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Relative distance judgments of familiar and unfamiliar objects viewed under representatively natural conditions

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Carlson and Tassone (1971) reported that an object of familiar size viewed at an appreciable distance is perceived to be more distant than an unfamiliar object. Six experiments were designed to examine this effect. The results indicated that the effect is not dependent on Carlson and Tassone's method for assessing perceived relative distance; it occurs at some minimum viewing distance; it is unlikely to be caused by stimulus attributes confounded with the familiar versus unfamiliar size dichotomy; appears to be specific to judgments of the familiar object itself; and it does not occur if the familiar and unfamiliar objects have a common reference target. These findings are discussed with respect to the issue of whether familiar size influences perceived distance as distinct from influencing judgments of distance.

Since the intial work of Hastorf (1950) and Ittelson (1951), numerous studies have demonstrated that under conditions of visual- and oculomotor-cue reduction, the familiar or assumed size of an object influences judgments of distance (see Epstein, 1967; Sedgwick, 1986). In contrast, in only a few studies (Carlson & Tassone, 1971; Fillenbaum, Schiffman, & Butcher, 1965; Higashiyama, 1984; Predebon, 1979a, 1979b, 1987) has the effect of familiar size on judgments of distance under naturalistic, unrestricted viewing conditions been investigated. In general, the results of these studies indicate that familiar size can be an effective cue to distance, although its effectiveness appears to be contingent on viewing attitude (Higashiyama, 1984) and on the method of measuring perceived distance (Predebon, 1987).

In the majority of studies on familiar size, its effectiveness has been evaluated by using off-size versions of familiar objects. This emphasis on off-size representations has diverted attention away from the potentially significant issue of whether a normal-size object viewed under naturalistic conditions influences perceptions of extents. In a full-cue situation, the familiar size information provided by a normal-size object does not conflict with the visual and oculomotor distance information, and, for this reason, such an object might be expected not to influence perceived distance. Yet a number of studies have shown that a normal-size object is judged to be more distant than one of unfamiliar size. This finding was first reported by Carlson and Tassone (1971) with objects (person, board) viewed from a distance of 183 m, and it was subsequently confirmed with different familiar objects (identification card, playing card) in a study conducted indoors (Predebon, 1979a). Similarly, Predebon (1979b) found that distance estimates of a chair viewed at a distance of 25 m were significantly greater than distance estimates of an unfamiliar object presented at the same distance. Fillenbaum et al. (1965), however, failed to find an effect of familiar size on estimates of distance.

Three different explanations of Carlson and Tassone's (1971) effect have been proposed. Carlson and Tassone assume that the subjective magnitude of a given unit of physical distance becomes increasingly smaller at progressively greater distances from the viewer, and they attribute the effect to a change in the subjective distance scale. An unfamiliar object in the test field leaves the subjective scale of distance established by the visual distance information unaffected. In the case of a familiar object, however, a rescaling of perceived distance occurs as a consequence of the visual metric provided by the object: The more distant physical units near the familiar object are rendered more equal in subjective magnitude to nearby units, and, as a result, a familiar object will be perceived as more distant than an unfamiliar object. A superficially similar but fundamentally different hypothesis (Predebon, 1979b) asserts that the spatial metric provided by a familiar object influences the judgment or response scale rather than the perceived distance scale. With unpracticed observers, verbal estimates of the distance of unfamiliar objects underestimate physical distance, a finding that has been attributed (Gogel, 1969), at least in part, to response errors in applying a memorial metric to perceived distance rather than, or in addition to, a perceptual underestimation of physical distance. The visual metric of a familiar object, however, is likely to attenuate response errors of underestimation, with the result that a familiar object is estimated to be at a greater distance than an unfamiliar object, even though the objects are perceived as

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equidistant. Finally, a third hypothesis assigns the effect to unavoidable differences in stimulus features, such as form and luminance (Carlson & Tassone, 1971) and texture detail (Predebon, 1979a), correlated with the familiar versus unfamiliar size dichotomy.

Carlson and Tassone's (1971) effect is of major significance for theories of space perception. Certainly, if familiar size is shown to be a determinant of perceived distance under natural viewing conditions, the effect calls into question the adequacy of stimulus-bound theories of space perception. Furthermore, the effect is of interest in itself, since it pertains to a normal-size familiar object. Clearly, in view of the effect's theoretical significance and also because of the limited amount of information on the role of familiar size under representatively natural conditions, additional examination of Carlson and Tassone's effect is warranted. The six experiments reported here were designed to identify some of the conditions under which the effect occurs and to evaluate its possible determinants. In brief, Experiment 1 was designed to assess whether the effect is specific to the relative distance task used by Carlson and Tassone, and Experiment 2 was carried out to examine the dependency of the effect on viewing distance. Experiment 3 was done to evaluate the contribution of two obvious stimulus attributes correlated with the familiar versus unfamiliar dichotomy, and Experiments 4, 5, and 6 were designed to assess whether the effect generalizes to unfamiliar objects adjacent to the familiar object.

EXPERIMENT 1

The purpose of Experiment 1 was to determine if Carlson and Tassone's (1971) effect could be obtained with a distance-matching task. The rationale for this investigation was the belief that if familiar size influences perceived distance, then the effect should be demonstrable with a variety of indicators of perceived relative distance. One method duplicated Carlson and Tassone's forced-choice procedure: Observers stated which of the two objects, the familiar or the unfamiliar object, was farther away. The distance-matching task required observers to adjust the distance of the familiar object to match the distance of the unfamiliar object. In addition, the opportunity was taken to examine Carlson and Tassone's finding that a person is judged to be smaller in apparent size and taller in objective size.

Method

Subjects. The subjects were 48 undergraduate volunteers, all of whom were unaware of the nature and purpose of the experiment. All subjects had normal or corrected vision and viewed the objects binocularly.

Test site, stimuli, and design. The familiar stimuli were two women, both 167 cm tall and of similar weight. The unfamiliar stimulus was a board, 31 cm wide and 167 cm tall, painted flat white; it was positioned vertically with respect to gravity. Both women wore white laboratory coats, white shoes and stockings, and a white head scarf, and they stood erect with their hands behind their backs.

The experiment was conducted in a public park adjacent to the university campus. The two objects were located 44° apart and 120 m from the observer's location. The test area was flanked on the left by two lampposts and on the right and in the background by several shrubs and large trees. In the test area, there were two lampposts, a park bench, and a few small trees. The ground sloped gently upward away from the observer's location, and the observers had unimpeded views of the objects, behind which could be seen the perimeter iron picket fence against a backdrop of university buildings and a carpark. People could be seen occasionally in the far distance, although well beyond and to the far left of the test area. Shadows were cast on the test area in the afternoon, and on approximately a third of the days the sky was overcast.

The subjects were randomly allocated to the experimental and control conditions, with 24 subjects in each condition. For the control condition, the stimuli were the two women, and for the experimental condition, the stimuli were the woman and the board. One woman—the reference person—participated in both the control and the experimental conditions. For the distance-matching task, the reference person acted as the variable distance marker.

Procedure. The first phase of the experiment followed Carlson and Tassone's (1971) procedure. Each subject was escorted to the test location and tested individually. The left/right locations of the woman and board in the experimental condition and the two women in the control condition were controlled across subjects. The size instructions were similar to those of Carlson and Tassone. The apparent instructions, in part, asked subjects to nominate which of the two objects "gives the visual impression, or visual appearance, of looking taller" and the objective instructions "which one of the two objects do you think would measure taller if you were to measure them with a ruler." The order of the instructions was counterbalanced. The distance instructions asked which of the two objects appeared farther away, and were always given last. The subjects then turned away from the test site and waited for the second phase (the distance-matching phase) of the experiment.

The subjects then turned around to face the test site, and they were given instructions on the general procedure and task. In the experimental condition, the task was to "adjust" the distance of the reference person from the observer to match the distance of the board. Through a system of arm signals, the experimenter, in response to the subjects' commands, directed the woman to move backwards or forwards, or to stop; bracketing was permitted. The woman walked at a steady slow pace, either forward to or backward from the observer, along the radial path connecting the test spot and the observer. Markers, invisible to the observer, specified the test spot and the path. There were 4 trials with different initial starting locations of the woman, 30 or 20 m nearer (N) or farther (F) than the test spot 120 m away. For half the subjects, the order of trials was NFFN, and for the other half of the subjects, it was FNNF. After completing the first distance match, the subject turned away while the woman measured and recorded to the nearest centimeter the distance between the tip of her shoes and the test spot. The woman then moved to the next starting position for the next trial, and the procedure was repeated. In the control condition, the board was replaced by the other woman, and the subject's task was to match the distances of the two women; otherwise the procedure was identical to the experimental condition.

The control condition was included mainly to evaluate the results of the distance-matching procedure. Without this condition, any difference between the points of subjective and physical equality found in the experimental condition could be attributable to characteristics of the measurement device rather than to an effect of familiar size.

Results and Discussion

Relative judgments. The results are shown in Table 1. None of the four size proportions was significantly differ-

Table 1
Proportions of Subjects Responding "Taller" or "Farther" for the Reference Person Relative to the Board or Person

Condition	Taller		Farther
	Apparent	Objective	
Experimental (board)	.54	.46	1.00
Control (person)	.58	.54	.58

ent from .5, indicating that the reference person and board in the experimental condition and the reference person and the other woman in the control condition were judged equal in both apparent and objective size. All subjects in the experimental condition judged the reference person to be more distant than the board; for the control condition, however, the proportion of subjects who judged the reference person to be more distant than the other person was not significantly different from .5.

Distance matches. The data for analysis were observers' four distance matches converted to signed errors, with positive and negative errors indicating that the reference person was positioned closer or farther, respectively, than the location 120 m away. A two-factor analysis of variance with repeated measures on the trials factor was carried out on these data. Neither the main effect of trials nor the interaction between trials and condition was significant [$F(3,138) = .29, 1.21, p > .05$, respectively]. The main effect of condition was significant, however [$F(1,46) = 7.26, p < .05$], indicating that the woman was perceived to be farther than the board; averaged across the four trials, the reference person was set 9.74 m closer than the board in the experimental condition, and 2.39 m closer than the woman in the control condition.

The size results are inconsistent with Carlson and Tassone's (1971) finding that a person is judged to be taller in objective size and smaller in apparent size than an unfamiliar object, although they confirm the results of a previous study (Predebon, 1979a). Possibly, the present experiment and the previous study failed to induce the appropriate instructional set; many subjects in the present experiment requested a clarification of the instructions, which were then simply reread.

The principal result of interest is the finding, obtained with two different indicators of relative distance, that an object of familiar size is judged to be more distant than an unfamiliar object. Although alternate explanations are not excluded, this finding is consistent with Carlson and Tassone's (1971) assumption that familiar size has the effect of increasing perceived distance, at least for objects at appreciable distances.

EXPERIMENT 2

The aim in this experiment was to establish whether the effect is dependent on the distance of the objects. From the perspective of Carlson and Tassone's (1971) hypothesis, the increasing discriminability of visual distance cues (e.g., texture) with decreasing distance suggests that the rescaling of perceived distance should occur only for objects at a certain minimum distance from the observer. In this and in the following experiments, perceived relative distance was assessed only with the forced-choice comparison task of Experiment 1.

Method

The subjects were 30 volunteer undergraduate students, none of whom had participated in the first experiment. The stimuli were a 20-year-old woman, 173 cm tall, and a white board of the same height as the woman; the woman's clothing was identical to that worn by the women in Experiment 1. The objects were 44° apart, and both were viewed from a distance of 60, 90, or 120 m. The order of presentation of the three distances was randomized across subjects, with the proviso that each distance was presented equally first. The left/right locations of the two objects was counterbalanced across subjects, although for any 1 subject, the relative locations of the objects were identical for all three distances. To clarify the distinction between apparent and objective size, the instructions included examples from visual size illusions. In all other respects, the procedure was similar to the first phase of Experiment 1.

Results

The results are shown in Table 2. The apparent size proportions for the 90- and 120-m distances and the objective size proportion for the 120-m distance were each significantly different from .5. Thus, the size proportions for the 120-m distance, although inconsistent with the results of Experiment 1, confirm Carlson and Tassone's (1971) finding that a person is judged smaller in apparent size and larger in objective size. Presumably, the discrepancy between this and the previous experiment's size results reflects the inclusion in the present experiment of examples clarifying the distinction between the notions of apparent and objective size.

The proportion of subjects who judged the woman to be more distant than the board tended to increase with distance, and only the size proportion for the 120-m distance was significantly different from .5. These results indicate that Carlson and Tassone's (1971) effect operates at some minimum distance which, in the present study, is approximately between 90 and 120 m from the observer.

EXPERIMENT 3

The familiar and unfamiliar objects in the preceding experiments differ in a number of stimulus attributes. The purpose of Experiment 3 was to examine whether two obvious stimulus attributes—namely, contour complexity and solidity—correlated with the familiar versus unfamiliar size dichotomy are major determinants of the effect.

Table 2
Proportions of Subjects Responding "Taller" or "Farther" for the Reference Person as a Function of the Distance of Objects

Distance of Objects	Taller		Farther
	Apparent	Objective	
60 m	.40	.53	.47
90 m	.20	.60	.63
120 m	.23	.70	.93

Method

The two stimuli, the woman of Experiment 2 and an unfamiliar object, were located at the test spots 120 m away from the observer. The unfamiliar object was either a white cardboard cylinder, 30 cm in diameter, or a somewhat irregularly shaped white cardboard sheet with maximum width of 30 cm in the middle, tapering to a width of 12 cm at the top and bottom; the latter object contained a few 2-cm wide black lines of irregular length and of random orientations. The unfamiliar objects were of the same height as the woman, and they were positioned vertically with respect to gravity by securing them to a wooden frame invisible to the observer. The subjects were 24 volunteer undergraduate students. Half of the subjects first gave size and distance judgments of the woman/cylinder objects and then of the woman/complex form, and the other half of the subjects made these judgments in reverse order. In all other respects, Experiment 3 was the same as Experiment 2.

Results

The results are presented in Table 3. The apparent size proportions, but not the objective size proportions, are significantly different from .5; for both the cylinder and the complex objects, the person was judged smaller in apparent size and equal in objective size. Importantly, the two distance proportions are significantly different from .5, indicating that the woman was judged to be more distant than either the complex form or the cylinder. It can be concluded, therefore, that Carlson and Tassone's (1971) effect is unlikely to be due to the stimulus attributes of solidity and contour complexity correlated with the familiar/unfamiliar dichotomy.

EXPERIMENT 4

The aim in this experiment was to examine whether Carlson and Tassone's (1971) effect generalizes to an unfamiliar target located adjacent to the familiar object. The results of two studies (Mershon & Gogel, 1975; Predebon, 1979b) with off-size familiar objects presented at near distances suggest that familiar size does not affect perceptions of other spatial extents within a visual display. Nevertheless, for the appreciable distance at which Carlson and Tassone's effect is obtained, it seems plausible to expect familiar size to affect the perceived distance of an unfamiliar object positioned in the immediate vicinity of the familiar object.

Method

The subjects were 28 undergraduate students. The stimuli were the women and board of Experiment 2, and two 60-cm-square yellow cardboard targets. The woman and board were located at the test spots 120 m away from the subjects. The cardboard target was positioned vertically, immediately in front of the woman and the board, with its bottom edge resting on the lawn. The subjects judged the relative sizes and distances of the cardboard targets, after which they turned away from the test area. The cardboard targets were removed, and the subjects then judged the relative sizes and distances of the woman and board. In all other respects, this experiment was identical to Experiment 3.

Table 3
Proportions of Subjects Responding "Taller" or "Farther" for the Reference Person Relative to Cylinder or Complex Form

	Taller		
Control Object	Apparent	Objective	Farther
Cylinder	.21	.67	1.00
Complex form	.29	.58	.96

Results

Of the 28 subjects, 16, 16, and 14 subjects judged the cardboard target in front of the woman to be more distant, smaller in apparent size, and taller in objective size, respectively, than the target in front of the board; these proportions, .57, .57, and .50, respectively, are not significantly different from .5. In the case of the woman and board objects, of the 28 subjects, 22 judged the woman to be smaller in apparent size and 20 subjects taller in objective size; both proportions (.79, .71) are significantly different from .5. Twenty-one subjects judged the woman to be more distant than the board, and this proportion (.75) is significantly different from .5.

Although the woman was judged to be more distant, smaller in apparent size, and taller in objective size than the board, there was no corresponding effect on judgments of the cardboard targets; the targets were perceived to be equidistant and equal in apparent size and in objective size. It appears, therefore, that Carlson and Tassone's (1971) effect is specific to the familiar object itself. However, since the proportion of subjects judging the woman as farther away than the board is much smaller than in the previous experiments, it is possible that the effect was weaker in the present experiment, and, for this reason, did not generalize to the cardboard targets. Alternatively, the smaller distance proportion of the person/board objects might be due to a carry-over effect of first judging the cardboard targets. In view of these possibilities, the purpose of Experiment 5 was to confirm the present findings under slightly different conditions.

EXPERIMENT 5

In Experiments 1–4, the 120-m distance was chosen to minimize the number of nontest objects in the test area. This distance, however, is much shorter than the 183-m distance examined in Carlson and Tassone's (1971) experiments. In Experiment 5, in order to increase the strength of the effect, the distance of the test objects from the observer was increased to 195 m. Additionally, to examine the possible carry-over effect operating in Experiment 4, the order of judging the cardboard targets and the person/board objects was counterbalanced across observers.

Method

The woman and board were located 77° apart and 195 m from the observer's location. In comparison with the previous experiments, there were many more objects in the test area, including shrubs, park benches, and lampposts. Additionally, a section of a low building intruded in the right-hand part of the test area, and an access road to the building, flanked by trees and a parkbench, crossed the area approximately 30 m in front of the observer's location. The ground sloped gently upward on the right, and down-

ward and then upward on the left. The subjects had unimpeded views of the test objects. The subjects were 20 undergraduate students, none of whom had participated in the previous experiments. Ten subjects first made judgments of the woman and board, and the other 10 subjects first made judgments of the cardboard targets. Otherwise, this experiment was identical to Experiment 4.

Results

Of the 20 subjects, 8, 11, and 12 subjects judged the cardboard target in front of the woman to be more distant, smaller in apparent size, and taller in objective size, respectively: None of these proportions, .40, .55, and .60, respectively, is significantly different from .5. In the case of the woman/board objects, 19 and 13 subjects judged the woman to be smaller in apparent size and taller in objective size than the board, respectively; only the former proportion (.95) is significantly different from .5. All 10 subjects who first made judgments of the woman/board and 7 of the 10 subjects who first made judgments of the cardboard targets judged the woman to be more distant than the board; the overall proportion of .85 is significantly different from .5. These results confirm the major finding of Experiment 4; although the woman was judged to be more distant than the board, the corresponding effect did not occur with the cardboard targets.

In both Experiments 4 and 5, judgments of the board/person were obtained in the absence of the cardboard targets, and judgments of the cardboard targets were made in the presence of the board/person. In the latter case, although the cardboard targets were perceived to be equidistant, it is conceivable that the person was perceived to be at a greater distance behind the cardboard target than the board behind its target. This possibility was examined in the last experiment.

EXPERIMENT 6

The 16 subjects were volunteer undergraduate students, none of whom had participated in the previous experiments. The subjects were required to state which of the two objects, the woman or the board, was farther behind the cardboard target. Since all subjects observed that the cardboard targets were adjacent to the woman/board, they were told to assume that one of the objects was at a greater distance behind the target and to nominate which one that might be.

Of the 16 subjects, 10 subjects nominated the woman to be farther behind the target; although in the direction of Carlson and Tassone's (1971) effect, this proportion (.63) is not significantly different from .5, indicating that the person and board were not located at different distances behind the cardboard targets.

GENERAL DISCUSSION

The main findings of the six experiments described here may be summarized as follows: First, Carlson and Tassone's (1971) effect occurs with a forced-choice comparison task and a more complex distance-matching task. Second, the objects must be at some minimum distance from the observer for the effect to occur. Third, the stimulus attributes of solidity and contour complexity correlated with the familiar/unfamiliar size dichotomy are unlikely to account for the effect. Fourth, the effect does not occur for unfamiliar objects in the immediate vicinity of the familiar object, and it is weakened if the familiar/unfamiliar objects are viewed in the presence of a common reference target. Fifth, apart from the size judgments of Experiment 1, the familiar object is judged to be smaller than the unfamiliar object in apparent size and either greater (Experiments 2 and 4) or equal (Experiments 3 and 5) in objective size.

Neither the stimulus-attribute nor the judgment-scale hypothesis provides a convincing account of the present findings. The stimulus-attribute hypothesis is inconsistent with the results of Experiment 3, although failing an exhaustive (and tedious) examination of all the possible stimulus attributes correlated with the familiar versus unfamiliar size dichotomy, it cannot be definitely rejected.[1] Similarly, the judgment-scale hypothesis fails to account for the pattern of relative size judgments, nor can it plausibly explain the failure of familiar size to influence spatial judgments of the adjacent cardboard targets in Experiments 4 and 5.

Carlson and Tassone's (1971) hypothesis that familiar size has the perceptual effect of increasing perceived distance is consistent with most of the present findings and, in particular, with the dependency of the effect on viewing distance and its occurrence with two different measures of perceived relative distance. In conjunction with the perspective attitude (Carlson, 1960, 1977)—that is, the widely held belief that if two objects are judged to be equal in size, the more distantly appearing one will be reported to look smaller—their hypothesis also accounts for the tendency to report the familiar object as smaller in apparent size and either equal or taller in objective size. According to Carlson and Tassone (1971), if the instructions successfully distinguish between objective and apparent size, then "If S assumes that the two objects are equal in objective size, he will judge the more distant-appearing one to be smaller in apparent size; if he assumes that the two are equal in apparent size, he will judge the more distant-appearing one to be larger in objective size" (p. 110). In the present experiment, the subjects assumed that the person was either equal to or taller than the board in objective size, and, as a result, they judged the more distantly appearing person to be smaller in apparent size.[2] In this analysis, then, the apparent size judgments are not construed as reflecting observers' visual size impressions; rather, the judgment that the person appears smaller than the board is interpreted as a semantically alternative way of reporting that the person looks farther away.

The one seemingly problematical finding for Carlson and Tassone's (1971) hypothesis is the failure of familiar size to influence spatial judgments of the cardboard targets. However, their hypothesis can accommodate this

finding if observers know or assume a metric size of the cardboard targets. For the cardboard target adjacent to the woman, the metric size information is provided by the familiar size of the woman. Given that size constancy prevails at appreciable distances (Gibson, 1950; Joynson, Newson, & May, 1965), observers will perceive the two cardboard targets as equal in objective size. It follows, therefore, that observers have potential information about the metric size of the cardboard target adjacent to the board and, therefore, of the board. Thus, the null findings of Experiments 4-6 cannot be interpreted necessarily as indicating a failure of familiar size to rescale perceived distance; rather, they reflect an equal rescaling of the perceived distance of the board and of the person, as a consequence of the common metric provided by the cardboard targets.

Nonetheless, Carlson and Tassone's (1971) hypothesis is unpersuasive. The preceding explanation of the cardboard target results is neither plausible nor predictable from the viewpoint of familiar size perceptually affecting perceived distance. More importantly, this explanation predicts that the woman should be judged to be at the same distance as the board. Specifically, Carlson and Tassone's assumption that the effect is due to the familiar, but not the unfamiliar, object's altering the subjective distance scale ignores the possibility of a similar rescaling effect's occurring with the unfamiliar object: If the board and person are perceived to be equivalent in objective size, then observers, by virtue of their knowledge of the average size of persons, will have information of the metric size of the board. It must be independently demonstrated, therefore, why this metric size information does not increase the perceived distance of the board in the same way as the familiar size information increases the perceived distance of the person. A more general reason for doubting the plausibility of Carlson and Tassone's hypothesis is this: Despite four decades of intensive research conducted under reduced-cue conditions—that is, under conditions optimally conducive to the occurrence of familiar size effects—the issue of whether familiar size influences perceived distance as distinct from affecting judgments of distance has yet to be resolved (see, e.g., Hochberg & Hochberg, 1952; Gogel, 1976). In view of these reservations, it seems prudent to consider explanations of Carlson and Tassone's effect that do not assume an effect of familiar size on either perceived distance or perceived size.

One proposal is that the effect arises from a confusion between two different senses of the "apparent" size of an object—namely, its perceived objective size and its perceived extensity (Rock, 1983) or proximal size.[3] These two notions of "apparent" size may explain the occasional disagreement in the literature over the "apparent" size of familiar objects viewed at appreciable distances. Thus, the conflicting claims (e.g., Day, Stuart, & Dickinson, 1980; Ross, Jenkins, & Johnstone, 1980) that persons at appreciable distances look doll-like or normal in size may reflect the different emphasis placed by researchers on the perceived extensity and perceived objective size of persons, respectively. The relevance of this distinction to the present results is that in response to the apparent size instructions, observers may have inappropriately compared the perceived extensity of the person with the perceived objective size of the board, and for this reason judged the person to be smaller in "apparent" size. Consequently, since the person and board are perceived to be equal in objective size, and are reported as such under objective size instructions, observers will judge the smaller appearing person to be more distant than the board. This judgment, however, should be considered to be a cognitive rather than a perceptual response to distance; it is probably an instance of observers' beliefs that for two objects of equivalent perceived objective size, the smaller appearing object must be more distant.

From the present perspective, the distance-matching results of Experiment 1 are explicable in terms of the competing requirements to set the person and board at perceived physical equality, on the one hand, and their belief that the woman is more distant than the board, on the other; obviously, any effect of the latter must be in the direction of setting the woman at a distance closer than the board. The point at which this distance match is achieved depends on the prevailing perceptual constraints, including the effectiveness of the visual cues to depth. Since the psychophysical effectiveness of cues to depth becomes less effective as physical distance increases (Gogel, 1973), at appreciable distances the observer's criterion for a distance-equality match is likely to be satisfied by a range of physical distances of the familiar object, a range that, in the present experiments, is probably increased further by the nonsimultaneous viewing of the familiar and unfamiliar objects. As a result, observers are likely to set the familiar object to a just discriminably closer distance than the distance of the unfamiliar object. More generally, any procedure that increases the effectiveness of cues to distance, such as decreasing the distance of the objects (Experiment 2), is likely to abolish the effect. Finally, the effect of the cardboard targets is to provide a common point of reference for the woman and board; since the cardboard targets are perceived to be equidistant and equal in objective size, there is no reason for observers to judge the person to be more distant than the board; the impression that the woman looks smaller than normal is consistent with the appreciable distances of both the woman and the board.

The present proposal is similar to Carlson and Tassone's (1971) hypothesis, in that both explanations invoke nonperceptual processes (namely, the perspective bias) as an important determinant of spatial responses. However, the present proposal differs from their hypothesis in two important respects: It does not assume an effect of familiar size on perceived distance, and it interprets the apparent size judgments as communicating a valid aspect of observers' visual size experience rather than as a semantic substitute for reporting the person to be more distant than the board. One weakness of this proposal is its incom-

pleteness; additional hypotheses are required to explain why the proximal perceptual mode characterizes size impressions of the person but not of the board.[4] Whether the present proposal is correct or not, however, the failure of familiar size to influence spatial judgments of unfamiliar objects in the immediate vicinity of the familiar object strongly suggests that familiar size does not influence the perceived distance of familiar objects viewed under representatively natural viewing conditions.

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NOTES

1. The effect is unlikely to be caused by stimulus attributes unique to persons, since it is obtained with a different familiar object; 10 subjects who viewed a chair and an unfamiliar object located at the test spots 120 m away all reported the chair to be more distant than the unfamiliar object.

2. The occasional finding that the person is judged taller in objective size may be due to a response frequency equalization effect; because equality judgments were not permitted, it is likely that some subjects who judged the woman as smaller in apparent size reported the person to be taller in objective size.

3. See Mack's (1978) and especially Rock's (1983) analysis of the distinction between the proximal (perceived extensity) and the constancy or world (perceived objective size) modes of perception. The proposal outlined here concurs with Rock's assessment that the distinction between the proximal and world modes of perception is not merely a matter of phenomenological interest; it has implications for any comprehensive theory of perceptual size constancy.

4. One reason is suggested by the notions of a normal viewing distance (Gilinsky, 1951) and a "true" size (James, 1890) of familiar objects. According to Gilinsky, in determining the perceived size of the same object at different distances, one viewing distance is selected, and this distance determines the true perceived size of the object. Similarly, James (1890, p. 179; cited in Gilinsky, 1951) argued that the "true" size of known objects "is that which we get when the object is at the distance most propitious for exact visual discrimination of its details. This is the distance at which we hold anything we are examining. Farther than this we see it too small, nearer too large." Given the assumption that under naturalistic viewing conditions the perceived size of objects remains invariant with distance, the notion of a remembered visual magnitude—the "true" size—of a familiar object must refer to a standard perceived extensity of the objects, or to a compromise between its perceived extensity and its objective size. Consequently, because the woman was viewed at an atypical or non-normal distance, she looked smaller than normal. Importantly, since the concept of a true size does not, by definition, apply to unfamiliar objects, there is no basis for an unfamiliar object to look smaller than normal.

A different reason is suggested by the claim (e.g., Gogel, 1973) that perceived distance increasingly underestimates physical distance. Assuming size-distance invariance, the perceptual underestimation of distance produces a corresponding underestimation of the perceived size of distant objects. Thus, the size of both the woman and board are perceptually underestimated to an equivalent extent. However, the perceptual size underestimation produces the impression of the woman's, but not of the board's, "looking" smaller than normal; by definition, a smaller-than-normal size impression of the board cannot occur, since there is no remembered visual magnitude of unfamiliar objects.

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