Two Amusing Water Tricks

1. Fill large glass to brim.
2. Cover with piece of paper.
3. Quickly turn glass over onto table.
4. Now smoothly pull glass up off water and twist. With a little practice, you will be able to leave the water standing about eighty per cent of the time.

1. From a high faucet, let two feet of water flow, then cut it off just under the faucet.
2. Carefully swing top (A) down and join to bottom (B) in a circle, taking care to not squeeze it, and stand gently on a flat surface.
3. Water will keep flowing like this for many minutes. (On the principle of hydrokinetic fusion)

3 Explaining Magic: Pictorial Instructions and Disinformation Design

Magic, the production of entertaining illusions, has an appeal quite independent of the local specifics of language or culture. In seemingly causing an object to vanish or an assistant to levitate, conjurers amaze, delight, and even shock their audiences by the apparent violation of the universal laws of nature and our daily experience of those laws. Since these principles of physics hold everywhere, magic is conceivably a cosmological entertainment, with the wonder induced by theatrical illusions appreciated by all, regardless of planetary system.

Explanations of magic involve pictorial instructions demonstrating a sequence of performance, a step-by-step description of conjuring activities. To document and explain a process, to make verbs visible, is at the heart of information design.

Also, as is the case for all sorts of narratives, explanations of magic tell a four-dimensional story, using words and images to navigate through time and three-space where conjuring activities take place. It is hard to imagine how the motionless, two-dimensional flatland of paper can fully disclose the swift fluidity of sleight of hand.

In magical performances, knowledge about the revealed frontview (what appears to be done) fails to yield reliable knowledge about the concealed backview (what is actually done)—and it is the audience’s misdirected assumption about such symmetric reliability that makes the magic. Comprehensive visual accounts of illusions must simultaneously depict the revealed and the concealed. As a result, such explanations are intriguing exercises in design.

Magicians, like other theatrical performers, are professionals in communicating and presenting information. Thus writings on the stagecraft of magical performances may well contribute to our understanding of information design.

Finally, the techniques of conjuring are especially relevant to theories of information display. To create illusions is to engage in disinformation design, to corrupt optical information, to deceive the audience. Thus the strategies of magic suggest what not to do if our goal is truth-telling rather than illusion-making.

*Jamy Ian Swiss, a professional magician, is co-author of this chapter.

1 See Earle Coleman, Magic: A Reference Guide (Westport, Connecticut, 1987), p. xii. In anthropology and histories of 12th to 17th century ideas, "magic" refers to pre-scientific belief systems—astrology, divination, prophecy, numerology, magic healing, witchcraft, demons—usually as competitors to religious beliefs; see Keith Thomas, Religion and the Decline of Magic (New York, 1971). Our interest here is only in conjuring, the creation of entertaining illusions.

In explaining magic, diagrams on paper illuminate spatial depth and
detail, simultaneously exhibiting the revealed illusion and unveiling
the concealed gimmick, the different views of audience and performer.
From a superbly illustrated book, The Royal Road to Card Magic, this
drawing at right describes a parlor trick in which some cards are placed
inside an envelope while, by stealth, the target card remains outside.
Remarkably, ten layers are depicted: (1) left thumb, (2) three of hearts,
(3) envelope, (4–7) stack of four cards within the envelope, (8) right
thumb, (9) other side of the envelope, and (10) ghosted fingers behind
the whole thing. Another layer of content comes from the annotation,
which accent the visual separations by pointing to various levels. Both
diagonals of the envelope read accidentally in perspective and suggest
an added (although representationally incorrect) depth. Perspective is
also enforced by the thicker lines around the left thumb compared to
the outline of the wrist.

Below we see the front and back views, the revealed and concealed
hands executing a Downs Eureka Pass. First a coin displayed in the right
hand vanishes via the backpalm, a deft one-handed maneuver whereby
an exposed coin is quickly concealed behind the fingers, disappearing
under the cover of a tossing motion of the right hand. Such a covering
gesture is based on a fundamental principle of Gestalt psychology and
of magical misdirection: larger motions hide or blur smaller motions.
The sequence continues as another coin is brought to the right finger-
tips by the left hand, which also secretly steals away the original coin
from the back of the right hand. Repeating the cycle, the right hand
waves and again causes the visible coin to disappear via a backpalm,
the left brings another coin forward and steals the vanished coin, and
so on through as many cycles as audience and magician can stand.
Since the left hand must hide an increasing accumulation of potentially
clinking coins, the repeated cycles grow more difficult. At left, the
audience’s view; at right, behind the scenes.

Jean Hugard and Frederick Braud, The
Royal Road to Card Magic (New York,

T. Nelson Downs, Modern Coin Manip-
Multiple, layered views exemplify the special power of diagrams, a capacity to show places or activities that we are unable to see directly from one fixed viewpoint in the real world. This drawing from an instruction manual for heart surgery unveils positions of the surgeon’s finger and knife (a valvulotomy) cutting the hidden fibers and opening up the mitral valve: “A number 1 3 valvulotome is used as a sharpened edge of the finger, not as a saw. Maneuvers 1 and 2 are whole hand and valvulotomy movements to initiate the opening in the anterolateral fusion bridge.” By illustrating sequences of action and hidden views, the diagram outperforms eye or camera in exhibiting the procedure. Also, drawings sometimes have a useful abstracting, idealizing quality; a generic heart is depicted, not a particular or idiosyncratic heart.

In the world of the diagram, showing a sequence of changes over time is identical to showing adjacent layers of information; on paper, time and space are as one. Multiple positions signal either temporal or spatial adjacency, movement or arrest. Although potentially ambiguous, the reading is usually clear; this surgeon does not have two right hands.

Of course an effective way to show two views is to show two views. At right, our flap arrangement discloses a trick dating back at least to 1581: on top, a view of a conjurer’s hands as seen by the audience and then, beneath the flap, what goes on backstage.4

4 “Lay the piece of wood across the palm of your left hand... with the thumb and all the fingers far apart, lest you be suspected of supporting the wood with them. Next, take your left wrist in your right hand, and grasp it tightly, for the purpose, as you state, of giving the hand more readiness. Now, suddenly turn the back of your left hand uppermost, and as your wrist moves in your right hand, stretch out the forefinger of your right hand, and as soon as the wood comes undermost, support it with such forefinger. You may now shake the hand, and, after a moment or two, suffer the wood to drop... This will, doubtless, create much amusement.” [John Wyman], The Magician’s Own Book, or the Whole Art of Conjuring (New York, 1857), p. 25. Also in Henri Decamps, Testament de Jerome Sharp, Professeur du Physique amusing (Paris, 1786); and Thomas Hill, A brief and pleasant treatise, entitled, Natural and Artificial Conclusions (London, 1581). Redrawn, with a flap added.
In the strike second deal (at right), the dealer appears to deliver the top card from the deck but in fact secretly substitutes the card immediately below. For magicians, this technique helps turn one card into another; for card hustlers, it serves to deliver a particular card to an ally or victim. To begin this maneuver, the left thumb pushes the top card slightly aside, thereby exposing a small part of the card beneath. Simultaneously the right thumb moves down to the exposed surface of the lower card, sweeps it rightward, and deals it off. Following the path shown in red, the right thumb "strikes" the lower or second card, hence the technique’s name. As the lower card leaves the deck, the left thumb squares up the top card, in order to neutralize its potentially incriminating offset. To achieve the desired effect requires a “dead certainty of execution, for perfect timing and for perfect gripping of the cards.”

Books on magic describe such dynamics and mechanics in great detail, but these paper accounts do not capture any of the sparkle of live action. As Hugard and Braüf rightly note: “In the hands of an expert it is absolutely unbelievable that the second card can be drawn off the deck when no movement of the top card is perceptible.”

Although apparently nothing special, this diagram above is effective and clever, using subtle techniques to show a moderately complex sequence. An arrow-line neatly traces out the three-space path of the otherwise absent right thumb. For the cards, a change in outline from solid to dotted indicates a change in position of the top card as it is moved aside to give access to the second card. The solid outline of the deck double-functions: when the top card is viewed as being in its shifted (dotted) position, the solid line (which previously located the top card) now represents the position of the lower card—a verbally complicated but visually transparent concept. To improve the design, the diagram was rotated 180° from the original, now showing the sleight from the viewpoint of the operator rather than the audience. After all, the audience for this illustration is the student of magic.

Turning now to sequences with three or more states, here is a fine explanation of the Charlier cut, with words and images together in tight sequence, just as in a lesson with a teacher-magician, who speaks while slowly demonstrating the moves. Again, an illustration reveals no sense of the deftness of this crisp maneuver when performed live.


6 Expert Card Technique, p. 17.


The Flying Glass of Water, from a 1932 magic catalog, illustrates a three-step sequence, reading left to right. This narration shows what the audience sees, rather than revealing the gimmick (send in $1.00 for that). To begin, a glass and cloth are displayed, and then the cloth apparently covers the glass.

and, then, a flourish and a magical moment

as the glass of water vanishes. On the silent and motionless flatland of paper, how smoothly GONE depicts voice, movement, the lightness of vanishing, the absence of weight—at least in this particular context. Vibrating stripes animate and lighten the word, making it airy and more active than a plain GONE.7 With text also serving as image, the idea, word, and drawing add up to a coherent and vivid whole.

7 Paul Rand, designer of the striped IBM logotype, writes: “Stripes are dazzling, sometimes hypnotic, usually happy. . . . Stripes attract attention. . . . The stripes of the IBM logo serve primarily as an attention-getting device. They take commonplace letters out of the realm of the ordinary. They are memorable. They suggest efficiency and speed.” Paul Rand, A Designer’s Art (New Haven, 1985), pp. 39–42. Usually the substantive meaning of visual devices is intensely contextual. Stripes suggest dazzle or drab speed when allied with a magic trick or computers but something else when marking the uniforms of military officers or prisoners.
In *The Flying Glass of Water*, changes in position of the disembodied hands, the rising background grid, and the *Flying* letters altogether loosely signal left-to-right flow, reinforcing the already understood direction of reading at least in left-right conventions of the occidental world. On paper flatland, unlike video, viewers are able to control the pace, sequence, direction, and focus of viewing. When this illustration is read quickly, the magician's illusion is performed smoothly; under the dissecting microscope of a slow reading, however, the trick falls apart, now diagnosed as the substitution of a thin circular ring or plastic disk for the glass in the second step, while the absent right hand disposes of the glass under the table. *The Flying Glass of Water* is shown as observed from the audience, although those hands do in fact belong to would-be magicians, the fantasizing readers of the catalog.

Above, in a difficult manipulation, the magician's hands quickly exchange a silver coin for a copper one. Timing is crucial in magic, and the complex and rapid performance required for deft conjuring is not easy to illustrate. For this sleight, the author notes that the swift moves "must be done in a one-two-three up and down wave of your hand."* Depicting the action at a rate of two frames per beat, the multiple images flow over time and through space, just as a statistical graphic records a time-series. (In fact, the magician's hands trace out a two-dimensional time-series; a similar statistical design is this account at right of Japanese economic history, as years track the points on a two-space grid of inflation and unemployment—the "Phillips curve," or non-curve.*) Heavy arrows conduct the rhythm of images, while streamers in frames 382 and 384 indicate finer movements of fingers and coins. In this trick, like many others, small maneuvers of fingers are masked by larger hand movements. To expose the method, these drawings depict the hand tipped at varying angles toward the reader. Yet a slightly different angle of adjustment will assure that the audience sees

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![Graph](https://via.placeholder.com/150)

Inflation rate (%)


Unemployment rate (%)
only a silver coin magically transformed into a copper coin. Magicians are preoccupied with such viewing angles, which make the difference between a successful deception and a disastrous exposure. And so for illustrators: Are readers to see the produced effect or how to produce the effect, or both, and by means of what angles?

Many traditional illustrations of magic do not convey such a finely detailed sense of sequence and rhythm as that shown at far left. Nonetheless the artwork is unpolished: the hands are silhouetted by a heavy outline (its uniform line-weight contradicts perspective); the strong dark arrows unintentionally cause the hands to read as if they are continually moving forward. In a later work, above right, the same artist-author-magician effectively portrayed motion by combining multiple, blurred, overlapping images and lines tracking movements, a device often used in comics.

Ghosting of multiple images, like blurring, can signal motion in pictorial descriptions. At right, a delightful illustration from Descartes’ Principles of Philosophy shows a bug crawling outward along a rotating ruler. Both the bug’s changing location and the sequence of alphabetic labels indicate direction of rotation (counter-clockwise) of the ruler, although an arrow pointing in the direction of rotation would clarify the reading. Particularly engaging are the ghosted letters X Y Y.

Illustrations of magic tricks are part of workaday writings designed to instruct practitioners. Because of efforts to restrict its secrets to professionals, the literature is somewhat fugitive and often privately published, inexpensively printed with homemade diagrams traced over photographs of tricks. We cannot expect the result to equal that of the scientific masters of motion, such as Etienne-Jules Marey16, who constructed this exquisite sequence of multiple overlapping images:

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These three panels below show some fish magic, the "distraction display" of the colorful male stickleback, as it seeks to lure a group of egg-eating predators away from its nest. Several methods depicting movement combine to create a lively narrative of threat and decoy: (1) separate diagrams show paragraphs of activity, (2) dotted lines track motion within images, and (3) just as a sequence of varying positions of a single object indicates motion, here varying postures of the many fish together signal motion. The three panels are separated by a gentle and effective visual move, simply the absence of background; heavy-handed compartments made from thick lines are never necessary in order to tell one image from another. This is a superb arrangement, a design so good as to be unnoticeable, transparent to the interesting content at hand.

DISTRACTION DISPLAY is a tactic a male may use to protect his nest from raiding females (top). The guardian male swims away from the nest, poking his snout into the ground several times (middle). This action resembles a feeding movement that lures the attacking females away from the nest (bottom).
Some 400 years of writings on magic make a very clear point about the design of information: there is no magic in still-land. Although the still-land of two-dimensional paper works reasonably well for explaining the step-by-step mechanics of a trick, paper is hopeless for revealing the swift dexterity of motion that makes for convincing illusions presented to an audience. In still-land, there is no spark of conjuring, no sense that a magician may have temporarily repealed the laws of everyday physics. Furthermore, a fundamental technique of illusion-making—retention of vision, the mind’s brief holding of an image after the image has departed the scene—requires precise timing of swift movements. The fixity of images on paper, despite clever techniques for showing motion, greatly limits representations of the quick rhythms of magic:

It is difficult to explain “Sleight” on paper, even with the aid of illustrations, because it is almost impossible to show by words or pictures exactly what one means. A demonstration would be the best way of explaining a good “sleight” to a learner who wished to get the utmost value out of the effect and to master the part which misdirects the attention of the audience at the critical moment.

Is there, then, magic in video-land? Moving images surely capture the fluidity of motion that produces the astonished surprise resulting from a good trick. A polished and witty video is David Williamson’s 1990 tape, Sleight of Dave, which first shows a magical effect and then unveils the method, along with explaining techniques of stagecraft. Some video recordings of magic performances, however, have serious problems of credibility, and not just because they look like television. How are we to assess an illusion seen on video? Did the assistant vanish from the box because the camera was turned off or because of a real trick? Magic is at its best alive, seen by our own eyes, rather than through the eyes of an illustrator or the lens of a camera.

The literature of magic is haunted by another issue of information design: how to combine text with images. In perhaps 80 percent of the work, two nearly separate stories march along apart, as a trick is described in words and then again in pictures, or in clumps of words with scattered pictorial interruptions. Sometimes it is helpful to see the entire sequence together. But when we teach step-by-step sequences in live-land, usually a few words describe a visual element (with words and object linked by pointing gestures), then some more words describe another view, and so on. In contrast, readers of pictorial instructions often have to spend too much of their time coordinating small steps buried in large blocks of text with small steps buried in a long sequence of illustrations. It is all as heavy-handed as Euclid, with endless back-and-forths between triangle ABC mentioned in the text and triangle ABC shown in the diagram. In contrast at right, The Royal Road to Card Magic, an exemplar of pictorial instruction, tightly links its shared verbs of text and of image—“pivots up to cross over and drop on.”

OKIJO [the stage name of Theodore Bamber], Quality Magic (London, no date, probably 1922), p. 3.

Magic and Disinformation Design

Magical illusions are based on techniques that deny, conceal, obscure, and manipulate optical information. In viewing magic performances, the spectator's astonishment

... is a species of perplexity caused by concealing important facts or factors or by obscuring the issues. ... Since bafflement and its various shades of meaning, including mystification, mean frustration by confusion—by concealment of important factors and by making intricate—successful deception is exactly the act of doing these things plus blocking the spectator from penetrating through them to solution of the problem. 12

To create illusions is to engage in disinformation design. An inventory of conjuring methods consequently provides evidence about what not to do in the proper arrangement of information—where the point is not at all to baffle the audience but rather to unveil and explain complex data clearly, accurately, unmistakably.

In conjuring, strategies of disguise and attention control work to regulate the optical information available to the spectator. 13 As we have seen for the backpalm and the copper–silver coin exchange, a common technique is to disguise smaller motions by means of larger motions; the fingers craftily manipulate while the hand grandly waves. The attention- attracting but resolution-reducing character of motion is described by Henning Nelms:

Although movement attracts attention, it also diminishes visibility. When a thread is used to support a light object, it can be seen from a surprising distance even when its color matches the background. However, the slightest movement makes it disappear. A large movement can be used to conceal a small one. For example, the weak spot in The Strong Man's Secret [a trick based on a cut-and-restored string] is the action of cutting the loop. The technique ... can be made more deceptive if you keep the knife still and force the string against it by a sudden movement of the left hand. ... The large movement of the left hand and the string draws every eye away from the knife so that no one can observe the unnatural way in which the string is cut. 14

And in detective stories, the small clue that solves the mystery may be similarly disguised: "It is Agatha Christie, too, who regularly contrives that just as the clue is dropped a distracting incident occurs. Here we are close to the art of the stage conjurer." 15 As well as close to the arts of propaganda, strategic intelligence, and politics 16—although for magic, at least, the targets of the deception are aware and pleased that they are being deceived. Related issues have engaged researchers in visual perception for more than a century, in work on visual masking, "the reduction of the visibility of one stimulus, called the target, by a spatiotemporally overlapping or contiguous second stimulus, called the mask." 17 In conjuring, The Mask makes the magic; elsewhere, The Mask makes a lie.

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12 Dariel Fitzkee, Magic by Misdirection (San Rafael, California, 1945), p. 124. In his essay on perception, magic, and ecological physics (the tact regularities of the everyday physical world), James J. Gibson writes: "An event that would violate the laws of ecological physics if it occurred would be impossible. Nevertheless, someone who knows how to manipulate and control the information available to an observer for perceiving events can make [an observer] perceive such an impossibility. (Note that the observer can perceive a happening without necessarily believing that it happened; [the observer] may assume that it was a 'trick'. Seeing does not always entail believing.) The magician does so by suppressing the optical information for what really happened or by preventing the observer from picking it up and, more rarely, by producing information for the impossible happening." James J. Gibson, "Ecological Physics, Magic, and Reality," in Edward Reed and Rebecca Jones, eds., Reasons for Realism (Hillsdale, New Jersey, 1982), p. 219.

13 Dariel Fitzkee, Magic by Misdirection (San Rafael, California, 1945), p. 114.


Here we see some distinctly unmagical disinformation design, as a noisy and repetitive carpet pattern masks the edge of each step in this treacherous staircase. Shill and strident visual activities will tend to dominate the information space, scrambling finely detailed but relevant content. Below, in a sinister piece of disinformation from a billboard advertising cigarettes, a thick frame clutters the words of warning (by activating the negative white space between word and box) just as a waving hand masks small moves of the fingers in switching coins.

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**SURGEON GENERAL’S WARNING: SMOKING CAUSES LUNG CANCER, HEART DISEASE, EMPHYSEMA, AND MAY COMPLICATE PREGNANCY**

The sans serif, capital letters minimize distinctions among letters and words, contributing to the difficulty of reading. “Where scrutiny is damaging, scrutiny is diverted,” explains *Magic by Misdirection*. Such masking of content resembles the obscurantist foolishness around of too much of contemporary graphic design. Paul Rand describes the triumph of decoration over information, similar to the mishmash of chartjunk for statistical graphics:

... a collage of chaos and confusion, swaying between high tech and low art, and wrapped in a cloak of arrogance: squiggles, pixels, doodles, dingbats, ziggurats, and aimlessly sprinkled Lilliputian squares; turquoise, peach, pea green, and lavender; corny woodcuts on moody browns and russets; art deco rip-offs, high-gloss finishes, sleazy textures; halos and airbrush effects; tiny color photos surrounded by acres of white space; indecipherable, zany typography; tiny type with miles of leading...  

Sometimes, of course, the disinformation is in the data rather than the method of display. Thoughtful designs may skillfully present false information, as in this famous example in the history of magic. 

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18 JohnTempler, *The Staircase: Studies of Hazards, Falls, and Safer Design* (Cambridge, Massachusetts, 1992), p. 142, describes another distracting design: “At one New York City railroad station, the stair treads had been treated with a material consisting of lines parallel to the tread edge. Over a six-week period (until the problem was corrected), more than 1,400 people fell on this stair.”


These drawings document a theory of concealed workings of the Automaton Chess Player, a sensation in Europe during the late 1700s. The apparatus seemingly played chess by mechanical means, defeating many human opponents (including perhaps Napoleon, who allegedly tested the machine by making illegal moves, only to be corrected each time). Developed by Wolfgang von Kempelen in 1769, the contraption went on tour for 50 years in various guises. While in France, Benjamin Franklin played and lost, and then wrote a letter of introduction for the keepers of the machine to another ambassador.\(^\text{21}\)

Decked out in Turkish dress, the magical automaton stiffly moved chess pieces with its left hand, rolled its eyes, and, when checking its human opponent, shook its head thrice. To begin each performance, von Kempelen briefly opened the cabinet and moved a candle around various compartments, revealing what appeared to be either empty space or intricate gears and levers.

A thorough analysis of the automaton was published in 1821 by Robert Willis in a book of 36 pages and 11 diagrams. These drawings (three are shown above) were widely copied, redrawn, and republished. Using a sometimes murky visual language of dotted outline, Willis depicts a human chess-player hidden behind a false wall in the cabinet, who secretly climbs up inside the Turk in order to move the pieces. Printed separately, these diagrams are inconveniently isolated from the explanatory text. This arrangement requires dozens of cross-references, filtered through an elaborate 19-letter code of call-outs (below), linking text to legend to 11 different diagrams bound in the front and back of the book:

THE FOLLOWING LETTERS OF REFERENCE ARE EMPLOYED IN ALL THE PLATES.

A Front door of the small cupboard.
B Back door of ditto.
CC Front doors of the large cupboard.
D Back door of ditto.
E Door in the trunk.
F Door in the thigh.
GG The drawer.
H Machinery in front of the small cupboard.
I Screen behind the machinery.
K Opening caused by the removal of part of the floor of the small cupboard.
L A box which serves to conceal an opening in the floor of the large cupboard, made to facilitate the first position; and which also serves as a seat for the player in the third position.
M A similar box to receive the toes of the player in the first position.
N The inner chest, filling up part of the trunk.
O The space behind the drawer.
PQ The false back, turning on a joint at Q.
R Part of the partition formed of cloth stretched tight, which is carried up by the false back to form the opening between the chambers.
S The opening between the chambers.
T The opening connecting the trunk and chest, which is partly concealed by the false back.
U Panel which is slipped aside to admit the player.

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Among those who shared Willis’ opinion and admired the “logical reasoning” of his solution were Edgar Allan Poe and Scottish physicist Sir David Brewster. 22 In 1834 Brewster completely appropriated Willis’ explanation of the chess machine, including all 11 diagrams. Brewster’s redrawings above make crisp and consistent visual distinctions: line for the revealed, darkened silhouette for the concealed. Effectively layering the information, the line-drawing remains visible against the finer vertical lines of the silhouette, a technique also used in maps for carrying multiple layers of data. These redrawings fail to reproduce the scale of measurement shown in the original, as incomplete plagiarism leads to dequantification. Although Brewster integrates the small diagrams into his text, he still retains the clumsy call-outs of Willis, and, for no good reason, places the captions several pages away from the diagrams themselves. Nevertheless, the illustrations developed a vigorous life of their own. They were reproduced in 12 editions of Letters on Natural Magic and often borrowed by other explainers of magic. 24 Because of their clarity, plausibility, and vividness, Brewster’s drawings became the definitive account of the mechanical chess-player.

Yet the most important fact about these technically well-executed diagrams is that they are false, detailed wrong guesses about how the automaton worked. The main thing that Willis (and thus Brewster) got right was that a human chess-master was hidden inside. But the person residing in the box never climbed up into the Turk; and the other proposals concerning the automaton’s inner mechanisms were incorrect. 23 These much-copied drawings resemble “urban legends,” picturesque stories told and retold about bizarre happenings that can never be traced to actual events or particular eye-witnesses. A student of folklore described the principle that governs the exuberant proliferation of such fictional narratives: “Rule 1: The truth never stands in the way of a good story.” 26 Or, for that matter, a good illustration.


24 Such borrowing is common. Raymond Tullo Scott [A Bibliography of English Conjuring 1581–1876 (Derby, 1976), p. 76] writes: “Reginald Scot, in his Discovery of Witchcraft, denied the existence of witchcraft and ... explained in detail how tricks popularly regarded in the nature of witchcraft were performed. Thus was born the first work to expound the technique of conjuring, and with it began a long course of literary theft which, as Sidney S. Clarke pointed out in his Amads of Conjuring, had been the bane and disgrace of the conjuring profession for more than 300 years. The Art of Ingling, the first work to be devoted exclusively to legerdemain, Hocus Pocus Junior, the first illustrated work on the subject, and Henry Dean’s The Whole Art of Legerdemain or Hocus Pocus in Perfection, were all founded upon Scott’s famous work. ... [T]he tricks in Samuel Rid’s The Art of Ingling were mostly copied word for word from Scott’s pages.”

25 The machine was more intricate than anyone imagined. The automaton was a puppet, animated with long sticks from below by the director concealed inside.

Several of the classic texts of magic advocate two primary principles for successful illusion-making, suppressing context and preventing reflective analysis. Here, for example, is Professor Hoffmann in 1876:

The first rule to be borne in mind by the aspirant [magician] is this: "Never tell your audience beforehand what you are going to do." If you do so, you at once give their vigilance the direction which it is most necessary to avoid, and increase tenfold the chances of detection. . . . It follows, as a practical consequence of this first rule, that you should never perform the same trick twice on the same evening. The best trick loses half its effect on repetition, but besides this, the audience knows precisely what is coming, and have all their faculties directed to find out at what point you cheated their eyes on the first occasion. 27

These techniques of disinformation design, when reversed, reinforce strategies of presentation used by good teachers. Your audience should know beforehand what you are going to do; then they can evaluate how your verbal and visual evidence supports your argument. And so we have some practical advice for giving a talk or paper.

1. Near the beginning of your presentation, tell the audience:
   What the problem is
   Why the problem is important
   What the solution to the problem is.

If a clear statement of the problem cannot be formulated, then that is a sure sign that the content of the presentation is deficient.

Magicians rarely perform the same trick twice in front of the same audience because they are aware that repetition helps people learn, remember, understand.28 Unlike magicians, you should give your audience a second chance to get the point. And a third. Repeated variations on the same theme will often clarify and develop an idea.

2. To explain complex ideas or data, use the method of PGP:
   Particular  General  Particular

For example, to help your audience understand a multivariate table of data, briefly introduce the table and point to a particular number and say what it means; then step back and describe the general architecture of the table; finally reinforce it all with a second particular, explaining what another number means.29 These two particulars can be selected to make a substantive point as well as to explain the data arrangement.

With PGP, your argument is more credible, for you have more than a single anecdote (you have two) to accompany the general theory.

To mask the optical information that would reveal their methods, magicians systematically reduce our ability to resolve their movement. In contrast, you should give high-resolution talks that are clear and also rich in content. Seek to maximize the rate of information transfer to your audience. Yet many presentations rely on low-resolution devices to communicate information—reading aloud from images projected.


28 Harlan Tarbell, The Tarbell Course in Magic (Brooklyn, 1927, 1971), 1, p. 54: "Never repeat a trick at the same performance . . . . What your audience has missed the first time, they will watch for the second time, and so may discover your secret." Dariel Fitzkee, Magic by Misdirection (Oakland, California, 1943), p. 219: "The same misdirection expedient must never be used twice in the same program. This is even worse craftsmanship than doing the same trick twice." In the current-day practice of magic, however, the same effect may indeed be repeated, produced by a different method each time, a chaining of magical effects that makes for a striking performance.

29 The idea of PGP (as described by Robert E. K. Rourke) is discussed in Frederick Mosteller, "Classroom and Platform Performance," The American Statistician, 34 (February 1980), p. 13.
up on the wall from computer screens or from the dreaded overhead projector, or talk talk talk. Instead, try a high-resolution method:

3. No matter what, give everybody in the audience one or more pieces of paper, packed with material related to your presentation.

Handouts can show pictures, diagrams, data tables, research methods, references, names of people at the meeting, or the complete text of the paper outlined in your talk. Unlike evanescent projected images, permanent and portable paper has credibility. Paper serves as a testimonial record documenting your talk, letting your audience know that you take responsibility for what you say. People can file your handouts away and then come back in a month and ask, “Didn’t you say this?”

Along with the perils of disinformation design, the practice of magic also exemplifies the stagecraft of theatrical performance, the professional techniques that can help us improve our presentations.30 The literature on the staging of magic reveals that there is a lot going on in a good performance, and that mastery of this detail requires constant attention and enthusiastic practice (sometimes several years are needed to perfect a few minutes of material for a magic act). These diagrams above from Nelms’ book on stagecraft give a sense of the intense detail involved in a magic performance. The message for our own work is clear:

4. Analyze the details of your presentation; then master those details by practice, practice, practice.

Good teachers know all about the value of preparation and practice. Frederick Mosteller, a superb statistics teacher and one-time magician, writes “rehearsals are extremely helpful, and rehearsals with timing very instructive. Rehearsals are, I think, the single best way of improving
one’s lecture work.” Magicians practice in front of a mirror, friend, or video camera; when you practice, work on what your audience sees and also hears. To detect mannerisms of speech, turn off the video and listen to the audio only.

Finally, plan your arrival and departure so as to make a difference:

5. **Show up early. Something good is bound to happen.**

6. **Finish early.**

By arriving early, you can look the place over, have time enough to recover from a problem (for example, the room is already occupied; or the projector is missing), check the lights, and greet people as they gradually arrive to await your performance. Give the talk and finish early: “People will be pleased with a nice short speech. I believe that Paul Halmos, a very great lecturer, noted that in a lifetime of giving and attending mathematics lectures he had never heard complaints about a seminar ending early.” Even magicians are urged to get on with their entertaining performances: “Always leave them wanting more. Get to the point. Be brief. Keep interesting them. Quit before they’ve had enough.”

**Conclusion**

The techniques of disinformation and the pseudo-explanation of the automaton chess-player illustrate once again the supreme and enduring test of all information design, the integrity of the content displayed:

- **Is the display revealing the truth?**
- **Is the representation accurate?**
- **Are the data carefully documented?**
- **Do the methods of display avoid spurious readings of the data?**
- **Are appropriate comparisons and contexts shown?**

Sometimes we have a clear empirical test of visual truth-telling: Was a wise decision made and prudent action taken on the basis of the displayed information? Thus, in our examples, the epidemic ends or persists, the space shuttle survives or explodes, the stairs escort us safely or trip us up, the map efficiently guides us to our destination or it confuses and misleads us.

Also professional standards of quantitative and graphical integrity point the way. For example, economists agree that graphs depicting money over a period of time should show inflation-adjusted (constant) monetary units. To use undeflated monetary units is to distort the evidence, mixing up changes in the value of money with real changes in the data, just as rainbow color-coding of quantitative data confounds what happens in a color scheme with what happens in the data.

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33 Mosteller, "Classroom and Platform Performance," p. 16.


The accuracy of visual representations can be checked against the real thing, if someone is willing to do the work. Errors do persist, however. A 1622 map depicting California as an island was reproduced in 182 variants, as the distinctive mistake traces out a disturbingly long history of rampant plagiary. The last copyist published in 1745, after which California cartographically rejoined the mainland. Then there is Albrecht Dürer’s gloriously wrong engraving of 1513 that portrays a fanciful two-horned, armor-plated rhinoceros. Copied repeatedly in guides and textbooks and even made into a monument, the bogus rhinoceros, along with a fable about its battles with the elephant, was taken as real for some 200 years until finally confronted with too many sightings of actual rhinoceroses.

And for the world of magical illusions, standards of truth-telling in illustration should at least rule out six-fingered conjurers, two of whom apparently perform below.

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36 R. V. Tooley, California as an Island (London, 1964); John Leighly, California as an Island (San Francisco, 1972); Glen McLaughlin with Nancy Mayo, The Mapping of California as an Island (Saratoga, California, 1995). The map shown here is from Nicolas Sanson, Cartes générales de toutes les parties du monde (Paris, 1658).


38 As far left, Cliff Green, Professional Card Magic (New York, 1961), p. 128, showing an error by the well-known illustrator, Edward Mishell. The extra finger is not needed in performing the depicted manipulation. Unnoticed for years, the slip was spotted by Richard Kaufman, who then drew a homage to Mishell’s sixth finger—at near left, Richard Kaufman, Coinmagic (New York, 1981), p. 266.