

## ADELBERT AMES, FRITZ HEIDER, AND THE CHAIR DEMONSTRATION

*Roy R. Behrens*

Adelbert AMES II was an American lawyer and artist who became known for his discoveries in optical physiology and perceptual psychology. In 1928, while at Dartmouth College in Hanover, New Hampshire, he diagnosed a visual dysfunction called *aniseikonia* which resulted in the founding of the Dartmouth Eye Institute. Later, in the 1930s, 40s and 50s, he developed nearly thirty experiments in perceptual psychology, now commonly referred to as „the AMES demonstrations.“ These ingenious laboratory setups, which are often cited in psychology textbooks, were extremely unusual, and they prompted extended discussions among psychologists, philosophers, educators, and artists (BEHRENS, 1994, 1998).

Fritz HEIDER was a Viennese-born Gestalt psychologist, who was a colleague of Kurt KOFFKA at Smith College, where he taught for sixteen years, beginning in 1930. HEIDER left Smith to join the faculty at the University of Kansas, where he wrote an influential text on *The Psychology of Interpersonal Relations*, in which he applied Gestalt theory to social psychology. In 1983, after his retirement, he recalled his experiences in a memoir titled *The Life of a Psychologist: An Autobiography* (HEIDER, 1983). In 1987-88, portions of his notebooks were also published (BENESH-WEINER, 1987, 1988).

In HEIDER's autobiography, he remembers a series of meetings with AMES, the first of which appears to have taken place at Dartmouth, where the annual meeting of the American Psychological Association was held in 1936. Not trained in psychology, AMES' research had been outside of that profession in the sense that he was not directly in touch with professional psychologists. When the APA gathered at Dartmouth, HEIDER recalls, „AMES was hopeful that he could get some of the bigwigs interested in his work.“ As a result, „he invited some of them to his laboratory [on the Dartmouth campus]; but when he showed them his demonstrations, they only shook their heads and said: ‘Very amusing, but we are sorry. What you have there are optical illusions that have been well known to psychology for a long time. All these problems were solved thirty years ago’“ (HEIDER, 1983, p. 140).

HEIDER does not say which demonstrations AMES exhibited at the APA meeting, but undoubtedly one of the things that he showed was a monocular distorted room. Conceived in 1934 by AMES and first constructed in 1935, the „AMES room“ (as it is often called) is a cleverly misshapen room interior which – providing it is observed through a designated peephole – appears to be perfectly normal in shape. However, viewed from any position other than the peephole, it is evident that

the room is extraordinarily distorted: The right wall, for example, is only one half the height of the left wall, and the back wall is clearly a trapezoid, not a rectangle.

As a result, objects placed inside the room appear either to shrink or to grow as they are moved from one corner to another, tilted surfaces appear flat, and trapezoids look rectangular. In addition, a marble placed within a trough in the room appears to violate gravity by rolling uphill, while liquid poured from one container to another appears to be strangely displaced to the side. And if a subject (while still looking through the peephole) is instructed to touch the back corners of the room with a lecturer's stick, the result is an awkward sensation in which the person's visual reality (the perception of the room as normal) is blatantly at odds with his or her kinesthetic reality, so that, predictably, the subject bangs into the wall with the stick on the right side and falls short of touching the wall on the left (ITTELSON, 1968, p. 184 -189; BEHRENS, 1994).

The second meeting of AMES and HEIDER took place in the summer of 1945. While teaching at MIT, the Gestalt psychologist Kurt LEWIN, whom HEIDER had known in Berlin, was invited to visit AMES's laboratory in Hanover, and he asked HEIDER to go along.

„At that time,“ recalls HEIDER, „I was fond of a little demonstration that I had made which showed that one can produce the experience of a three-dimensional cube by means of a two-dimensional drawing seen from a particular angle. I do not mean just a drawing of a cube, but a setup that gives one the experience of having a real cube in front of one's eyes“ (HEIDER, 1983, p. 140-141).

HEIDER's description is confusing. It is likely that his demonstration was neither a cube nor a drawing, but an anamorphic wire construction. Anamorphosis or „secret perspective“ is a kind of distortion that artists have used since the 15th century. In conventional linear perspective, a painting (or other artwork) is normally viewed from the front. In anamorphic constructions, the picture appears distorted when seen frontally, even indecipherable, the image becoming intelligible only from an eccentric point of view, such as the edge of the painting (BALTRUSAITIS, 1977; BEHRENS, 1994).

Scores of historic examples exist of anamorphic artworks. Among the best known is a perspective cabinet at the National Gallery in London. Titled *Peepshow with Views of the Interior of a Dutch House*, it was created around 1656 by Samuel VAN HOOGSTRATEN, a pupil of REMBRANDT. In this anamorphic simulation of a room interior, all sorts of dramatic distortions are seen when the front wall of the cabinet is removed (the image of a dog, for example, is partly painted on the floor, partly on an adjacent wall). But when the box is closed and one looks only through a designated peephole, the view is that of a normal, undistorted room interior (BRUSATI, 1995).

Even from a verbal description, the resemblance between the AMES room and Van Hoogstraten's room is apparent. The former is obviously an anamorphic construction, although there is no evidence that AMES was aware of or influenced by

Dutch perspective cabinets. Nor did HEIDER apparently make a connection between anamorphic art and the AMES demonstrations when he first saw them. But years later he did, as is confirmed by the following notebook entry (added after 1978). „National Gallery London: S. van Hoogstraten, 1627-1678; box with peep-holes, illusion of rooms, like AMES“ (BENESH-WEINER, 1988, p. 235).

In the summer of 1945, when LEWIN and he visited AMES at his Hanover laboratory, writes HEIDER, „I showed AMES one of these [cube] demonstrations, and I explained how he could build different setups that would all give the impression of three-dimensional cubes although they would actually be different wire models that would have no similarity to cubes except when each was seen from a specific angle“ (HEIDER, 1983, p. 141).

To better understand anamorphoses, including HEIDER's cube demonstration and the AMES room, it may help to realize that anamorphic phenomena are experienced daily, and that among the most common examples are constellations. In the Big Dipper, for example, the distance of the farthest star (Alkaid) is 210 light-years, while the star adjacent to it (Mizar) is only 88 light-years away. Despite such phenomenal separation, we perceive these stars (as viewed from our „peephole“ position on Earth) as lying next to one another on a perpendicular plane. Through calculated manipulation, any number of different stars, of varying size and brightness, could theoretically be placed at different distances from the Earth to create the same retinal image as does the Big Dipper. Indeed, as art historian E.H. GOMBRICH writes, stellar constellations „may be described as a gigantic AMES experiment which nature has set up for man“ (GOMBRICH, 1982, p. 207).

AMES was not unaware of the parallel between constellations and his laboratory experiments. Among his constructions is a „star point demonstration,“ which consists of a light-tight box with three small star-like holes in front, each illuminated by a separate bulb within the box. By increasing or decreasing the illumination, AMES could make the three „stars“ appear to be nearer or farther away (ITTELSOON, 1968, pp. 147-148).

Having studied optical physiology for more than three decades, AMES realized (as HELMHOLTZ had in 1867) that an infinite variety of stimuli can produce the same retinal image. Thus, just as a limitless number of stars can produce the same constellation, it is theoretically possible to construct an infinite number of rooms, each uniquely distorted, which – providing we view them through designated peep-holes – would result in the same retinal image as would a normal rectangular room. Knowing this, AMES constructed at least one other laboratory-sized monocular distorted room. In that model, the distortion is vertical: Both the floor and ceiling are level and completely square, but the floor is one half the size of the ceiling, and all the walls are upended trapezoids, with the large end at the ceiling and the smaller sloping toward the floor (ITTELSOON, 1968, p. 185).

Similarly, when he visited AMES in 1945, HEIDER realized that an infinite number of anamorphic wire models, none of which is actually a cube, can produce the same retinal image as would the presence of a real cube. „Obviously, the trick

consists," as he explains in his autobiography, "in producing proximal stimuli which the distant [or distal] stimulus would ordinarily cause, and these stimuli can often be produced without having the object present" (HEIDER, 1983, p. 141).

HEIDER believed that he influenced AMES by showing him his wire cube demonstration, but it may be of parallel interest to note that HEIDER also was influenced. It is likely that his wire cube demonstration was inspired by experiments published in 1930 by Gestalt psychologist Herta KOPFERMANN, who had been WERTHEIMER and KOHLER's student at the Psychological Institute at the University of Berlin. Her research, which is discussed and illustrated in Kurt KOFFKA's *Principles of Gestalt Psychology*, includes three "projections of one and the same wire-edged cube," in KOFFKA's words, "either of [which] could therefore be the retinal image of such a cube" (KOFFKA 1935, 159). They demonstrate that a single distal stimulus (which in this case might actually be a wire cube) can produce three dramatically different proximal stimuli (two-dimensional, three-dimensional, and spatially ambiguous) by slight changes in the observer's point of view (that is, by shifting the peephole). In HEIDER's notebooks, there are repeated references to KOPFERMANN's cube drawings, including the statement that "It is instructive to compare KOPFERMANN with AMES (or the cube demonstration)" (BENESH-WEINER, 1988, p. 176).

AMES was "greatly pleased," according to HEIDER, when he saw the cube demonstration in 1945. "When I visited him again in the fall," continues HEIDER, "he had constructed a very nice setup to demonstrate the effect that I described, but with one difference that he had introduced: he used a chair instead of a cube for the model of the object that would appear at a distance" (HEIDER, 1983, p. 141).

The setup that AMES had constructed was a large wooden, covered box, five feet deep by four feet wide. Three identical peepholes are spaced equally on the front of the box, each fitted with a viewing lens. The observer is instructed to peer into each of the peepholes, with the result that in each case one experiences what appears to be a normal-looking chair. The three supposed chairs are of identical size, shape, and at the same distance from the peephole. However, when the lid of the box is removed, and the setup is examined from other points of view, it is obvious that only one of the objects is a miniature chair. The other two objects are extraordinary distortions: One is chair-like but dramatically stretched, while the other is a crisscross of seemingly unrelated wires and suspended wood pieces (ITTELSON, 1968, pp. 170-173).

Having actually seen this demonstration (which, apparently, no longer exists), GOMBRICH writes that, for those of us who have seen only photographs of it, "what is hard to imagine is the tenacity of the illusion, the hold it maintains on us even after we have been undeceived [after the lid is removed]. We return to the three peepholes and, whether we want to or not, the illusion is there" (GOMBRICH, 1961, p. 249).

This setup, which is usually called the "chair demonstration," is typical of AMES's laboratory inventions. Virtually all require that the subject look through a

designated monocular peephole, through which one witnesses a proximal stimulus (a retinal image) which appears to be that which would likely result from an identifiable common object, such as a chair, window, or room interior. However, when the setup is examined from other points of view, it is apparent that we have misjudged the proximal stimulus, and the distal stimulus is not at all as expected. Such setups, AMES concluded, are tangible evidence that perception is not the absorption of truth; it is not a passive reception of fact. The experience of seeing is analogous to a „transaction“ between the observer (who is informed by past experience) and reality: it is based on functional probabilities, not absolute certainties.

As a young lawyer, AMES had spent much of his time at the track at Saratoga Springs, New York, betting on horse races. Thirty-five years later, as a „transactional psychologist,“ he used gambling as a metaphor in explaining the AMES demonstrations. In 1943, he wrote in his notebooks: „Our sense responses disclose the probability of future events for the same reason that ‘dope sheets’ disclose the probability as to which race horse will win or not win a race: namely, because our sense responses are recordings of observations of the results of action in connection with past events of a similar nature. The race horse dopester keeps a record of the performance of all race horses. When any particular horses are going to race, the averages of their past performances disclose a reliable probability as to their relative future performance. So the human being keeps a record of the result of all action following the experiencing of particular visual sensations and records them against the characteristics of the visual stimulus that gave rise to his visual sensations“ (CANTRIL, 1960, pp. 5-6).

HEIDER’s cube setup used abstract geometric shapes; AMES’s chair demonstration used identifiable common objects. The change by AMES from cubes to chairs, writes HEIDER, „was significant with regard to the difference between us in our ideas about perception. It was important for him to use the chair, because it had a familiar practical significance and because one could relate to it by actions – for example, by sitting on it“ (HEIDER, 1983, p. 141). To HEIDER, a Gestaltist, AMES and the other transactionalists had overestimated the importance of past experience.

Despite such differences, HEIDER’s interest in AMES’s research continued for many years, even as colleagues were voicing their doubts about its legitimacy. In HEIDER’s notebooks, for example, we learn that his friend James J. GIBSON, a Cornell University psychologist and author of *The Ecological Approach to Visual Perception*, „detested“ the AMES demonstrations, which he dismissed as „peephole experiments.“ „I think these experiments [are] very important,“ HEIDER retorts, and, in several entries, he suggests that his friend is irrational in his objection to AMES: „Jim Gibson was very impressed when I showed him the cube demonstration. But later, when we were talking about AMES’s room, he was for some reason violently opposed to it – he said it was a very bad experiment, etc.“ (BENESHWAINER, 1988, pp. 226-227).

Of the same era as GIBSON and of equal prominence was Jerome BRUNER, the Harvard psychologist, who first saw the demonstrations in the late 1940s, and whose second wife (née Blanche Marshall, whom he later divorced) was AMES's niece. Her uncle's demonstrations „were ingenious all right,“ BRUNER says sarcastically in his autobiography, because, in his opinion – a view that others find unfair – they were trickery more than research. They were not scientific „experiments“ but artful „demonstrations,“ in the sense that the eye was held captive by artificial constraints. We rarely perceive anything in daily life from a designated peephole with one eye only, through „snapshot vision.“ Instead, we are constantly moving around, gathering information with both eyes from multiple points of view. By speciously withholding clues, says BRUNER, the AMES demonstrations have insufficient resemblance to normal experience, evoking what BRUNER refers to as „weird decisions“ (BRUNER, 1983, pp. 88-90).

HEIDER does not disagree: In a note that anticipates the content (if not the tone) of Bruner's remarks, he concedes that „the AMES room is an arrangement of distal stimuli that is completely artificial and that has an infinitely small probability of happening in nature uncontaminated by psychologists. It will be a very exceptional case when the good solution from one point of view will not also be a good solution from any other point of view“ (BENESH-WEINER, 1987, p. 243).

There is no indication that HEIDER and AMES met after 1945 or on more than the several occasions described. Nor is there any more definite proof that HEIDER's cube demonstration was really the model for the chair demonstration; that AMES was aware of Dutch perspective cabinets; or that HEIDER was influenced by KOPFERMANN.

AMES died in 1955 at age seventy-four. About twenty-five years later, when HEIDER wrote his memoirs, he reiterated his belief that the AMES demonstrations are „significant and interesting, partly, of course, because they fit right in with my own tendency to consider environmental factors lying beyond the retina and to consider the functioning of the whole perceptual system“– with the result that „I cannot help feeling,“ he wrote, „that his [AMES's] experiments should occupy a central place in 'ecological' treatments of perception“ (HEIDER, 1983, p. 142).

### *Summary*

Adelbert AMES II (1882-1955) was an American transactional psychologist who invented the „AMES demonstrations“ in perceptual psychology. Fritz HEIDER (1896-1954) was a Viennese-born Gestalt psychologist whose interest was in social psychology. It is shown that one of AMES's experiments (called the „chair demonstration“) was probably inspired by HEIDER, while HEIDER was probably influenced by an experiment by Gestalt psychologist Herta KOPFERMANN. HEIDER's interest in AMES's research continued for many years, even as others were voicing their doubts about its legitimacy.

### *Zusammenfassung*

Adelbert Ames II (1892-1955), amerikanischer Transaktions-Psychologe, entdeckte für die Wahrnehmungspsychologie die sogenannte „Ames Demonstration“. Fritz HEIDER (1896-1984), Wiener Gestalt Psychologe, forschte vor allem im Bereich der Sozialpsychologie. Der Artikel befaßt sich mit Gemeinsamkeiten der beiden Forscher: Es wird gezeigt, daß eines der Experimente von AMES (Stuhl-Demonstration) wahrscheinlich durch Arbeiten von HEIDER inspiriert wurden, während HEIDER wahrscheinlich durch ein Experiment der Gestalt-Psychologin Herta KOPFERMANN beeinflusst wurde. HEIDER's Interesse an den Forschungsarbeiten von AMES hielt lange Jahre an, obgleich Zweifel gegenüber diesen Arbeiten laut wurden.

### *References*

- BALTRUSAITIS, J. (1977). *Anamorphic Art*. New York: Harry N. Abrams.
- BEHRENS, R.R. (1994). Adelbert Ames and the Cockeyed Room. *Print* 48, 2, 92-97.
- BEHRENS, R.R. (1998). The Artistic and Scientific Collaboration of Blanche Ames Ames and Adelbert Ames II. *Leonardo*, 31, 47-54.
- BENESH-WEINER, M. (ed.) (1987). *The Notebooks / Fritz HEIDER: Vol. 1*. Munchen-Weinheim: Psychologie-Verlags-Union.
- BENESH-WEINER, M. (ed.) (1988). *The Notebooks / Fritz HEIDER: Vol 2*. Munchen-Weinheim: Psychologie-Verlags-Union.
- BRUNER, J. (1983). *In Search of Mind: Essays in Autobiography*. New York: Harper and Row.
- BRUSATI, C. (1995). *Artifice and Illusion: The Art and Writing of Samuel Van Hoogstraten*. Chicago: University of Chicago Press.
- CANTRIL, H. (ed.) (1960). *The Morning Notes of Adelbert Ames, Jr.* New Brunswick, New Jersey: Princeton University Press.
- GOMBRICH, E.H. (1961). *Art and Illusion*. New York: Pantheon Books.
- GOMBRICH, E.H. (1982). *The Image and the Eye*. Ithaca, New York: Cornell University Press.
- HEIDER, F. (1983). *The Life of a Psychologist: An Autobiography*. Lawrence: University Press of Kansas.
- ITTELSON, W.H. (1968). *The Ames Demonstrations in Perception*. New York: Hafner.
- KOFFKA, K. (1935). *Principles of Gestalt Psychology*. New York: Harcourt Brace and World

#### **Anschrift des Autors:**

Prof. Roy R. Behrens  
2022 X Avenue  
Dysart IA 52224-9767 USA  
E-mail: ballast@netins.net