Blur as a critical factor in the visual cliff¹

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Abstract

The hypothesis that chicks on the visual cliff discriminate the deep side from the shallow side on the basis of focusing cues was tested using sharp and photographically blurred checkerboard patterns. One-hundred eighty nine Cornish Cobb chicks were tested on all possible combinations of shallow, deep, sharp and blur. The results fail to confirm the hypothesis.

Problem

Shinkman's (1963) suggestion that the young chick's avoidance of the deep side of the visual cliff is due to differential focusing, rather than to motion parallax alone, was based on the observation (Walls, 1942) that the chicken's range of accommodation is between 3 and 5 in. Thus the deep side of the cliff would present a blurred image in contrast to the sharp image provided by the shallow side. Under d-tubocurarine chloride, which presumably creates a fixed focus of 5 in resulting in a blurred image on either side of the cliff, Shinkman found no preference for either the shallow or deep side.

Both Palen (1965) and the present authors have extended this suggestion by using blurred photographs of checker-board patterns in the visual cliff. The present experiment, which was completed just prior to the publication of Palen's data, differs in several critical respects, including (1) the use of additional control groups, (2) measurement of latency, and (3) the use of an apparatus which permitted the patterns to extend indefinitely.

Method

One-hundred eighty nine Cornish Cobb chicks were obtained from a local hatchery within 24 hr. of hatching and tested between 24 and 48 hr. of age. The Ss were housed together until testing in 36 by 16-1/2 by 16-1/2 in cages lighted and heated by 60 w incandescent bulbs.

The apparatus was a modified Model II visual cliff (Walk & Gibson, 1961). The glass floor, 24 in square, was suspended beneath a 20 by 21 in frame hanging from the ceiling to a height of 12 in above the floor. Inside the frame were walls 8 in high fitting flush with the glass and enclosing an area on the glass 14-1/2 by 8-1/2 in. This area was bisected by a wooden runway 8-1/2 by 3 by 5/8 in high and covered with masking tape for ease of cleaning. The shallow pattern was suspended 1/2 in below the glass, and the deep pattern rested on the floor. The supports for the shallow pattern and the glass were positioned on the outside of the frame, 8-1/2 in from the wall of the test area so they would not be visible to the S. The entire apparatus was painted a flat gray. In order to minimize reflections on the glass, illumination was

supplied from below the glass by a 30 w fluorescent bulb extending the length of the frame immediately beneath the runway. The overhead lights in the experimental room were extinguished during testing.

The patterns were 1/2 in square checks for the shallow cliff conditions and 2 in square checks for the deep cliff conditions. The two check sizes subtended the same retinal angle from a height of 2.7 in above the runway. Note that the patterns were large enough (deep-96 by 96 in, shallow-24 by 27 in) to extend to the outer ranges of the S's visual field from the runway. For the blurred patterns, photographs of the checkerboard were used.

In order to prevent a S which had stepped off the runway from seeing the line where the pattern texture changed from sharp to blur in the deep-sharp vs. deep-blur condition, a two-sided mirror was placed along this line extending laterally to the edges of the pattern and vertically to the underside of the runway. The mirror was kept in place for all deep-deep conditions.

The groups tested are shown in Table 1.

Each S was given one trial by being placed in the center of the runway and facing parallel to it for 10 min. To control for response bias and distracting stimuli half the Ss were randomly selected to face one end of the runway and half the other. The position of the checkerboard patterns within each group was interchanged randomly. White noise was generated from a point at one end of the runway to eliminate auditory distractions. The E observed the S's activity from a point across the room by means of a mirror on the ceiling above the apparatus. Three measures, first choice of pattern upon descent, time spent on either side of the runway, and latency before descent, were recorded on automatic recording and programming equipment. After each trial the runway and both sides of the glass were wiped clean with a damp towel and dried to eliminate any olfactory cues.

Results and Discussion

Table 1 shows the results. The p values are obtained by binomial expansion for first choice and by two-tailed t-tests for "time-off" runway. In 1-4, with both depth and texture equal, no preference appears. In 5-8, where the contrast is between one side deep and one shallow, Ss select the shallow side regardless of texture. No preference is shown in 9-10, in which depth is equal but texture different. The data on crossovers—Ss which crossed the runway after descending—are included since this was Palen's measure. Our procedure differs, however, in that Palen placed Ss back on the runway facing the opposite side from their initial jump "who failed to look to both sides before jumping" (1965,

TABLE I
p values of first choice responses and results of t tests on total
time spent off the runway for 10 treatment groups on the visual cliff

GROUP	TREATMENT ¹	N	NUMBER DESCENDING	FIRST CHOICE		TIME OFF RUNWAY			
				Right ²	p	Entire Group		Crossovers	
						Preference	<u>p</u>	Preference	n
1	SW-SP vs. SW-SP	21	10	5	.623	no preference		no preference	5
2	SW-B vs. SW-B	21	6	2	.688	no preference		no preference	3
3	D-SP vs. D-SP	10	5	2	1.00	no preference		no test	2
4	D-B vs. D-B	10	5	3	1.00	no preference		no preference	3
				Shallow ²					
5	SW-SP vs. D-SP	14	10	10	.002	shallow	.01	no test	2
6	SW-SP vs. D-B	12	10	10	.002	shallow	.01	no test	2
7	SW-B vs. D-B	17	10	9	.022	shallow	.01	no preference	4
8	SW-B vs. D-SP	17	10	9	.022	shallow	.01	no test	2
				Blur ²					
9	SW-SP vs. SW-B	15	10	6	.754	no preference		no preference	4
10	D-SP vs. D-B	10	3	2	1.00	no preference		no test	1

¹Abbreviations: SW = shallow, D = deep, SP = sharp, B = blur

²Left, deep, and sharp may be determined by subtraction

p. 453). Note that tests could not be performed in some groups because of n. A one-way analysis of variance of latency did not result in a significant difference.

It is concluded (1) that Ss avoid the deep side, when given a choice in depth, (2) that when sides are of equal depth, blurredness of one side is irrelevant, and (3) that significant differences in latency as a function of blur are not found.

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