THE EFFECT OF 'MEANING' ON THE AUTOKINETIC ILLUSION

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The autokinetic illusion is conventionally described as "illusory movement presented by a small light of weak intensity in a dark room."[1] This definition is somewhat misleading, because the basic experience requires neither a weak light (pin-point source) nor a dark room. In fact, the first recorded observation of autokinesis, that of Alexander van Humboldt in 1799, took place on a mountaintop at daybreak. Humboldt noted that stars sometimes seem to perform oscillatory movements (*Sternschwanken*). Humboldt's astronomical observation was shown to be an illusion by Schweizer, who not only demonstrated that the stars 'oscillate' differently for different observers, but also duplicated the phenomenon in his laboratory. One of his demonstrations followed the conventional pattern of today (an opaque lantern, with a small opening, in a darkened room); another consisted of a black speck on a white background, which he reported to have behaved like an animated insect.[2]

The variety of sources which can produce autokinesis make it plausible to define the illusion in relatively general terms. Adams provides such a definition when he describes autokinetic movement as "illusory movement of a small object, or a collection of small objects, which is seen after a longer or shorter fixation against a relatively uniform background."[3]

Adams observes that when geometrical figures serve as stimuli for autokinesis, the nature of the movement is related to the shape of the stimulus. A 'round' light, for instance, "often gave the impression of a balloon, floating freely through the air"; it tended to turn in arc-like fashion, and to spin like a billiard ball; also, "it was possible for this light to go as fast in one direction as in any other, there being nothing in the shape of the light which would check movement in any direction." A 'square' light "often suggested a boat going through the water"; it tended to turn in sharp angles, and "like the round light, it could go in all directions with equal facility."[4] By contrast, a 'perpendicular, rectangular' light "moved much more frequently than did the square one to the right and left, less frequently up and

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[1] H. A. Carr, The autokinetic sensation, *Psychol. Rev.*, 17, 1910, 42-75.

[2] S. Exner, Ueber autokinetische Empfindungen, *Z. Psychol.*, 12, 1896, 315.

[3] H. F. Adams, Autokinetic sensations, *Psychol. Monogr.*, 14, 1912 (No. 59), 1-32.

[4] Adams, *op. cit.*, 13.

down and along the diagonals."[5] The perpendicular light also showed differences in apparent speed. Whereas it tended to move slowly to the right or left, it moved fast upward or downward.

These observations with geometrical shape suggest the possibility that meaningful connotations in the stimulus-figure may also be able to determine the direction and quality of autokinetic movement. If a round light, giving "the impression of a balloon," tends to move in any of several directions, might not a figure shaped like an "airplane" tend to move in the direction of its "nose"? If a perpendicular rectangle tends to move left or right, could a perpendicular arrow not tend to move up or down, depending on where it was pointed?

Meaningful stimulus-figures have been used with some success to determine the direction of movement with various types of apparent movement, such as movements of shadows and after-images, induced movement, and stroboscopic movement.[6] The autokinetic illusion, which in its pure form provides no directional information, should lend itself even better than other forms of apparent movement to determination through 'meaning.'

Autokinesis has been experimentally modified by means of various types of experiences. The movement has been 'conditioned' for instance, by means of motor tasks and rewards and punishments.[7] The direction of the perceived movement has been determined by means of suggestive instructions.[8] Most important, individual *O*s have been made to yield their perceptual preferences in the face of pressures toward social conformity. They have come to perceive the autokinetic illusion in line with what they felt was being perceived by others.[9]

The use of 'meaningful' figures parallels the administration of social suggestion and the use of training techniques. In the latter cases, *O*'s perception is structured by experiences brought to bear on him before he perceives. In the case of 'meaningful' figures, past experiences are presumably built into the stimulus. Insofar as a figure is meaningful, it resembles objects which the subject has encountered in the past. The fact that the connotations of objects can play a role in structuring perceptual experience may be deduced from differences between the perception of 'meaningful' figures and their geometrical equivalents, or from differences among perceptions engendered through the use of differently 'meaningful' figures.

The present study explores the possibility of determining the direction of autokinetic movement through the use of figures representing objects

[5] *Ibid.*, 16.

[6] H. H. Toch and W. H. Ittelson, The role of past experience in apparent movement: A revaluation, *Brit. J. Psychol.*, 47, 1956, 195-207.

[7] E. A. Haggard and Rachel Babin, On the problem of "reinforcement" in conditioning the autokinetic phenomenon, *J. exp. Psychol.*, 38, 1948, 511-525; E. A. Haggard and G. J. Rose, Some effects of mental set and active participation in the conditioning of the autokinetic phenomenon, 34, 1944, 45-49.

[8] Muzafer Sherif, A study of some social factors in perception, *Arch. Psychol.*, 27, 1935, (No. 187), 1-60.

[9] Sherif, *op. cit.*, 1-60 also, *The Psychology of Social Norms*, 1936.

with movement connotations. If perceived movement should tend to occur predominantly in 'meaningful' directions, the *O* has presumably responded in line with his past experience with relevant objects.

Apparatus and stimulus material. The apparatus used for the study was a portion of a larger set of equipment described elsewhere.[10] Illumination is provided by two 7½-w. filament bulbs contained in a 2½ x 4½-in. compartment fronted with diffusion glass. Between this diffusion glass and a screen of silvered glass facing the subject, a photographic transparency can be centered by means of a slideholder. For the present study, the light was switched on and off manually. Intensity was maintained constant (at approximately 11-ft. candles) with the aid of a voltmeter.

O sat 7 ft. directly in front of the screen, with his head immobilized in a headrest. In one set of conditions, he viewed the stimulus in a 5 x 5-in. square produced by covering the sides of a 5 x 15-in screen with black construction board. Another set of conditions faced *O* with a circular opening, 3½ in. in diameter, in a large round wooden disk, 30 in. in diameter. Observations took place in the dark.

The slides containing the stimulus-figures were opaque, with the stimulus-figure transparent, and all (except the control stimulus) approximately ¾ in. long. The stimuli were solid drawings, each occupying approximately the same area. Six figures were used: two (depicting a running man and a jumping deer, respectively), were employed to elicit horizontal movement; two (an airplane and a bomb or rocket) were used for vertical movement; one (an arrow) was used either horizontally or vertically; and another (a small solid disk) was used as a control stimulus.

General procedure. Each *O* was presented with a series of four figures, the control stimulus (small disk) and three 'meaningful' figures. The three figures either fell into the horizontal or the vertical group. They were alternately pointed in opposite directions. The specific figures were systematically randomized, and the *O*s were randomly assigned to a given sequence. Typical sequences, for instance, were (1) disk; running man, facing left; jumping deer, facing right; and arrow, pointed left; (2) disk; arrow, pointed down; airplane, pointed up, and bomb (rocket), pointed down.

The *O*s were instructed as follows:

> I shall show you a light. After a while, this light will start to move. Tell me *at once*, as soon as the light starts to move. Please also tell me in what direction the light is moving.

Pilot Study

In the pilot study, 26 *O*s were presented with the vertical figures (airplane; bomb or rocket; arrow) in the square screen. The data obtained in this experiment are summarized in Table I. As may be noted, three out of five of the movements perceived with each figure, proceeded in the 'correct' direction (up or down). For each of the test-figures, a Chi-square test of independence (corrected for continuity) was computed to see

[10] Toch and Ittelson, *op. cit.*, 203 f.

whether the number of persons perceiving movement in the 'correct' and 'incorrect' vertical direction was independent, *i.e.* whether it departed significantly from 50%. In the case of the airplane and the arrow, the chi-squares were significant ($p < 0.02$ and $p < 0.01$ respectively). The difference in the case of the bomb or rocket fell short of significance ($p < 0.10$).

Main Study

In the main study, 150 *Os* were exposed to the autokinetic illusion using the 'horizontally meaningful' figures (arrow, running man, and jumping deer). The square screen was used with roughly half this group (73 *Os*).[11] The data obtained show an anomalous distribution of movements for the

TABLE I

Autokinetic Movements Observed with 'Meaningful' Stimulus-Figures that Suggest Vertical Movement
(N = 26)

Stimulus-figure (Pointed up or downward)	Horizontal movement			Vertical movement		Other kinds
	none	left	right	correct	incorrect	diagonal
Airplane	1	0	5	16	4	0
Arrow	0	2	2	16	3	3
Bomb	0	1	3	15	6	1
Total	1	3	10	47	13	4
Control (circle)	0	3	7	9*		7

* Four movements upward and five downward.

control figure, which seemed to be related to the shape of the screen. The circular screen was constructed to control for this possibility, and the remaining 77 *Os* were processed with it. Table II shows the 'control' observations of *Os* exposed to the square and round screens. With the square screen, two thirds of the perceived movements occurred on the horizontal plane—over three times as many horizontal movements as vertical movements. This horizontal preference is not evident with the circular screen. A horizontal-vertical Chi-square test of independence proved signficant for the square screen ($p < 0.001$), but not for the circular frame. The circular frame also frequently elicited definite circular and ambient (three dimensional) movements, which only rarely occurred in passing using the square screen.

Table III presents the data for the 'meaningful' figures, as viewed by

[11] Seventeen additional *Ss* were used with the square screen and the control stimulus.

the 150 *Os*.[12] The Chi-square test of independence was applied to the horizontal movement of the arrow, and to the horizontal and diagonal movements of the running man and jumping deer (which were somewhat ambiguous as to plane of movement). The difference in favor of 'correct' movement proved significant for each figure ($p < 0.001$).

Discussion

Our data show that meaningful connotations in an autokinetic stimulus participate in determining the direction of the perceived movement. A figure depicting an object which has been experienced as moving seems to include directionality among its connotations. This directional connotation may facilitate the perception of movement in the implied direction, and reduce the probability of movement in other directions.

TABLE II

Effect of Frame on the Perception of Movement with a Disk Figure

		Horizontal movement				Vertical movement			Other kinds	
Frame	*N*	none	left	right	both	up	down	both	diagonal	circular or ambient
Horizontal	90	0	26	33	1	9	9	1	11	0
Circular	77	1	21	12	—	13	6	—	12	12

The autokinetic illusion is probably the most sensitive available test for determinants of the direction of movement, since the stimulus itself is structurally neutral. It occasions movement *per se*, and seems to leave the direction, extent, speed, and duration to *O*. Any subjective and structural biases in the perceptual transaction can function to supplement the inconclusiveness of the stimulus. Fixation, 'will power,' and 'suggestion' have been cited among such biasing factors.[13] Eye dominance or other functional non-equivalence along the optic pathways could act as biasing determinants. The experiment reported above shows that 'meaning' can also play this role.

Admittedly the nature of autokinetic movement is such that relatively 'weak' determinants can enter to determine what is perceived. All that

[12] Pooling the data for the two viewing conditions seemed justified because (a) both screens are symmetrical, so that no left or right bias would be expected; and (b) each stimulus was pointed left or right 50% of the time, so that *even if there was* a directional effect, it could not qualify the results.

[13] Exner, *op. cit.*, 313, 330; Carr, *op. cit.*, 75; Adams, *op. cit.*, 32; Sherif, *op. cit.*, 60.

can be inferred about the effectiveness of any determinant in this type of perceptual situation is that it *can* function as a determinant. Thus we can conclude no more from the above than that meaningful connotations *can* influence movement direction—at least for *some Os*, under *optimal* conditions.

It is also not legitimate to conclude from our data that the autokinetic phenomenon is *centrally* determined. To be sure, it is not likely that 'meaning' can operate at the retinal or oculo-motor level directly. We may not conclude, however, from this that autokinesis does not depend for its effectiveness on peripheral determinants which occasion apparent movement nor that retinal mechanisms are not used in the service of meaning. It is very likely, in fact, that the determining pattern is so com-

TABLE III

AUTOKINETIC MOVEMENTS OBSERVED WITH 'MEANINGFUL' STIMULUS-FIGURES THAT SUGGEST HORIZONTAL MOVEMENT
(N = 150)

Figure (pointed left or right)	Vertical movement				Horizontal movement			Other kinds		
	none	up	down	both	correct	incorrect	both	right diagonal	left diagonal	circular or ambient
Arrow	9	12	8	2	69	25	5	0	3	17
Running man	8	15	11	1	63	15	6	13	4	14
Jumping deer	9	14	8	3	47	20	4	21	10	14
Total	25	41	27	6	178	60	15	33	17	45

plex, and the causal relationships so mutually dependent, that one can not speak of a 'sequence' of determination, except didactically. The central-peripheral controversy, here as elsewhere, may be an artifact, analogous to selecting the 'winner' in a horse race where the animals run in all directions simultaneously.

Among the determinants of autokinetic movement no mention seems to have been made of the shape of a 'frame.' This is understandable since, in theory, autokinesis presupposes complete darkness or a homogeneous field. In practice, when a visible frame has been used, the shape appears to have been a constant.[14] Our data indicate that a physical frame can become a psychological frame of reference for autokinesis. In the case of our partially covered rectangular screen, movement appears to have been

[14] E. L. Hoffman, D. V. Swander, S. H. Baron, and J. H. Rohrer, Generalization and exposure-time as related to autokinetic movement, *J. exp. Psychol.*, 46, 1953, 171-177.

channelled into the horizontal plane. To what extent is this effect generalizable? How would differently shaped frames function? Subsequent experimentation should answer these questions.

SUMMARY

The study explored the effectiveness of meaning connotations in determining the direction of autokinetic movement. 'Meaningful' figures were presented on a screen in a dark room. A preliminary experiment used stimuli pointed upward or downward, and the main experiment used figures pointed left or right. In both instances, the autokinetic movement was found to occur to a large extent in the 'meaningful' direction. The use of two differently shaped screens also showed that the direction of autokinetic movement can vary with the shape of the screen. The implications of these findings were discussed.

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