OPTICAL ILLUSIONS

Here are some of the typical OPTICAL ILLUSIONS and their explanations, thanks to a deck of cards.

CAN YOU BELIEVE YOUR EYES?

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ACES and **KINGS** are unfortunately omitted because they are color illusions.

QUEENS
Ambiguous Figures

Each drawing can be seen as two different figures. Except for the Queen of Diamonds, once you see both pictures it is impossible for you to focus on only one without the other "popping" into your vision from time to time!

Clubs: This is called the Winson figure. The dark area represents either an Eskimo and the opening of the igloo, or an Indian's head-dress. The Indian's ear is the Eskimo's arm, and the Eskimo's legs are the Indian's neck.

Diamonds: Depending on which side is up, you can see either a young woman or an old clown.

Hearts: Depending on whether you see the figure as facing right or left, it can be seen as a rabbit or a duck. This figure was first used by a psychologist named Joseph Jastrow in about 1900.

Spades: Do you see an old woman or a young one? Both are there. If you cannot see them both, think of the tip of the old woman's nose as the young woman's chin, or vice versa. The old woman is seen in full profile while the young woman is turned away from you. The illustration was first published in Puck in 1915 entitled "My wife and my mother-in-law."

JACKS
Impossible Figures

It is possible to draw figures which, while appearing to be designs for objects, could never be manufactured as solid objects. The Dutch artist, M.C. Escher made many drawings of this type.

Hearts: Steps which appear to go either continuously up or down.

Diamonds: A seemingly solid rectangular bar which has no well defined inside or outside.

Spades: A triangular figure which seems to twist in three-dimensional space without a well defined inside or outside.

Clubs: The top of the middle peg appears to rest on the space between the two outer pegs.

CLUBS
Size and Figure Distortion

Our ability to judge sizes and shapes is often distorted by the context in which the object is seen. Even when one is aware of the distortion, it is often impossible to change the perception!

2. Line A-B appears to be longer than B-C, but they are exactly the same. (Sandor's parrallelogram - 1926)
3. The letters in the word LIFT appear to be tilted. You can see that they are not by following the striped lines which form the letters through the alternating diamonds in the background.
4. Which line leads to "C"? It appears to many people that it is "A" but it is not. You can see this by using a straight edge.
5. Looked at one way, the 8's and S's seem to have nearly equal size tops and bottoms. When the card is turned upside down, the inverted 8's and S's do not.
6. The center lines are perfectly straight although they appear to bulge outward in the middle. This is called the Herring Illusion (1861).
7. The three arcs appear to come from different size circles. However, when you block off the ends of the top two so that you can see an equal amount of all three arcs, they are all the same.
8. The small round figure is actually a perfect circle. The lines radiating from the center tend to pull your gaze in such a way that you cannot easily follow the circle smoothly around its entire circumference.
9. Both center circles are the same size. The different sizes of the associated circles distort your estimate.
10. This illusion is repeated on the Joker which has illustrations on both sides. To see the effect you must spin the card. The extra Joker was provided so that you could make a hole in it without damaging the basic deck. Make a small pin hole in the center of the spiral. Place the straightened end of a paper clip through the hole so that the card may spin around the clip. Look at the center of the figure while spinning it at a moderate speed for about 20 seconds. While you are spinning it, the spiral appears to be expanding or shrinking depending on the direction of the rotation. After 20 seconds, shift your gaze to a stationary object (your hand for example) and it will appear to expand if the spiral was shrinking, or, shrink if the spiral was expanding!

DIAMONDS
Depth Perception

There are many clues to the perception of three dimensions which can be portrayed on a two-dimensional surface. Not only can we "see" three dimensions on a two-dimensional surface, but such clues may distort other perceptions associated with the figure. Thus, when there are several clues to depth which are consistent with one another, and one which is not, the inconsistent clue is "forced" into consistency by the brain and seen in a fashion which is distorted from reality.

2. The rectangle on the "horizon" appears to be larger than the one in the "foreground." They are the same size. The effect can be even stronger if you look at the card with one eye. Since there appears to be depth to the figure, our brain assumes that if two objects look the same and one is further away, it must be larger.

3. All of the people appear to be in a corridor. The one "furthest away" looks largest, although they are all the same size.

4. At point X the top card seems to be the white one, since we tend to assume that both figures are rectangles. At Y, it is the tinted one which appears to cover the other. This is an example of interposition in depth perception.

5. Place a piece of paper perpendicular to the card between the two figures and position your face so that your left eye sees only the left figure and your right eye only the right figure. Allow the two images to merge by gently crossing your eyes. The figure will appear three dimensional. You can also see it by simply crossing your eyes gently. Try to focus your eyes at a point about half way from your eyes to the card. You will then see three figures, and the middle one will appear three dimensional. Holding a pencil about half way to the card and fixating your gaze on it may help.

6. The influence of shadows on depth perception. We tend to assume that light comes from above and "wraps" around objects. Thus, when the shadow is at the bottom of a figure we think the object is sticking out, but when it is at the top, we think there is a dent.

7. Changes in the texture make one part of the figure appear to be receding in the distance, while the even pattern looks flat. Thus the image appears to "bend" near the middle.

8. This figure is actually a series of segments bent toward the center which form concentric circles. Try tracing the largest circle with a pencil point or your finger tip. It is called Frazer's spiral. Figures like these were first published in the British Journal of Psychology around the turn of the century.

9. Shadows are important in perceiving three dimensions. Depending on how you hold the card, it appears to be either a hill or a crater. It is actually a meteorite crater. (From a photograph by D.J. Roddy and K. Zeller, U.S. Geological Survey.)

10. How far away is the circle from the attractive young woman? If you think it is the moon, you see it at a great distance. If you think of it as a wedding ring, it is in front of the woman. If it is seen as a basketball it seems to be behind her. You tend to compare the figure with the size of the woman's head, and adjust your perceptual judgement of the distance away from you the identified object would have to be to keep the proportions correct.

HEARTS
Figure Ground Illusions and Unstable Figures

When we look at things we tend to separate our visual image into an object or figure, and a background. In printed materials, the figure tends to be darker than its background. In general, figures tend to be smaller, and more regular than backgrounds. Sometimes these principles do not hold, and we have difficulty in deciding which is the figure and which the background. Usually this difficulty disappears when we can organize parts of the visual image into a meaningful pattern. When this is done, only the figure and background can be seen, and what ever was seen before is gone forever! Sometimes there are two equally good figures. When this occurs, their appearance will alternate in our vision.

2. Actually no triangles have been drawn on this card. Your eye tends to fill in spaces. The "V" shaped figures can be "closed" together and form one large triangle, or "closed" opposite the apex to form three. The eye can connect the wedges in the circles together to form a large white triangle formed with the V's. In addition, the eye can use that portion of the V triangle "underneath" the large white one to close off three smaller white triangles with an apex in each circle. You can also see a six pointed star by combining the large white triangle with the one formed by the V's.

3. The circle is an even gray. However, when a pencil is placed along the black-white dividing line, the part over the white area appears to be darker than the part over the black area. This is called brightness contrast.

4. This figure contains contradictory cues to depth perception. As a consequence you are not sure which part is closest to you, and the figure becomes unstable.

5. This card is a reproduction from a deck produced in France about 1800. The eyes can be in 10 different faces: a full face, two profiles in white, and two in black. Turning the card upside down produces 5 more faces.

6. This is a map. Looking at most maps, we consider the water areas to be the background for the land masses. On most printed material we assume the paper color to be the background to the figure we are looking at. In this map, the black area represents water, the Mediterranian Sea. Many nautical maps confuse people who are not used to them, because the water is the feature of interest and the land masses define the water's boundaries.

7. This is a variation of the four of hearts with conflicting cues of depth.

8. Depending on how you hold the card, and whether you look at the black or white section, the figure can have different meanings. The black or white parts can be either the figure or the background. Viewed with the black points facing up, the black area can be seen as waves with the white area as background. Conversely, the white area can be a figure séen as a theater curtain with the black area the darkened stage in the background. Viewed the other way around, the black area can be seen as a series of tornado clouds against a white lower sky background, or, the white area as a figure representing theater seats with the dark area once again a darkened stage.

9. Most people cannot tell what this is at first. It appears to consist of meaningless black and white areas. When it is pointed out that it is a picture of a Cow's Head, most people can no longer see what they were seeing before! The picture becomes meaningful! You can help people see the cow by showing them where its eyes and ears are.

10. Since there is no clear figure or background in this picture you can see it as either a vase, or as two faces. Since neither figure is "better" than the other, the two images "pop" in and out of our perception. It was first published about 1915.

SPADES
Seeing What is Not There and Not Seeing What is!

Many of these illusions involve movement or the perception of movement. They depend on white light striking or failing to strike certain cells in the light sensitive area of the eye called the retina.

2. The strong lines and contrast effects seem to produce a visual vibration, especially if the card is moved slightly. This is similar to the moire pattern seen in some silk materials.

3. This illusion is repeated on the Joker which has illustrations on both sides. To see the effect you must spin the card. The extra Joker was provided so that you could make a hole in it without damaging the basic deck. Make a small pin hole in the center of the circle on the Joker. Using the straightened end of a paper clip, spin the card at a moderate speed. At certain rotational speeds the black arcs appear as different colors. This figure was designed in 1894, but others with different black and white patterns were designed as early as 1856.

4 and 5. When either card is moved with a small circular motion, there seems to be "spokes" which rotate with the card. If you move one, while holding the other stationary along side it, both will appear to have moving spokes. This effect was first observed in 1876.

6. Small gray spots appear at the intersections of the squares, but if you look directly at any one intersection, the gray spot disappears! The same illusion will appear if the squares are white and the intersections are black.

7. The two gray squares appear to differ in overall brightness. It is only true at the border between them where one side is slightly lighter and the other side slightly darker than the overall shade of gray. If you cover the border with a pencil you will see that they are equal in brightness.

8. Like the two of Spades, this card seems to vibrate. It is especially true if moved slightly, although no movement is necessary to see the vibration. The particular patterns of alternating light and dark areas strike different parts of the retina as the eye makes its natural movements, and creates a "flashing" sensation.

9. Each eye has a blind spot where nerves leave the eye to go to the brain. There are no light receptors there. To find your blind spot, close your left eye and fixate your right eye on the target. Gradually move the card a few inches away from your eyes. At some point, the face will disappear because the light reflected from it will be falling on your blind spot.

10. At first glance, some people see only lines forming right angles. The black lines actually represent what would be the shadow of a block letter E if illuminated from above. Once this is seen, the letter E becomes apparent to all.

The design of the card backs is the reverse image of the six of spades. On the back of your cards you will see small light blue dots at all of the intersections except the one you focus upon.

ILLUSIONS BOOK

The authors of these cards have written a book on the subject of illusions called **"Can You Believe Your Eyes?"**. It includes almost 300 examples of illusions and visual oddities and is published by Gardner Press, N.Y.. It is available through book stores or directly through Y & B Associates at the address below.

OTHER EDUCATIONAL PLAYING CARDS

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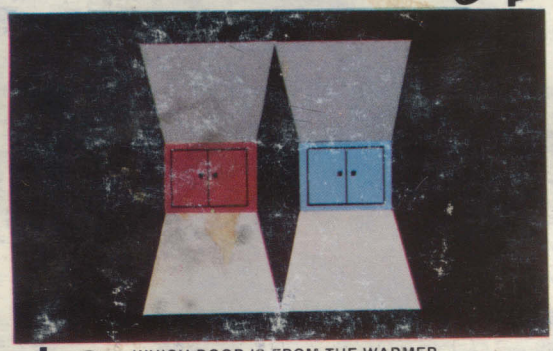
WHICH GRAY SQUARE LOOKS LIGHTER?

ARE THE GRAY SQUARES THE SAME SHADE OF GRAY?

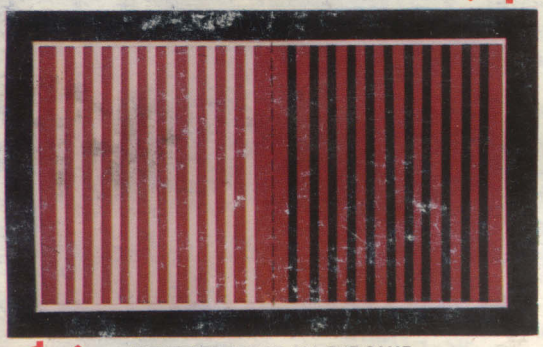
WHICH NATION DOES THIS FLAG REPRESENT?

WHICH DOOR LOOKS CLOSER?

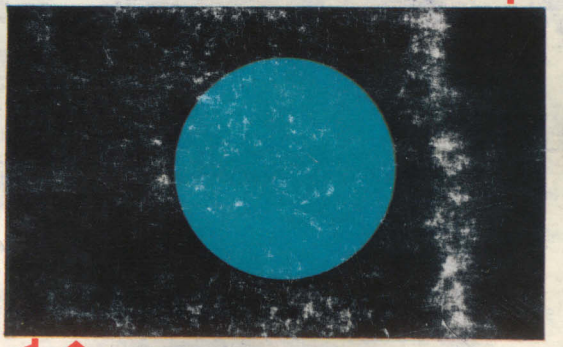


WHICH DOOR IS FROM THE WARMER ROOM?

WHICH NATION DOES THIS FLAG REPRESENT?

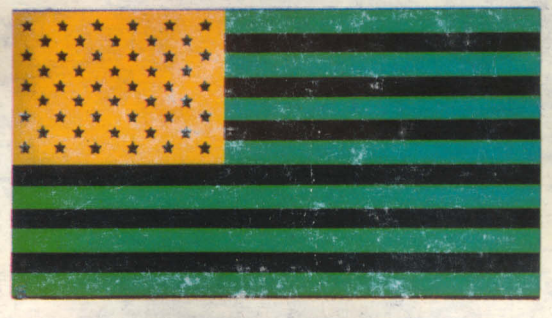


IS THE RED COLOR ALL THE SAME SHADE?

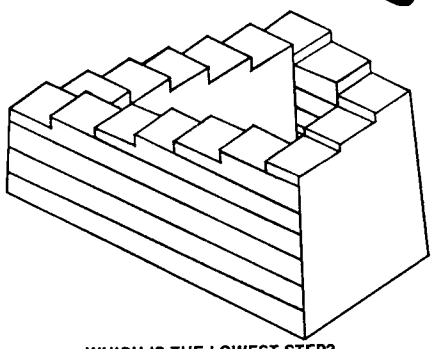


WHICH NATION DOES THIS FLAG REPRESENT?

ARE BOTH SIDES OF THE GREEN FIGURE THE SAME SHADE?

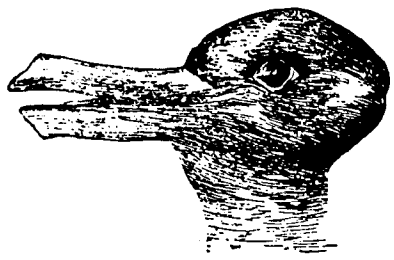


WHICH NATION DOES THIS FLAG REPRESENT?

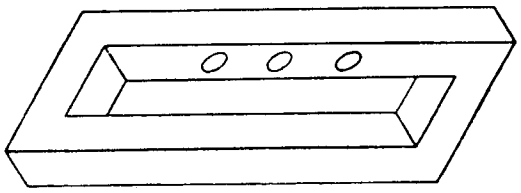


WHICH IS THE LOWEST STEP?

A DUCK?



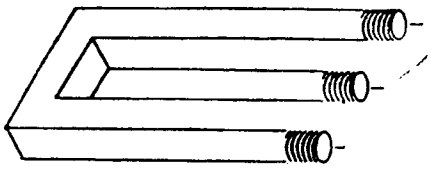
A RABBIT?



ARE THE HOLES ON THE TOP OR INSIDE?

A GROUCHY OLD CLOWN?

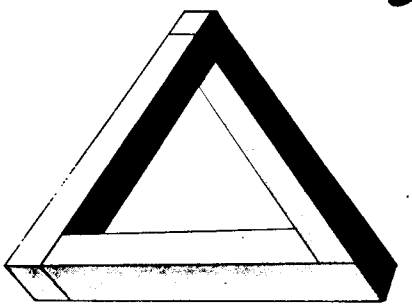
A YOUNG WOMAN?



WHERE DID THE MIDDLE PEG COME FROM?

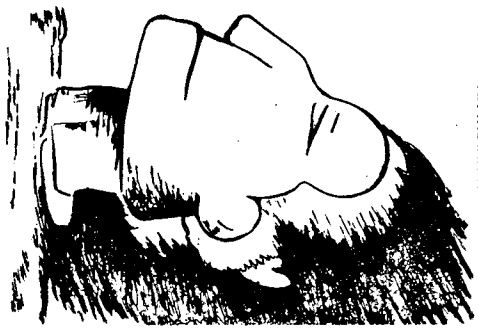
A YOUNG WOMAN?

AN OLD WOMAN?



ARE THE BLACK SIDES INSIDE OR OUTSIDE?

AN ESKIMO?



AN INDIAN HEAD?

QUEENS OVER JACKS!

3

CAN YOU MAKE LIFT STRAIGHT?

3

4

DOES A OR B CONTINUE TO C?

4

5

WHICH SET OF 8's AND S's LOOKS MORE SYMMETRICAL?

WHICH SET OF 8's AND S's LOOKS MORE SYMMETRICAL?

5

6

ARE THE DARK LINES STRAIGHT?

6

7

WHICH ARC COMES FROM THE LARGEST CIRCLE?

7

8

WHICH CIRCLE ISN'T PERFECTLY ROUND?

8

9

WHICH CENTER CIRCLE IS LARGER?

9

10

THIS SPIRAL CAN MAKE THINGS LOOK LARGER OR SMALLER.

10

3

THIS FIGURE CAN MAKE COLORS.

3

4

DOES THIS FIGURE MOVE?

4

5

DOES THIS FIGURE MOVE?

5

6

ARE THERE GRAY SPOTS AT THE INTERSECTIONS?

9

7

WHICH GRAY SQUARE LOOKS LIGHTER?

7

8

VISUAL VIBRATION.

8

9

CAN YOU MAKE THE FACE DISAPPEAR?

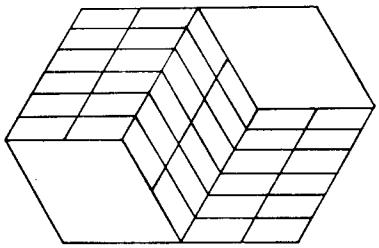
6

10

WHAT IS THIS?

10

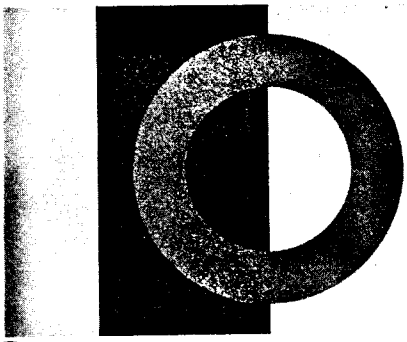
7



DOES THIS FIGURE "POP" IN AND OUT?

7

3

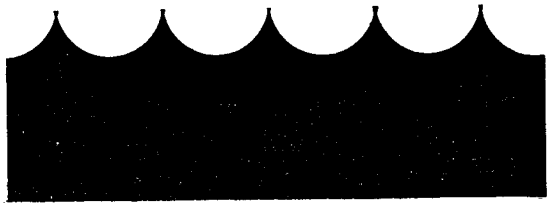


IS THE RING AN EVEN GRAY?

3

8

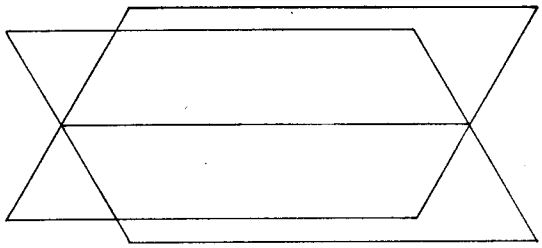
WHAT IS THIS?



WHAT IS THIS?

8

4



ARE THE SHORT FINS NEAR OR FAR?

4

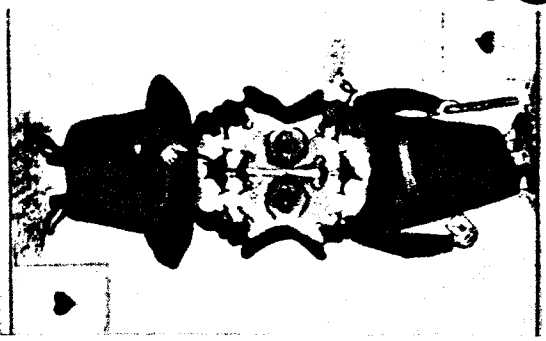
9

WHAT IS THIS?

9

5

HOW MANY FACES?

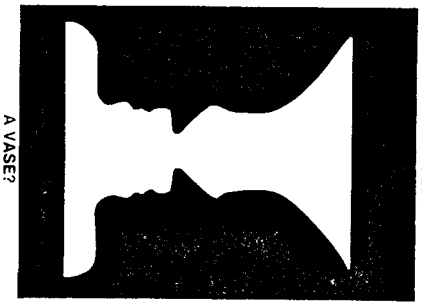


HOW MANY FACES?

5

10

A VASE?



TWO FACES?

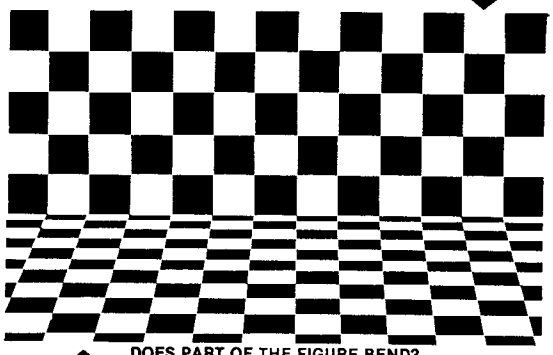
10

6

WHAT IS THIS?

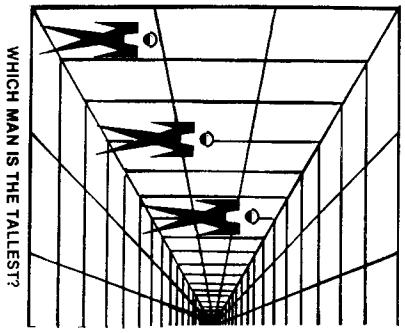
6

7



DOES PART OF THE FIGURE BEND?

3



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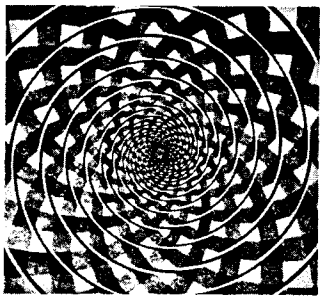
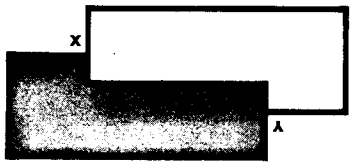


IS THIS A SPIRAL?

4

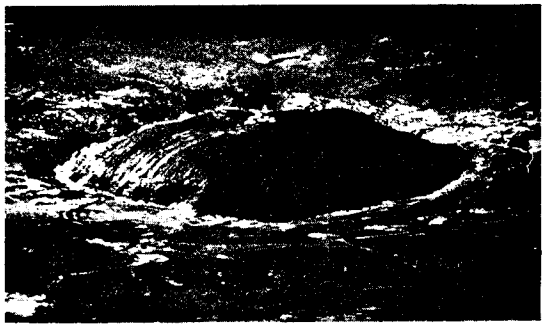
WHICH FIGURE IS ON TOP AT X?



WHICH AT Y?

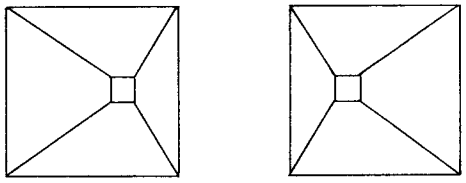
9

A HILL?



A CRATER?

5



CAN YOU MAKE THIS FIGURE THREE DIMENSIONAL?

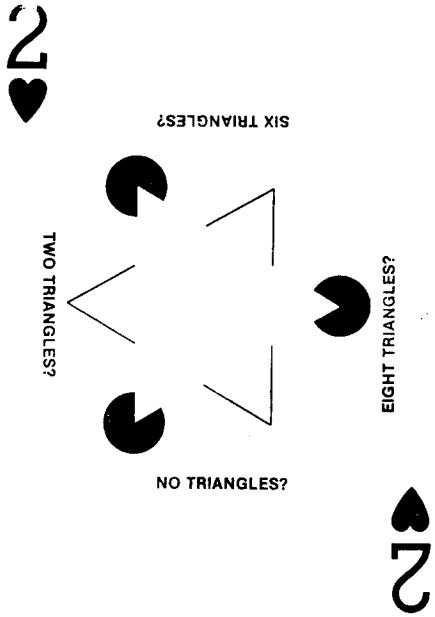
10

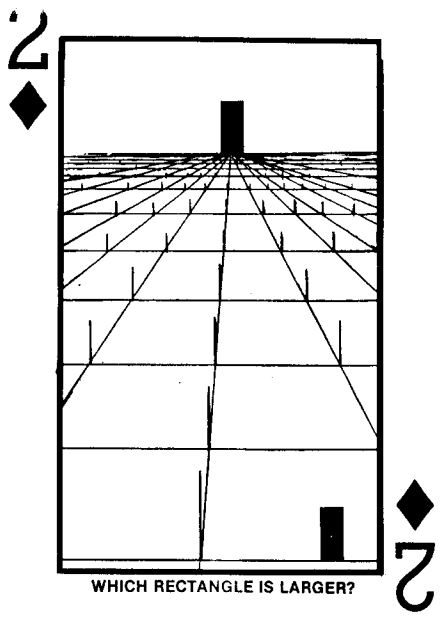
HOW FAR AWAY IS THE CIRCLE:
IF IT IS THE MOON? BASKETBALL?
WEDDING RING?

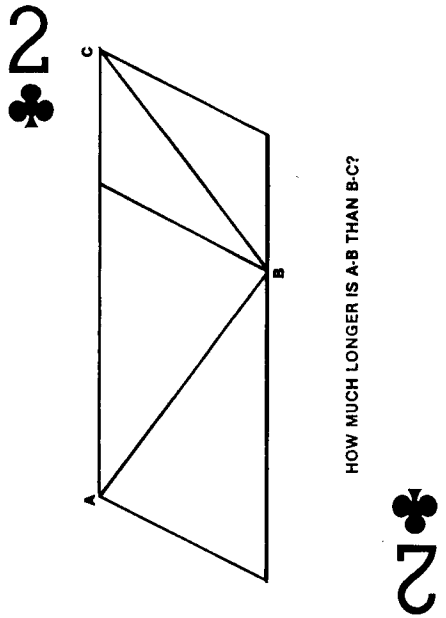
6

DENTS OR BULGES?

DENTS OR BULGES?

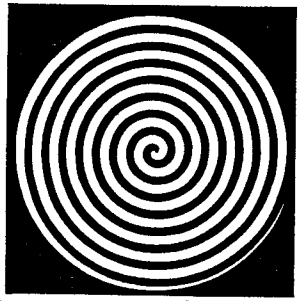


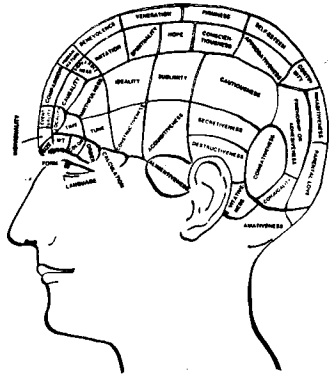




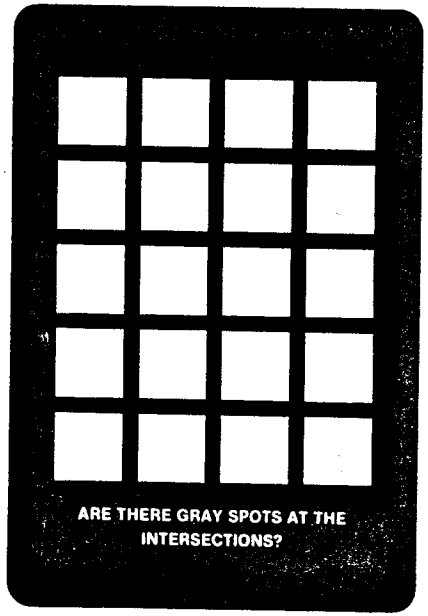
DEUCES ARE WILD!

Cut Out and Spin!





JOKER!



The Back of the Deck