Apparent equivalence between perception and imagery in the production of various visual illusions

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The ability of high and low imagers (as assessed by the Vividness of Visual Imagery Questionnaire) to utilize imagery in the production of a visual illusion was examined in three experiments. In Experiment 1, subjects were to imagine noninducing elements of the Ponzo figure. In Experiment 2, subjects were asked to imagine the inducing angle of the Ponzo figure. Subjects were requested to imagine the inducing diagonals of the Hering and Wundt figures in Experiment 3. Regardless of which figure was presented, high imagers consistently reported an illusion whether it was produced by real or imagined lines. Also, the imagery-produced illusion was equivalent in magnitude to the actual illusion (when all lines are physically present). Low imagers reported an illusion only when lines were physically present. These results were interpreted in terms of Finke's (1980) equivalence theory.

Several recent studies by Finke and his collaborators (Finke & Kosslyn, 1980; Finke & Schmidt, 1977, 1978) have examined the possible relationship between self-ratings of vividness of visual imagery and imagery-induced perceptual phenomena. Specifically, they have reported that when subjects are assessed on a measure of imaging ability (the Vividness of Visual Imagery Questionnaire, or VVIQ; Marks, 1973), high imagers appeared better able than low imagers to create an event through imagery and subsequently to employ that event in the production of a percept. And furthermore, high imagers appeared capable of perceiving a phenomenon to a degree comparable to what would transpire had the imagined event been present as an actual stimulus. As examples, imagery has been found to be capable of substituting for a physically present stimulus in a variety of cognitive tasks, including perceptual adaptation to displacing prisms (Finke, 1979), letter search and identification (Podgorny & Shepard, 1978), observation of the McCollough effect (Finke & Schmidt, 1977, 1978; Kunen & May, 1980), perceptual acuity of objects in the peripheral visual field (Finke & Kosslyn, 1980), and area and contrast effects (Finke & Kurtzman, 1981).

Finke (1980) argued that because experiments have demonstrated functional equivalence or comparability between physical stimuli and imagery-induced events,

as appears to be the case for high imagers, then similar visual processes must be involved for both. That is, if a phenomenon can be created and demonstrated through imaging, then this should result in the activation of information-processing mechanisms at many levels of the visual system, comparable to what has been demonstrated and theorized to exist with physically present stimuli (e.g., Hubel & Wiesel, 1977; Marr, 1978; Posner, 1978).

If Finke's theory is correct, functional equivalence or comparability should be generalizable to visual illusions. It should be possible, especially with high imagers, to create an illusion with imagery-induced lines just as it is possible to create such with physically present lines. And, in fact, there are several reports in which this appears to be the case. Berbaum and Chung (1981) presented subjects with a version of the Müller-Lyer illusion figure in which the subjects were to imagine the inducing wings. Such a manipulation proved successful in producing an illusion that was comparable to what would have been produced had the inducing wings actually been present. Functional equivalence between physical stimuli and imagined events has also been demonstrated for the production of the Poggendorff illusion (Goldstein & Weintraub, 1973; Pressey & Wilson, 1974) and the autokinetic illusion (Wallace, 1980).

Given that support for Finke's theory exists, it should be possible to demonstrate that functional equivalence for the creation of all visual illusions exists. The present study did not seek to verify this for all visual illusions, because this might have proved to be an endless task. However, three illusions that would test the generalizability of Finke's theory to visual illusions were selected: the Ponzo illusion (Experiments 1 and 2) and the Wundt and the Hering illusions (Experiment 3).

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The Ponzo illusion was chosen to extend the findings reported by Berbaum and Chung (1981). If the Müller-Lyer illusion can be created through imagery, an illusion involving the judgment of line lengths, such should also be possible for other line-length illusions. The Wundt and the Hering illusions were selected to determine the robustness of Finke's equivalence theory. In both the Hering and the Wundt figures, an illusion is created when a pair of parallel lines is placed in a specific location among a series of diagonal lines. The illusion is that the parallel lines appear to be altered (nonparallel). If high imagers can image the presence of the inducing diagonal lines and subsequently report that the parallel lines appear to be bowed outward for the Wundt figure or bowed inward for the Hering figure, then this should contribute additional support to the validity of Finke's equivalence theory.

Thus, the present experiments were concerned with two major issues. The first was to test the validity of the VVIQ as a predictor of imaging ability in the production of various visual illusions. And if it appeared to be a valid predictor, such that high imagers performed differently from low imagers, then a second issue was to determine if imagined lines are equivalent to and can be substituted for physically present lines in the induction of various visual illusions.

EXPERIMENT 1

Method

Subjects. Sixty-four volunteers from introductory psychology classes served as subjects. Prior to participation, all subjects had responded in a testing session of 438 individuals to items on the Vividness of Visual Imagery Questionnaire, or the VVIQ (Marks, 1973). This questionnaire has been shown to be a good screening device for determining who is most capable of beneficially utilizing imagery in a perceptual task (Gur & Hilgard, 1975; Marks, 1973). Half of the subjects were selected for having scored high on the VVIQ. That is, they scored in the top one-third of subjects who took the test. As such, they were considered to be good imagers. The remaining subjects scored in the lower one-third of those who took the VVIQ and thus were considered to be poor imagers.

Stimuli. Four stimulus configurations, produced on white nonglare paper, were employed (see Figure 1). Each leg of the 35-deg angle was 12 cm long. Each horizontal line, when present, was 3 cm long. Stimuli were observed from a distance of 1 m.

Procedure. Eight high and eight low VVIQ scorers were assigned randomly to one of the four configurations depicted in Figure 1. The subjects were tested individually by an experimenter who was blind with respect to the subjects' VVIQ scores and to the hypothesis of the experiment. In fact, the experimenter was not aware that a VVIQ score was available for each subject. Furthermore, the subjects were not told that their VVIQ scores were a factor in their selection for the experiment. This was possible because the administration of the VVIQ was a part of a mass-testing session in which several tests in addition to the imagery test were given.

When Figure 1b was presented, the subjects were told to imagine a line of the same physical length as the horizontal one present and to imagine their line as being located below the one that they could see. The experimenter showed them where their line should be imagined to be (2 cm below the one present). For Figure 1c, the instructions were similar to those employed

Figure 1. Experiment 1 Ponzo figure stimuli.

for the presentation of Figure 1b, except that the subjects were asked to imagine a horizontal line above the one present. As with Figure 1b, the experimenter indicated to the subjects where they should imagine their line to be (2 cm above the one present). When Figure 1d was presented, the subjects were told to imagine two horizontal lines of equal length, one above the other. The experimenter indicated to the subjects where their two lines were to be placed via imagery (2 cm apart).

Regardless of whether Figure 1b, Figure 1c, or Figure 1d was presented, the subjects were asked the following: "Are you able to see the line(s) I have asked you to imagine?" [Most subjects inquired what was meant by "see," and synonyms (e.g., "create," "produce," "conjure up") were provided to help the subjects understand the task.] If a subject responded "no," no further questions were asked. If a subject responded in the affirmative, he/she was also asked, "Can you tell me if the top line appears to be longer than the bottom line, if the bottom line appears to be longer than the top line, or if the two lines appear to be equal in length?" If a subject responded that the two lines appeared to be equally long, this concluded experimenter questioning. If a subject responded that one of the lines appeared to be longer, he/she was also asked, "How much longer does the top/bottom line appear to be?" A ruler calibrated in millimeters was given to the subject to make this estimate.

When Figure 1a was presented, the subjects were first asked to respond to the second question (see above). If individuals reported that one line appeared to be longer than the other, they were also asked to respond to the third question (see above). In Figure 1a, the two horizontal lines were 2 cm apart. Also, whether Figure 1a or one of the other figures was presented, at no time did the experimenter give any clues or make any suggestions that one line should appear longer. Furthermore, the order of alternatives for those who received the second question was randomized to avoid possible primacy or recency effects.

Results and Discussion

All high imagers reported that they were able to "see," "create," "produce," or "conjure up" a line or lines for the various versions of Figure 1 that required the use of imagery. Thus, regardless of condition assignment, these individuals reported the classical Ponzo

illusion. This illusion is, of course, one in which the upper horizontal is perceived as being longer than the lower horizontal (Coren & Girgus, 1978; Robinson, 1972; Wallace, 1977). Of the subjects judged to be low in imagery ability, only three reported being able to produce a stimulus via imagery. These individuals also correctly reported the illusion (two for Figure 1b and one for Figure 1c). When Figure 1a was presented, both high and low imagers correctly reported the Ponzo illusion.

When independent-groups *t* tests were applied to the magnitude estimates (the difference between the two horizontal lines), the difference between the imagined and real versions of the Ponzo illusion for high imagers was not significant (all *t* values < 1.00). Also, the mean value for Figure 1a for low imagers did not significantly differ from any of the mean values for any version reported upon by high imagers (all *t* values < 1.00). The mean values are depicted in Table 1.

It is clear that high and low imagers differed markedly in their reports of the Ponzo illusion, both with respect to its presence and magnitude. If these reports are valid, then it appears that an imagined line, when compared with a physically present line or with another imagined line, can result in the production of the Ponzo illusion. Although it might be suggested that some demand characteristics (Orne, 1962) may have been present as a function of how questions to which subjects had to respond were worded, these appear to have played a minimal role at best. Had such characteristics been present to a large extent, many more low imagers would have reported the presence of an imagined line and the subsequent appearance of an illusion. This, of course, did not occur. Also, regardless of imagery classification, none of the subjects reported ever having been exposed to the Ponzo figure, at least not as an illusion. Finally, this figure was not to be found in the text that the students were using in their introductory psychology class.

The results of this experiment provide support for Finke's equivalence theory in that high imagers reported a perceptual phenomenon as being equivalent to what would be produced had a stimulus been physically present (as it was for the subjects exposed to Figure 1a). Some low imagers also reported a Ponzo illusion for figures other than Figure 1a. As was mentioned earlier, two reported perceiving the illusion for Figure 1b and

one for Figure 1c. Finke and Kosslyn (1980) also reported that some low imagers were able to experience a perceptual phenomenon through the deployment of imagery. However, perceptual reports by low imagers were not equivalent to what would be the case had a physically present stimulus been employed.

The findings of Experiment 1 also support the results reported by Berbaum and Chung (1981) in that a visual illusion involving the comparison of line lengths was produced through imagery. However, in the Berbaum and Chung study, the illusion was produced by having subjects image only the inducing portion of the illusory figure. This was not accomplished in Experiment 1. The subjects were asked to image lines other than the inducing element. Since the inverted angle is considered to be the element that brings about the illusion, it might be argued that Experiment 1 was not a valid test of the creation of an illusion through imagery. It might also be argued that the metric that the subjects were to employ when imaging the lines for Figures 1b, 1c, and 1d was ambiguous. Thus, for example, one subject's version of how long 1 mm might be might differ from that of another subject. As a result, Experiment 2 was conducted to remedy some of the problems inherent in Experiment 1. Experiment 2 involved a more traditional test of illusory induction, such that the subjects were to image the angle of the Ponzo figure, thereby circumventing the problem with the ambiguous metric.

EXPERIMENT 2

Method

Subjects. Thirty-two volunteers from introductory psychology classes served as subjects. Prior to participation, all subjects had responded in a mass-testing session of the response of 146 individuals (separate from the mass testing of Experiment 1) to items on the VVIQ. Half of the subjects were selected for having scored in the top one-third of subjects who took the test (high imagers). The remaining subjects were chosen for having scored in the lower one-third on the VVIQ (low imagers).

Stimuli. Two stimulus configurations, produced on nonglare white paper, were employed (see Figure 2). In Figure 2a, each leg of the 35 deg angle was 12 cm long. The horizontal lines in both figures were 3 cm long and 2 cm apart. Stimuli were observed from a distance of 1 m.

Procedure. Eight high and eight low imagers were assigned randomly to one of the two configurations depicted in Figure 2. The subjects were tested individually by an experimenter who was blind with respect to the subjects' VVIQ scores and to the hypothesis of the experiment. Prior to the presentation of Figure 2b, the subjects were shown the inverted 35 deg angle for 5 sec. This was then removed, and the subjects were told to imagine the angle as encompassing the two horizontal lines of Figure 2b such that the top horizontal touched both diagonals of the angle. The subjects were then asked the following: "Are you able to see the lines I have asked you to imagine?" (As in Experiment 1, most subjects inquired as to what was meant by "see," and synonyms were provided.) If a subject responded "no," no further questions were asked. If a subject responded in the affirmative, he/she was also asked, "Can you tell me if the top line appears to be longer than the bottom line, if the bottom line appears to be longer than the top line, or if the two lines appear to be equal in length?" If a subject responded that the

Table 1
Magnitude Estimates (in Millimeters) of the Ponzo Illusion
as a Function of Imagery Ability and Figure Type

	Figure Type							
	1a		1b		1c		1d	
Imagery Ability	Mean	SD	Mean	SD	Mean	SD	Mean	SD
High	3.88	0.99	3.75	0.89	3.88	0.99	3.75	1.67
Low	3.88	0.83	2.52*	0.38	2.00**			

*Based on two subjects. **Response of one subject.

Figure 2. Experiment 2 Ponzo figure stimuli.

two lines appeared to be equally long, this concluded experimenter questioning. If a subject responded that one of the lines appeared to be longer, he/she was also asked, "How much longer does the top/bottom line appear to be?" A ruler calibrated in millimeters was employed by the subjects to make this estimate.

When Figure 2a was presented, the subjects were first asked to respond to the second question (see above). If individuals reported that one line appeared to be longer than the other, they were also asked to respond to the third question. Also, whether the subjects were presented with Figure 2a or Figure 2b, at no time did the experimenter give any clues or make any suggestions that one line should appear longer. Furthermore, the order of alternatives for those who received the second question was randomized to avoid possible primacy or recency effects.

Results and Discussion

As in Experiment 1, all high imagers were able to create a portion of the Ponzo figure via the deployment of imagery. Thus, high imagers from two different population samples demonstrated remarkably similar abilities. In Experiment 2, all high imagers reported that they were able to produce the inverted angle via imagery for the Ponzo figure. In so doing, as in Experiment 1, the classical Ponzo illusion was subsequently reported. For the subjects judged to be low in imagery ability, only one reported being able to produce the inducing angle of the Ponzo figure via imagery. When presented with Figure 2a, all high and low imagers reported the Ponzo illusion.

When independent-groups *t* tests were applied to the magnitude estimates (the difference between the two horizontal lines), the difference between the imagined and real versions of the Ponzo figure for high imagers was not significant [$t(14) = 0.04$]. The mean Ponzo illusion differences were 3.67 mm ($SD = 1.12$) and 3.65 mm ($SD = 1.07$), respectively. Similarly, the magnitude of the Ponzo illusion did not differ between high and low imagers with Figure 2a [$t(14) = 0.09$]. Low imagers reported a 3.70-mm ($SD = 1.20$) Ponzo illusion. A statistical analysis was not conducted between high and low imagers on Figure 2b, since only one low imager was able to image the inducing stimulus.

It is clear that high and low imagers differed markedly in their reports of an illusion for Figure 2b when the inducing stimulus was to be imagined. It is obvious that this was the case, because low imagers, for the most part,

were incapable of imaging the inducing angle of the Ponzo figure. However, for high imagers who did image the inducing angle, it appears that an imagined inducing event (the inverted angle) could result in the production of the Ponzo illusion. As in Experiment 1, it might be suggested that some demand characteristics may have been present as a function of how questions to which subjects had to respond were worded. At best, these appear to have played a minimal role. As was previously argued, had such characteristics been present to a great extent, many more low imagers would have reported the presence of an imagined angle and the subsequent appearance of an illusion. This, of course, did not occur. Also, as determined in a postexperimental interview, none of the subjects, regardless of imagery classification, reported ever having previously been exposed to the Ponzo figure, at least not as an illusion. Finally, as in Experiment 1, the population of individuals from which the subjects were drawn was not using an introductory psychology textbook that contained an illustration of the Ponzo figure.

The findings of Experiments 1 and 2 support the results reported by Berbaum and Chung (1981) in that a visual illusion involving the comparison of line lengths was produced through imagery. This was the case whether the subjects were asked to imagine inducing (Experiment 2) or noninducing (Experiment 1) elements of the Ponzo figure. The results of this experiment also provide support for Finke's equivalence theory in that high imagers reported a percept (created through imagery) equivalent to what would have been produced had a stimulus been physically present. However, this theory should also predict illusion production for figures not involving length judgments. For example, if high imagers are shown the horizontal lines of the Wundt or the Hering configuration minus the inducing diagonal lines, it should be possible to create illusions of line bending or bowing through the deployment of imagery. This possibility was examined in Experiment 3.

EXPERIMENT 3

Method

Subjects. Forty volunteers from introductory psychology classes served in this experiment. All subjects had participated previously in the same mass-testing session described in Experiment 2. Twenty of the subjects had scored in the top one-third of the VVIQ and 20 in the lower one-third. Subjects who had participated in previous imagery experiments were excluded.

Stimuli. Three stimulus configurations, produced on nonglare white paper, were employed (see Figure 3). Figure 3a was the traditional Wundt figure with no lines missing. Figure 3b was the traditional Hering figure. Figure 3c consisted only of the two horizontal lines of Figure 3a and Figure 3b. The horizontal lines in all three figures were 6 cm long and 1.5 cm apart. The figures were observed from a distance of 1 m.

Procedure. Ten high and ten low imagers were assigned randomly to observe either Figures 3a and 3b or Figure 3c twice (once to image the Wundt diagonals and once to image the Hering diagonals). As in Experiment 2, the subjects were tested individually by an experimenter who was blind with respect

Figure 3. Wundt figure and Hering figure stimuli.

to the subjects' VVIQ scores and to the hypothesis of the experiment. When Figure 3c was presented, the subjects were instructed to image the inducing stimulus. This was accomplished by first showing them the stimulus to be imaged (either the Wundt diagonals or the Hering diagonals in a random order) for 5 sec. The stimulus was then removed, and the subjects were to image the presence of the diagonals in a location specified by the experimenter. This location was identical to the one depicted in Figures 3a and 3b. The subjects were then asked to respond to one or more questions. First, they were asked, "Are you able to see the configuration I have asked you to imagine?" (As in Experiments 1 and 2, "see" was explained to most subjects.) If the subjects responded "no," no further questions were asked. If the subjects responded in the affirmative, they were then asked, "Do the horizontal lines appear to be parallel or nonparallel with one another?" (Almost all subjects asked for clarification here. They were not certain what was meant by "parallel" and "nonparallel." As a result, "nonparallel" was clarified as describing the appearance of curved lines.) If the subjects indicated that the lines were parallel, this ended experimenter questioning. If the subjects indicated that the lines appeared to be nonparallel (or curved), they were asked, "In which direction are they bowed or bent and by how much?" The subjects were given a ruler calibrated in millimeters to make this estimate.

For Figures 3a and 3b (presented in a random order), the subjects were first asked to respond to the second question (see above). If the subjects responded that the horizontal lines appeared to be nonparallel (curved), they were then asked to respond to the third question.

Results and Discussion

All high and low imagers correctly reported the outward bowing in the center of the two horizontal lines for Figure 3a and the inward bowing in the center of the two horizontal lines for Figure 3b. Independent-groups *t* tests applied to magnitude estimates of bowing showed the difference between high and low imagers to be nonsignificant for the Wundt illusion [$t(18) = 0.19$] and for the Hering illusion [$t(18) = 0.10$]. With respect to Figure 3c, only high imagers reported that they were able to create the inducing portion of the Wundt and the Hering figures via imagery. In addition, all of these individuals reported the Wundt and the Hering illusions. Magnitude estimates for both illusions are presented in Table 2.

As in the previous experiments, high imagers displayed a remarkable ability to create lines through

imagery and to report perceiving a visual illusion. In Experiment 3, the illusions were of a different nature from that of the line-length illusions of Experiments 1 and 2. Thus, high imagers appear to be able to perceive line-bowing illusions through imagery as easily as through the actual presence of inducing lines. Also, as in the previous experiments, precautions that would reduce demand characteristics, if present, were exercised. Since low imagers did not deduce the hypothesis of Experiment 3 by reporting that they could produce inducing lines via imagery and since high imagers who reported being able to produce such lines through imagery also reported the illusions and in the correct direction, the data appear to be a valid assessment of imaging ability. In addition, a postexperimental interview with the subjects indicated that none had ever been exposed to either the Wundt or the Hering figure (these figures were not present in their course textbook). Therefore, a possible criticism—that the subjects were familiar with these illusions—can be dismissed.

GENERAL DISCUSSION

It appears that, for high imagers, regardless of which type of illusory configuration or stimulus situation was employed, imagined lines (inducing or noninducing) seem to have substituted as an equivalent for physically present lines in the production and subsequent perception of a visual illusion. This was not the case for the subjects judged to be low in the attribute of imagery production. Thus, the results obtained from the high imagers appear to support Finke's equivalence theory.

If equivalence does exist between imagined lines and physically present lines in the creation of a percept for high imagers, several important comparisons should be made. As Finke (1980) asserted, if experiments that demonstrate functional equivalence between the aforementioned stimuli exist, then this might imply that information-processing mechanisms operating during the perception of an event in the presence of physically present stimuli should also be operating when events are perceived through the assistance of imagery.

For the Ponzo illusion, as considered in Experiments 1 and 2, size constancy (Gregory, 1963; Tausch,

Table 2
Magnitude Estimates (in Millimeters) of the Wundt and the Hering Illusions as a Function of Imagery Ability and Figure Type

	Wundt Figure				Hering Figure			
	3a		3c		3b		3c	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Imagery Ability								
High	2.10	1.25	2.00	1.15	2.15	1.05	2.10	1.00
Low	2.00	1.07			2.10	1.12		

Note—The difference between the mean values for high imagers in Figures 3a and 3c (Wundt figure) was not significant. This was also true when comparing the mean values for Figures 3b and 3c (Hering figure).

1954), contour proximity (Fisher, 1969, 1973), and assimilation of stimuli (Pressey, 1967, 1971) have been proposed as explanations. The Wundt and the Hering illusions of Experiment 3 have been explained as being due to neural lateral-inhibition processes (Ganz, 1966; von Békésy, 1967). If such theories are valid when physical stimuli induce a visual illusion, it is also possible that these same theories can explain illusions created through imagery-induced events. In other words, the same information-processing mechanisms might be at play in both situations. Thus, size constancy, comparison of contours, assimilation of stimuli, and lateral-inhibition processes might be in operation for the various illusions considered here, regardless of whether the illusions are created through the presence of physical stimuli or through imagined events.

Berbaum and Chung (1981) also argued that mental images or imagined events are of a neurally central origin. According to these investigators, in their experiment with the Müller-Lyer illusion, the wings to be imagined were described by verbal instructions and were then processed in short-term memory (STM). This memory was then employed with iconic memory and subsequent STM, in which the central shaft was briefly stored. Figural synthesis (Neisser, 1967) was then employed, and the wings and shaft became attached. The result was the perception of the Müller-Lyer illusion. Whether something such as this actually occurs is only conjecture. However, the mental image is obviously formed, especially for high imagers. If this formed image is stored for a sufficient period and is then combined with the remaining physically present elements of the stimulus configuration, then the illusions described here can occur. This was quite possible in the present investigation, given that the subjects were exposed briefly to the stimulus from which they were to form a mental image (except for Figure 1d in Experiment 1). Incidentally, one might argue that being exposed to an inducing stimulus could produce an afterimage that could then be combined with the physically present stimulus to produce an illusion. In a pilot study, this was found to occur if stimulus configurations were highly reflectant. With nonglare stimuli, this did not occur. Had the afterimage problem remained, both high and low imagers would have reported an illusion for the imagery-induced version of the Ponzo, Wundt, and Hering figures. This, of course, did not happen.

If the illusions examined here can be explained in a manner similar to what has been proposed by Berbaum and Chung (1981) and if a mental image is in STM, high imagers should be superior to low imagers in storing information in STM. They should also be capable of demonstrating size constancy (if this explanation of the Ponzo illusion is correct), as well as other constancies (shape, brightness), through the deployment of imagery. These possibilities need to be examined before Berbaum and Chung's definition of a mental image can be accepted.

It should be mentioned that not all investigators have found or believe that there exists an equivalence between physical stimuli and imagined events (see Banks, 1981, Broerse & Crassini, 1980, 1981, Harris, 1982, Intons-Peterson, 1983, Intons-Peterson & White, 1981, and Mitchell & Richman, 1980). These investigators have argued that experimenter bias and demand characteristics may account for equivalence when it occurs. However, experimenter bias probably can be ruled out in the studies reported here, since the experimenter was blind with respect to the subjects' VVIQ scores and to the experimental hypothesis. Also, demand characteristics were minimized by the manner in which the subjects were asked to respond to stimuli, imagined or real. This was accomplished by giving the subjects choices with respect to a response. And if the subjects responded that they had been able to create an inducing stimulus via imagery, possible responses to describe the resultant illusion were presented to them in a random fashion. It is also important to emphasize that not all individuals were capable of creating vivid mental images. As is clear from the results reported here, those judged to be excellent imagers appeared to be able to substitute a mental image for a physical stimulus in the creation and perception of a visual illusion. Low imagers appeared almost universally incapable of so doing. This distinct difference has also been reported by Acosta, Crawford, and Hall (1984), Finke and Schmidt (1977, 1978), and Gur and Hilgard (1975). Also, even if it appears that all high imagers in the three experiments were able to create images when asked to do so, this finding is not unique. Berbaum and Chung (1981) reported that 19 of 20 high imagers were able to image the inducing wings of the Müller-Lyer illusion. Similarly, unusually large, disproportionate numbers of high imagers were found to be capable of utilizing imagery in studies reported by Finke and his collaborators (Finke, 1979; Finke & Kosslyn, 1980; Finke & Schmidt, 1977, 1978).

Incidentally, one should not assume that the VVIQ is a perfect predictor of who can utilize imagery in tasks such as those described here. More likely than not, that all high imagers were able to utilize imagery here was probably coincidental. Why there was a perfect relationship between high imagery ability as judged by a VVIQ score and the ability to produce an image cannot be explained. After all, one does not typically find such a relationship. Yet, this was the case in the experiments reported here. Obviously, in and of itself, this finding is interesting, and further research is necessary to determine why this relationship was found.

Further research is also necessary to determine the strength of the VVIQ as a general predictor of a subject's ability to employ imagery in other perceptual tasks. Its value has been questioned (Harris, 1982). However, at least with respect to the utilization of imagery in the production of a visual illusion, the VVIQ appears to be an excellent predictor.

Additional experimentation is also necessary to test the possible equivalence between imagery and perception. However, with respect to the illusions considered here, the evidence is rather strong that high imagers are capable of creating an image and of employing it in the subsequent perception of an illusion. For all intents and purposes, an imagined event was equivalent to a physically present stimulus. For low imagers, this was not the case.

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