trials interaction was only significant under apparent instructions ($F=2.46$, $df=8/640$, $P < .025$). Analysis of the simple effects of this component of the triple interaction did not provide any additional significant findings. Further analyses (F-tests) failed to provide evidence that either interanls or externals differentially perceived the control distance over trials when given apparent instructions.

A second way of looking at the triple interaction was to examine the instructional set by trials interaction for both levels of locus of control. A graphic representation of the interaction for each locus of control condition is seen in Figure 16. For internals, both sets of instructions appear to affect performance over trials similarly, especially in the later trial blocks. For externals, however, objective instructions seem to facilitate a decrease in performance more than do apparent instructions. A posteriori analyses of the interaction were performed with the alpha level evenly divided by the number of comparisons (two) so that the critical value was .025. Neither comparison was

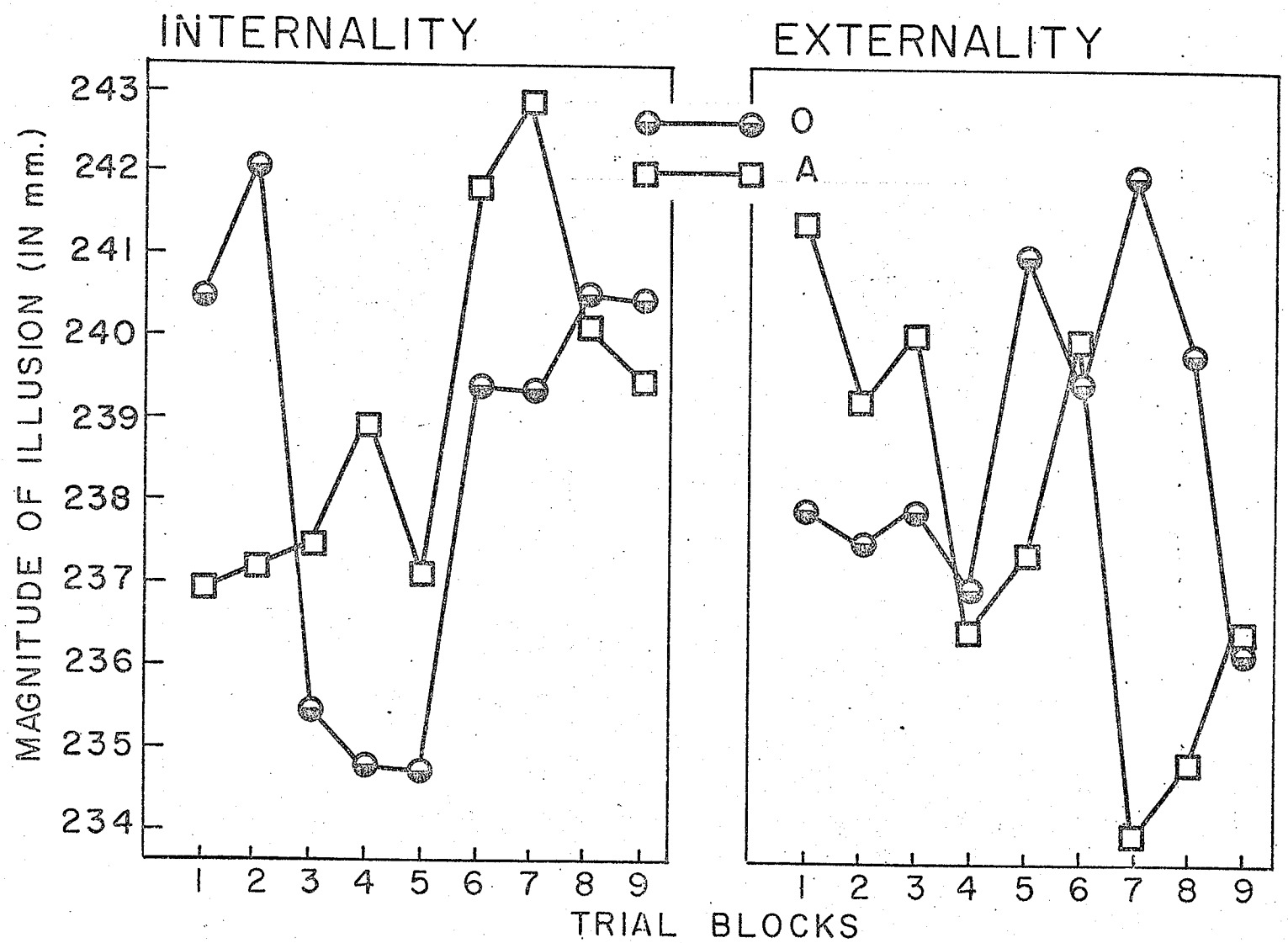


FIGURE. 16. INSTRUCTIONAL SET BY TRIALS INTERACTION FOR LOCUS OF CONTROL ON IML CONTROL TASK

significant which indicated that the analyses failed to provide statistical support for the observations of Figure 16.

A third way of dealing with the higher order interaction was to explore the locus of control by instructional set interaction at each of the nine trial blocks. For these *a posteriori* tests the alpha level was evenly divided for the nine comparisons yielding a critical value of .003. No significant differences were found using this criteria.

In sum, *a posteriori* analyses of simple effects produced only one significant finding despite the fact that a significant triple interaction was obtained in the main analysis of variance. Although a control score trials effect is not demonstrated with a psychophysical method of production, the analyses and inspection of the data provide some justification for the use of a control task in this study. The data suggested that under some conditions externals appeared to show a mild decrease in performance which is unrelated to the illusory tasks. This decrease *actually represents* a tendency toward underestimation because the control distance is perceived as shorter than it really is. This phenonmenon could lead, theoretically, to an artifically decreasing measurement of the Ingoing Mueller-Lyer illusion since a smaller number would be subtracted from the raw illusion score yielding biased corrected scores on which predictions are based. However, there is little hard evidence that the personality differences found in this study are related to non-illusory tasks. In any event, it was contended

that to obtain a clearer understanding of the control condition's function, it might be of value to analyze the raw Ingoing Mueller-Lyer illusion data.

The Ingoing Mueller-Lyer Illusion (Uncorrected Raw Data)

Like the control score data, these data were examined on a post-hoc basis. The mean and standard deviation for each block of trials in each experimental group are presented in Table 22. A graphic representation of the means can be seen in Figure 17. Some apparent trends of the data are consistent with the hypotheses: the illusion decreases markedly over trials with internals perceiving the figure more accurately than externals. Also, objective instructions seem to facilitate performance over trials more than do apparent instructions. The analysis of variance of these results is summarized in Table 23. Again, the design of this analysis was identical to the illusion and control score analyses. Reference to the table indicates one significant main effect: trials ($F=26.00$, $df=8/640$, $P<.01$). Three interactions were also significant: the locus of control by trials interaction ($F=3.48$, $df=8/640$, $P<.05$), the instructional set by trials interaction ($F=1.98$, $df=8/640$, $P<.05$), and the triple interaction ($F=4.51$, $df=8/640$, $P<.01$).

Starting with the higher order interaction, analyses of simple effects were conducted. The way of exploring this interaction which is most pertinent to the hypothesis (2d) is to examine the locus of control by trials inter-

TABLE 22

MEANS AND STANDARD DEVIATIONS FOR EACH BLOCK OF FOUR TRIALS IN EACH EXPERIMENTAL GROUP FOR THE INGOING MUELLER-LYER ILLUSION (UNCORRECTED RAW DATA, IN MM.)

| | BLOCKS OF TRIALS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Group | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| IO | | | | | | | | | |
| $\bar{X}$ | 31.24 | 24.76 | 30.14 | 32.45 | 25.79 | 20.60 | 18.17 | 13.45 | 12.50 |
| SD | 20.47 | 14.91 | 18.19 | 17.73 | 16.94 | 16.05 | 13.92 | 12.11 | 16.85 |
| IA | | | | | | | | | |
| $\bar{X}$ | 38.83 | 32.48 | 29.52 | 26.17 | 25.67 | 19.31 | 10.62 | 15.52 | 16.14 |
| SD | 12.56 | 9.82 | 12.31 | 14.38 | 11.01 | 12.77 | 13.39 | 11.41 | 13.23 |
| EO | | | | | | | | | |
| $\bar{X}$ | 33.45 | 31.88 | 27.31 | 34.12 | 23.33 | 22.69 | 13.76 | 16.29 | 17.64 |
| SD | 17.67 | 15.82 | 23.48 | 18.58 | 22.99 | 18.64 | 17.85 | 15.09 | 16.74 |
| EA | | | | | | | | | |
| $\bar{X}$ | 29.74 | 30.62 | 25.50 | 32.05 | 27.07 | 28.83 | 28.64 | 28.71 | 24.21 |
| SD | 19.59 | 25.36 | 22.03 | 19.27 | 21.37 | 18.76 | 17.64 | 15.13 | 12.81 |

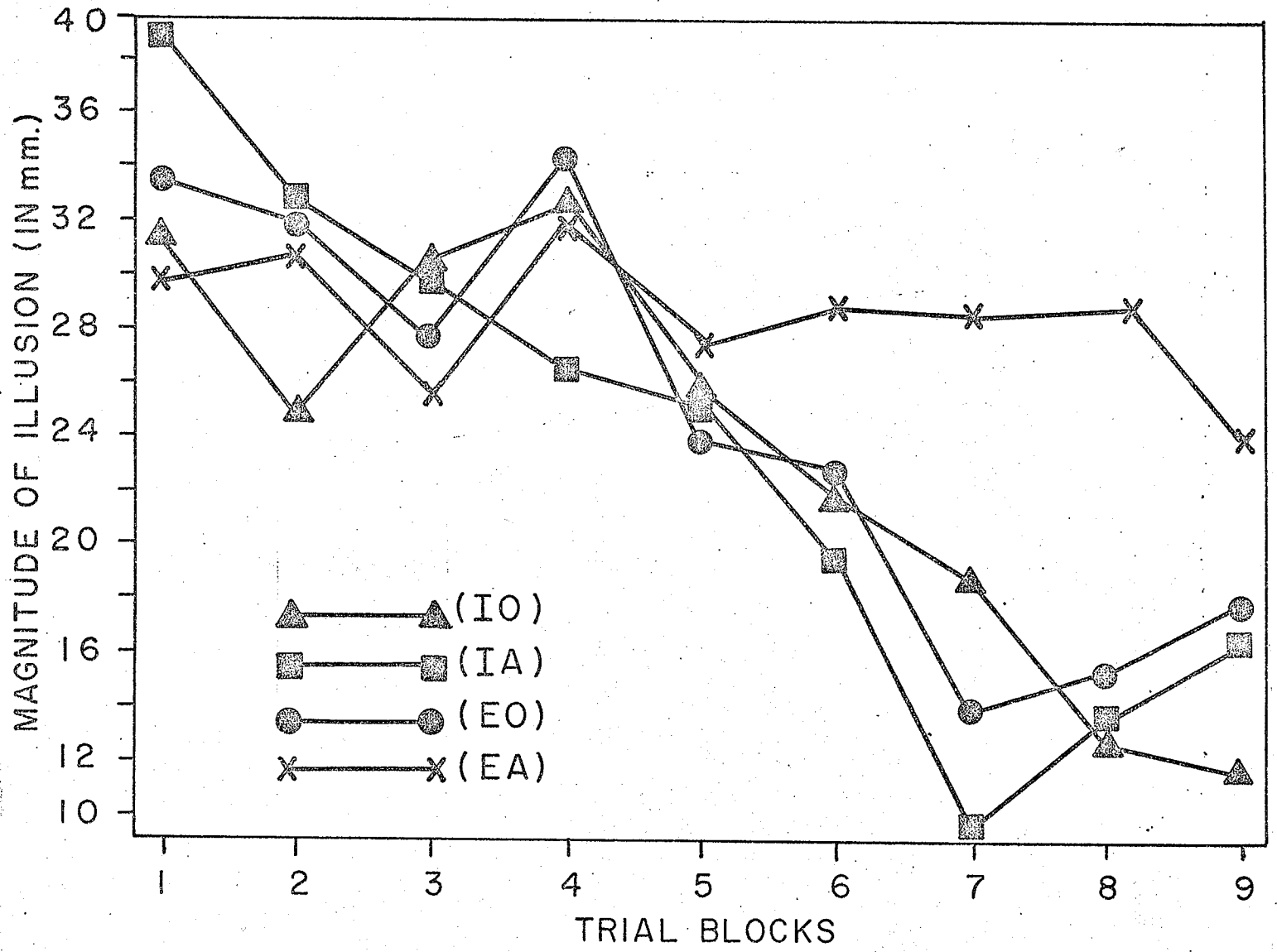


FIGURE. 17. RAW INGOING MUELLER - LYER ILLUSION FOR ALL GROUPS

TABLE 23

SUMMARY OF ANALYSIS OF VARIANCE PERFORMED ON THE INGOING MUELLER-LYER ILLUSION (UNCORRECTED RAW DATA)

| Source of Variance | Sum of Squares | df | Mean Square | F |
|---|---|---|---|---|
| Between Subjects | 134716.11 | 83 | | |
| Locus of Control (LC) | 1607.81 | 1 | 1607.81 | 0.98 |
| Instructional Set (IS) | 936.67 | 1 | 936.67 | 0.57 |
| LC x IS | 515.87 | 1 | 515.87 | 0.31 |
| Error | 131655.76 | 80 | 1645.70 | |
| Within Subjects | 110493.03 | 672 | | |
| Trials (T) | 24781.37 | 8 | 3097.67 | 26.00** |
| LC x T | 3285.08 | 8 | 410.64 | 3.45** |
| IS x T | 1885.12 | 8 | 235.64 | 1.98* |
| LC x IS x T | 4296.30 | 8 | 537.04 | 4.51** |
| Error | 76245.16 | 640 | 119.13 | |
| Total | 245209.14 | 755 | | |

*$P < .05$
**$P < .01$

action for both levels of instructional set. Figure 18 reveals a graphic representation of the interaction for each condition of instructional set. Internals and externals both seem to improve with practice at a similar rate under objective instructions. With apparent instructions, though, internals appear to improve more rapidly with practice than do externals. A posteriori analses of the simple effects of the interaction were performed with the alpha level evenly divided by the number of comparisons (two) so that the critical value was .025. The locus of control by trials interaction was significant under apparent instructions ($F=6.67$, $df=8/640$, $P<.025$), but not under objective instructions. Analysis of the simple effects of this component of the triple interaction revealed additional significant results. The analysis of trials for internals under apparent instructions was significant ($F=14.64$, $df=8/640$, $P<.025$), but the analysis of trials for externals under apparent instructions was not significant. Next, the nine means of the internals were compared with each other on an a posteriori basis using the Tukey HSD multiple comparison test (Kirk, 1968) to determine specifically where significant changes had occured over trials, and to assess the progressive aspect of these changes. The results are presented in Table 24. A large number of comparisons were significant indicating that under apparent instructions internals perceived the illusory figure quite accurately and rapidly. Post-hoc

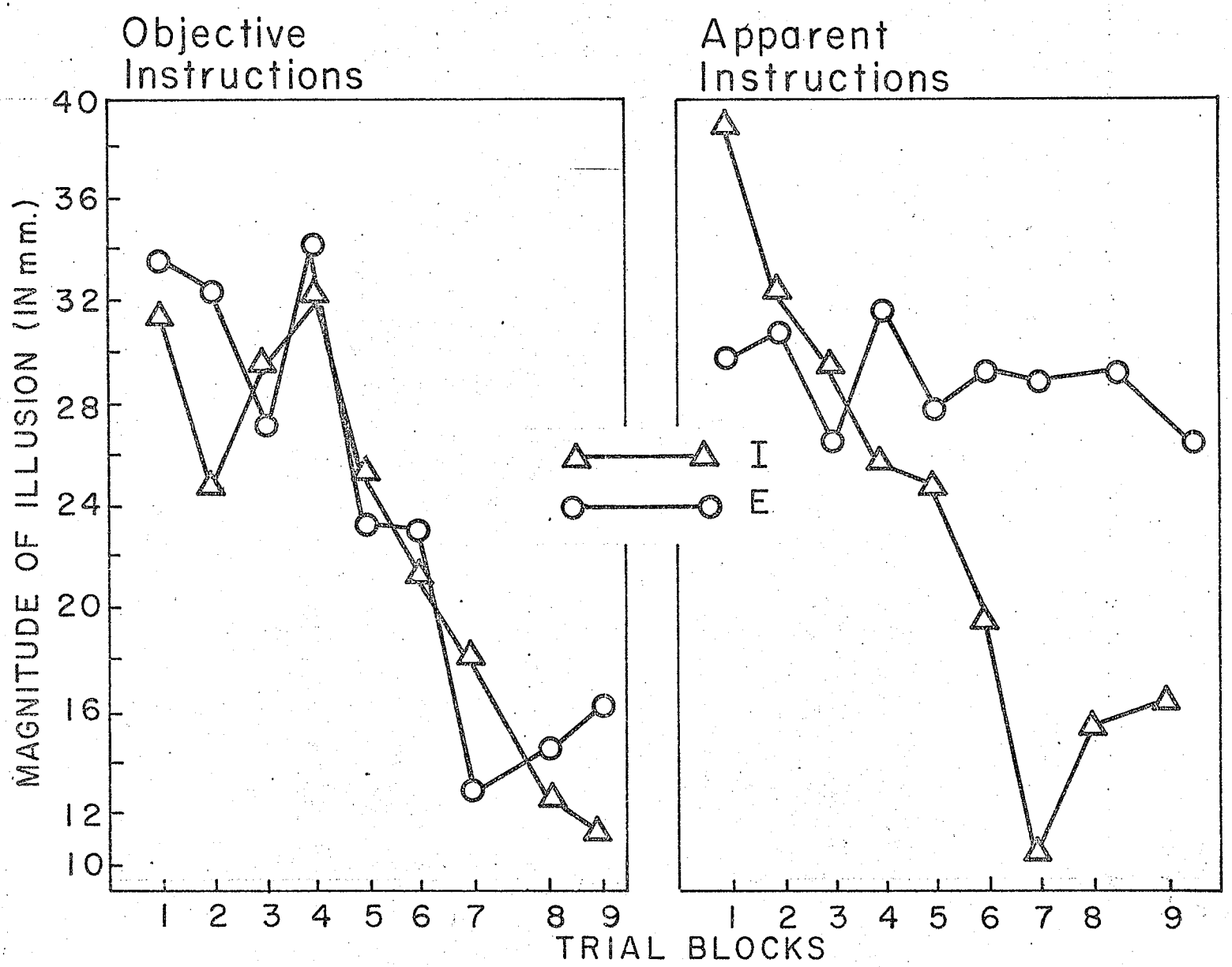


FIGURE. 18. LOCUS OF CONTROL BY TRIALS INTERACTION FOR INSTRUCTIONAL SET ON IML - RAW

TABLE 24

TUKEY HSD TEST OF MEANS INVOLVED IN THE LOCUS OF CONTROL BY TRIALS INTERACTION UNDER APPARENT INSTRUCTIONS FOR INTERNALS ON THE RAW MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1 = 38.83$ | 6.35 | 9.31 | 12.66* | 13.16* | 19.52* | 28.21* | 23.31* | 22.69* |
| $\bar{X}_2 = 32.48$ | - | 2.96 | 6.31 | 6.81 | 13.17* | 21.86* | 16.96* | 16.34* |
| $\bar{X}_3 = 29.52$ | | - | 3.35 | 3.85 | 10.21 | 18.90* | 14.00* | 13.38* |
| $\bar{X}_4 = 26.17$ | | | - | 0.50 | 6.86 | 15.55* | 10.65 | 10.03 |
| $\bar{X}_5 = 25.67$ | | | | - | 6.36 | 15.05* | 10.15 | 9.53 |
| $\bar{X}_6 = 19.31$ | | | | | - | 8.69 | 3,79 | 3.17 |
| $\bar{X}_7 = 10.62$ | | | | | | - | -4.90 | -5.52 |
| $\bar{X}_8 = 15.52$ | | | | | | | - | -0.62 |
| $\bar{X}_9 = 16.14$ | | | | | | | | - |

*$P < .01$

t-tests (two-tailed) were performed, comparing internals and externals for each trial block under apparent instructions, to specify at which blocks these subject groups differed. For these *a posteriori* tests the alpha level was evenly divided for the nine comparisons yielding a critical value of .003. Reference to Table 25 reveals increasing differences after the fifth block of trials. Employing this stringent criteria, however, only two significant differences were found: at the seventh trial block (t=3.73, df=40), and the eighth trial block (t=3.19, df=40). In sum, these results confirmed the hypothesis (2d). More precisely, under objective instructions, the data failed to provide evidence for differential performance over trials as a function of locus of control--internals and external performed with similar effectiveness. Under apparent instructions, on the other hand, internals performed progressively more effectively as predicted.

Although the locus of control by trials interaction was only significant under apparent instructions, it was also predicted (hypothesis 1b) that with successive trials internals would be progressively more accurate in their perception of the illusory figure than externals when instructional set was disregarded. Combined across instructions, the locus of control by trials interaction is shown in Figure 19. Consistent with the hypothesis (1b), internals seems to destroy the illusion more quickly than externals, particularly after trial block five. *A posteriori* analyses of the simple

TABLE 25

POST-HOC T-TESTS COMPARING INTERNALS AND EXTERNALS OVER TRIALS UNDER APPARENT INSTRUCTIONS ON THE RAW INGOING MUELLER-LYER ILLUSION

| TRIAL BLOCK | df | t |
|---|---|---|
| 1 | 40 | 1.78 |
| 2 | 40 | 0.31 |
| 3 | 40 | 0.73 |
| 4 | 40 | 1.12 |
| 5 | 40 | 0.27 |
| 6 | 40 | 1.92 |
| 7 | 40 | 3.73* |
| 8 | 40 | 3.19* |
| 9 | 40 | 2.01 |

*$P < .003$

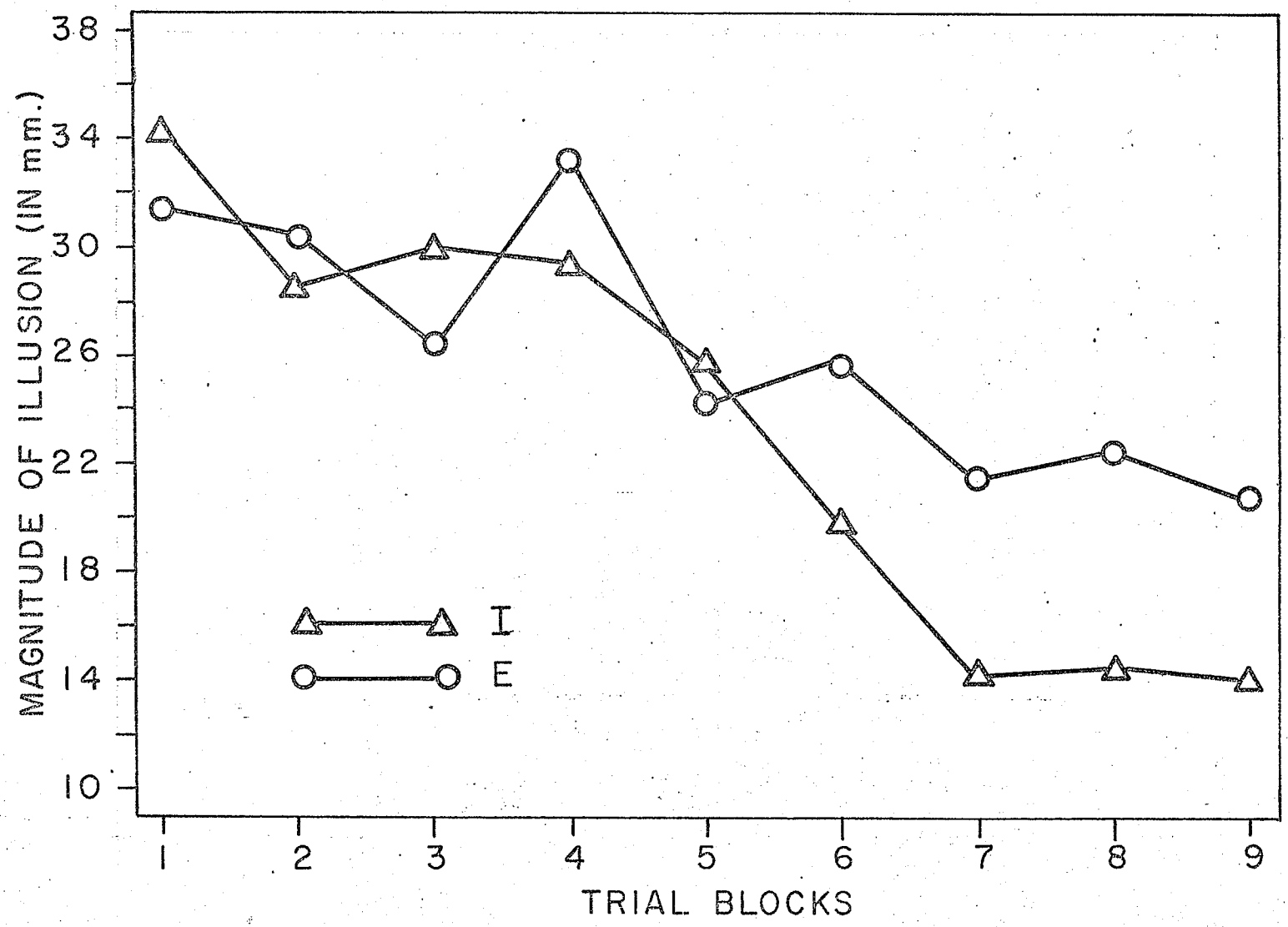


FIGURE. 19. LOCUS OF CONTROL BY TRIALS INTERACTION FOR IML - RAW

effects of the interaction were performed with the alpha level evenly divided by the number of comparisons (two) so that the critical value was .025. The decreasing trials effect for both internals and externals was significant. The F value for internals was 21.99 ($df=8/640$, $P<.025$), and for externals the F value was 7.46 ($df=8/640$, $P<.025$). Next, the nine means of the internal subjects were compared with each other employing the Tukey HSD test (Kirk, 1968) to pinpoint where significant changes had occurred across trials. Table 26 summarizes these results. Similarly, the nine means of the external subjects were compared with one another. These results are seen in Table 27. For internals, a greater number of comparisons were significant in contrast with external subjects. Again, this indicated that internals perceived the illusory figure more rapidly and accurately across trials. Perceptual learning during the middle trial blocks was greatest for internal subjects, leveling off after trial block six. On the other hand, externals perceived the figure at a slower rate and less accurately during the trials sequence. Post-hoc t-tests (two-tailed) were also completed, comparing the two levels of locus control for each trial block, to determine where internals and externals differed. For these _a posteriori_ tests the alpha level was evenly divided for the nine comparisons yielding a critical value of .003. No significant differences were obtained employing the stringent criteria, despite increasing differences observed after the fifth trial block in Figure 19.

TABLE 26

TUKEY HSD TEST OF MEANS INVOLVED IN THE LOCUS OF CONTROL BY TRIALS INTERACTION FOR INTERNALS ON THE RAW INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$ = 35.04 | 6.42 | 5.21 | 5.73 | 9.31* | 15.09* | 20.65* | 20.55* | 20.72* |
| $\bar{X}_2$ = 28.62 | - | -1.21 | -0.69 | 2.89 | 8.67* | 14.23* | 14.13* | 14.30* |
| $\bar{X}_3$ = 29.83 | | - | 0.52 | 4.10 | 9.88* | 15.44* | 15.34* | 15.51* |
| $\bar{X}_4$ = 29.31 | | | - | 3.58 | 9.36* | 14.92* | 14.82* | 14.99* |
| $\bar{X}_5$ = 25.73 | | | | - | 5.78 | 11.34* | 11.24* | 11.41* |
| $\bar{X}_6$ = 19.95 | | | | | - | 5.56 | 5.46 | 5.63 |
| $\bar{X}_7$ = 14.39 | | | | | | - | -0.10 | 0.07 |
| $\bar{X}_8$ = 14.49 | | | | | | | - | 0.17 |
| $\bar{X}_9$ = 14.32 | | | | | | | | - |

*P $<$ .01

TABLE 27

TUKEY HSD TEST OF MEANS INVOLVED IN THE LOCUS OF CONTROL BY TRIALS INTERACTION FOR EXTERNALS ON THE RAW INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1 = 31.60$ | 0.35 | 5.20 | -1.48 | 6.40 | 3.84 | 10.40* | 9.10* | 10.67* |
| $\bar{X}_2 = 31.25$ | - | 4.85 | -1.83 | 6.05 | 3.49 | 10.05* | 8.75* | 10.32* |
| $\bar{X}_3 = 26.40$ | | - | -6.68 | 1.20 | 1.36 | 5.20 | 3.90 | 5.47 |
| $\bar{X}_4 = 33.08$ | | | - | 7.88 | 5.32 | 11.88* | 10.58* | 12.15* |
| $\bar{X}_5 = 25.20$ | | | | - | -2.56 | 4.00 | 2.70 | 4.27 |
| $\bar{X}_6 = 27.76$ | | | | | - | 6.56 | 5.26 | 6.83 |
| $\bar{X}_7 = 21.20$ | | | | | | - | -1.30 | 0.27 |
| $\bar{X}_8 = 22.50$ | | | | | | | - | 1.57 |
| $\bar{X}_9 = 20.93$ | | | | | | | | - |

*$P < .01$

In sum, these results confirm the hypothesis (1b) that with successive trials internals would be progressively more accurate in their perception of the illusion than externals. In line with this hypothesis, it was also predicted (1c) that with successive trials the illusion would be perceived more accurately. The significant main effect of trials, which combines the effects of all other variables, seems to confirm this prediction. In Figure 17, it can be seen that the amount of illusion decreases with trials for at least three of the four experimental groups. However, the lack of a trials effect for externals under apparent instructions modifies the interpretation of the hypothesis to the extent that it supported for three of the four experimental groups.

A graphic representation of the instructional set by trials interaction is presented in Figure 20 in which the data are combined over locus of control. The graph shows that both sets of instructions seem to facilitate a decrease of the illusion over trials, but that after the fifth block objective instructions appear to be more facilitative than apparent instructions. The alpha level was evenly divided by the number of comparisons (two) yielding a critical value of .025 when a posteriori analyses of the simple effects of the interaction were conducted. The decreasing trials effect for both sets of instructions was significant. The F value for objective instructions was 18.96 ($df=8/640$, $P<.025$), and for apparent instructions the F value was 9.01

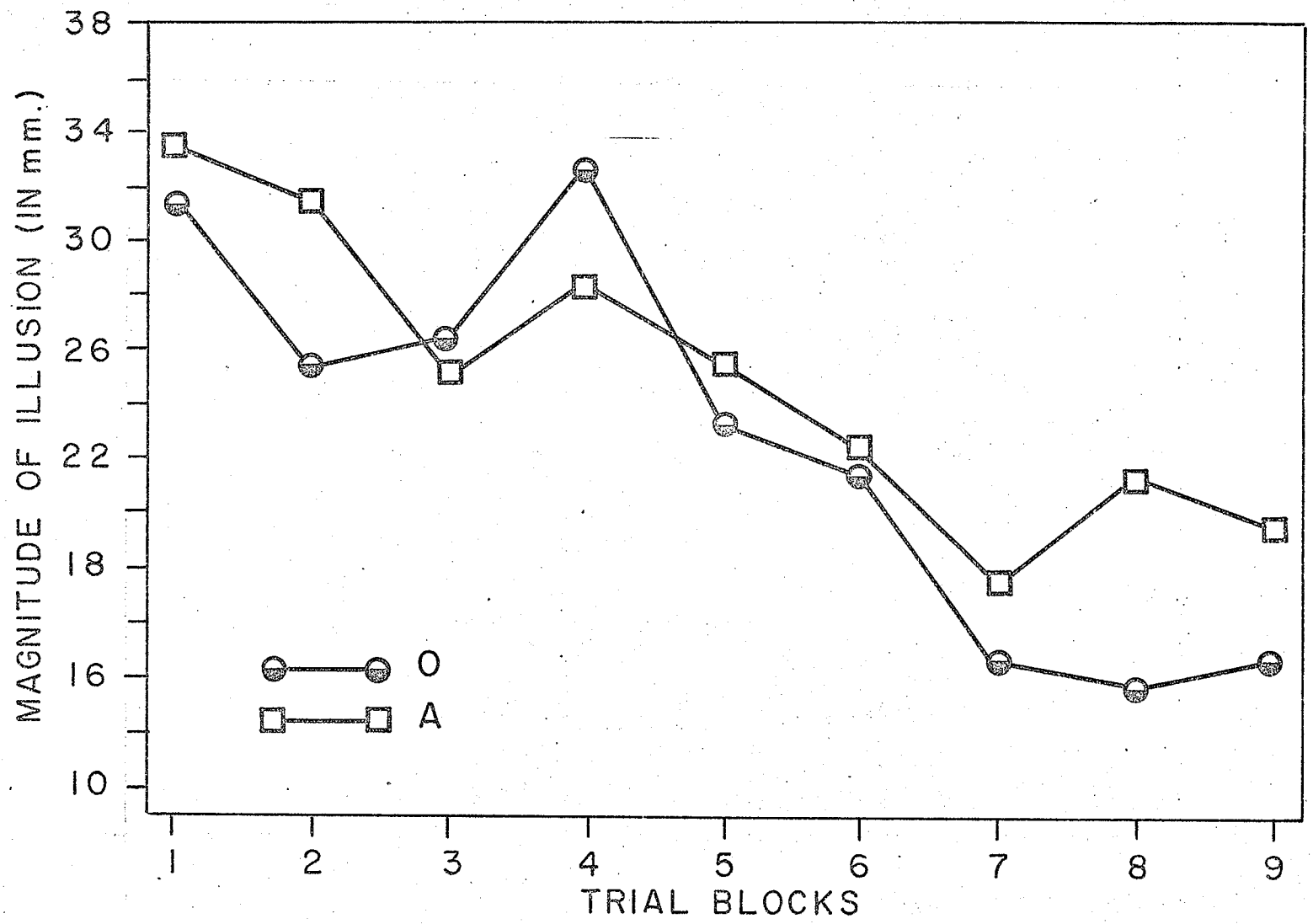


FIGURE. 20. INSTRUCTIONAL SET BY TRIALS INTERACTION FOR IML - RAW

(df=8/640, $P < .025$). Next, the nine means of the objective instructions were compared with one another using the Tukey HSD method (Kirk, 1968) to determine where significant changes had occurred over trials, and to assess the progressive nature of these changes. The results of this analysis are seen in Table 28. Similarly, the nine means of the apparent instructions were compared with each other. Table 29 summarizes these findings. For objective instructions, a greater number of comparisons were significant in contrast with apparent instructions. Again, this indicated that objective instructions were more facilitative than apparent instructions. Perceptual learning in the middle trial blocks was greatest under objective instructions, after an initial period of difficulty. Under apparent instructions learning was also greatest in the middle blocks, but it occurred at a slower rate throughout the trials sequence. Post-hoc t-tests (two-tailed) were also conducted, comparing performance with objective and apparent instructions for each trial block, to specify at which blocks instructional set significantly affected performance. For these a posteriori tests the alpha level was evenly divided yielding a critical value of .003 for the nine comparisons. No significant differences were found using this stringent criteria, in spite of the increasing differences observed after trial block five in Figure 20. In sum, these findings confirmed the hypothesis (2c) that under the condition of objective instructions, individuals would perform more accurately over

TABLE 28

TUKEY HSD TEST OF MEANS INVOLVED IN THE INSTRUCTIONAL SET BY TRIALS INTERACTION FOR OBJECTIVE INSTRUCTIONS ON THE RAW INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1 = 32.35$ | 4.03 | 3.62 | -0.94 | 7.79 | 10.71* | 16.39* | 17.48* | 17.28* |
| $\bar{X}_2 = 28.32$ | - | -0.41 | -4.97 | 3.76 | 6.68 | 12.36* | 13.45* | 13.25* |
| $\bar{X}_3 = 28.73$ | | - | -4.56 | 4.17 | 7.09 | 12.77* | 13.86* | 13.66* |
| $\bar{X}_4 = 33.29$ | | | - | 8.73* | 11.65* | 17.33* | 18.42* | 18.22* |
| $\bar{X}_5 = 24.56$ | | | | - | 2.92 | 8.60* | 9.69* | 9.49* |
| $\bar{X}_6 = 21.64$ | | | | | - | 5.68 | 6.77 | 6.57 |
| $\bar{X}_7 = 15.96$ | | | | | | - | 1.09 | 0.80 |
| $\bar{X}_8 = 14.87$ | | | | | | | - | -0.20 |
| $\bar{X}_9 = 15.07$ | | | | | | | | - |

*$P < .01$

TABLE 29

TUKEY HSD TEST OF MEANS INVOLVED IN THE INSTRUCTIONAL SET BY TRIALS INTERACTION FOR APPARENT INSTRUCTIONS ON THE RAW INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$ = 34.29 | 2.74 | 6.78 | 5.18 | 7.92 | 10.22* | 14.66* | 12.17* | 14.11* |
| $\bar{X}_2$ = 31.55 | - | 4.04 | 2.44 | 5.18 | 7.48 | 11.92* | 9.43* | 11.37* |
| $\bar{X}_3$ = 27.51 | | - | -1.60 | 1.14 | 3.44 | 7.88 | 5.39 | 7.33 |
| $\bar{X}_4$ = 29.11 | | | - | 2.74 | 5.04 | 9.48* | 6.99 | 8.93* |
| $\bar{X}_5$ = 26.37 | | | | - | 2.30 | 6.74 | 4.25 | 6.19 |
| $\bar{X}_6$ = 24.07 | | | | | - | 4.44 | 1.95 | 3.89 |
| $\bar{X}_7$ =19.63 | | | | | | - | -2.49 | -0.55 |
| $\bar{X}_8$ = 22.12 | | | | | | | - | 1.94 |
| $\bar{X}_9$ = 20.18 | | | | | | | | - |

*P $<$ .01

trials on the illusion than under the condition of apparent instructions, regardless of locus of control. However, data snooping of the triple interaction revealed some other interesting findings.

A graphic representation of the instructional set by trials interaction for each level of locus of control is shown in Figure 21. Both conditions of instructional set appear to generally facilitate performance over trials for internals. On the other hand, only objective instructions seem to facilitate performance across trials for externals. A posteriori analyses of the simple effects of the interaction were performed with the alpha level evenly divided by the number of comparisons (two) so that the critical value was .025. The instructional set by trials interaction was significant for both levels of locus of control. Under the condition of internality the F value was 2.54 ($df=8/640$, $P<.025$), and under the condition of externality the F value was 3.95 ($df=8/640$, $P<.025$). Analysis of the simple effects of this component of the triple interaction produced other significant findings. The analyses of trials for internals under both instructional conditions were significant. The F value under objective instructions was 9.89 ($df=8/640$, $P<.025$), and under apparent instructions the F value was 14.63 (df-8/640, $P<.025$). Next, the Tukey HSD procedure (Kirk, 1968) was employed to specify where significant changes had occurred over trials for each instructional set, and to assess the progressive nature of these changes. Table

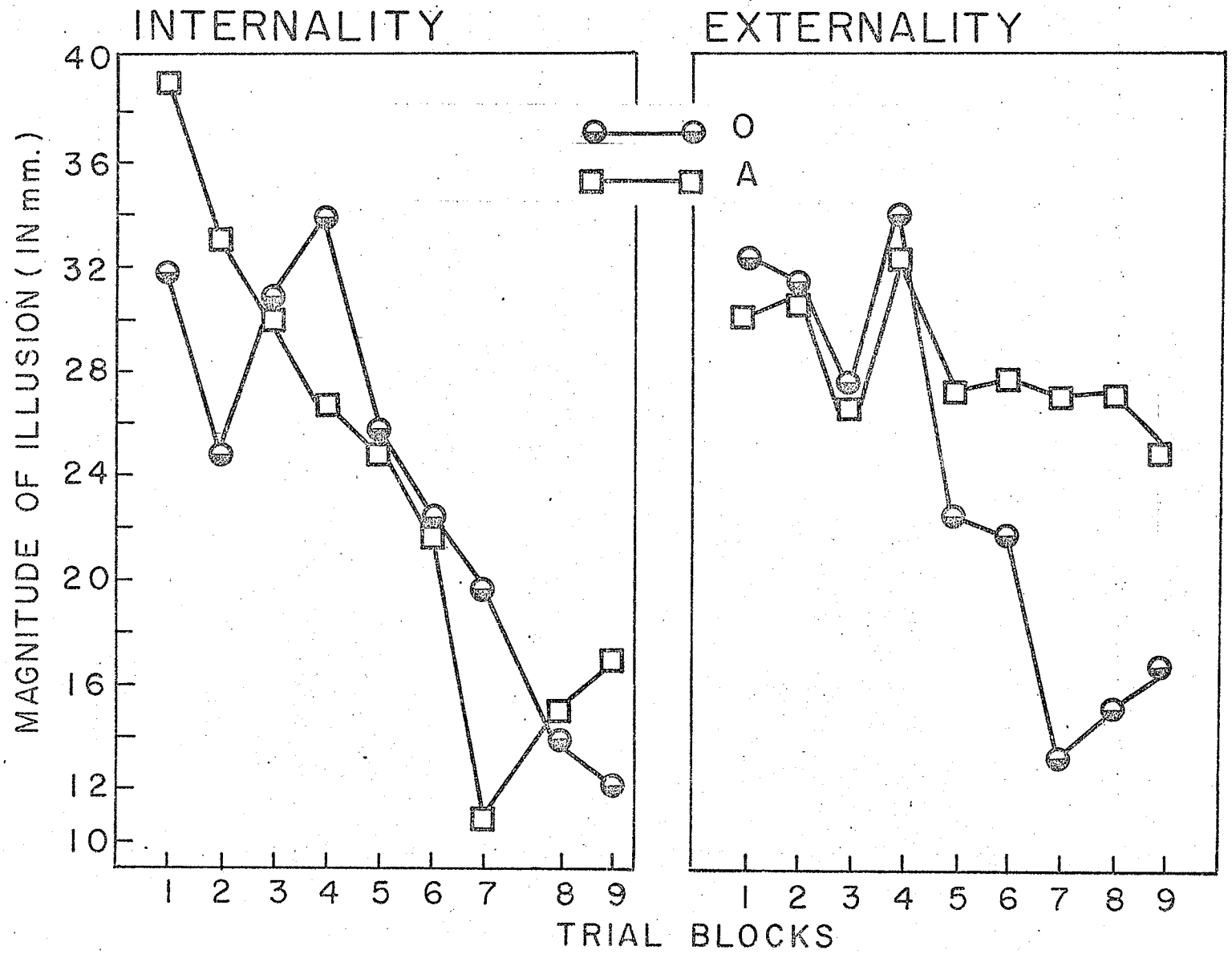


FIGURE. 21. INSTRUCTIONAL SET BY TRIALS INTERACTION FOR LOCUS OF CONTROL ON IML - RAW

30 summarizes the results for objective instructions, and Table 31 summarizes the findings for apparent instructions. For apparent instructions, a somewhat greater number of comparisons were significant, in contrast with objective instructions. Thus, while both sets of instructions facilitated performance for internals, it appears that apparent instructions were somewhat more facilitative. Post-hoc t-tests were also performed, comparing performance with objective and apparent instructions for each trial block for internals, to determine at which blocks instructional set significantly affected performance. The alpha level was evenly divided for these a posteriori tests yielding a critical value of .003 for each of the nine comparisons. Using this stringent criteria, no significant differences were found despite seeming differences in the early and late trial blocks in Figure 21. The analysis of trials for externals was significant under objective instructions ($F=10.35$, $df=8/640$, $P<.025$), but not under apparent instructions. Next, the Tukey HSD test (Kirk, 1968) was used to pinpoint where signficant changes had occurred over trials, and to assess the progressive aspect of these changes. The findings are presented in Table 32. A moderate number of comparisons were significant indicating that under objective instructions externals perceived the illusory figure fairly accurately, particularly in the middle trial blocks. Again, post-hoc t-tests, comparing performance with objective and apparent instruction for externals, did not produce any

TABLE 30

TUKEY HSD TEST OF MEANS INVOLVED IN THE INSTRUCTIONAL SET BY TRIALS INTERACTION UNDER INTERNALITY FOR OBJECTIVE INSTRUCTIONS ON THE RAW INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$ = 31.24 | 6.48 | 1.10 | -1.21 | 5.45 | 10.64 | 13.08* | 17.79* | 18.74* |
| $\bar{X}_2$ = 24.76 | - | -5.38 | -7.69 | -1.03 | 4.16 | 6.59 | 11.31 | 12.26 |
| $\bar{X}_3$ = 30.14 | | - | -2.31 | 4.35 | 9.54 | 11.97 | 16.69* | 17.64* |
| $\bar{X}_4$ = 32.45 | | | - | 6.66 | 11.85 | 14.28* | 19.00* | 19.95* |
| $\bar{X}_5$ = 25.79 | | | | - | 5.19 | 7.62 | 12.34* | 13.29* |
| $\bar{X}_6$ = 20.60 | | | | | - | 2.43 | 7.15 | 8.10 |
| $\bar{X}_7$ = 18.17 | | | | | | - | 4.72 | 5.67 |
| $\bar{X}_8$ = 13.45 | | | | | | | - | 0.95 |
| $\bar{X}_9$ = 12.50 | | | | | | | | - |

*P $<$ .01

TABLE 31

TUKEY HSD TEST OF MEANS INVOLVED IN THE INSTRUCTIONAL SET BY TRIALS INTERACTION UNDER INTERNALITY FOR APPARENT INSTRUCTIONS ON THE RAW INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1$ = 38.83 | 6.35 | 9.31 | 12.66* | 13.16* | 19.52* | 28.21* | 23.31* | 22.69* |
| $\bar{X}_2$ = 32.48 | - | 2.96 | 6.31 | 6.81 | 13.17* | 21.86* | 16.96* | 16.34* |
| $\bar{X}_3$ = 29.52 | | - | 3.35 | 3.85 | 10.21 | 18.90* | 14.00* | 13.38* |
| $\bar{X}_4$ = 26.17 | | | - | 0.50 | 6.86 | 15.55* | 10.65 | 10.03 |
| $\bar{X}_5$ = 25.67 | | | | - | 6.36 | 15.05* | 10.15 | 9.53 |
| $\bar{X}_6$ = 19.31 | | | | | - | 8.69 | 3.79 | 3.17 |
| $\bar{X}_7$ = 10.62 | | | | | | - | -4.90 | -5.52 |
| $\bar{X}_8$ = 15.52 | | | | | | | - | -0.62 |
| $\bar{X}_9$ = 16.14 | | | | | | | | - |

*$P < .01$

TABLE 32

TUKEY HSD TEST OF MEANS INVOLVED IN THE INSTRUCTIONAL SET BY TRIALS INTERACTION UNDER EXTERNALITY FOR OBJECTIVE INSTRUCTIONS ON THE RAW INGOING MUELLER-LYER ILLUSION

| | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ |
|---|---|---|---|---|---|---|---|---|
| $\bar{X}_1 = 33.45$ | 1.57 | 6.14 | -0.67 | 10.12 | 10.76 | 19.69* | 17.16* | 15.81* |
| $\bar{X}_2 = 31.88$ | - | 4.57 | 2.24 | 8.55 | 9.19 | 18.12* | 15.59* | 14.24* |
| $\bar{X}_3 = 27.31$ | | - | -6.81 | 3.98 | 4.62 | 13.55* | 11.02 | 9.67 |
| $\bar{X}_4 = 34.12$ | | | - | 10.79 | 11.43 | 20.36* | 17.83* | 16.48* |
| $\bar{X}_5 = 23.33$ | | | | - | 0.64 | 9.57 | 7.04 | 5.69 |
| $\bar{X}_6 = 22.69$ | | | | | - | 8.93 | 6.40 | 5.05 |
| $\bar{X}_7 = 13.76$ | | | | | | - | -2.53 | -3.88 |
| $\bar{X}_8 = 16.29$ | | | | | | | - | -1.35 |
| $\bar{X}_9 = 17.64$ | | | | | | | | - |

*P $<$ .01

significant findings in spite of differences in the later trial blocks observed in Figure 21. In sum, the prediction (2c) that under the condition of objective instructions, individuals would perform more accurately over trials on the illusion than under the condition of apparent instructions is sustained, more specifically, in the case of externals while the data failed to provide support for the hypothesis in the case of internals.

Additional data snooping concerning the hypothesis (2b) dealing with locus of control and instructional set was unproductive. The hypothesis was not supported in the main analysis of variance nor in any of the *a posteriori* analyses of the locus of control by instructional set component of the triple interaction. This component was explored at each of the nine trial blocks with the alpha level evenly divided for the nine comparisons so that the critical value was .003.

## Summary of Differences Found in the Analyses of the Corrected and Raw Ingoing Mueller-Lyer Illusion Data

At this point it may be of value to summarize the differences between the corrected and raw Ingoing Mueller-Lyer illusion data analyses. Furthermore, how these differences relate to the study's hypotheses is the major issue with regard to assessing the function of the Ingoing Mueller-Lyer illusion control task.

Corrected ingoing Mueller-Lyer illusion data. Here, three significant main effects (locus of control, instructional set, and trials) were obtained in the main analysis

of variance. Two significant interactions were also found (locus of control by trials, and locus of control by instructional set by trials).

Hypothesis 1a was confirmed. It was found that internals perceived the illusion more accurately than externals, particularly in later trial blocks. Hypothesis 1b was confirmed, but it was found, surprisingly, that externals as well as internals perceived the illusion more accurately over trials. In line with this, hypothesis 1c was confirmed as it was found that the amount of illusion decreased over trials for all experimental groups.

Hypothesis 2a was partially confirmed. Objective instructions facilitated more accurate performance than apparent instructions for externals, and over trials. The data did not indicate support for the hypothesis in the case of internals. The hypothesis (2b) concerned with locus of control and instructional set was not supported in any general sense. Only at one of nine trial blocks was the prediction sustained. The hypothesis (2c) dealing with instructional set and trials was not supported in the main analysis. However, the prediction was partially salvaged on a post-hoc basis as it was found that objective instructions facilitated performance over trials for externals, but the data failed to provide support for the hypothesis in the case of internals. Lastly, hypothesis 2d was partially confirmed. Under objective instructions there was little difference in the performance of internals and externals over trials.

However, under apparent instructions, both internals and externals performed more accurately over trials. Externals did not perform progressively less effectively as predicted.

Raw ingoing Mueller-Lyer illusion data. Here, only one significant main effect (trials) was found in the main analysis of variance. Three significant interactions were also obtained (locus of control by trials, instructional set by trials, and locus of control by instructional set by trials).

Hypothesis 1a was not confirmed. The data failed to provide evidence that internals, in general, perceive the illusion more accureately than externals. However, hypothesis 1b was confirmed. With successive trials, internals were progressively more accurate in their perception of the illusion. However, externals also perceived the illusion more accurately over trials. Hypothesis 1c was also confirmed. It was found, however, that the amount of illusion decreased over trials except for externals under apparent instructions.

Hypothesis 2a was not confirmed. The data did not provide support for more accurate performance as a function of objective instructions as contrasted with apparent instructions. The hypothesis (2b) dealing with locus of control and instructional set was also not confirmed. At no trial block was the prediction supported. The hypothesis (2c) concerned with instructional set and trials was partially confirmed. It was found that objective instructions

facilitated performance over trials for externals, while the data did not provide evidence for the prediction for internals. Lastly, hypothesis 2d was confirmed. Under objective instructions there was little difference between internals' and externals' performance over trials. Also, under apparent instructions, internals performed more accurately over trials whereas externals did not.

The most salient difference between the corrected and raw Mueller-Lyer illusion data is the absence of the between subjects main effects of locus of control and instructional set in the raw illusion data analysis. Other, more subtle, differences affecting the interaction hypotheses have already been noted. The relationship of this phenomenon to the function of the control condition will be discussed shortly. At this point, however, the different results obtained in the main analyses of variance for the corrected Ingoing Mueller-Lyer illusion, the raw Ingoing Mueller-Lyer illusion, and the Poggendorff illusion prompt further *a posteriori* analyses. For the Poggendorff data, like the raw Mueller-Lyer data, a main effect of instructional set was not demonstrated in addition to other interactions.

## Correlation Analyses

Different findings with the assorted illsuory tasks suggest examination of the relationships between the dependent variables in the study's main analyses of variance. Pearson product-moment correlations (Games and Klane, 1967)

were calculated comparing each set of illusion task data in each experimental group. Table 33 reveals, generally, low non-significant correlations.

One would have expected that effective performance on one illusory task is related to effective performance on another--particularly in the case of the corrected Ingoing Mueller-Lyer and Poggendorff illusions. The introduction of a control condition for the Ingoing Mueller-Lyer corresponds to different analysis of variance results. Neither the corrected nor the raw Mueller-Lyer illusion correlate significantly with the Poggendorff illusion, but the corrected illusion appears to be somewhat more related to the Poggendorff figure, and the hypotheses were predicted for control-corrected Mueller-Lyer data.

It is possible that the correlations in Table 33 are low because the range in the illusion measures may have been restricted due to the dicotomization of subjects on the I-E dimension. Therefore, the corrected Ingoing Mueller-Lyer illusion was correlated with the Poggendorff illusion under objective and apparent instructions allowing locus of control to vary more widely. Under objective instructions, it was found that the corrected Ingoing Mueller-Lyer figure was not related to performance on the Poggendorff illusion ($r=0.22$, $df=40$, $P > .05$). Similarly, under apparent instructions, it was found that Mueller-Lyer performance was not related to Poggendorff performance ($r=-.15$, $df=40$, $P > .05$).

Next, partial correlations (McNemar, 1955) were conducted

TABLE 33

PEARSON PRODUCT-MOMENT CORRELATION MATRIX COMPARING EACH SET OF ILLUSION TASK DATA IN EACH EXPERIMENTAL GROUP

| Group | TASK<br>IML (C) vs. IML (R) | IML (C) vs. POG | IML (R) vs POG |
|---|---|---|---|
| IO | .3293 | .0814 | .0595 |
| IA | .3407 | .0573 | .1819 |
| EO | .325 | .2733 | .1115 |
| EA | .5741* | .4210 | .1380 |

*P $<$.05

IML (C) - Ingoing Mueller-Lyer Illusion (Corrected with Control Data)

IML (R) - Ingoing Mueller-Lyer Illusion (Uncorrected Raw Data)

POG - Poggendorff Illusion

partialing out any possible effect of the personality variable from both illusion tasks in order to get the most pure measure of relationship between the two illusions. First, a correlation was calculated between the personality variable across objective instructions and the corrected Ingoing Mueller-Lyer illusion. An r of -0.03 (df=40) was obtained which suggested that locus of control is not related to the corrected Mueller-Lyer illusion under this set of instructions. The correlation between the personality variable over apparent instructions was significant (r= 0.32), df=40, $P < .05$)which indicated that locus of control is related to performance on the corrected Ingoing Mueller-Lyer illusion under apparent instructions. The correlation between the personality variable across objective instructions and the Poggendorff illusion was significant (r=0.52, df= 40, $P < .05$) which indicates that locus of control is related to performance on the task under this set of instructions. The correlation between the locus of control variable over apparent instructions and the Poggendorff illusion was not significant. An r of 0.27 (df=40) suggested that the personality variable is not related to performance on the Poggendorff illusion under this set of instructions. Finally, the partial correlation between the corrected Ingoing Mueller-Lyer and Poggendorff illusions under objective instructions, with locus of control partialed out, was 0.28. This partial correlation was tested for significance by the *t* technique. The *t* value was 1.80 (df=39) which indicated

that the probability of the correlation deviating from zero was not significant. The partial correlation between the corrected Ingoing Mueller-Lyer and Poggendorff illusions, with locus of control partialed out was -0.26. Again, the partial correlation was tested for significance by the *t* technique. The *t* value was -1.62 (df=39) which indicated that the probability of this correlation deviating from zero was also not significant. In conclusion, partialing out the effect of the locus of control dimension did not improve the relationship between the illusions, and the low correlations demonstrate that performance on the illusions are essentially unrelated.

# CHAPTER IV

# DISCUSSION

The present study was conducted for several reasons: First, to assess the predictive capacity and generality of the organismic model of trials effects. Secondly, to determine if goemetric illusions can be employed to differentiate perceptual performance of internals and externals. Third, to determine if objective versus apparent instructions defined along a dimension of task-relevant cue explicitness affect perception of the Poggendorff illusion as well as the Ingoing Mueller-Lyer illusion. Lastly, to determine if a successive trials effect can be replicated with the Ingoing Mueller-Lyer illusion when a psychophysical method of production is employed.

## The Organismic Model of Trials Effects

Two different types of illusory tasks were employed in this study in order to assess the generality of the trials effect model. The first task was the Poggendorff illusion, an illusion of direction. The second task, upon which predictions were based, was the corrected form of the Ingoing Mueller-Lyer illusion. The issue of the predictive capacity of the model was approached from two directions: use of a selection variable (the locus of control personality construct),

and the manipulation of instructional set.

Conceptualized as articulate perceivers, internals perceived both illusions more accurately, particularly during the later trial blocks. General confirmation of the first set of hypotheses (1a to 1c) essentially supports this statement. With repeated presentation of the same stimulus, internals processed perceptual information more efficiently than externals. Interestingly, though, externals also demonstrated a successive trials effect on both illusions. Within the context of the organismic model of trials effects, externals were conceptualized as global perceivers. As such, they were expected to demonstrate little, if any, practice effect on the illusory tasks. The contrary phenomenon suggests that the effect of trials, and the learning mechanism instrinsic to the illusions, may be more influential than locus of control in affecting what happens to the figures over trials. In other words, the nature of the task (a long series of repeated measures) seems to attentuate locus of control differences. Clearly, externals also effectively processed perceptual information over trials, though not at the same rate as externals. A comparison of epsilon values (Cohen, 1965) supports the interpretation that the learning mechanism of the illusions may be more influential than locus of control. For the corrected Ingoing Mueller-Lyer illusion, the epsilon value for the effect of locus of control was .26, and for trials it was .69. The effect of trials accounts for a much larger proportion of variance than locus of control. For the Poggendorff illusion an

epsilon value of .23 was obtained for locus of control, and an epsilon value of .51 was obtained for the effect of trials. Again, trials accounts for a greater proportion of variance.

The locus of control results demonstrated with the corrected Ingoing Mueller-Lyer and Poggendorff illusions can be integrated into a body of data generated from several previous studies. Internals have been found to be better perceptual learners than externals (Chance & Goldstein, 1971; Crandall & Lacy, 1972). It has also been shown that internals are more visually attentive (Lefcourt, Lewis, & Silverman, 1968), have lower recognition thresholds (Sauber, 1971; Strickland & Rodwan, 1964), and are more perceptually vigilant (Lefcourt, 1967; Lefcourt & Wine, 1969) than externals. With regard to information-processing, internals have been found to be more effective at extracting task-relevant information (DuCette & Wolk, 1973; Wolk & DuCette, 1974), utilizing it (Bartell, DuCette, & Wolk, 1972), and performing more accurately when feedback is intrinsic (Baron, et al,1974). In sum, the predictive capacity of the organismic model of trials effects, assessed in terms of the locus of control personality construct, appears to be quite adequate.

The second approach to estimate the predictive capacity of the trials model employed manipulation of instructional set. Objective instructions were conceptualized as conveying articulate information to the observers. This information elaborated some of the task-relevant cues which were assumed

to be required by the subjects in order for them to perform more successfully on the illusory tasks. In addition, it was contended that this type of instructions would provide the observer with definite extrinsic cues. Apparent instructions, on the other hand, were conceptualized as providing comparatively global information to the subjects. This information did not elaborate explicit task-relevant cues. It was also maintained that this type of instructional set would allow the observer to process the visual information contained in the task on her own (i.e., without the aid of previously defined explicit cues). The second set of hypotheses (2a to 2d) was partially confirmed for the corrected Ingoing Mueller-Lyer illusion, but not the Poggendorff illusion. None of the hypotheses involving instructional set were confirmed for the Poggendorff task. For the Mueller-Lyer illusion, it was found that objective instructions facilitated performance for externals _per se_, and over trials for external subjects. Also, under objective instructions there was little difference in the performance of internals and externals across trials. Under apparent instructions, however, internals performed progressively more effectively; but externals did not perform less accurately over trials as predicted. As with the locus of control variable, instructional set accounted for a smaller proportion of variance than the effect of trials in the main analysis of variance. For instructions, the epsilon value was .26, whereas an epsilon value of .69 had been obtained

for the effect of trials. The fact that trials accounted for the greatest proportion of variance than either the personality or instructional variables corresponds with Gibson's (1953) findings that greater accuracy in perceptual judgment occurs across repeated measures with a large variety of perceptual phenomena. The learning mechanism intrinsic in the task may, to some extent, obviate the effect of other experimental variables--particularly variables of a cognitive nature. In line with this, even for the raw Ingoing Mueller-Lyer illusion data, the epsilon value for trials was quite high, .46, while neither of the other cognitively-oriented variables (e.g., locus of control, and instructional set) were obtained as main effects.

The instructional set results found with the corrected Ingoing Mueller-Lyer illusion can be related to other studies' findings. Benussi's (1904, 1912, 1914) work contends that objective, cue explicating instructions facilitate destruction of the geometric illusions, including the Mueller-Lyer figure. Day's (1962a, b) investigations also suggest that objective instructions are related to Mueller-Lyer illusion decrement. Boht Benussi and Day manipulated observation attitude along a dimension of "whole viewing" and "part isolating." They found that the latter set of instructions facilitated visual accuracy. Mountjoy (1965) found that subjects who are aware of the type of distortion the Mueller-Lyer figure produces perceived the illusion more accurately over trials than subjects who have misconceptions about the

nature of the illusion. Several locus of control studies (Lefcourt, 1967; Lefcourt & Wine, 1969) have found that task-clarifying directions attentuate internal-external differences whereas in low cue conditions internals function more effectively than externals. Another set of investigations (Nickels & Williams, 1970; Williams, 1971) revealed that when the experimental task is highly structured locus of control differences weaken.

In the present study, neither previous illusion or locus of control findings are especially predictive of this experiment's instructional set results. For the Poggendorff task, no instructional set hypothesis was confirmed. Partial confirmation of only two instructions hypotheses (2a, 2d) was obtained for the corrected Ingoing Mueller-Lyer illusion. Another hypothesis (2c) was partially salvaged on a post-hoc basis. Furthermore, the hypothesis (2b) concerned with locus of control and instructional set was not confirmed for any of the study's tasks. Several possible explanations are offered. First, it has already been pointed out that externals performed more effectively over trials than expected on both tasks, and under apparent instructions on the corrected Ingoing Mueller-Lyer figure. These findings may lessen the probability of obtaining specific instructional set interactions, particularly since the effect of trials (or learning) is so strong for all experimental groups on both tasks. Second, the apparent instructions may not have been global enough. The subjects, especially

externals, may have been supplied with too much extrinsic information which made the tasks less ambiguous so that the instructional set hypotheses could not be demonstrated more conclusively. Third, similarly, the task itself may not have been highly structured enough to diminish the importance of the subject's generalized locus of control expectancy. Here, unlike in other studies cited, the experimenter did not alter schedules of reinforcement, or institute other response-contingent manipulations during the course of the subject's performance. In any event, the post-experimental questionnaire did not provide any insight into these issues.

Based on the Poggendorff data, it appears that any effects of instructional set did not generalize from an illusion of extent (the Mueller-Lyer) to an illusion of direction. In sum, the predictive capacity of the organismic model, assessed in terms of differential instructional set, seems to be quite limited. Further examination of the instructional sets (see Appendices) may offer another tentative explanation of the lack of generality, which is worthy of future systematic investigation. The apparent, low cue instructions which supplied comparatively global information to the subjects seem similar for the Ingoing Mueller-Lyer and Poggendorff illusions. That is, the instructions are approximately the same length--61 words for the Ingoing Mueller-Lyer illusion instructions, and 64 words for the Poggendorff figure instructions. Also, the number of "cue blocks" for each set of instructions is the same--one "cue

block" for each set of instructions. This term cue block is arbitrarily defined by the experimenter as a word or phrase assumed to convey a succinct piece of information to the subject which is necessary for efficient task performance. It should be pointed out that this aspect of the discussion of instructional set is a preliminary one based on post-experimental assessment. Cue blocks for each set of illusion instructions are denoted by italics in the respective appendix. The objective, high cue instructions which supplied comparatively articulate information to the subjects do not appear similar for the Ingoing Mueller-Lyer and Poggendorff illusions. That is, the instructions are not approximately the same length--109 words for the Ingoing Mueller-Lyer figure instructions, and 88 words for the Poggendorff target instructions. More importantly, the number of cue blocks for each set of instructions varies--5 cue blocks for the Mueller-Lyer instructions, and 3 cue blocks for the Poggendorff instructions. Cue blocks for each set of illusion instructions are represented by italics in the respective appendix. These frequency analyses suggest that the objective instructional set for the Ingoing Mueller-Lyer illusion was more cue-loaded than the objective instructions for the Poggendorff illusion. In other words, more task-related information may have been conveyed to the subject in preparation for performance on the Mueller-Lyer task than on the Poggendorff task. This may account for the finding that when between subjects error is minimized, by

use of a control condition in the case of the corrected Ingoing Mueller-Lyer illusion, instructional set is an effective variable in the perception of illusions. The Poggendorff figure did not employ a control condition to derive a response bias corrected illusion score. Lastly, these instructional set post-experimental analyses did not take into account the weighting of the cue blocks. Clearly, different cue blocks may be more essential to performance than other cue blocks. Also, the relative weighting of the cue blocks may interact with the type of illusion under investigation. In summary, lack of attention to possible differential information content of the objective instructional condition for each illusion was a methodological flaw of the study.

## The Function of the Control Condition for the Ingoing Mueller-Lyer Illusion

In the present study, no predictions were made regarding the Mueller-Lyer control task. These data were examined on an *a posteriori* basis to determine if a control score trials effect existed when a psychophysical method of production was employed in a repeated measures design, and to assess whether personality differences operated on non-illusory tasks. In summary, for the present study, no control score trials effect was demonstrated (unlike Sweeney's 1973, finding), only a triple interaction was obtained. A possible explanation is that a control score trials effect interacts with the particular experimental methodology used in the

investigation. This interpretation supports Sweeney's (1973) assertion that a control score trials effect is probably specific to the illusion measurement technique, and other conditions of the experiment. Analysis of the components of the triple interaction failed to produce substantive evidence for any clear relationship between the locus of control personality variable and performance on non-illusory tasks.

The purpose for correcting the Ingoing Mueller-Lyer illusion data in the first place has already been elaborated in the chapter on Method. The major reason was to increase the precision of the study by correcting for any between subject response bias. Correction was successful in accomplishing this as the between subjects raw Ingoing Mueller-Lyer illusion error term (1645.70) was much greater than the between subjects corrected Ingoing Mueller-Lyer illusion error term (148.74). Clearly, the use of a control condition minimized the possibility of error as a function of both between subjects variables. It should be noted, nevertheless, that the analyses of the raw Ingoing Mueller-Lyer illusion data were carried out on a post-hoc basis. Consequently, even though conservative confidence intervals were used, the results require replication to reach more certain conclusions. The same argument pertains to the control score data analyses.

The necessity of a control condition whenever possible in the investigation of geometric illusions cannot be

overemphasized, especially when organismic variables are studied. Phenomologically, an illusion has been defined as a perceptual judgment which is the net result of past experience and present stimulation (Merleau-Ponty, 1945). Organismic variables can be conceptualized to encompass a variety of past experiences which may influence perception of illusory and non-illusory figures. Illusion experiments which employ own-control designs and appropriate control conditions, such as the present study, allow the subject's perceptual functioning to be studied from a more valid phenomenological framework.

Despite the fact that no control condition was used with the Poggendorff illusion, several hypotheses (1a to 1c) received support for this task. Interestingly, the Poggendorff figure produced a much larger absolute illusion than the Ingoing Mueller-Lyer figure. The mean trial block score for all experimental groups on the Poggendorff target was 101.47. The mean trial block score for all experimental groups on the Mueller-Lyer figure was 23.61. The Poggendorff figure produced an absolute illusion more than four times as large as the Mueller-Lyer target. The point is that not only do the targets yield different sized illusions, but that the figures may be different in terms of the basic nature of their illusory mechanisms. The Poggendorff figure is essentially an illusion of direction, whereas the Ingoing Mueller-Lyer target is an illusion of extent (Pressey, 1970). As such, the degree to which data produced by these illusions

can be compared meaningfully with each other may be limited. This phenomenon argues for the lack of generality of the effect of instructional set across the tasks.

## Implications for the Organismic Model and Perceptual Functioning

The trials model depicts successive trials effects as sequential two-factor phenomenon. The illusory response is established, and with repeated trials perceptual information is processed so that the figure is seen more accurately. Flexible responding (i.e., destruction of the illusion with practice) is associated with articulate perceptual functioning, while rigid responding (i.e., relative lack of destruction of the illusion with practice) is associated with global perceptual functioning. In the present study, internals were conceptualized as articulate perceivers, and externals were conceptualized as global perceivers. Categorization of externals as global perceivers appears to be too simplistic as they demonstrated sizeable trials effects, although at a relatively slower rate than internals. The specific type of task, and task length may be some important variables to consider in conjunction with perceptual-development status when predicting criterion behavior as a function of locus of control, or other organismic variables.

In this study, locus of control represented a dispositional, or preestablished, strategy of information-processing as a function of prior learning history. The instructional

set variable, on the other hand, represented an experimentally induced strategy of information-processing. Support for the dispositional strategy was strongest. That is, the type of strategy a subject brings into an experimental situation seems to persist, irregardless of other experimental manipulations over different tasks. Thus, the present study's data suggest that how information is acquired, organized, and utilized may depend more on pre-experimental events that situational ones. This conceptualization supports a cognitive style basis of locus of control. Embedded arrangement of cognitive, organizational functions appear primary in determining not only what is learned, but at what rate the learning occurs. Effects of experimentally-induced strategies of information-processing seem more short-term and task specific.

An inference that may be drawn from the study's results is that the organismic variable of locus of control mediates the extent of practice effects on geometric illusions. On a more limited basis, instructional set also mediates practice effects, specifically for an illusion of extent. Both these types of variables have been discussed in terms of information processing strategies. Another factor which appears to be operating in a successive trials effect is that of information load. It is speculated that this hypothetical factor operates at two points: before the subject is instructed, and during actual task performance. Measurement of information processing ability with the internal-

external scale, or another related criterion behavior instrument, and "cue block" analysis are two techniques which could be employed to make more accurate predictions for perceptual learning of illusions. In line with this, the original conception of a successive trials effect as a two-factor phenomenon is most likely limited. Information load based on dispositional and experimentally-induced information processing strategies is a viable third factor to consider when predicting trials effects. Future research aimed at further delineation of this third hypothetical factor is warranted.

## The Issue of the Model's Generality

The lack of correlation between the corrected Ingoing Mueller-Lyer illusion, the raw Ingoing Mueller-Lyer illusion data, and the Poggendorff illusion poses some serious questions about the generality ofthe organismic model of trials effects. An implicit basic assumption of this study is replication of the experiment with different illusions. In other words, it is assumed that the same processes underlie perception of illusions. That is why identical sets of hypotheses were made for each dependent measure. Analysis of variance assesses this assumption to a certain extent. With this technique, it was found that both main effects (locus of control and instructional set) were not evident in the raw Mueller-Lyer data analysis. One reasonable explanation for this, in terms of the function of the

control condition, has been asserted. It was also discovered, however, that the main effect of instructional set also dissipated for the Poggendorff illusion. A more speculative set of explanations has been offered for this finding. Correlation analysis is a more direct test of the study's basic assumption. Based on these results it is difficult to interpret the main effects that have been obtained. The main effects seem to be tapping variances which are relatively non-overlapping. Therefore, it is hard to make a general statement about the relationship between personality variables and performance on geometric illusions. Similarly, it is difficult to make a general statement about instructional influence variables and illusion performance. Perhaps the most crucial finding of this study is that there is no simple relationship between cognitive variables and perceptual performance on illusions. It is evident that the phenomena found in this study are more complex than the organismic model of trials effects. The theory should be improved to take into account specific properties of different illusions. In a sense, this contention corresponds with Rotter's (1975) most recent observation that the broad generalized expectancy of internal-external control predicts at a low level even for similar subclass situations. In the present study, even though locus of control predictions were generally confirmed it was found that the meaningfulness and generality of these predictions was limited. Therefore, although the predictions

were supported in a broad manner, Rotter would probably argue for the low level quality of the predictions in terms of their explanatory capacity. Much more specifically, the data of the current study relate to Mischel's (1973) model of a cognitive social learning conceptualization of personality. Essentially, Mischel challenges the assumption that personality dispositions or traits (such as locus of control) are highly consistent, comparatively stable attributes that influence generalized causal effects on a variety of behaviors. These traits are inferred from behavior, and as such they are hypothetical. Mischel, on the other hand, argues for a behavioral specificity approach to personality investigation. This strategy focuses on the interdependence of behavior and situations mediated by cognitive activities. Situations are viewed in terms of informational input. The major point of Mischel's model is that accurate predictions depend on specifying variables from two vantage points: the stimulus and the person. It can be inferred from Mischel's work that the greater the specificity of the variables the more accurate and valid the prediction. In this study, the finding that there is no simple relationship between cognitive variables and perceptual performance on illusions, and the suggestion that the theory should be improved to take into account specific properties of different illusions corresponds with Mischel's recommendations. More systematic research on the Ingoing Mueller-Lyer and Poggendorff illusions is required. Similarly, further inquiry concerned with the

interindependence of cognitive variables (such as locus of control and instructional set), and performance on illusions is warranted. Manipulation of target viewing time, information content in terms of target stimulus variables, information load of instructions, and components of the locus of control construct provide some avenues for future research.

## Implications for Other Illusion Theories

The results of the present study have some interesting implications for two major theories of illusions. Pertinent theories briefly introduced here are categorized as primarily involving information-sampling, or learning.

Piaget's (1967) centration theory is a developmentally-oriented attempt to explain perception of illusory figures. He has found that adults adopt more active information search patterns than children. They are also more capable of focusing their attention (centrations) more accurately and quickly during inspection of illusory targets. As a result , adults display more perceptual activity during inspection, and simultaneously sample information more efficiently which results in greater illusion decrement. It is further contended that for children, attentional activity is not tempered by other perceptual activities which enable additional information-sampling to occur.

Theoretically, acts of attention are initially directed toward large stimulus contours which inhibit comparison

with smaller contours and less perceptual error unless the subject possesses appropriate counteractive skills which Piaget contends develop primarily as a function of age. These skills include better perceptual judgment, increased eye movement, and scaning abilities. Some of the results of the present study and previous investigations can be integrated into Piaget's body of data. Internals have been found to be more perceptually sensitive, more effective perceptual learners, and more efficient processors of perceptual information than externals. Here, internals were found to destroy two types of geometric illusions more effectively than externals. However, contrary to expectation, externals also demonstrated sizeable trials effects. Piagetian theory would probably have predicted these unexpected findings. For Piaget, the development of cognitive structures are interrelated with perceptual functioning. Age is the crucial developmental factor which accounts for differential cognitive-perceptual performance. Therefore, adult externals would not be expected to perform on a child-like level on illusory tasks. They may not perform as well as internals, but they are more capable at information-sampling than children.

For one illusion in the present study, instructional set was found to be an effective predictor of perceptual performance. As previously discussed, this finding may be related to the informational content of the instructions. The lack of a significant locus of control by instructional

set interaction for either task would also support Piaget's position that children and adults perceive illusions quite differently. Mores specifically, objective instructions did not appear to supply externals with enough information so that they performed like internals. Piaget would probably contend that the information-sampling skills of adult externals were already adquate so that additional information would have little influence on their current level of perceptual functioning.

Pressey's (1967, 1970, 1971) assimilation theory of illusions is a phenomenological learning-oriented approach to the explanation of geometric illusions. Two postulates, one concerned primarily with perceptual information-processing and one concerned with attentional processes, form the conceptual network of the theory. Assimilation, the first postulate, refers to the phenomenon that in a series of magnitudes, smaller magnitudes are overestimated and larger magnitudes are underestimated. Information is processed during the period of judgment, and the subject's response, although it may be illusory, generally becomes more accurate with repeated trials as information-processing becomes more efficient. Attentive fields, the second postulate, refers to the phenomenon that a context that falls within the attentive field will be more effective in contributing to the information which the subject processes than contexts which fall outside the field.

As stated earlier, internals have been found to process

visual information more efficiently than externals. They have also been found to scan problematic stimulus fields more effectively. They deploy visual attention more accurately, make more eye movements, and make a greater number of detailed observations than externals. In general, as Lefcourt, Lewis, and Silverman (1968) claim, internals appear to make better use of their own sensory apparatus. The results of this study are also congruent with Pressey's theory if one accepts the position that efficacy of assimilation and attentive field size can interact with organismic variables, such as locus of control. One could argue that internals assimilate perceptual data more accurately than externals so that less of an illusory response is present. Internals may have a type of correction mechanism in their assimilative process which enables them to perceive more accurately as well as more rapidly. The correction for externals may be delayed, and as such may vary as a function of target viewing time. With regard to attentive field, internals would be expected to have larger attentive fields, at least initially, which dissipate with repeated presentation of the stimulus. Externals, on the other hand, may not be capable of modifying attentive field size as readily, and thus "gate out" irrelevant data. As such, their illusory response would continue for a longer period of time. The data in the present study provide some support for this speculative discussion which requires additional research for further clarification.

Future Research

Suggestions for further investigation have been made during the course of the discussion section. At this point, more general ideas for research will be presented which focus on subject population variables and information-processing styles.

A fruitful area of future investigation involves comparison studies for different populations including children, and psychopathological groups such as schizophrenics. A major issue involves whether or not the organismic model of trials effects can predict illusory performance for internal and external schizophrenics. This type of research would deal with issues of development and perceptual functioning. The present study employed adult subjects and found that subjects considered to be at a lower level of perceptual development (externals) performed adequately, but not quite as well as subjects considered to be at a higher level of perceptual development (internals). Subject group comparison studies could deal with developmental aspects of cognitive and perceptual skills from two vantage points: one which focuses on age, and one which focuses on learning. The integrative issue would be concerned with the development of cognitive structures at different age levels which are related to capacity of perceptual learning.

The teaching of information-processing style raises some other questions for additional inquiry. Pre-training in information utilization may be required of externals in

order for their perceptual performance to be more effective: this subsumes a more basic and general problem of whether or not , and how, information-processing styles can be taught. Implications for remedial education are wide, particularly since many culturally deprived children have been found to be externals (Gurin, et al, 1969). Somewhat in line with this, manipulation of the orienting response in children and pathological subject populations (particularly schizophrenics) and subsequent performance on illusions may lead to different methods of assessing attentional deficits. Clearly, the current study has generated a variety of suggestions for future research.

## Clinical Implications

The discussions of the necessity of a control condition when investigating illusions, and the data here which demonstrated this necessity empirically point to an important psychotherapy issue. In general, the verbal psychotherapies conceptualize the patient or client as an individual person having a comparatively unique phenomenological framework of mental life. Most psychotherapies focus on the cognitive and emotional qualities of the person's mental functioning together with observable behavior. In this study, each subject served as her own control, and perceptual functioning was measured from each subject's phenomological framework. For the Ingoing Mueller-Lyer illusion, the control condition in a sense maximized the uniqueness

of each subject by minimizing between subjects error. Consequently, differences between internals and externals could be demonstrated. Also, instructional set differences could be shown. These findings correlate with a common technique of many verbal psychotherapies which involves the therapist learning about the phenomenological world of his client or patient. Rogerian (1951) technique is an example of a therapy style which clearly takes the position of letting the client and therapist explore fully the individualized aspects of the problem at hand. Jackson (1958) and Laing (1965) both propound that the multidimensional character of schizophrenic communication patterns requires extremely careful analysis by the therapist if he wants to understand how his patient uses language. It is maintained that this technique leads to a more accurate understanding of the patient's unique experience.

Pierce, Schauble, and Farkas (1970) have directly investigated the teaching of internalization behavior to psychotherapy clients. It was found that subjects who externalized the responsibility for their problems, and perceived themselves as victims gained more from internalization training than internals who were already at a higher pretest level of appropriate functioning. Perhaps human potential-oriented and self-actualizing therapies are more appropriate for externals as a strategy to be employed in the initial phase of personality change. Insight-oriented therapies which stress more independent cognitive and

emotional functioning may be more effective at a later stage of the individual's therapy process. It might be interesting to monitor therapy on a basic perceptual level by testing illusion performance at different treatment intervals.

# CHAPTER V

## SUMMARY AND CONCLUSIONS

This study was designed for different purposes, but primarily to assess the predictive capacity and generality of the organismic-developmental model of successive trials effects on geometric illusions. Secondarily, the study was conducted to find out if illusions can be used to differentiate between internal and external locus of control subjects, in terms of perceptual performance. Additional reasons for conducting the investigation were to determine if objective versus apparent instructions, defined along a dimension cue explicitness, affect perception of an illusion of direction as well as an illusion of extent. Also, to attempt to replicate a trials effect with the Ingoing form of the Mueller-Lyer illusion using a psychophysical method of production.

The trials model was assessed along two dimensions--the locus of control personality variable, and instructional set. The model depicts a successive trials effect as a sequential two-factor phenomenon. First, the illusory response is established. Second, with repeated presentation of the same data, the illusory effect decreases. Demonstration of a practice effect corresponds to flexible and articulate perceptual responding. On the other hand, lack of a successive trials effect is associated with rigid, global perceptual functioning. Within a Werner-Wapnerian

(1957, 1961) developmental framework, internals can be conceptualized as articulate perceivers, and externals can be thought of as global perceivers.

The experimental sample consisted of 37 female volunteers, and 47 paid participants. Subjects were classified as internal or external as a function of their score on the Internal-External Scale (Rotter, 1966). The median-split technique was used to categorize subjects. Subjects were classified in four experimental groups: internal-objective, internal-apparent, external-objective, or external-apparent. Two major sets of predictions, the first involving locus of control and the second concerned with instructional set, were made. Each set was identical for both the Poggendorff figure (an illusion of direction), and the Ingoing Mueller-Lyer target (an illusion of extent). Initially, it was found that type of renumeration was not related to the subjects' performance.

Hypothesis 1a. Previous research indicated that internals were more perceptually sensitive, vigilant, adept at processing visual information, etc., than externals. Therefore, it was predicted that internal locus of control subjects would perceive both illusions more accurately than externals. The hypothesis was confirmed in both tasks, but the effect developed in later trial blocks.

Hypothesis 1b. In line with the first prediction, it was hypothesized that with successive trials internals would be progressively more accurate in their perception of both

illusions than externals. For both figures, this prediction was sustained. Surprisingly, however, it was found that externals also demonstrated sizeable and significant trials effects, although not at the same rate as internals.

Hypothesis 1c. Consistent with previous findings that a large number of illusions decrease with practice, it was predicted that with successive trials both targets would be perceived more veridically. This hypothesis was also confirmed. It should be noted that for the first time a trials effect was found for the Ingoing form of the Mueller-Lyer illusion with a psychophysical method of production.

Hypothesis 2a. Previous research suggested that more directive, part-isolating instructions facilitate performance on the Mueller-Lyer illusion. Therefore, it was predicted that objective, cue explicit instructions would facilitate destruction of both illusions more readily than apparent instructions. The prediction was not supported for the Poggendorff illusion, and only partially confirmed in the case of the Ingoing Mueller-Lyer target. The prediction was supported, more specifically, for externals and over trials.

Hypothesis 2b. Locus of control data reveals that task structuring attentuate internal-external differences. In highly explicit and/or controlled tasks externals perform more up to the level of internals. Ambiguous, loosely structured tasks accentuate locus of control differences. Thus, under objective instructions less internal-external

differences were anticipated in contrast with apparent instructions under which it was predicted that internals would perform more effectively than externals. This hypothesis was not supported for either illusory condition.

Hypothesis 2c. In line with the predicted main effects of trials (1c) and instructional set (2a), it was also hypothesized that under objective instructions subjects would perform more accurately over trials on both illusions than under the condition of apparent instructions. This hypothesis was not supported for the Poggendorff task, but it was partially salvaged on an *a posteriori* basis. The hypothesis was supportable in the case of externals.

Hypothesis 2d. In line with previous research already mentioned, and the other instructional set hypotheses, it was predicted that with objective instructions there would be less difference in the performance of internals as compared to externals over trials, but with apparent instructions there would be progressively increasing differences between internals and externals, over trials, with externals performing progressively less effectively. For the Poggendorff illusion, this prediction was not supported. On the other hand, the hypothesis was partially confirmed for the Mueller-Lyer task with the exception that externals did not perform progressively less efficiently as predicted.

On a post-hoc basis, it was found that the Ingoing Mueller-Lyer control condition minimized between subjects error. Control scores were analyzed to determine if a

control score trials effect existed with a method of production, and whether personality and instructional differences were related to perception of non-illusory tasks. Neither point was substantiated, but the control score data suggested a possibility of response bias on the part of externals. This led to analysis of the raw Mueller-Lyer data in which the main effects of locus of control and instructional set dissipated. It was contended that the control condition minimized between subjects error, and thereby increased the probability of obtaining between subjects effects.

Further a posteriori analyses challenged an implicit basic assumption of the study: replication of the experiment with different illusions. It was maintained that there appeared to be no simple relationship between cognitive variables and perception of illusions. Specific properties of illusions may have to be taken into account in order to make more accurate predictions. A methodological flaw was also delineated. It appeared that the information content of the objective instructions for each illusory task was not controlled. This point, and related phenomena were discussed in relation to the lack of instructional set findings for the Poggendorff illusion. Suggestions for future research concerning a variety of information, perceptual learning, and organismic variables were made, and clinical implications were discussed. The data were also related to two other relevant, and comprehensive theories

of illusions.

Lastly, the results of the present investigation lead to the following conclusions: the predictive capacity of the organismic model of trials effects is fairly adequate; the generality of the model is quite limited; geometric illusions can be employed in locus of control research usefully; objective cue-explicit instructions do not appear to modify the perception of the Poggendorff illusion; and a trials effect exists for the Ingoing Mueller-Lyer illusion when a method of production is used.

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# APPENDICES

# APPENDIX A

## BASIC INFORMATION SHEET

NAME:

ADDRESS:

AGE:

YEAR IN COLLEGE:

## SOCIAL OPINION SURVEY

Please select the one statement in each pair of statements which you more strongly believe to be the case (as far as you personally are concerned). Be sure to select the one **YOU BELIEVE TO BE CLOSER TO THE TRUTH** rather than the one you think you should choose or the one you would like to be true. This is a measure of personal belief; obviously there are no right or wrong answers. (Remember, mark one and only one statement in each pair).

USE IBM SHEET #1 = a
#2 = b

I more strongly believe that:

1. a. Children get into trouble because their parents punish them too much.

   b. The trouble with most children nowadays is that their parents are too easy with them.

2. a. Many of the unhappy things in people's lives are partly due to bad luck.

   b. People's misfortunes result from the mistakes they make.

3. a. One of the major reasons why we have wars is because people don't take enough interest in politics.

   b. There will always be wars, no matter how hard people try to prevent them.

4. a. In the long run people get the respect they deserve in this world.

   b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

5. a. The idea that teachers are unfair to students is nonsense.

   b. Most students don't realize the extent to which their grades are influenced by accidental happenings.

6. a. Without the right breaks one cannot be an effective leader.

   b. Capable people who fail to become leaders have not taken advantage of their opportunities.

7. a. No matter how hard you try some people just don't like you.

   b. People who can't get others to like them, don't understand how to get along with others.

8. a. Heredity plays the major role in determining one's personality.

   b. It is one's experiences in life which determine what they're like.

I more strongly believe that:

9. a. I have often found that what is going to happen will happen.

   b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

10. a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.

    b. Many times exam questions tend to be so unrelated to course work that studying is really useless.

11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.

    b. Getting a good job depends mainly on being in the right place at the right time.

12. a. The average citizen can have an influence in government decisions.

    b. This world is run by a few people in power, and there is not too much the little guy can do about it.

13. a. When I make plans, I am almost certain that I can make them work.

    b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.

14. a. There are certain people who are just no good.

    b. There is some good in everybody.

15. a. In my case getting what I want has little or nothing to do with luck.

    b. Many times we might just as well decide what to do by flipping a coin.

16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.

    b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

17. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.

    b. By taking an active part in political and social affairs the people can control world events.

18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.

    b. There is really no such thing as "luck".

19. a. One should always be willing to admit his mistakes.

I more strongly believe that:

b. It is usually best to cover up one's mistakes.

20. a. It is hard to know whether or not a person really likes you.

b. How many friends you have depends upon how nice a person you are.

21. a. In the long run the bad things that happen to us are balanced by the good ones.

b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

22. a. With enough effort we can wipe out political corruption.

b. It is difficult for people to have much control over the things politicians do in office.

23. a. Sometimes I can't understand how teachers arrive at the grades they give.

b. There is a direct connection between how hard I study and the grades I get.

24. a. A good leader expects people do decide for themselves what they should do.

b. A good leader make it clear to everybody what their jobs are.

25. a. Many times I feel that I have little influence over the things that happen to me.

b. It is immpossible for me to believe that chance or luck plays an important role in my life.

26. a. People are lonely because they don't try to be friendly.

b. There's not much use in trying too hard to please people, if they like you, they like you.

27. a. There is too much emphasis on athletics in high school.

b. Team sports are an excellent way to build character.

28. a. What happens to me is my own doing.

b. Sometimes I feel that I don't have enough control over the direction my life is taking.

29. a. Most of the time I can't understand why politicians behave the way they do.

b. In the long run the people are responsible for bad government on a national as well as a local level.

# APPENDIX C

Objective Instructions for Ingoing Mueller-Lyer Practice Card:
"Your task is to make a point, on a given signal (E demonstrates click), which is in line with the dot on the lower right so that it indicates the exact distance, as it looks to you, between the middle of the two parallel lines above. Remember, here your task is to estimate the precise physical distance between the two lines. You will be able to see the distance most accurately by concentrating on the dots which indicate the middle of the parallel line. Any questions?"

Apparent Instructions for Ingoing Mueller-Lyer Practice Card:
"Your task is to make a point, on a given signal (E demonstrates click), which is in line with the dot on the lower right so that it indicates the exact distance, as it looks to you, between the middle of the two parallel lines above. Remember, here your task is to estimate the precise distance between the two lines. Any questions?"

# APPENDIX D

Objective Instructions for the Poggendorff Practice Card:

"Your task is to mark a point, on a given signal (E demonstrates click), where the straight short line on the left would precisely intersect the vertical line on the right if it continued. Remember, here your task is to estimate the exact physical point at which the short line would hit the vertical line as it looks to you. You will be able to estimate the meeting point if you concentrate on the short line alone. Any questions?"

Apparent Instructions for Poggendorff Practice Card:

"Your task is to make a point, on a given signal (E demonstrates click), where the straight short line on the left would precisely intersect the vertical line on the right if it continued. Remember, here your task is to estimate the exact physical point at which the short line would hit the vertical line as it looks to you. Any questions?"

# APPENDIX E

Objective Instructions for the Ingoing Mueller-Lyer Control Card: "Your task is to mark a point, on a given signal (E demonstrates click), which is in line with the dot on the lower right so that it indicates the exact distance between the two dots above. Remember, here your task is to estimate the precise physical distance between the two dots as it looks to you. You will be able to see the distance most accurately by concentrating only on the distance between the dots. Any questions?"

Apparent Instructions for the Ingoing Mueller-Lyer Control Card: "Your task is to mark a point, on a given signal (E demonstrates click), which is in line with the dot on the lower right so that it indicates the exact distance between the two dots above. Remember, here your task is to estimate the precise distance between the two dots as it look to you. Any questions?"

# APPENDIX F

Objective Instructions for Ingoing Mueller-Lyer Illusion:

"Your task is to mark a point, on a given signal (E demonstrates click)

(1) which is in line with

the dot on the lower right so that it indicates the exact distance, as it looks to you, between the apices of the two angles above. Remember, here your task is to estimate the precise distance between the two angles. You will be able to see the distance most accurately

(2) by concentrating on the points where the angles join,

(3) by looking at parts of the figure,

(4) by going over the distance between the points again and again,

(5) and by looking at the distance between the points as a straight line.

Apparent Instructions for Ingoing Mueller-Lyer Illusion:

"Your task is to mark a point, on a given signal (E demonstrates click)

(1) which is in line

with the dot on the lower right so that it indicates the exact distance, as it looks to you, between the apices of the two angles above. Remember, here your task is to estimate the precise distance between the two angles. Any questions?"

# APPENDIX G

Objective Instructions for the Poggendorff Illusion:

"Your task is to mark a point, on a given signal (E demonstrates click), where the straight short line on the upper left

(1) would precisely intersect

the vertical line on the right it is continued. Remember, here your task is to estimate the exact physical point at which the short line would hit the vertical line as it looks to you. You will be able to see the point of intersection most accurately

(2) by concentrating on the short line, and

(3) by isolating parts of the figure. Any questions?"

Apparent Instructions for the Poggendorff Illusion:

"Your task is to mark a point, on a given signal (E demonstrates click), where the straight short line on the upper left

(1) would precisely intersect

the vertical line on the right if it continued. Remember, here your task is to estimate the exact physical point at which the short line would hit the vertical line as it looks to you. Any questions?"

# APPENDIX H

## POST-EXPERIMENTAL AWARENESS QUESTIONNAIRE

In order to better evaluate this experiment and gain suggestions about future related ones, please answer the following questions:

1. What are some of your reactions to this task? What did you think of it?

2. Generally speaking, would you qualify yourself as a success on this task? If yes, why and if no, why not?

3. What did you observe and what were the most significant thoughts and feelings you had during the experiment?

4. What were the most significant or unusual things that you found the experimenter doing?

5. Any additional comments or suggestions.