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AN EXPERIMENTAL STUDY OF APPARENT BEHAVIOR

By FRITZ HEIDER and MARIANNE SIMMEL, Smith College

The processes which are involved in perceiving other individuals, their behavior and their personal qualities, have received but little attention in psychological literature.¹ Although these processes are basic in almost any social act, few experimental investigations relating to them are to be found. It is true that there have been studies concerning the inference of emotions from gestures or facial change. But most of these leave the reader with a feeling of disappointment and with the conviction that facial 'expressions'—at least as taken by themselves—do not play an important rôle in the perception of other persons. We are usually referred to the 'importance of the situation'; but what features of the situation are of importance or how the situation influences the perception are problems which are left unanswered. The reason is that research in this field has seldom been carried out from the point of view of the psychology of perception. The problem usually studied has concerned the 'correct' interpretation of expression, and not the stimulus-configurations as a determinant of interpretation. The same is true of another group of related investigations which concern the correctness of our judgments of others. If processes of perception are mentioned they are treated only so far as they impair the correctness of judgment.

In the investigation of the apprehension of colors, forms, or movement, which has attained a more mature stage of development, questions of achievement or correctness—though these still play a rôle of legitimate importance with some psychologists (*e.g.* E. Brunswik)—have largely given way to other problems. When the perception of movement is investigated, it is with the purpose of finding out which stimulus conditions are relevant in the production of phenomenal movement and of determining the influences of the surrounding field. Only when we attempt to answer these questions can we hope to

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¹ The word *perception* is used in this paper in the sense of cognitive response, *i.e.* as covering all cognitive processes which follow the exposure of a set of receptors to stimulation.

deepen our insight into the processes of perception, whether of movement or of other human beings.

The experiments on the perception of the behavior of others here reported are in method and purpose different from the investigations mentioned. In the first place, instead of presenting faces with the exclusion of the situation, we have presented situations and activities without the face. Secondly, our aim has not been to determine the correctness of the response but instead the dependence of the response on stimulus-configurations.

THE EXPERIMENTS

Method. Our subjects were requested to interpret a moving picture-film of about 2½ min. duration in which three geometrical figures (a large

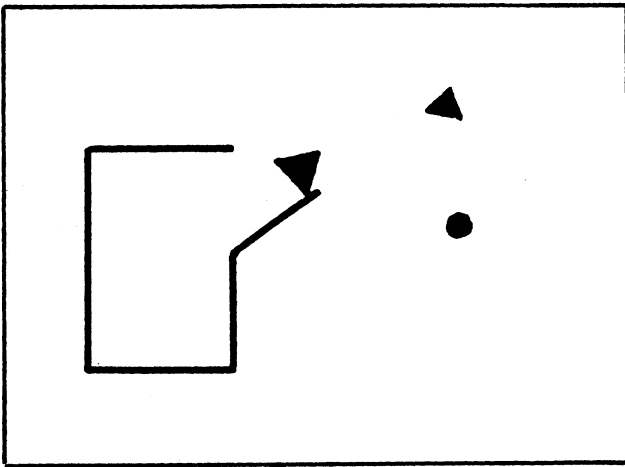


FIG. 1. EXPOSURE-OBJECTS DISPLAYED IN VARIOUS POSITIONS AND CONFIGURATIONS FROM THE MOVING FILM.

Large triangle, small triangle, disc and house.

triangle, a small triangle and a disc, also called a circle) were shown moving in various directions and at various speeds. The only other figure in the field was a rectangle, a section of which could be opened and closed as a door is. The film, one frame of which is shown in Fig. 1, was produced by a trick-film method. The geometrical figures were cut from cardboard and placed on a horizontal translucent-glass plate illuminated from above. A mirror below the plate threw the image into the

camera. After each exposure the figures which were to be shown in motion were moved a short distance, then another exposure was made, and so on.

In the following description of the main features of the picture, the action is, for purposes of reference, divided into scenes. A few 'anthropomorphic' words are used since a description in purely geometrical terms would be too complicated and too difficult to understand. The large triangle is referred to by T , the small triangle by t , the disc by c (circle) and the rectangle by 'house.'

1. T moves toward the house, opens door, moves into the house and closes door.
2. t and c appear and move around near the door
3. T moves out of the house toward t
4. T and t fight, T wins: during the fight, c moves into the house
5. T moves into the house and shuts door
6. T chases c within the house: t moves along the outside of the house toward the door
7. t opens the door and c moves out of the house and t and c close the door
8. T seems to try to get out of the house but does not succeed in opening the door: t and c move in circles around outside of the house and touch each other several times
9. T opens the door and comes out of the house
10. T chases t and c twice around the house
11. t and c leave the field
12. T hits the walls of the house several times: the walls break

The scenes of the picture shown in advancing order will be referred to by f (forward) added to the number of the scene, those of the picture shown in reverse by r .

Three experiments were performed with three different groups of undergraduate women: 34 Ss in Exper. i; 36 in Exper. ii; 44 in Exper. iii. In all three the film was shown twice, instructions given before the presentation of the film. The time allowed for describing the picture and answering the questions was not limited.

In the first experiment, instructions were general; "write down what happened in the picture."

In a second (the main) experiment, S was instructed to interpret the movements of the figures as actions of persons and a short sealed questionnaire was prepared which S was asked to open and answer after view-

ing the picture. It contained the following questions; (1) What kind of a person is the big triangle? (2) What kind of a person is the little triangle? (3) What kind of a person is the circle (disc)? (4) Why did the two triangles fight? (5) Why did the circle go into the house? (6) In one part of the movie the big triangle and the circle were in the house together. What did the big triangle do then? Why? (7) What did the circle do when it was in the house with the big triangle? Why? (8) In one part of the movie the big triangle was shut up in the house and tried to get out. What did the little triangle and the circle do then? (9) Why did the big triangle break the house? (10) Tell the story of the movie in a few sentences.

In the third experiment the same picture was shown in reverse. *S* was instructed to answer Questions 1, 2, 3, and 10, above.

RESULTS

In Exper. i the instructions were general, in order to find out how many *Ss* would perceive the picture in terms of animated beings. A large majority of them did. Only one *S* described the film almost entirely in geometrical terms. Her report follows.

A large solid triangle is shown entering a rectangle. It enters and comes out of this rectangle, and each time the corner and one-half of one of the sides of the rectangle form an opening. Then another, smaller triangle and a circle appear on the scene. The circle enters the rectangle while the larger triangle is within. The two move about in circular motion and then the circle goes out of the opening and joins the smaller triangle which has been moving around outside the rectangle. Then the smaller triangle and the circle move about together and when the larger triangle comes out of the rectangle and approaches them, they move rapidly in a circle around the rectangle and disappear. The larger triangle, now alone, moves about the opening of the rectangle and finally goes through the opening to the inside. He (sic!) moves rapidly within, and, finding no opening, breaks through the sides and disappears.

All other *Ss* interpreted the movements as actions of animate beings, in most cases of persons; in two cases of birds. Nineteen *Ss* reported a connected story. Two examples of this last group are given below, the first representative of the interpretation commonly made in the group, the second an excerpt of a report showing unusual elaboration.

(1) A man has planned to meet a girl and the girl comes along with

another man. The first man tells the second to go; the second tells the first, and he shakes his head. Then the two men have a fight, and the girl starts to go into the room to get out of the way and hesitates and finally goes in. She apparently does not want to be with the first man. The first man follows her into the room after having left the second in a rather weakened condition leaning on the wall outside the room. The girl gets worried and races from one corner to the other in the far part of the room. Man number one, after being rather silent for a while, makes several approaches at her; but she gets to the corner across from the door, just as man number two is trying to open it. He evidently got banged around and is still weak from his efforts to open the door. The girl gets out of the room in a sudden dash just as man number two gets the door open. The two chase around the outside of the room together, followed by man number one. But they finally elude him and get away. The first man goes back and tries to open his door, but he is so blinded by rage and frustration that he cannot open it. So he butts it open and in a really mad dash around the room he breaks in first one wall and then another.

(2) The first thing we see in this little episode is triangle number-one closing the door of his square. Let's insist that the action of the play is on a two-dimensional surface (not that it makes much difference) and we will undoubtedly start calling the square in which the triangle number-one seems to make his dwelling, a house, which infers three dimensions. But we are not sticking to the theme of our story.

Triangle number-one shuts his door (or should we say line) and the two innocent young things walk in. Lovers in the two-dimensional world, no doubt; little triangle number-two and sweet circle. Triangle-one (hereafter known as the villain) spies the young love. Ah! . . . He opens his door, walks out to see our hero and his sweet. But our hero does not like the interruption (we regret that our actual knowledge of what went on at this particular moment is slightly hazy, I believe we didn't get the exact conversation), he attacks triangle-one rather vigorously (maybe the big bully said some bad word).

In this experiment a few features were common to all reports save that first quoted (using geometrical terms). These common features follow. In Scene 4, *T* and *t* fight; in Scene 8, *T* is shut up in the house and tries to get out; in Scene 10, *T* chases *t* and *c*; throughout the picture, *T*, *t* and *c* move the door (the door never moves the actors).

In Exper. ii, all *S*s followed instructions and interpreted the movements as human actions. We shall try to indicate the degree of uniformity found

in the answers. The reasons given for the interpretations are necessarily only tentative and based on impressions in viewing the picture.

Questions 4 and 10 refer to the main interpretations. Q. 4: 'Why did the two triangles fight?' and Q. 10: 'Tell the story of the movie in a few sentences.' All reports have in common the following features.

(1) *T* and *t* fight. The events of impulsion with sudden impact give rise to this interpretation. (2) *t* and *c* belong together and are in antagonism to *T*. The reason for this is that during the course of the picture *t* and *c* are frequently shown moving together, they appear together in the field and they leave the field together. On the other hand, *t* fights *T*, and *c* is chased by *T*. The fight between *T* and *t* is the central event and the stories can best be classified in terms of the cause of this fight. In 11 cases (30%) this cause lies in the personality of *T*. *T* is an aggressive bully and he attacks *t*, or *t* and *c*, without any further reason. In one of these cases, *T* is a witch who tries to catch the children *t* and *c*. In the remaining cases the cause lies, at least in part, in the situation. The most common interpretation (18 cases, 50%) is that *T* and *t* are two men who fight over the girl or woman *c*.

This story has several variations: *T* does not want to marry *c*; *T* is the villain, *t* the hero and *c* his sweetheart; the wife *c* of *T* came home with another man. In three cases it is stated that *T* and *t* fight over *c*, but no allusion is made to an erotic triangle. In opposition to these cases are those in which the cause of the fight lies in the behavior of *t* and *c*. Two *Ss* write that *T* is provoked to his aggression by the fact that *t* and *c* tease him; in one case the fight started because *t* and *c* want to regain the house which *T* had taken from them; one *S* reports that *T* is an angry mother who wants to punish her two children because they came home late.

Thus *S* obtains a unified story and a central theme by referring to the causes of the events as seen in the picture.

Q. 1: What kind of a person is the big triangle?

The personality of *T* is judged with great uniformity. The expressions used are classified below in groups containing words with similar meaning. After each group is indicated the number and (after the larger groups) also the percentage of *Ss* who used at least one word of a given group.

Aggressive, warlike, belligerent, pugnacious, quarrelsome, troublesome, mean, angry, bad-tempered, temperamental, irritable, quick to take offense, bully, villain, taking advantage of his size, picking on smaller people, dominating, power-loving, possessive. *N* = 35 (97%)

Strong, forceful, slow but powerful. *N* = 5 (14%)

Dumb, stupid, apt to get confused, more strength than brains. N = 3 (8%)

Ugly, not attractive, spoiled, always on defensive, shy, crafty and sly. One S each.

We might expect that *T* would be described differently according to whether the cause of the fight is seen to lie in his personal characteristics or in the situation. Even an average man can become aggressive when he is provoked. *T* is almost always described, however, as an aggressive bully, even in the cases in which the fight starts, because *t* and *c* tease *T*. The reason lies probably in the way he fights *t*. He is portrayed in the picture as hitting *t* relentlessly until *t* cannot move and is pinned against the wall.

T makes the impression of being strong, probably not so much because of his greater size as because he wins in the fight with *t*. The interpretation "*T* defeats *t*" itself is based on the following data: *T* hits *t* more often than *t* hits *T*; *t* is driven backward by *T*; at the end of the fight *t* stands motionless against the wall while *T* hits him.

That *T* is described (3 Ss) as stupid is a consequence of the interpretation "*T* is fooled by *t* and *c*," *i.e.* *T* is locked up in his house by *t* and *c* and is thus frustrated in his attempt to chase them.

Q. 2: What kind of a person is the small triangle?

Heroic, valiant, brave, courageous, fearless, defiant, more aggressive than *c*, independent, resents being bullied, a fighter, does not allow himself to submit, spirited, cocky, snappy. N = 17 (47%)

Timidly aggressive, antagonist, then afraid, not too brave, quick to run away. N = 4 (11%)

Cagy, sly, crafty, tricky, wary, brains instead of brawn, clever, intellectual. N = 13 (36%)

Weak, not very strong. N = 6 (17%)

Protective, loyal, devoted. N = 5 (14%)

Inquisitive, likes to tease, appealing, attractive, more personality, less force, persevering, persistent, quiet. (One S each)

Figure *t* is called brave by many because, though smaller than *T*, he hits back and defends himself and *c*. He is clever and tricky because he is more active than *c* and therefore he is usually considered the cause of the locking up of *T*.

In 4 cases there is reported an element of cowardice in the description of *t*. We can assume that in these cases the reason for his going back in the fight may then be differently regarded, *i.e.* not his physical inferiority to *T*, but his fear of *T*.

Q. 3: What kind of person is the circle?

Does not like fighting, is frightened, afraid, fearful, cowardly, shy, timid, meek, not too sure of herself, goes where *t* goes, a follower, not much personality of her own, less initiative and nerve, relies for protection on *t*, helpless, dependent. N = 27 (75%)

Girl, woman, female, feminine. N = 22 (61%)

Shrewd, intelligent, clever, smart. N = 5 (14%)

Courageous, resistent, has courage. N = 4 (11%)

Weak. N = 3 (8%)

Opportunist, looks after own good, teasing, curious, playful, good natured, more gentle, very refined, nervous, retiring, beautiful, loyal, affectionate, coming to aid when necessary. (One *S* each)

The withdrawing of *c* during the fight and the fact that *c* never hits *T* accounts for the description of it as 'afraid, meek,' etc. Some *S*s obviously make *c* at least partly responsible for the ruse played on *T* and call *c* clever.

Q. 5: Why did the circle go into the house?

For protection, afraid to watch fight, frightened by fighting, to get out of the way of the fight, scared, tried to hide, for shelter against *T*, to escape villain *T*, afraid of what *T* might do to *t*. N = 33 (92%)

2 *S*s have *c* chased in or forced in by *T*, and one *S* makes *c* go in order "to lure *T* in and trap it."

In the first and second experiments, the majority of *S*s interpret the event as 'hiding' (though not always using this word). This high degree of uniformity is probably produced by the simultaneous event of *T* and *t* fighting and the movements of *c* preceding *c*'s entrance to the house. It is clear that *c* is afraid of the fight.

Q. 6: In one part of the picture, the big triangle and the circle were in the house together. What did the big triangle do then? Why?

T always subject, *c* object: went after, tried to catch, chased, cornered, trapped, tried to get closer to, tried to pin down, attacked, tried to harm, to kill, to torture, punished, pushed into corner. N = 27 (75%)

Tried to kiss, made love to. N = 3 (8%)

Was mad at and scolded; stood in front of *c* keeping *c* in suspense, closed the door to keep *t* out, stood guard at door afraid that *t* would come in, did not know what to do. (One *S* each)

The high degree of uniformity in the answers to this question is determined mainly by the temporal relationships of the movements. It is a case of successive movements without contact, which will be described later.

Q. 7: What did the circle do when it was in the house with the big triangle? Why?

Ran away from, avoided, eluded, evaded, stayed away from, tried to escape, did not want *T* to catch her, was almost captured, retreated, ran into corner, was afraid of, scared, terrified, frightened, shrank from, became nervous, disliked, was bored with. $N = 33$ (92%)

Tried to distract *T*'s attention from *t*, tried to tempt *T* into attacking it so that it could shut *T* in the house, fought with *T*. (One *S* each)

Most of the *S*s report that *c* tried to run away from *T* partly because *c* was afraid of *T*. $N = 14$ (39%); partly because *c* disliked, or was bored by, *T*. $N = 3$ (8%).

In two cases *c* is seen as cause; *c* tried to distract or tempt *T*. These cases belong to those exceptions in which *c* is described as playing a more active role ("resistant and courageous" and "coming to aid when necessary").

Q. 8: In one part of the picture the big triangle was shut up in the house and tried to get out. What did the little triangle and the circle do then?

Were elated, happy, glad, joyful. $N = 8$ (22%)

Kissed each other. $N = 3$ (8%)

Congratulated each other and shook hands very pleased (1)

The other answers either described merely the movements ('ran around') or referred to the scene immediately following (escaped).

The interpretation of the circular movements of *c* and *t* around each other and of their touching each other, as expressions of joyful emotion, is probably determined to a high degree by the preceding events; *T* is locked up in the house and *t* and *c* are together again.

Q. 9: Why did the big triangle break the house? 34 *S*s (95%) write to the effect that *T* was mad and thwarted because *c* and *t* had escaped. The act is again interpreted as an indication of emotion. One *S* puts the blame partly on *T*'s personality (a problem child). Two connect the act more definitely with the house. "*T* decided that it wasn't a strong enough trap to capture anybody," and "the purpose of the house could not be fulfilled without the circle, and then there would be no need for it."

These results show the possibility of investigating thus the perception of behavior of persons. The stimulus has many geometrical and temporal features which can be defined in an exact way and which can be varied infinitely. The tentative analysis of the answers to the questionnaire seems also to point to the great importance which causal interpretation plays in the organization of the events into a story. A few events stand out and

are seen by all Ss in the same way; these events are organized into a meaningful whole which contains causal centers (persons). Events and persons gain their significance by the way they are causally connected.

In Exper. iii, the picture was shown in reverse. All but two Ss again interpreted the movements as human actions. The interpretations show much more variation and, presumably, more projection than those of Exper. ii, and do not lend themselves to a quantitative analysis. Some of the results referring to single scenes will be given in the next section.

Following are three examples of the answers to the question: "Tell the story of the movie in a few sentences."

Man (*T*) finds himself in chaos, which finally resolves itself into a sort of cell representing Fate. He is able to free himself (but only temporarily), when Woman (*c*) accompanied by Evil (*t*) comes upon him, and disrupts his momentary peace. He feels called upon to rescue her, but Evil imprisons them both by Fate, from which Man escapes, leaving the woman there for safe-keeping. He at first seems to vanquish Evil, but Woman comes into the picture again and again disrupts Man. She goes off with Evil, as he seems the winner of the struggle, and Man, not understanding her, himself, or anything, resigns himself to Fate.

T is supposed to be in jail. The little ball (*c*) has come to kill him. When *c* and *T* are in the cell, *t* comes down to tell *c* how to kill *T*, *T* escapes, and *t*, unable to kill him, finally puts him back in the cell. The executioner and the keeper, thinking that their prisoner is safely locked in, go away; but the prisoner manages to escape unnoticed.

The story might be interpreted as an argument between husband and wife over child. The big triangle is the father, the smaller triangle the mother, and the disc the child. The father sent the child off in a room. The mother tries to persuade it to come out. When the child cannot be persuaded, the father and mother have a fight about it. The mother assails the father who does little to fight back. Finally the child comes out and goes off with his mother, leaving the father alone.

ANALYSIS OF THE RESULTS

We shall now attempt to answer in a more systematic way the question of how the interpretations arise.

Interpretation of the movement combinations. (1) Successive movements with momentary contact. We shall first consider the stimulus-conditions for elementary actions. Scene 4f offers an easy approach to such an analysis. Most of our Ss in Exper. i described this event in the

same way and, indeed, the apprehension of the moving *T* and *t* as hitting each other is phenomenally compelling. In order to begin our analysis we shall have to describe the stimulus-configuration and then to make clear the term 'hitting.' The stimulus consists of coördinated movements of *T* and *t*. *T* rapidly approaches *t* until it comes into contact with it. Then *T* stands still while, at the moment of contact, *t* starts moving in the direction of *T*'s previous movement. *S* has the strong impression of a transfer of kinetic energy from *T* to *t*. One could almost speak of an 'apparent movement' of energy. *T*'s movement is clearly the cause and *t*'s movement ('reeling back under the impact of *T*'s blows') is the effect. This phenomenal relationship is obviously determined by temporal succession and spatial proximity. The good continuation of the line—the fact that the direction of *t*'s movement continues the direction of *T*'s probably plays a rôle in the convincing appearance of this apparent energetic movement.

Another example of causation by impact occurs in Scene 12f, which all *S*s in Exper. i interpreted as '*T* breaking the house.' Again the impression of an apparent movement of energy is very strong. The effect consists here, not merely in a backward movement of the units as struck but also in a breaking to pieces.

(2) Simultaneous movements with prolonged contact. When the actors (*T*, *t* or *c*) are seen opening or closing the door, they seem to impart movement to the door, not by sudden impact but by pushing or pulling in prolonged contact. The stimulus-conditions are very simple: when *T* 'opens' or 'shuts' the door, *T* and the door move together in contact. The problem at once arises as to what determines which of two things moving together shall be seen as the origin and which as recipient of the movement. In the case of impulsion by sudden impact just considered, the causal origin is determined by succession in the events. In the case of slow pushing or pulling the local stimulus-conditions are insufficient for a full determination of the origin of locomotion.

Actually the interpretations are highly uniform in the case of the door. All *S*s see the actors as pushing or pulling the door. This is true whether the picture is shown forward or in reverse. A scene in the 'forward' film in which *T* closes the door by pushing is interpreted in reverse as '*T* opens the door by pulling.' The reversal

changes only the activity, not the origin. With impulsion by sudden contact it is different; reversal changes the temporal relation of the events and thereby the origin. What is seen in the forward picture as *T* hitting *t*, is seen in reverse as *t* hitting *T*.

The reason for the fact that *T*, *t* or *c*, rather than the door, is always seen as origin must lie in the larger field in which the local event door-actor-movement is embedded. The door never moves of itself, *i.e.* without another moving unit in contact with it. *T*, *t* and *c* continually move around by themselves. These units are therefore described as 'persons,' as potential origins of movement. If the door had been shown in other parts of the picture as moving independently, and *T* (for instance) as never moving alone, then a combined movement of the door and *T* would be ascribed to the door as origin, the door would push *T*.

(3) Simultaneous movements without contact. The situation is somewhat similar when two or more units move in the same direction, one behind the other, without touching each other. Such stimulus-conditions are again ambiguous and the interpretation will vary according to the place of origin of the movement. Let *A* be the front unit and *B* the back unit. Then if *A* is seen as origin, *A* will 'lead' *B*. If *B* is seen as origin, *B* will 'chase' *A*. In leading or chasing, both units have to move under their own power, both must be persons or animals, and the transmission of movement is not by means of physical, but by means of psychological, causation.

Again the surrounding data can determine the phenomenal position of the origin.

In Scene 10f there occurs an event which was in almost all cases interpreted as "*T* chases *t* and *c*." The film order is as follows; *T*, *t* and *c* move together, but not in contact with each other, twice around the house. *T* moves behind *t* and *c*. We can safely say that the reason for this uniform interpretation of *T* as the origin lies in the interpretation of the previous parts of the picture. The event '*T* chases *t* and *c*' is coordinated to two facts; *T* is stronger than *t* and *c*, and there is an antagonism between *T* and the pair *t* and *c*. These two features are contained in almost all interpretations of the 'forward' picture. Therefore, the event has to be interpreted as "*T* chases *t* and *c*" if it is to conform to what has happened before.

In the reverse picture, we do not find such uniformity in the interpretation of Scene 10. In only 13 cases (31% of the 42 Ss who were able to follow instructions) the event is dealt with explicitly. In 9 cases the origin is put definitely in *T* or in *t* and *c*.

Since in the r-picture *c* and *t* move behind *T*, the interpretation is '*c* and *t* chase *T*' when *c* and *t* are taken as the origin (4 cases), and '*T* leads *c* and *t*' when *T* is the origin (5 cases). Which interpretation is taken depends again on the interpretation of the rest of the story and the kind of persons the actors are taken to be. In the 4 cases with *t* and *c* as origin, *T* has the following characteristics; (1) *T* has done wrong, *t* and *c* rout *T*, (2) *T* timid, *t* fierce, (3) *T* a coward, (4) *T* is cautious, prudent. The 5 cases with *T* as the origin have the following features; (1) *T* is a bully, mean, clever and constructive (he has constructed a house and then shown the outside of the house to *t* and *c*), (2) *T* is aggressive (he tries to lead *t* and *c* into the house), (3) *T* is dictatorial and stubborn (he wants to rent his house to *t* and *c* and shows it to them), (4) *T* is a bully and playful (he lures *t* and *c* into the house), (5) *T* is a person of initiative, a good business man (he tries to sell his idea or his house to *t* and *c* and shows it to them).

The r-picture has no definite organization and it lends itself to very different interpretations. But each interpretation presents a unified whole and these parts, which are ambiguous as parts, are made to fit the whole. And one of the most important sources of ambiguity is the possibility of seeing the origin of changes in different individuals.

If one sees two animals running in file through high grass, one will interpret these movements in accordance with other data. If the one in front is a rabbit and the one behind a dog, he will perceive a dog chasing a rabbit. If the first one is a big rabbit and the second a small one, he will not see 'chasing' but 'leading' and 'following.'

(4) Successive movements without contact. In Scene 6f, *T* and *c* are in the house and the following movements occur; *c* stands in one corner, *T* approaches *c* suddenly but before *T* reaches *c*, *c* suddenly moves to another corner. This sequence is repeated several times. The movements of *T* and *c* are again successive. The origin is determined by the temporal relationship. In Exper. ii (Q6), 95% of the Ss interpret the event as '*T* chases *c*' or '*T* is the aggressor, *c* tries to evade *T*,' etc.

In the r-picture this event is interpreted only 4 times. Three times *c* is the origin ('*c* tries to drive *T* out of the house'; '*c* tries to catch *T*'; '*c* keeps *T* inside the house'). In one case the interpretation is ambiguous; '*T*, surprised at first by intruder *c*, finds her unresponsive to any friendly overtures.'

The unit which moves first is again more likely to be seen as the origin. It is another case of post hoc ergo propter hoc and a reversal of succession reverses the attribution of origin.

Causal origins. Thus we see that the interpretation of these simple movement-combinations varies according to the unit seen as the origin. The movements of lines and figures are the stimuli; but these movements become anchored in a field of objects and persons and are interpreted as acts. The distinction between perception that is relatively more directed by the stimulus and a perception that is more directed by the object can be applied in this case as legitimately as, for instance, in color-perception. Phenomenal movements per se are comparable to reduction colors, and acts of persons are comparable to object-colors. In both cases we can speak of attribution. In the case of color-perception the color is attributed in different degrees either to object or to illumination. In the case of movement-combinations the movement is attributed to the one or the other moving unit.²

In other words, the movements (or, more generally, any changes in the field) are organized in terms of acts of persons. It is obvious that this organization has many advantages from the point of view of achievement, *i.e.* from the point of view of the adaptation of the organism to the environment. The changes, when identified with a constant figural unit, no longer follow each other in an arbitrary and unconnected way. They are connected with invariable characteristics of the environment, they are meaningfully embedded in our picture of reality. We saw how the interpretation of movements is intimately connected with the interpretation of personality-traits of the actors, *i.e.* with the interpretation of invariances.

But this organization must be considered also from the point of view of performance. What processes take part in it? How is this

² The term 'attribution' describes what happens only in a formal and intellectualistic way since the actual process of perception does not start with an awareness of reduction-colors which are then turned into object-colors.

result attained? These questions cannot be answered on the basis of these experiments. It might be useful, however, to try to use an hypothesis of unit-formation. The movements and changes are in some way identified with figural units and thereby gain the significance of acts. Are persons units consisting of figural units and movements as their parts? And if movements are at all considered as parts, are they parts of a special kind? Does this unit-formation follow some of the laws of purely figural unit-formation? These are some of the questions to which such an hypothesis would lead us. In trying to answer them we may come nearer to an adequate theory.

Needs as origins. So far we have only considered the attribution of the origin of movement to persons as a whole. Often the attribution goes beyond that. The descriptions not only make clear which person, but also what motive or need within that person, is responsible for the movement. As a matter of fact, as soon as we ascribe a certain movement to a figural unit and consider this unit as an animated being, perception of motive or need is involved. When we see *T* hitting *t* we seem to perceive at the same time that *T* wants to hurt *t*. When we see *T* chasing *c* the fact of *T* wanting to catch *c* seems to be implied. But often the attribution to motive adds something and differentiates between different interpretations of actions with the same person as origin. This can be seen in the interpretation of the events of 'entering' and 'leaving.'

During the picture it happens several times that one of the actors (*T* or *c*) moves either in or out of the house. These movements, which can be defined in topological terms as entering or leaving the region of the house, give rise to various interpretations. The moving-in is called hiding, being-forced-in, being-lured-in, etc. The moving out is called escaping, being-invited-out, being-let-out, etc. What are the conditions which determine which of these interpretations is used to describe one and the same scene?

When we try to classify these interpretations, we find first of all that they differ according to whether the origin is attributed to the entering or leaving person itself or to another person. To the first class belong spontaneous actions (such as hiding or escaping); to the second class such induced movements as being-forced-out, being-invited-in, etc. But these are not the only differences which appear

in the interpretations. A person can enter a house in order to hide or in order to look for something in the house. That is to say that, although the moving person himself is the origin in both cases, the motivation may be different. Expressions like 'going to hide' and 'escaping' refer to movements and at the same time to motives.

We cannot read off the motivation from the movements themselves, *e.g.* from the movement of a circle entering the house. Movements of the other actors, or of preceding or succeeding events, offer cues for the determination of motives. In Scene 4f, *c* enters the house; of 14 Ss who mention the origin of the event in Exper. i, 11 describe it as hiding, running to shelter (92% in Exper. ii), etc., 2 as being-pushed-in by *T*, and one as going in 'because *c* does not want to be with *T*.'

When *T* enters the house in Scene 5f, the event is, in all the 9 cases where mention is made of the origin (Exper. i), described as *T* follows *c* in, *T* goes in to pursue *c*, etc. This interpretation is probably based on the immediately following Scene 6f, in which *T* chases *c* around within the house. Scene 5f is assimilated in regard to the origin to Scene 6f and both the movements of entering and the movements of chasing *c* are then interpreted as manifestations of the same motive to catch *c*. Thus we see that the event 'figure-entering-house' may be interpreted in many ways; as hiding, as pursuing somebody, or as being pushed in. The surrounding field determines the motive, and thereby the meaning of the event.

A description of movements in terms of motives again taps environmental layers of greater invariancy. Just as the successive perspective views of a landscape seen through the window of a moving train can only be 'resolved,' or made to yield a meaningful unit, by reference to distant objects laid out in space, so acts of persons have to be viewed in terms of motives in order that the succession of changes becomes a connected sequence.

SUMMARY

A motion picture which shows movements of three geometrical figures was the material of the investigation. It was presented to a first group of 34 Ss with the instruction to describe it; to a second group (36 Ss) with the instruction to interpret the movements as

actions of persons and to answer a number of questions relating to them. A third group (44 Ss) was treated like the second except that the picture was shown in reverse and with fewer questions.

The reports show that all but one S of Group I, all of Group II, and all but two of Group III interpreted the picture in terms of actions of animated beings, chiefly of persons. A characteristic feature of this organization in terms of actions is the attribution of the origin of movements to figural units and to motives. It has been shown that this attribution of the origin influences the interpretation of the movements, and that it depends in some cases on the characteristics of the movements themselves, in others on surrounding objects. The way in which the actors are judged is closely connected with this attribution of origin. It is held that this method is useful in investigating the way the behavior of other persons is perceived.